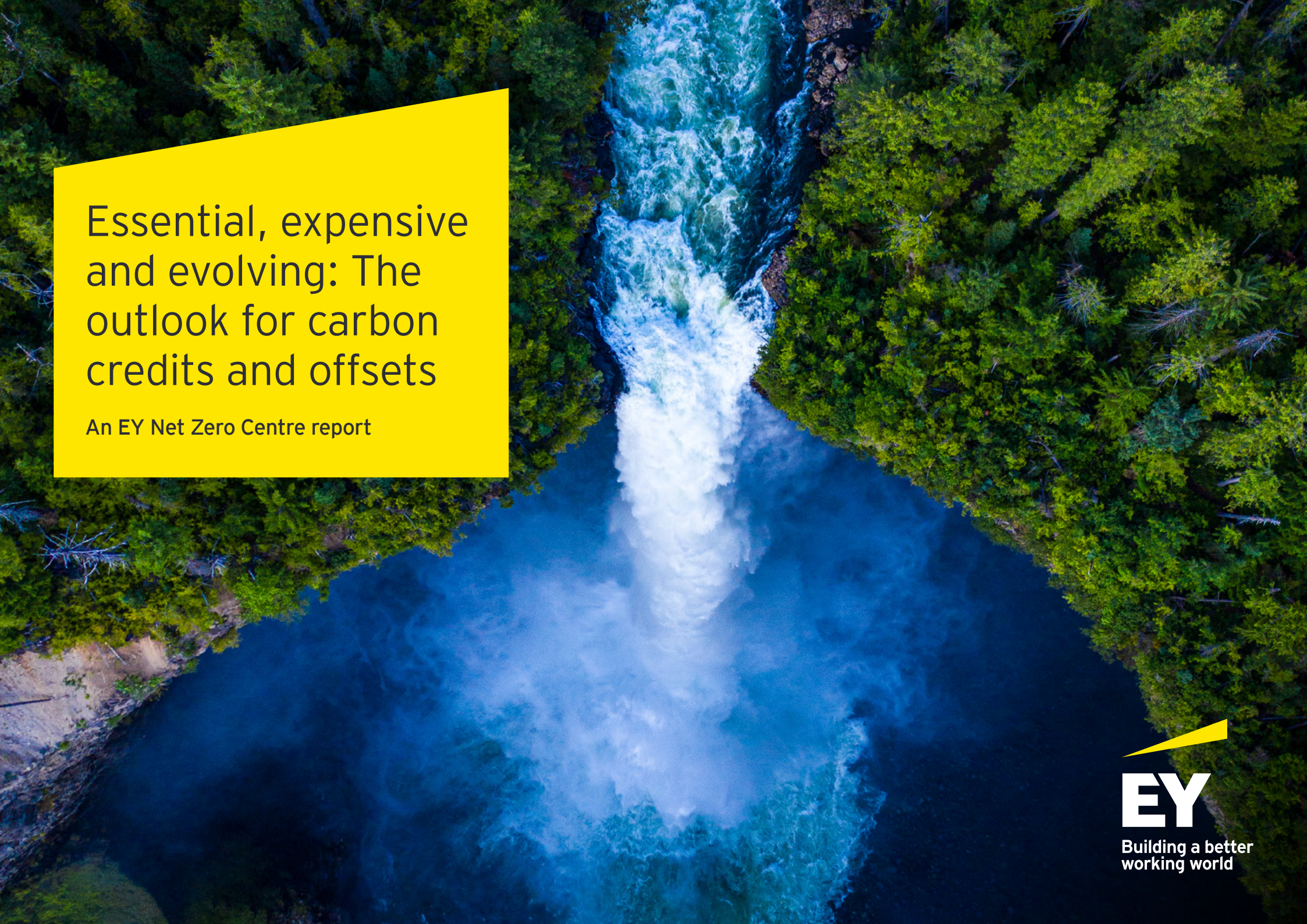


Essential, expensive and evolving: The outlook for carbon credits and offsets

An EY Net Zero Centre report

EY
Building a better working world

Contents

Executive summary

Carbon credits are essential to achieving net zero

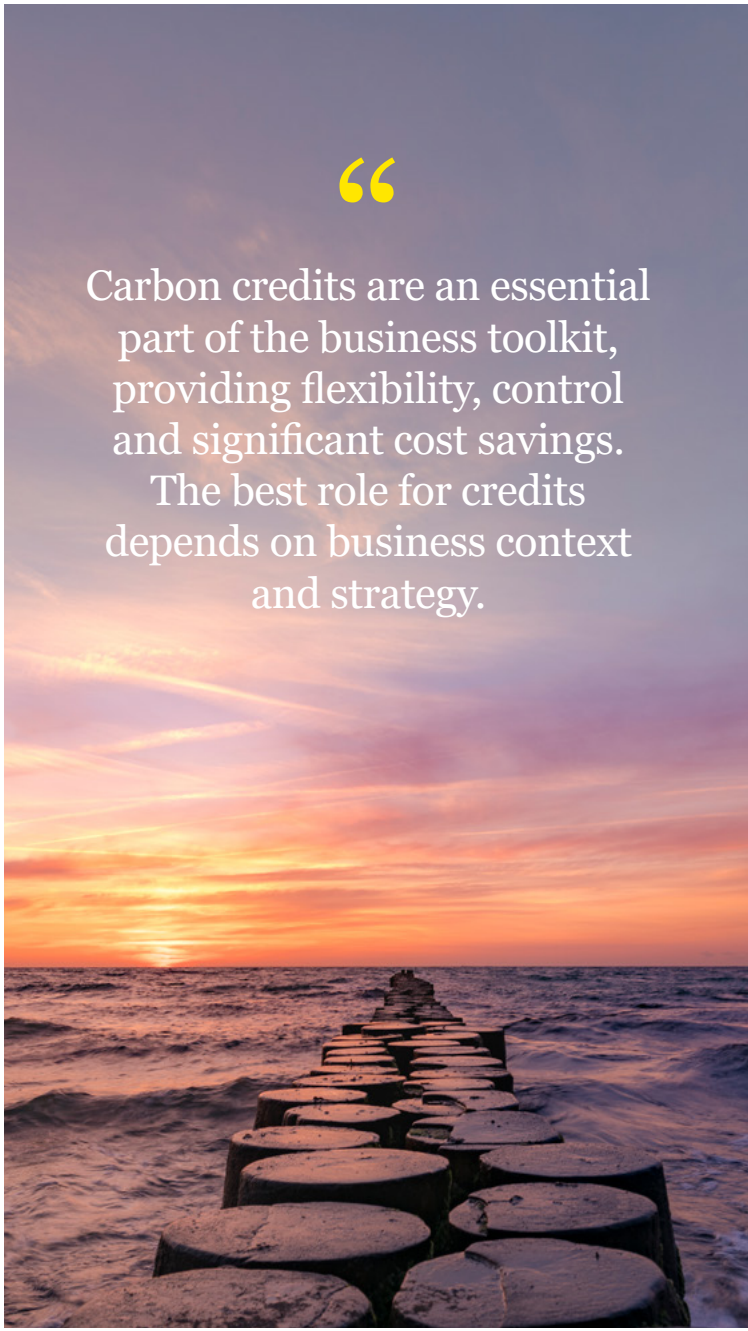
Governments and companies around the world are ramping up their decarbonisation commitments due to increasing pressure to act on climate change from multiple stakeholders. But making and achieving credible decarbonisation commitments is challenging for businesses, particularly in emissions-intensive sectors.

Carbon credits allow businesses to make earlier and more ambitious commitments. Credits allow businesses to reduce their emissions now through offsets, while taking cost-effective action to reduce future emissions through asset turnover and evolution of their business models. In the longer term, credits have an essential role in offsetting hard-to-abate emissions from products which lack low or zero emissions options.

Carbon credits are an essential part of the business toolkit, providing flexibility, control and significant cost savings. The best role for credits depends on business context and strategy.

Emissions-intensive businesses should generally prioritise reducing direct emissions, with the use of credits focused on emissions which stakeholders agree are difficult or very expensive to reduce. Businesses with lower emissions intensity can make stronger carbon commitments and use credits with co-benefits to reinforce their brand values and positioning.

Businesses should act now to identify their best decarbonisation strategy and positioning, including whether and how offsets and carbon credits can contribute over time.



> Prices for carbon could rise to a central estimate of US$80-$150 per tonne by 2035 (in real 2020 dollars). In comparison, prices are currently US$25 per tonne today.

Carbon credits will be scarce and expensive

We have modelled four future scenarios to 2050 to explore and assess a range of possible carbon credit market outcomes.

Rising demand, a race to quality and higher unit supply costs will make high-quality credits scarce and expensive across all outlooks.

The volume of credits required globally is projected to increase at least 20-fold by 2035, with volumes increasing 30 to 40-fold from current levels in scenarios consistent with the Paris Agreement on climate change. Volume grows more slowly after 2035 across all the outlooks modelled.

The increase in credit volumes will drive rising supply costs as growing credit volumes exhaust low-cost supply options. Carbon credits with co-benefits will continue to command a price premium, with the value of benefits varying across different types of buyers.

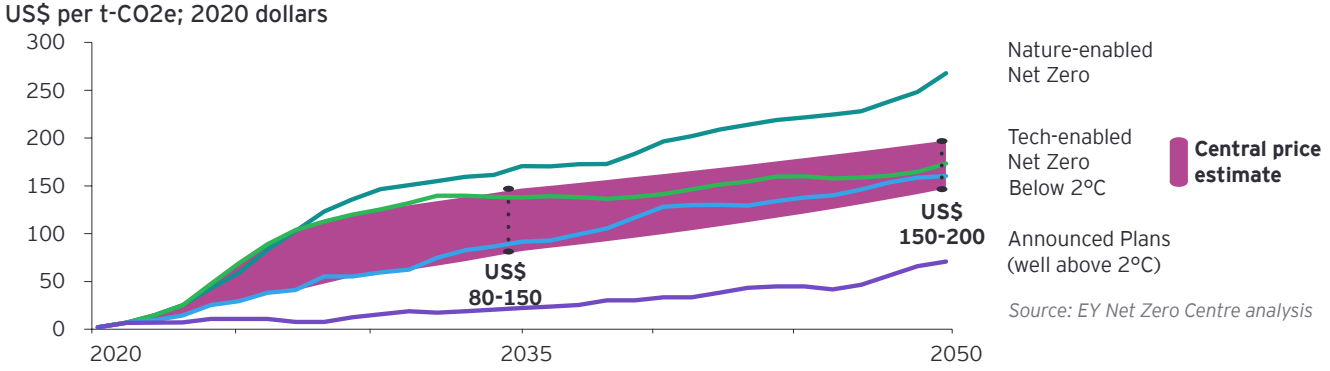
Prices for credits could rise to a central estimate of US$80-$150 per tonne by 2035 (in real 2020 dollars). In comparison, prices are currently US$25 per tonne today.

Prices are likely to be in the lower end of this range if technology costs fall more rapidly, or if the total global abatement effort is less ambitious. Prices are likely to be in the higher end of the range if the total global abatement effort is more ambitious, if technology costs fall more slowly, or if market friction is more significant and persistent.

The price trajectory has significant implications, as the price of carbon credits directly reflects society's willingness to act on climate change. In addition, higher credit prices will increase companies' willingness to implement higher cost internal abatement, accelerating the pace of internal action.

Increasing demand, expectations of quality, and unit supply costs will make carbon credits scarce and expensive

Offset credit price outlook, 2020-2050



Source: EY Net Zero Centre analysis

Markets and requirements of credits will evolve

Changes in policy context and technology costs will shift baselines for offset projects and make it harder to create credits based on avoided emissions, increasing the role of removals-based credits. Avoidance based credits dominate current supply and use of offsets, accounting for more than 90% of all carbon credits used in 2020 across the four largest voluntary standards.

In addition, the Intergovernmental Panel on Climate Change has stressed that limiting global warming to 1.5C above pre-industrial levels will require carbon to be removed from the atmosphere. However, it is not clear which technologies will be able to remove carbon from the atmosphere at scale, and the costs and other impacts of doing so.

Tightening national emissions budgets will drive governments to impose more stringent regulatory requirements on organisations over time, particularly in advanced countries. This will reduce the space for 'voluntary carbon commitments' and draw attention to co-benefits as a point of differentiation between businesses. More fundamentally, tightening emissions budgets will increase the need for organisations to use high-integrity carbon credits (often created voluntarily in other jurisdictions) to meet regulatory obligations, particularly after 2035. This will create new challenges for registry functions to prevent double counting of credits and ensure system integrity.

The supply of credits will become more standardised, including in relation to co-benefits, driven by competitive pressures and the requirement to scale up supply.

While we are confident of the overall direction, the pace of market consolidation and associated efficiency improvements is uncertain. There is a risk that national governments will act to favour local markets and constrain trade, increasing the costs and complexity of credit delivery.

Low credit volumes, and ongoing uncertainty about demand, supply and prices may mean some markets are slow to provide price visibility and accessible options. An absence of accessible market offerings would push some buyers to consider direct project participation to manage business risks.

Business leaders who engage early are most likely to achieve a successful transition

The balance of forces favours the emergence of more efficient markets, trading high-integrity carbon credits through a small number of exchanges linked to multiple registries in a coherent global framework.

Stakeholder expectations, competitive pressures and carbon management options are all evolving rapidly. This report argues that carbon credits are an essential part of the business toolkit, but that credits will be scarce and increasingly expensive. We find tightening emissions budgets will result in more stringent regulatory obligations and increasing demand for (more expensive) removal-based carbon credits.

Each of these trends amplifies the risks and opportunities associated with transitioning to a low carbon future and heightens the urgency of business leaders to engage and act. Every business will be expected to make a positive contribution to the defining challenge of our generation. And every leader will need a clear decarbonisation strategy which recognises the role of credits to create value and support thriving businesses in a rapidly changing world.

We suggest business leaders consider the following five steps to position for disruptive change and the opportunities and challenges it will bring.

We provide more specific advice on developing a climate and energy transition strategy, including therole of carbon credits on pages 17,18 and 23-36 of this report.

01 **Act now to create options and manage risks**

What early actions would provide non-carbon benefits as well as reduce your carbon risks? Where might you gain confidence or insight through learning-by-doing? How might you gain an advantage over your peers and competitors?

02 **Review your long-term strategy**

What are the implications of your stakeholder pressures, emissions intensity, and opportunity space for strategy and positioning? Is your strategy robust to a range of carbon credit price trajectories?

03 **Identify potential tipping points for pressures and opportunities**

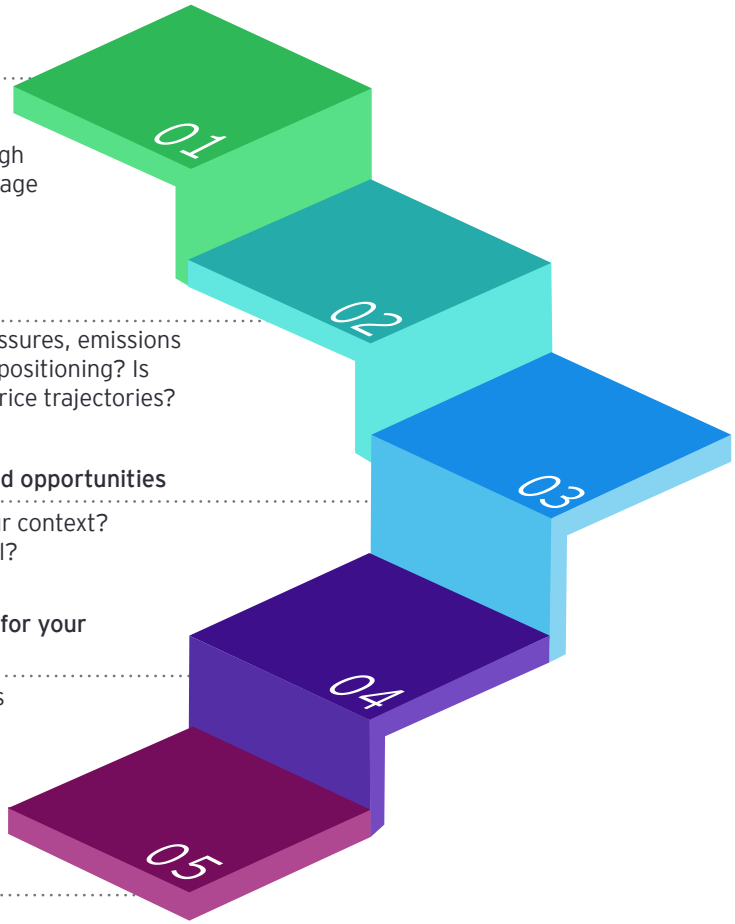
What swift shifts or surprises could transform your context? What new technology options would move the dial?

04 **Articulate several distinctive value propositions for your company in 2030-35**

What could be your distinctive offer? What factors would give weight to one option over another? How would these long-term value propositions be implemented and delivered?

05 **Act now to create options and manage risks**

What early actions would provide non-carbon benefits as well as reduce your carbon risks? Where might you gain confidence or insight through learning-by-doing? How might you gain an advantage over your peers and competitors?



Introduction

Climate change is a defining challenge for all businesses

Climate impacts and responses will transform established sectors and provisioning systems for food, shelter, built assets and mobility over coming decades. All businesses in all sectors will be affected by this transition, and all will be expected to contribute to the solutions.

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

This report explores the role and outlook[1] for carbon credits and offsets as part of a sound net zero strategy. It has been prepared by the EY Net Zero Centre to help business decision makers identify and understand the best use of credits for their businesses.

Our analysis and findings are presented in three sections:

1. **The role of carbon credits and offsets,** which finds that carbon credits have an essential role in decarbonisation, but that the best use of credits varies with the context and strategy of each firm

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

3. **The outlook for credit markets,** which finds the markets and requirements for credits will evolve, driven by interacting climate imperatives, business needs and national government priorities

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.

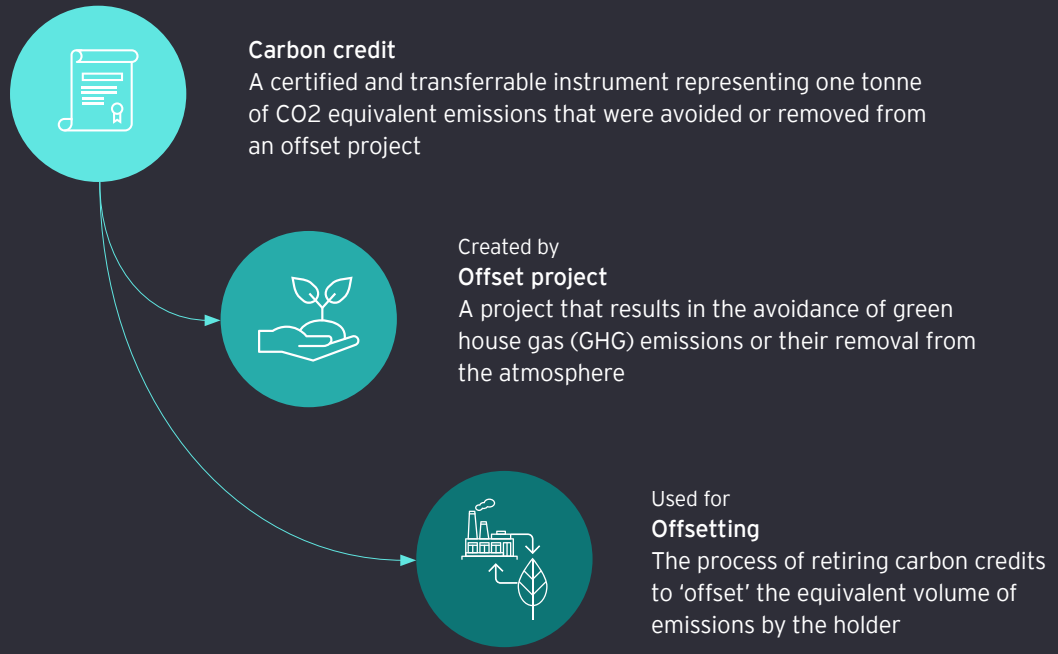
How we define carbon credits and offsets

A range of terms are used to discuss the use of offsets.

We define a carbon credit as a certified and transferable instrument representing one tonne of CO2 or equivalent greenhouse gases that has been avoided or removed. (Here 'avoided' means the gases did not enter the atmosphere, while 'removed' means the gases were removed from the atmosphere and safely stored.)

Credits are created by offset projects and can be retired to 'offset' the equivalent volume of residual emissions by the holder of the credit.

Understanding carbon credits and offsets



Source: EY Net Zero Centre analysis

Essential:
Carbon credits are essential to achieving net zero

Delivering on government and business commitments will require transformative change

Governments and companies around the world are accelerating their decarbonisation commitments.

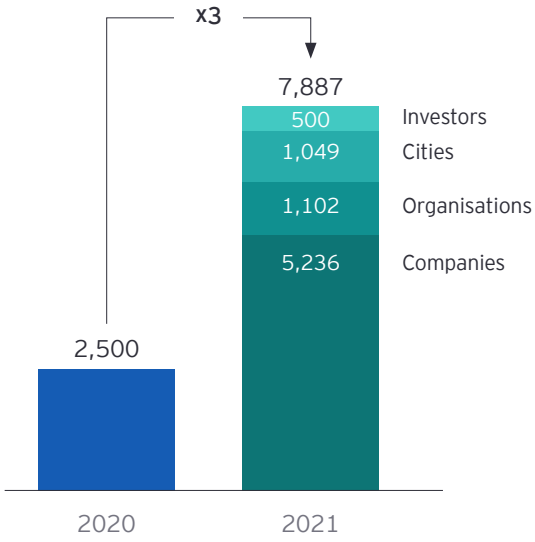
More than 130 countries have committed to ambitious emissions reductions and net zero targets. All member countries of the Organisation for Economic Co-operation and Development (OECD) have adopted net zero targets by no later than 2050, with several countries committing to net zero by 2045 or earlier.

Net zero commitments by companies, cities and other organisations tripled over the 12 months from 2020 to 2021, with one in three setting targets for 2045 or earlier, including many businesses that are setting net zero targets for 2035 or earlier.

But achieving credible decarbonisation commitments is challenging, costly and complex for businesses, particularly in emissions-intensive sectors.

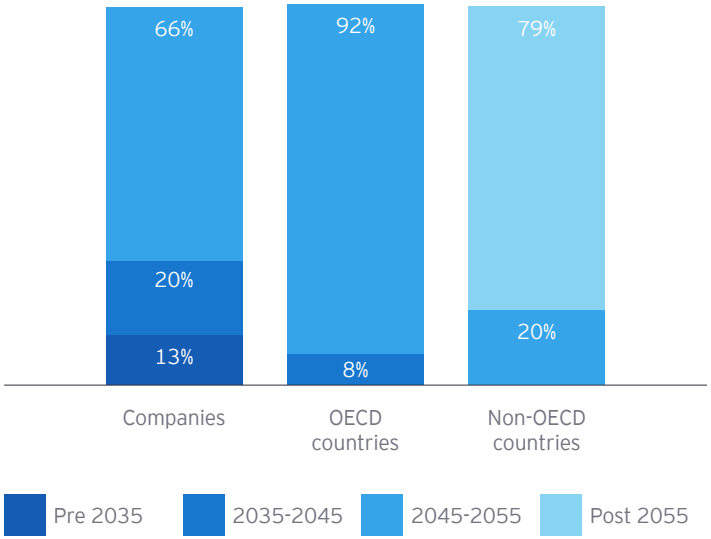
Net zero commitments are accelerating

Official country commitments by type



Companies are committing to achieve net zero more quickly than countries

Timeframes for company and country net zero and carbon neutrality commitments



Paris commitments require advanced countries to reduce emissions more than 90% by 2050

The UNFCCC Paris Agreement commits 196 countries to limit climate change to "well below 2°C" and establishes an aspiration of the much more difficult challenge of limiting warming to around 1.5°C.

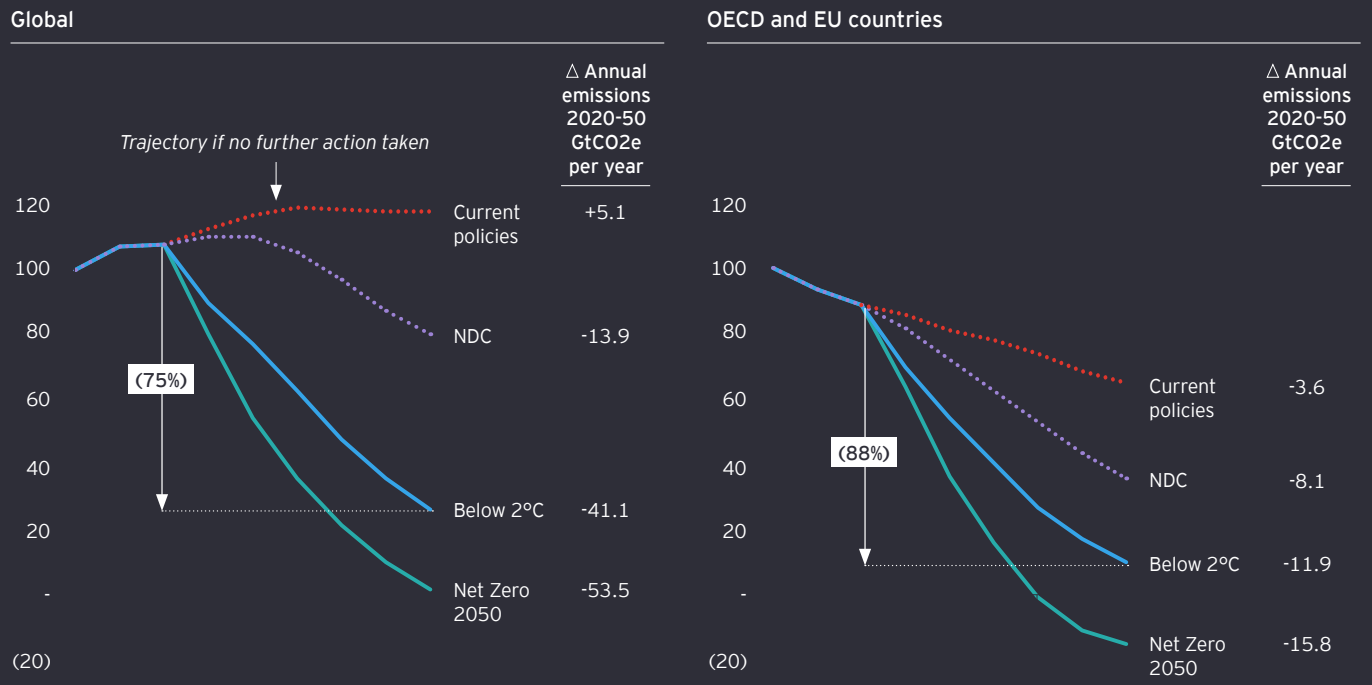
Reflecting equity issues and capacity to pay, advanced countries are expected to take the lead to reducing their emissions. This implies OECD countries will need to reduce their net emissions by 90% – 100% by 2050 to keep long-term temperature outcomes below 2°C.

High level commitments by advanced countries are broadly consistent with limiting temperatures to below 2°C. However, in most cases the detailed policies and frameworks required to achieve this outcome are not in place, or even under discussion.

Limiting temperature outcomes to around 1.5°C will require much more radical transformation, with OECD countries achieving net zero around 2040 and continuing to support net negative emissions after that for at least several decades. While challenging and costly, this would avoid significant climate impacts that will occur even if long-term climate change is limited to 2°C of warming.

Radical change is required to reach net zero – including eliminating emissions in key sector, 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
Source: Network for Greening the Financial System, REMIND-MAgPIE model with Net Zero 2050 scenario


“
Moving to net zero is both ‘the least we can do’ and transformational.

Stakeholders expect business to act on climate change and decarbonisation

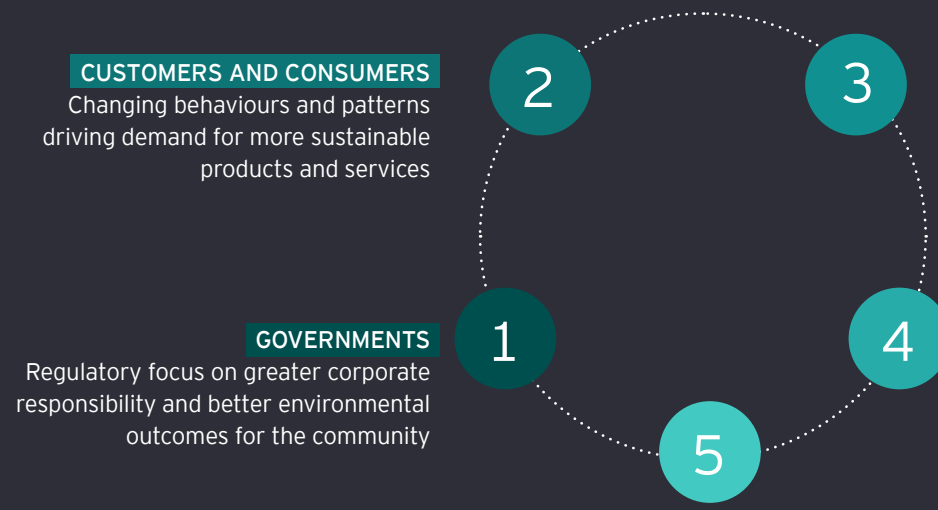
Businesses around the world are feeling pressure to act on climate change from five sources.

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 builds that climate change is real and consequential, and must be addressed, businesses that choose not to respond are increasingly likely to have action forced upon them by government, investors and other stakeholders.

Pressure to act on climate across five dimensions



CUSTOMERS AND CONSUMERS
Changing behaviours and patterns driving demand for more sustainable products and services

SHAREHOLDERS
Sustained demand for return on capital as well as higher levels of ESG transparency and reporting

GOVERNMENTS
Regulatory focus on greater corporate responsibility and better environmental outcomes for the community

EMPLOYEES
Safer work environments and greener, more sustainable policies and practices aligned with core values

PHYSICAL RISKS
Chronic and long term shift in climate patterns and increased severity and frequency of acute events (e.g. flooding, drought)

There is no status quo option

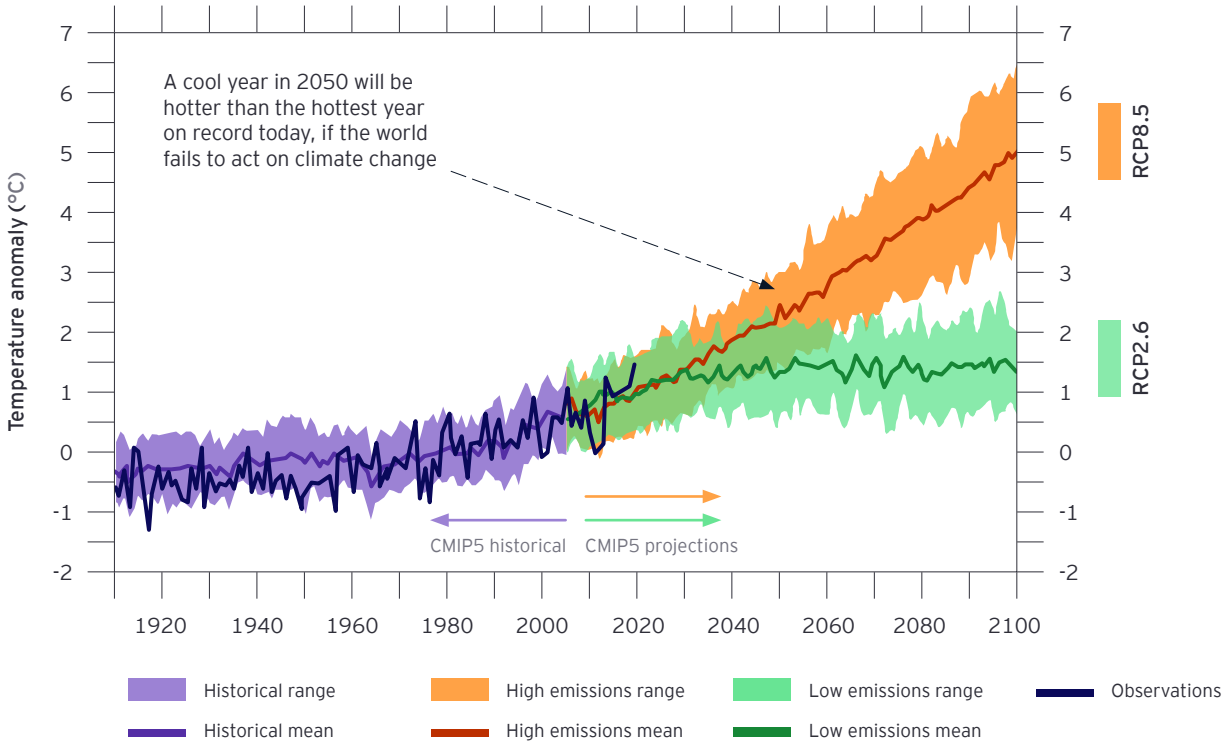
While pressures to act on climate change have been building for years, it can be useful to recognise that committing to transition to net zero emissions simply represents a commitment to 'do no harm'.

Achieving net zero prevents new or additional climate damage but does not repair or prevent harm occurring from past emissions. This makes moving to net zero both 'the least we can do' and transformational due to the huge changes required to energy systems, food, transport and industrial processes.

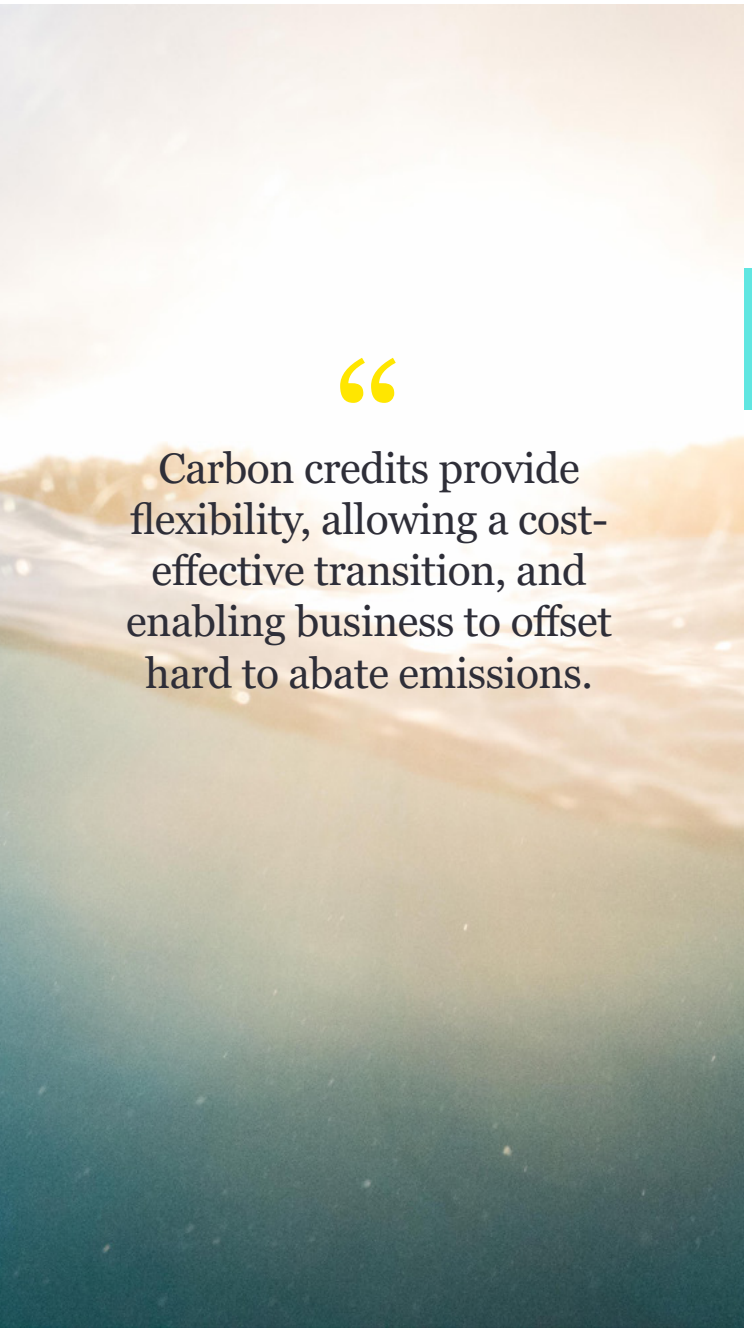
In addition, as lags in the global climate system will see continuing climate impacts and extreme weather events for many years to come, stakeholders will apply more pressure to business.

Expect more extreme weather and events even in a 2°C world

Past and projected future Australian annual temperature anomalies for two global emissions pathways, relative to 1961–1990 average



Source: Hatfield-Dodds et al (2021) Stocktake of megatrends shaping Australian agriculture, ABARES



> Carbon credits provide flexibility, allowing a cost-effective transition, and enabling business to offset hard to abate emissions.

Stakeholder pressures, business risks and ability to decarbonise define the best strategy

The strategic context of emissions reductions is different for each business and is shaped by emissions intensity and stakeholder pressure.

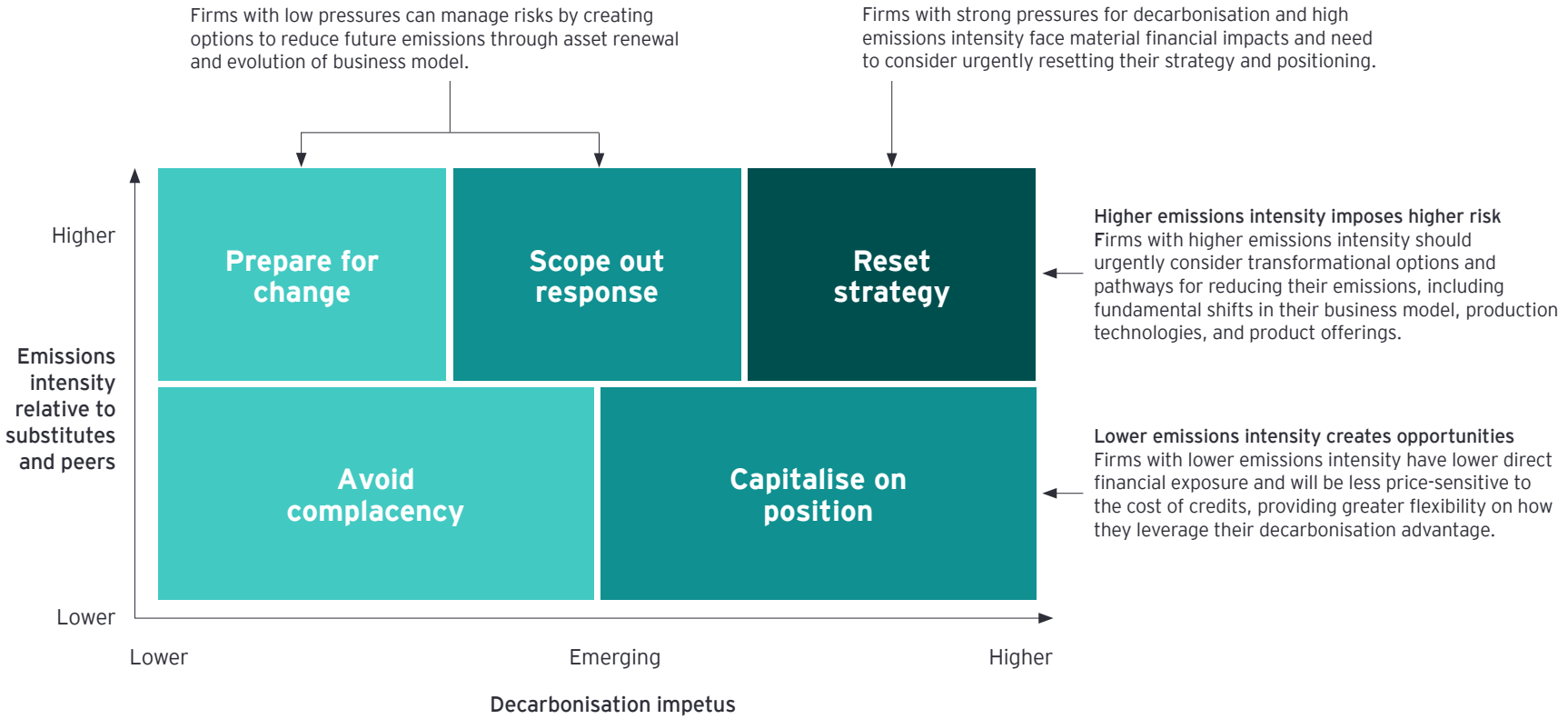
Vulnerability has two aspects. The first is emissions intensity, or emissions per dollar of revenue, relative to other businesses in the same sector (contributing to relative competitiveness). The second aspect is the emissions intensity of sector output relative to potential substitutes, such as plant-based alternatives to red meat. The attractiveness of substitutes shapes the outlook for an emissions-intensive sector as a whole.

Mapping context in this way gives framework for identifying the default 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,** conscious 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 model, production technologies and the set of product offerings.

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

Carbon credits allow earlier and more ambitious commitments, smoothing the net zero transition

Carbon credits are an essential part of the toolkit for achieving decarbonisation commitments, but their most valuable role depends on the business context and strategy.

Credits allow organisations to reduce their emissions now through offsets, while taking cost-effective action to reduce future emissions through asset turnover and evolution of their business models. This enables organisations to support immediate beneficial action on climate change through credits, while 'buying time' to implement attractive internal abatement options.

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

In both cases credits must be high quality to deliver genuine reductions in emissions, either by avoiding emissions that would otherwise occur, or by removing emissions from the atmosphere. Unfortunately, this has not always been the case in the early use of credits.

Giving stakeholders confidence that carbon credits are a legitimate part of the decarbonisation toolkit, will require significant improvements in the quality and integrity of carbon credits and associated assurance processes.

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

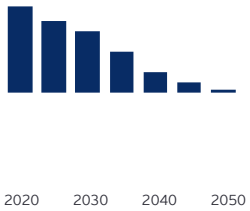
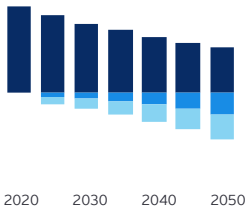
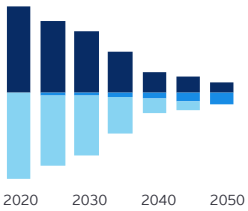
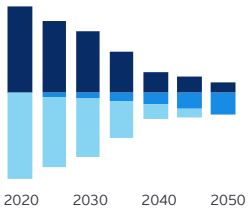
Two primary uses of carbon credits

	Ease transition timing to net zero	Balance out hard to abate emissions
Primary use	Transition role to "buy time" allowing cost effective action to reduce future 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 over time

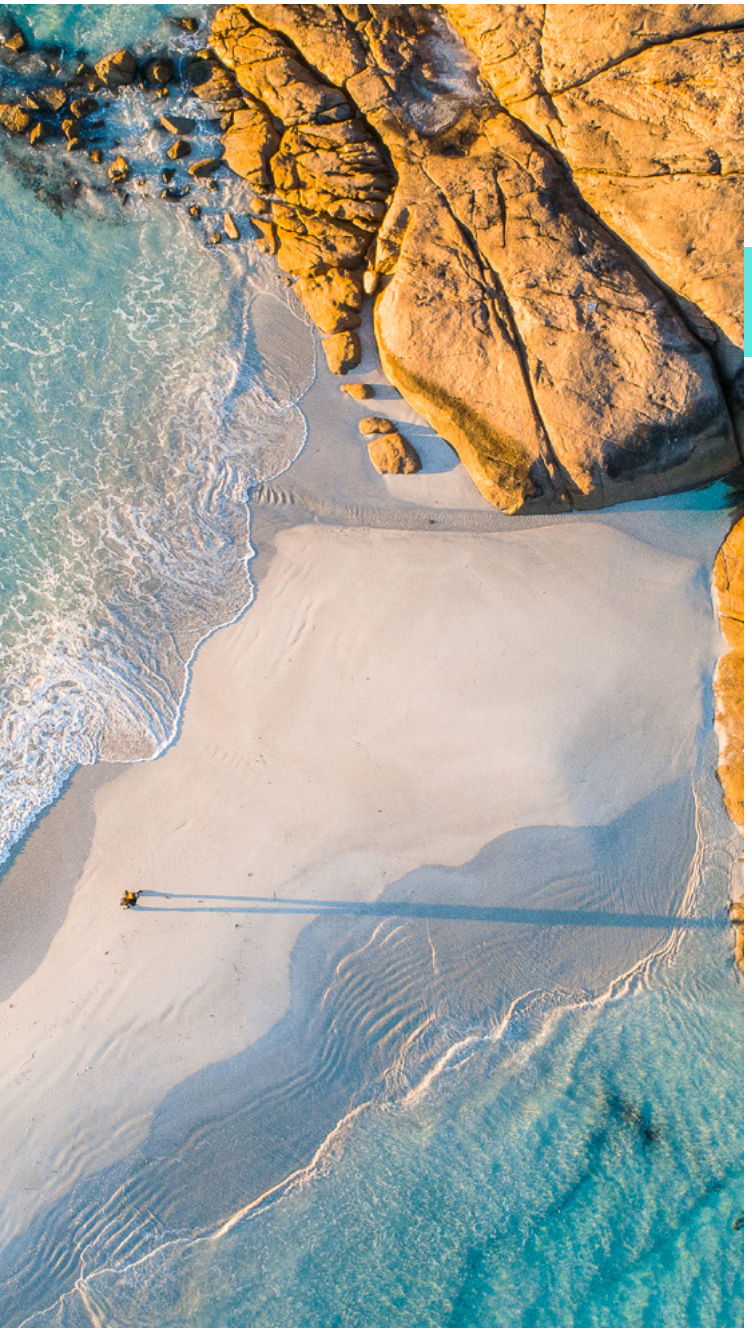
Source: EY Net Zero Centre analysis

Business commitments can take a variety of forms

Characteristic use of offsets in emission reduction pathways

	Direct decarbonisation	Path to carbon neutral	Net Zero Emissions	Beyond net zero
Emissions profile Tonnes CO2e				
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



Credits are essential, but play different roles in different strategies

Carbon credits give businesses flexibility and control.

Voluntary supply of credits will continue to be important as companies seek greater control over their emissions intensity and positioning.

Carbon credits provide flexibility in achieving emissions reductions, allowing a cost-effective transition and offsetting hard-to-abate emissions.

The quality, characteristics and unit cost of carbon credits should be matched to business needs below is a summary of the attributes, key determinants of quality and types of co-benefits.

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 risk.

Characteristics of carbon credits

Credits can vary in quality, with different attributes and types of non-carbon co-benefits

Determinants of carbon credit quality

- **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

Specific attributes of carbon credits

Examples of specific features:

- **Location** of the project that is supply credits
- **Vintage** or year that the credits were produced
- **Standard** or method that underpins the projects and credits

Types of co-benefits

Non-carbon co-benefits can provide additional value to buyers of credits when aligned to brand.

Examples of types of co-benefits:

- **Social benefits** or specific communities such as employment of local labour, or empowerment of under-represented groups
- **Economics 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 practice of traditional farming practices

Source: EY Net Zero Centre analysis

The cost savings from credits and offsets are material

Analysis by the EY Net Zero Centre finds that offsets are essential to achieving cost-effective emissions reductions, lowering the cost of decarbonisation by 50% – 80% in Paris consistent scenarios relative to a pure internal abatement approach.

This implies carbon credits have an enduring 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 or zero emissions production methods.

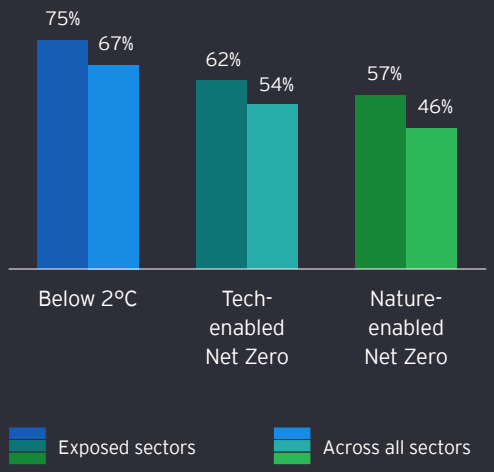
More information on our analysis of carbon credit markets is provided in the Appendix.

Credits provide substantial cost savings

Using carbon credits cuts decarbonisation costs by more than 50%

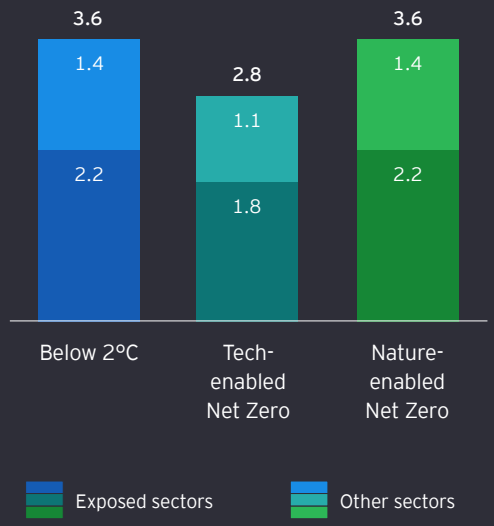
Cost reduction from mixed decarbonisation strategy

Percent of lifetime cost against internal abatement only



Total cost savings from mixed decarbonisation strategy

US$ Trillions; present value against internal abatement only



Please note: Scenarios are defined in more detail on page 26. 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

Strategic questions and issues to consider in shaping the right offsets strategy

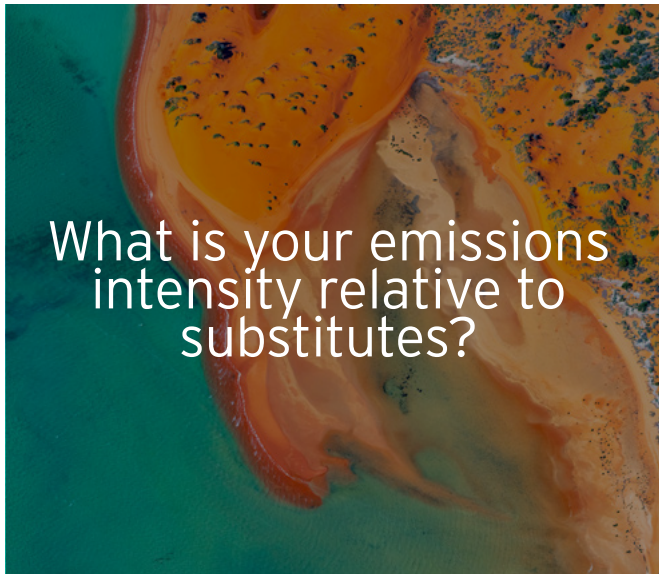
The most appropriate use of credits will be determined by the same factors that shape an organisation's decarbonisation strategy: business exposure, stakeholder pressures and opportunity space.

These factors can be explored through three sets of questions that inform strategy and decisions on the pace and extend of emissions reductions and help identify the desired role and contribution of internal abatement versus the use of carbon credits.

Issues to consider in shaping the right offsets strategy

Strategic questions	Issues to consider
What is your emissions intensity relative to substitutes?	Potential financial exposure across different outlooks for cost of credits, and volume required
	Desired balance between internal emission reductions versus use of credits over time
How immediate and strong are the pressures from stakeholders?	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
What is the opportunity space for reducing emissions?	Access to credits that meet business needs (including quality, supply timeframe, likely cost, alignment, co-benefits)
	Mechanisms or strategy for securing credits

Source: EY Net Zero Centre analysis



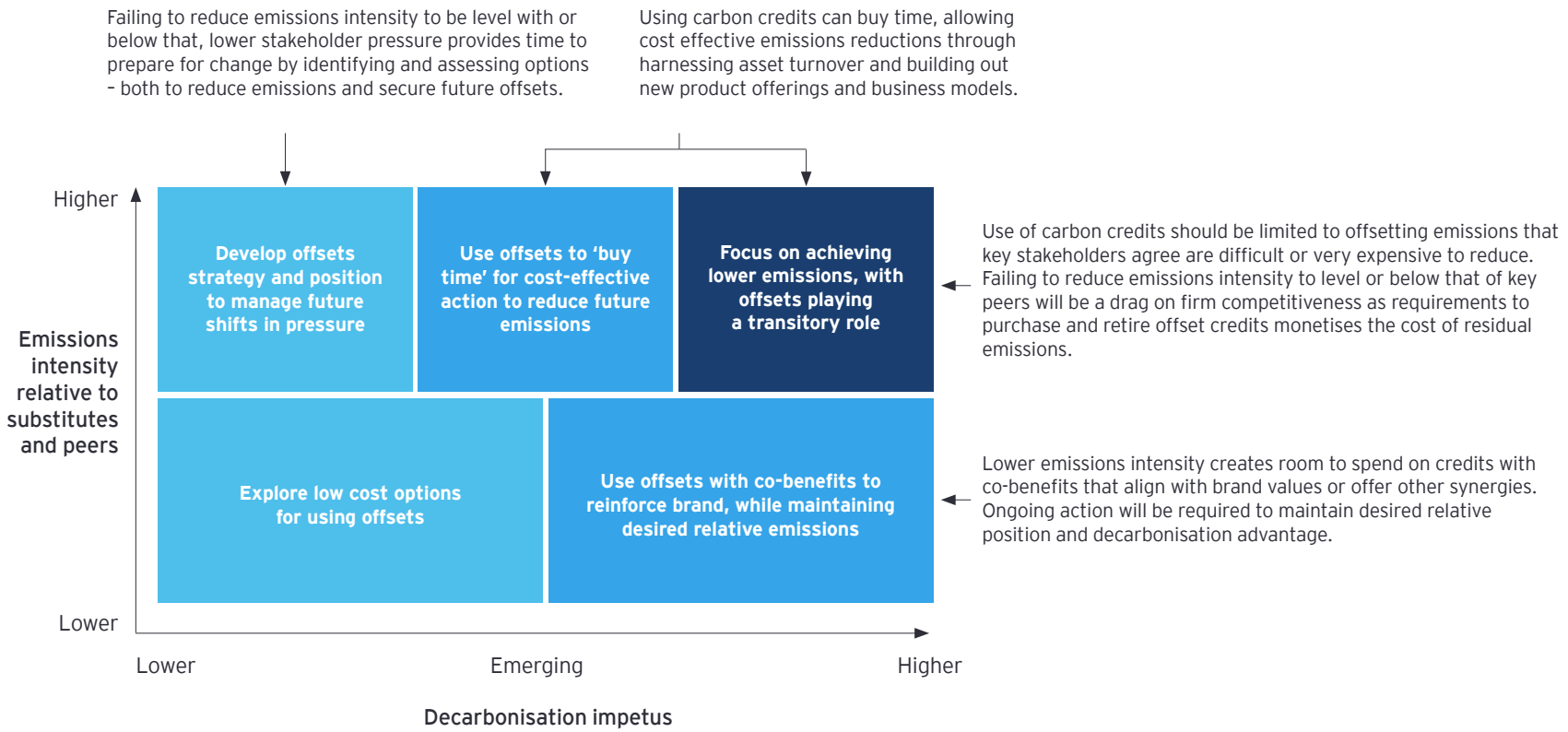
Seek to understand your emissions profile now and into the future under different outlooks. How will emissions intensity change over time? What are the key decision points and options, including in relation to the asset life of more emissions and energy intensive equipment, and to the evolution of your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

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.

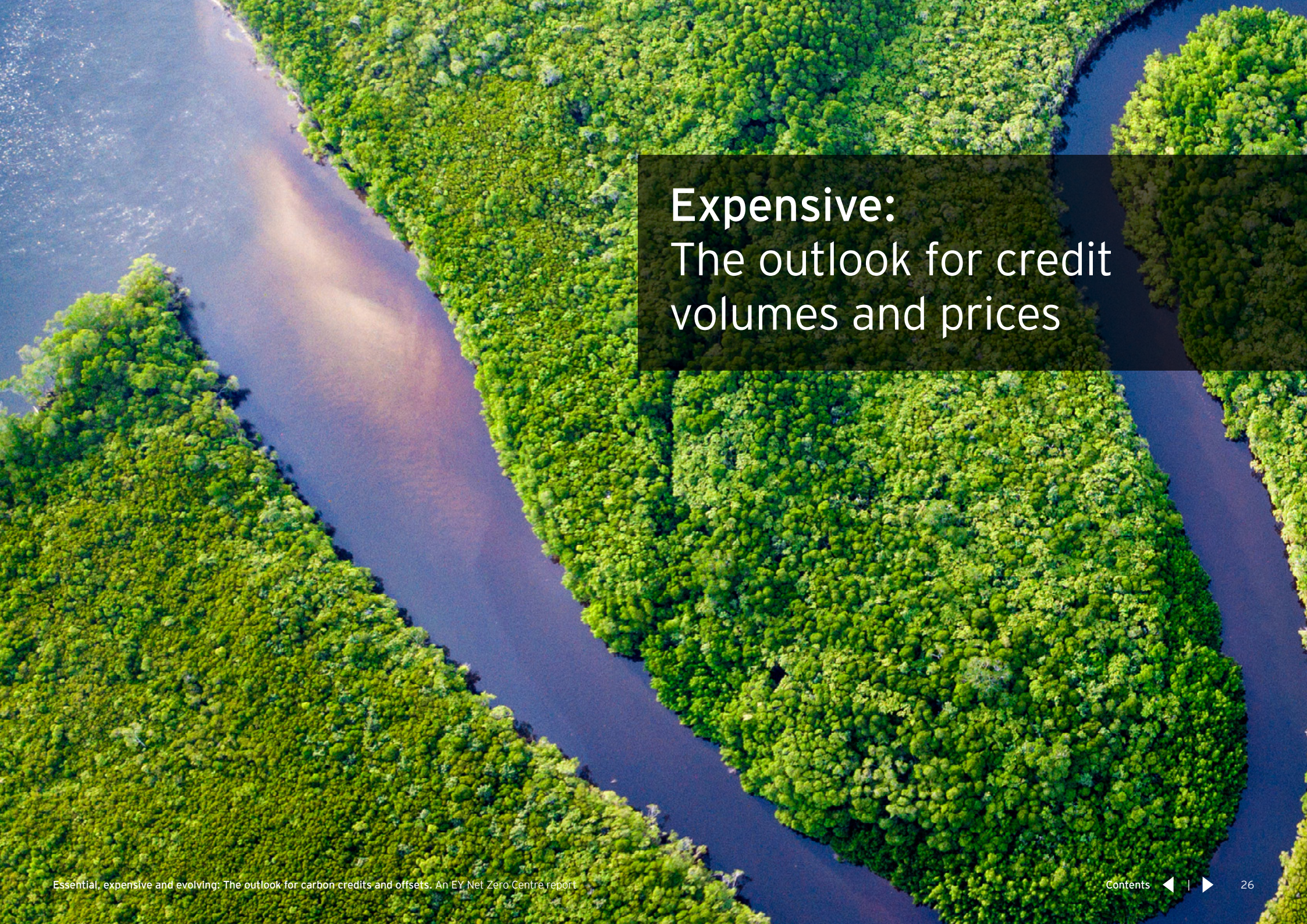
Seek to identify the most salient types and sources of emissions (including attitudes towards Scope 3 emissions). How well does your asset lifecycle align with the desired timeframe for reducing emissions? To what extent do technology solutions exist for your organisation's main sources of emissions?

The use of carbon credits should be informed by organisational positioning and decarbonisation strategy

The role and contribution of carbon credits



Source: EY Net Zero Centre analysis



Expensive: The outlook for credit volumes and prices

We use four future scenarios to explore and assess a range of potential carbon credit market outcomes

The EY Net Zero Centre modelled four future scenarios[2] 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 (NGFS) 2021. 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 Net Zero and Tech-enabled Net Zero scenarios.

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

Announced plans scenario

Assumes that there is no increas 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 Net Zero 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.

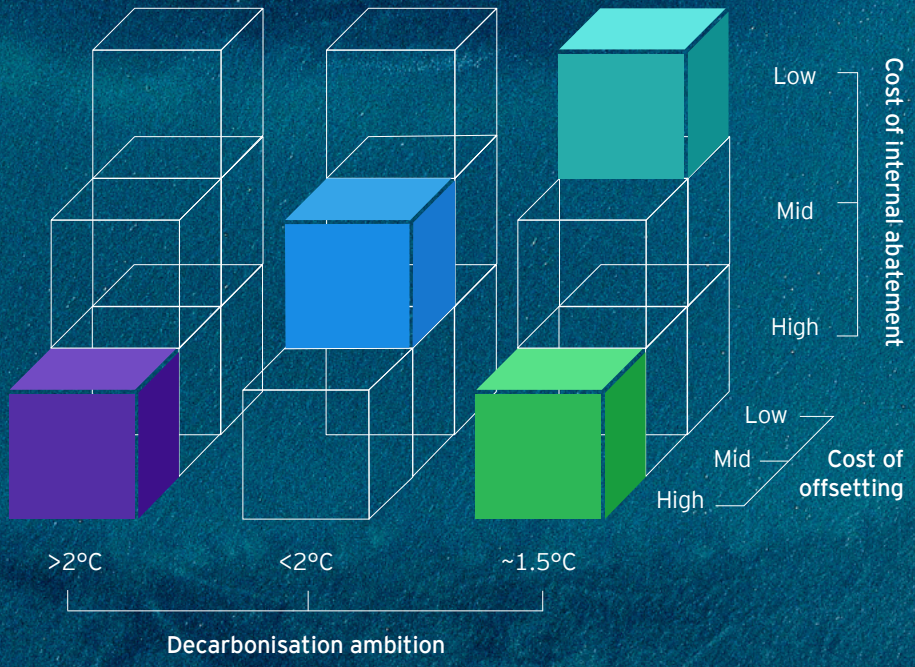
Nature-enabled Net Zero scenario

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

2. This report uses 'scenarios' to refer to specific future pathways each defined by a specific combination of assumptions. Scenarios are internally consistent physically and technically possible futures and are not predictions or forecasts. 'Outlooks' is used as a more general term for potential futures.

We model four future scenarios to explore and assess carbon 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

Source: EY Net Zero Centre analysis

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

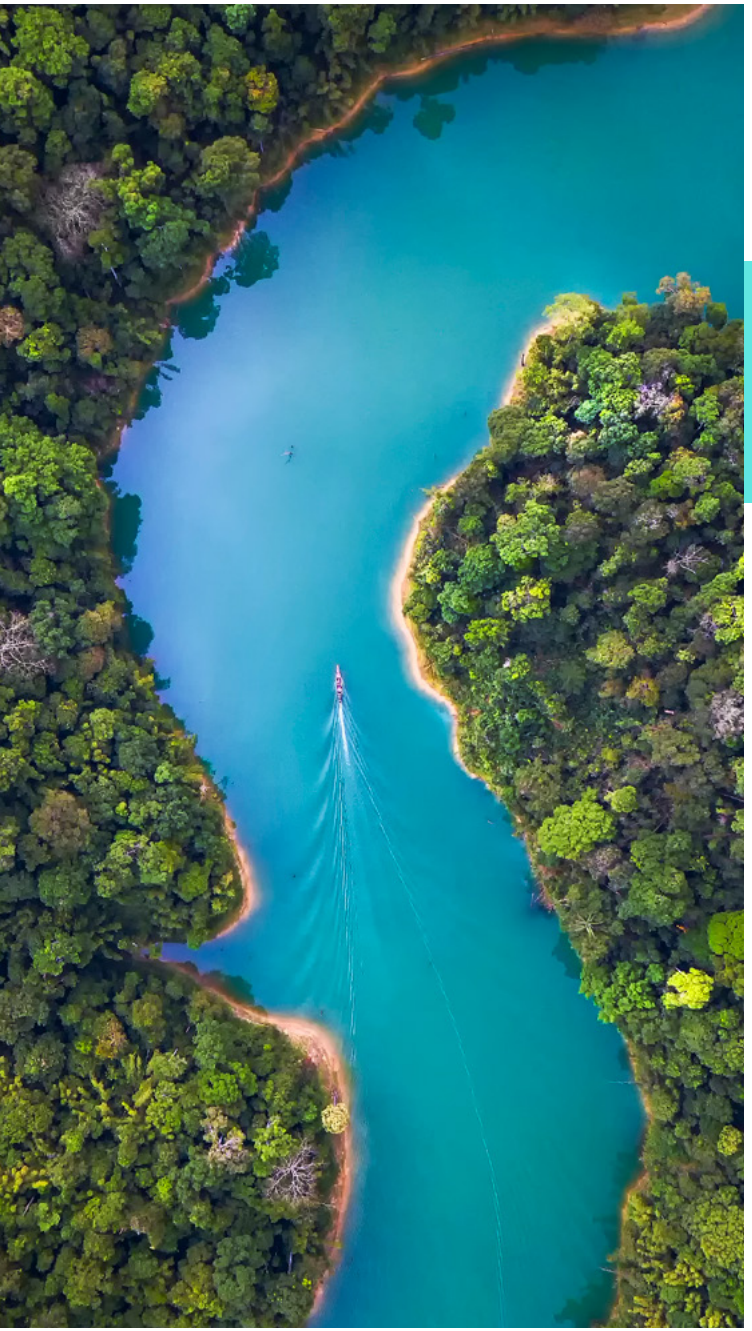
- A forecast of all carbon credit supply and demand or system constraints

Four scenarios assess different combinations of climate, technology and institutional drivers

Drivers across four scenarios

Scenario drivers	Announced plans	Below 2°C	Tech-enabled Net Zero	Nature-enabled Net Zero
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 as described in Appendix A



Carbon credit volumes will increase to 30-40 times current supply by 2035

The volume of credits required globally is projected to increase at least 20-fold by 2035, with volumes increasing 30 to 40-fold from current levels in scenarios consistent with the Paris Agreement on climate change (the Below 2°C and 1.5°C Net Zero scenarios).

Rising demand sees carbon credit volumes and prices grow rapidly to around 2035, after which time the volume of credits stabilises or grows more slowly across all the outlooks explored. This reflects a decline in the relative contribution of credits (in volume terms) as a share of the total abatement task, with internal abatement making a larger contribution towards 2050.

The analysis assumes that markets will evolve towards more efficient supply chain arrangements in order to achieve this dramatic increase in scale.

The modelling results are subject to several important uncertainties. These include the ambition of business-led emissions reductions and the pace and extent of technology cost reductions for different mitigation options. Also uncertain are the evolving preferences for the balance between internal abatement and the use of credits, and for the types of credits considered most attractive.

Modelled projections for credit supply volumes are shown for four scenarios in the figure on page 31. The left panel shows the increase in credit volumes required to meet the emissions reductions commitments of businesses to 2050. The right panel shows the share of total reductions that are met using credits, including both avoidance-based and removals-based credits.

To interpret these projections, it is important to note that 100% of offsets and credits are high integrity, across all scenarios. All credits represent additional permanent reductions in emissions. Put bluntly: there is no greenwashing.

If a scenario fails to properly address climate change, or falls short of a desired level of ambition, this failure is transparent – as illustrated by the 'Announced Plans' scenario (which results in well over 2°C of warming).

It is also important to note that the scenarios are framed to provide the 'central estimate' of outcomes given the specific assumptions for each scenario, and do not cover all potential outcomes. It is possible, for example, that business norms may evolve to favour more limited use of credits.

This would result in less reliance on credits and a corresponding increase in internal abatement (raising total abatement costs), while achieving the same benchmark global scenario.

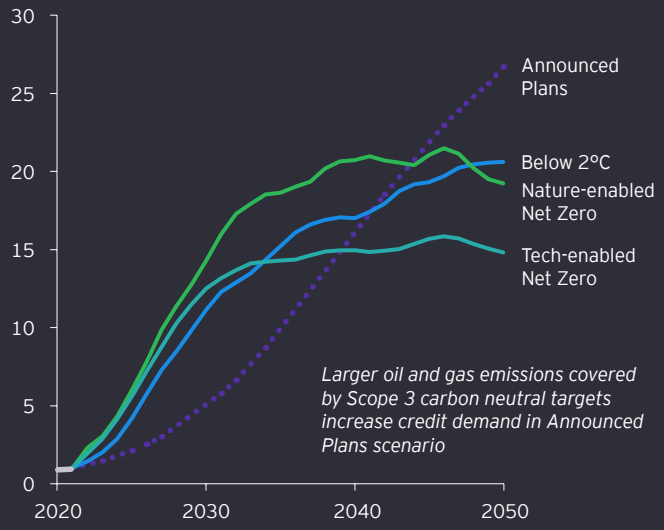
The mix of different types of carbon credits are discussed in more detail later in the report.

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

Total supply of credits and share of abatement, 2020-2050

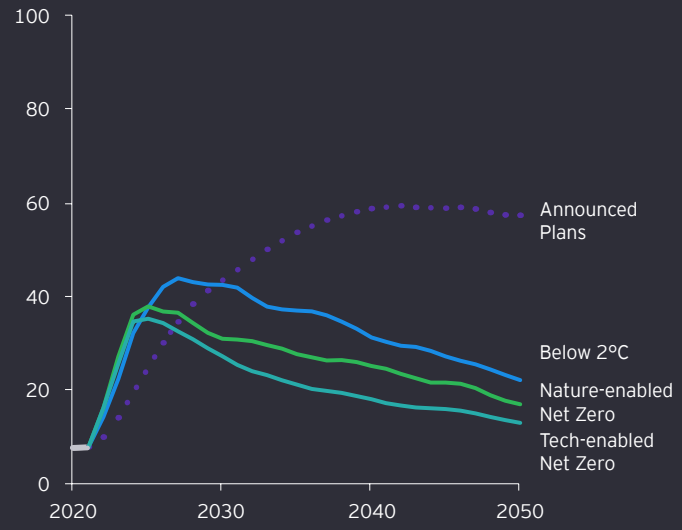
Realised credit volumes

Multiple of voluntary retirements in 2021



Realised credits as a share of total emissions reduction

Percent; credits retired annually relative to cumulative reduction since 2020



Source: EY Net Zero Centre analysis

Increasing demand, 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 a good or service 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 the case for the supply of high-quality carbon credits, which is subject to multiple constraints. These 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.

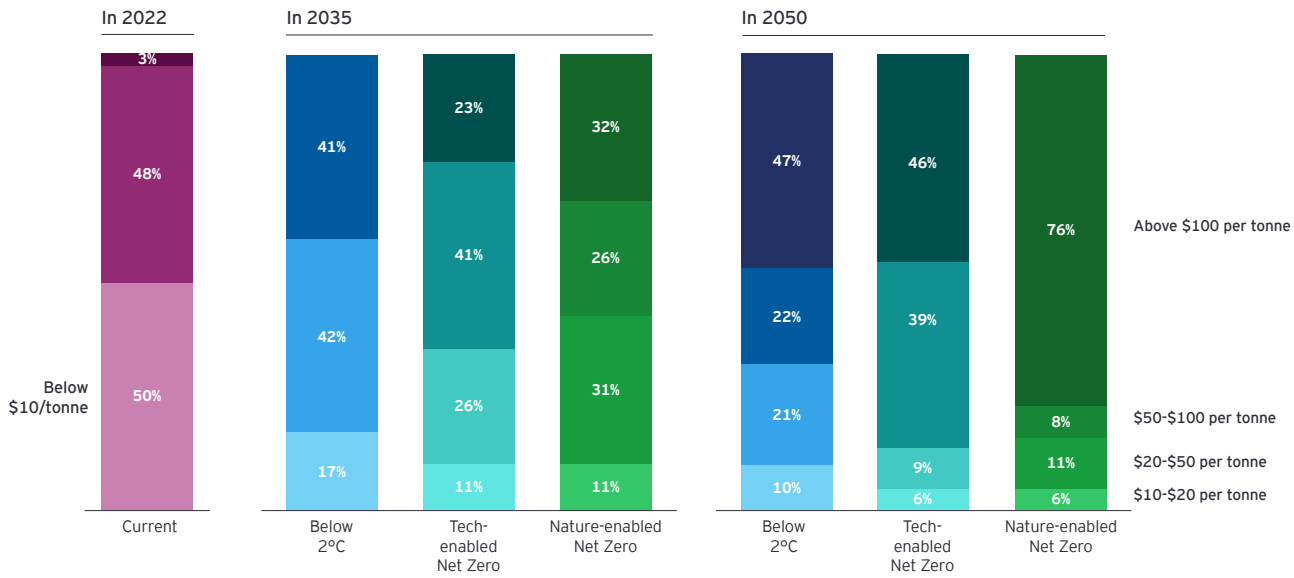
Average costs of high-quality carbon credits will increase significantly to 2035 across all scenarios. These price increases are projected to continue after 2035 in most scenarios, as the cumulative increase in emissions reductions intensifies competition for avoidance-based credits and increases the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

Against this backdrop, we also find 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.

> “Incremental cost of supply will rise as volume increases, with 40-60% of credits to cost more than US$50 per tonne by 2035

Incremental costing of supply will rise as volume increases, with 40-60% credits to cost more than US$50 per tonne by 2035

Distribution of credits and share of abatement, 2020-2050



Source: EY Net Zero Centre analysis

Credit prices are projected to rise to US$80-150 per tonne by 2035 in our central outlooks

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.

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 and markets could be subject to significant friction and inefficiencies for several decades (as shown on page 34).

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 under US$25/tCO2-e today to US$80-150/tCO2-e in 2035, and continue to rise to $150-200/tCO2-e in 2050 (in real 2020 dollars).

This central 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.

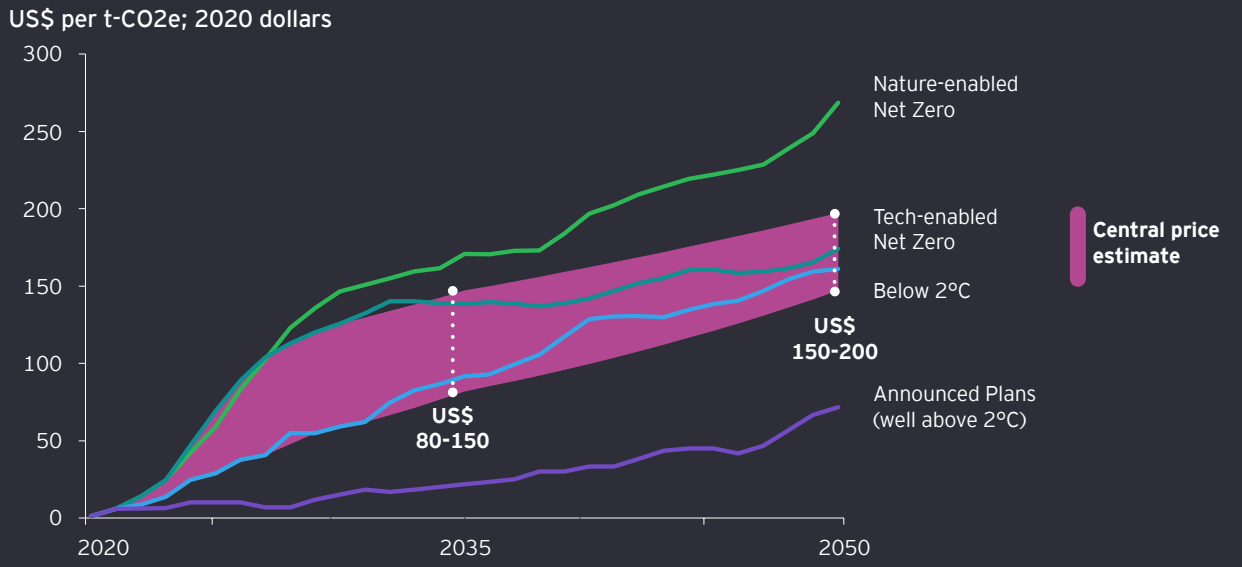
Within this range, different assumptions would see:

- 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 Net Zero 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.

Increasing demand, expectations of quality, and unit supply costs will make carbon credits scarce and expensive

Carbon credit price outlook, 2020-2050



> Eliminating emissions from business activities and supply chains will be complex and costly.

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

Eliminating emissions from business activities and supply chains will be complex and costly. High and rising unit cost of credits will reinforce other incentives for businesses to pursue internal abatement, reducing their direct emissions wherever this is cost effective.

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.

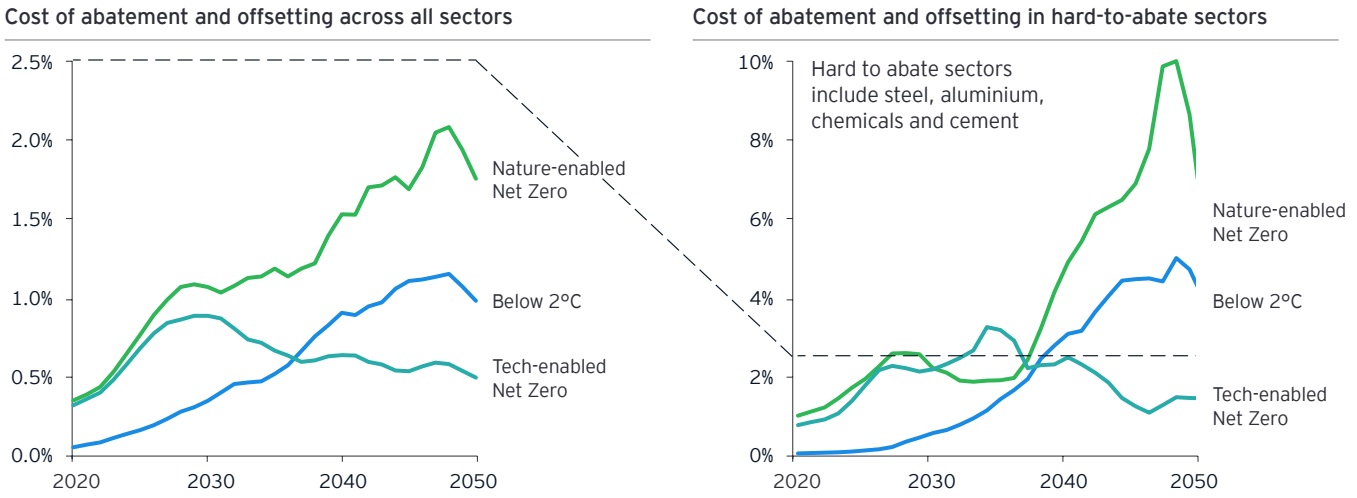
Over time, this will change the competitive landscape of emissions-intensive sectors, supporting decarbonisation of electricity, transport, heavy industry and agri-food industries.

Reflecting decarbonisation costs in the prices of goods and services will increase the relative prices of products that are more difficult to decarbonise 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, for example, and in train travel over flying for shorter journeys.

> “Over time, cost pass-through will change the competitive landscape of emissions-intensive sectors.

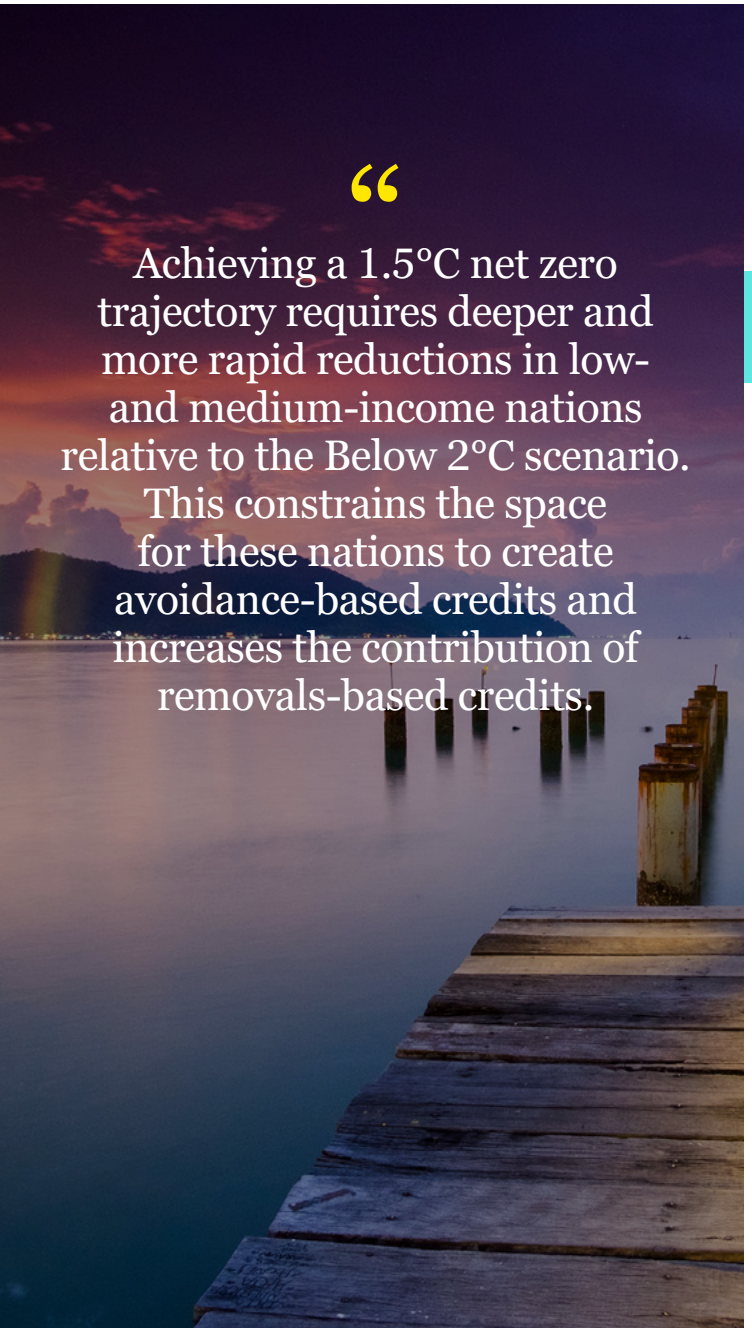
Cost of abatement and offsets is material, and likely to increase

Percentage of 2021 revenue spent on internal abatement and offsetting, without cost passthrough or change in output mix



Source: EY Net Zero Centre analysis

Evolving:
The outlook for the structure and outcomes from credit markets



Tightening emissions budgets will impact the mix of credits required and how they are used

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

Changes in technology costs and policy context will 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, accounting for more than 80% of all credits issued and more than 90% of all credits used (or retired) in 2020 across the four largest voluntary standards and registries (Climate Action Reserve, American Carbon Registry, Verified Carbon Standard, Gold Standard).

For example, many early credits were created through projects that avoided emissions by establishing new renewable electricity generation in place of gas or coal-fired generation. The emission reductions from these projects were considered additional because using wind and solar would not have been commercially viable without the carbon credit revenues.

However, reductions in technology costs in recent years have resulted in wind and solar projects that are commercially attractive without credit revenues. Where this is the case, wind and solar generation becomes the ‘baseline’ and these projects no longer meet the criteria for generating offset credits.

Policy context is also relevant. Increasingly ambitious national commitments to reduce emissions change the context of what is considered an appropriate baseline, or ‘business as usual’ outlook, for assessing avoided emissions. For example, an urban transport project providing light rail and electric bus services may be considered eligible but earn fewer credits because the baseline now assumes greater uptake of electric road transport in line with global trends.

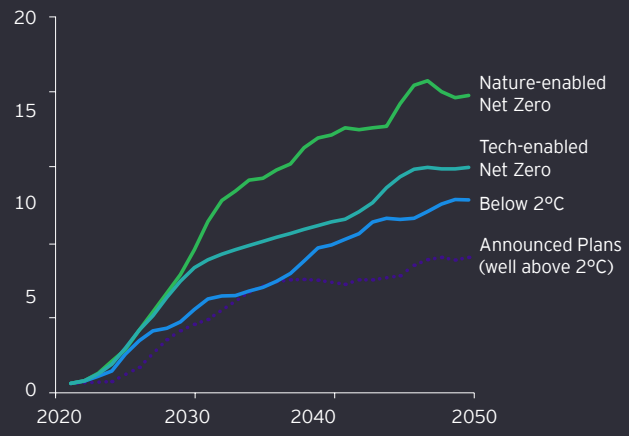
Shifts in policy context are most pronounced for the Tech-enabled Net Zero and Nature-enabled Net Zero scenarios. Consistent with differences in national commitments, the modelling assumes the majority of avoidance credits are generated in low or middle income nations, and are purchased and retired by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

Removal credits are essential in net zero scenarios

Projected volume and contribution of removal-based credits

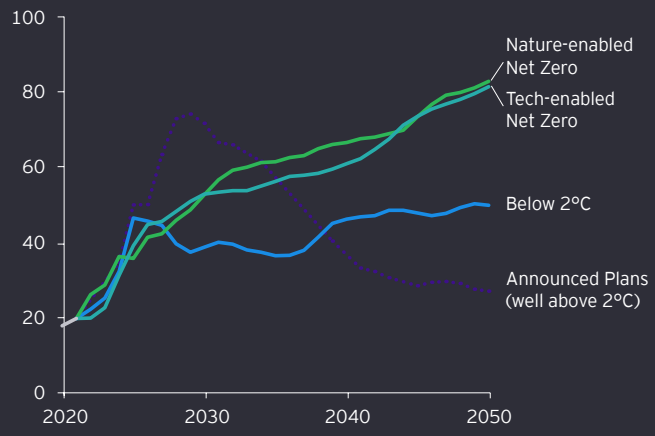
Volume of removal credits

Relative to total voluntary credit retirements in 2021

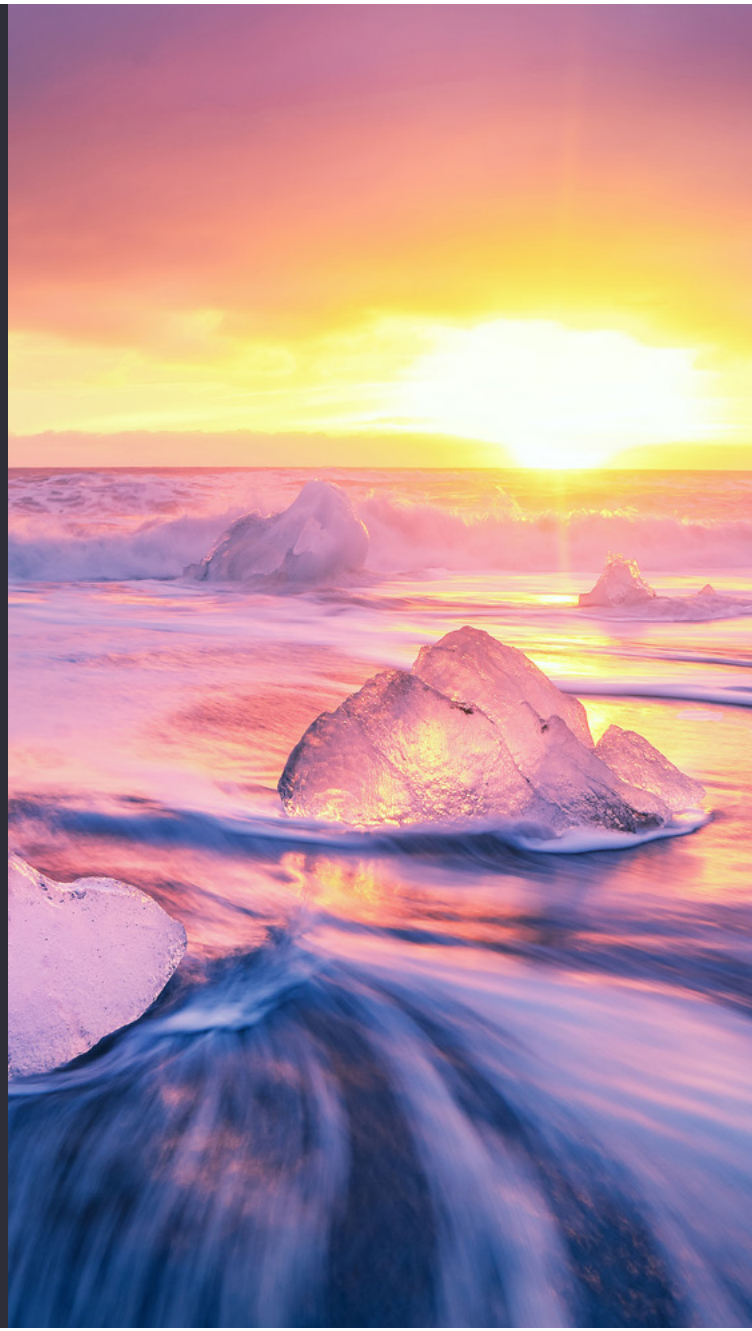


Share of annual retirements from removals:

Percent



Source: EY Net Zero Centre Analysis



The outlook for large-scale carbon removal 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.

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 generally competes with other land uses, particularly 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 1.5C 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.

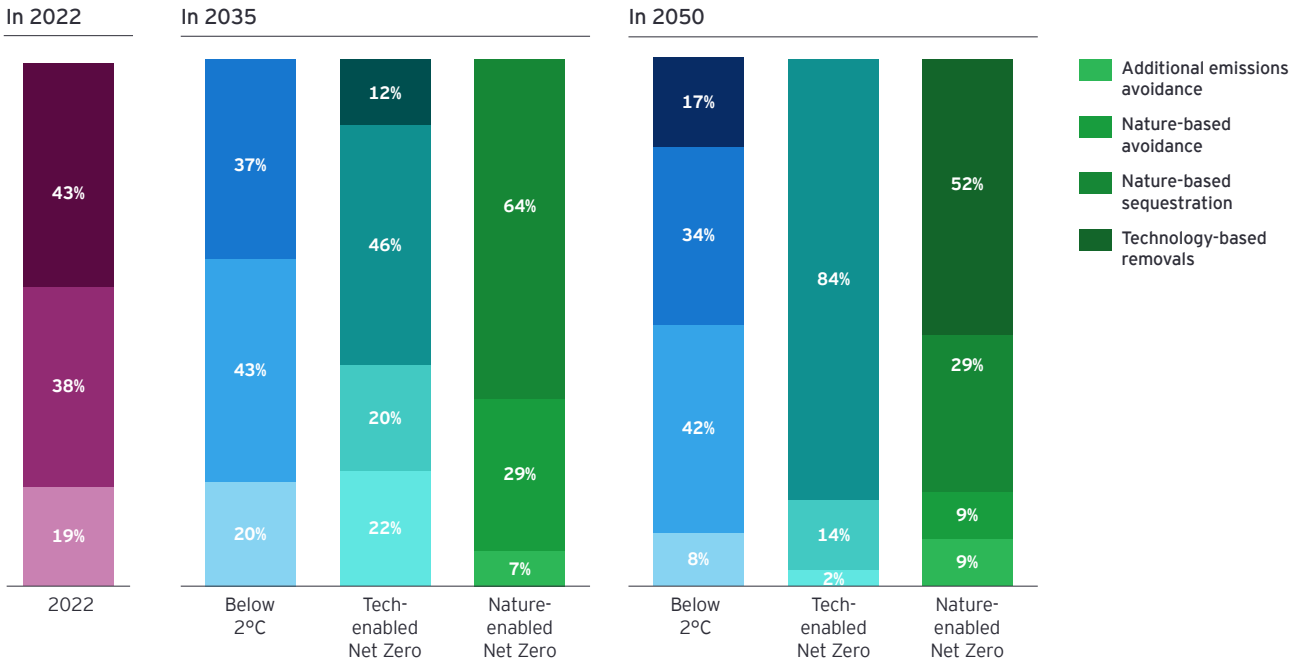
More ambitious climate scenarios with lower cumulative net global emissions and long-term temper-ature outcomes, including 1.5°C scenarios, typically find that land and carbon storage constraints will make it impractical to rely on reforestation and BECCS alone, and so DAC or alternative non-land removal 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.

This range of potential outcomes is explored across the three Paris-consistent scenarios in the modelling, as shown on page 41.

Nature based sequestration and technological removals will play an increasing role across all outlooks

Distribution of credits by type, three scenarios, 2020-2050



Source: EY Net Zero Centre Analysis

> Stricter regulatory requirements will reduce the space for voluntary carbon commitments and blur the current distinction between voluntary and compliance markets.

Governments will devolve their national commitments through stricter regulatory obligations on business

Tightening national emissions budgets will drive governments to impose more stringent regulatory requirements on businesses over time, particularly in advanced countries, driving multiple changes in credit markets and their application.

Stricter regulatory requirements will reduce the space for 'voluntary carbon commitments' and draw attention to using co-benefits as a point of differentiation between businesses. However, this is unlikely to prevent strong growth in the demand for credits, as net zero targets will continue to require offsets.

More fundamentally, tightening emissions budgets will blur the current distinction between voluntary and compliance markets for carbon credits, by increasing the need for businesses to use voluntary supply of high-integrity carbon credits (often created in other jurisdictions) to meet regulatory obligations, particularly after 2035.

This will create new challenges for registry functions. To maintain the integrity of the overall system, buyers and other stakeholders will want confidence that there is no double counting and that a credit generated by a project is only used once.

Accounting and acquittal arrangements will need to recognise the nature of different types of commitments and obligations. These include:

- Commitments by national governments, related to all emissions sources and sinks within their jurisdictions, adjusted for any trade or reallocation of entitlements between nations.
- Commitments by, and obligations of, businesses and other organisations in relation to their direct (Scope 1 and 2) emissions.
- Commitments by businesses and other organisations in relation to their supply chain (Scope 3) and total net emissions, which will often include Scope 1 and 2 emissions of other organisations or offsets created and sold by third parties.

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 to 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

The structure of carbon credit markets will be shaped by economic fundamentals, national governments and emerging international norms

Carbon credit supply chains and markets are not yet mature.

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 are sold through exchanges or 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.

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) 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

Economic fundamentals will drive efficiencies as credit volumes increase, but the pace and extent of change is uncertain

Over the medium term, we will see a shift towards well-functioning markets and supply chains, driven by competitive pressures and the imperative to increase supply. The types of credits available will become more standardised, including in relation to co-benefits. However, the pace of change is more uncertain for other aspects of the market, such as the relative roles of brokers versus exchanges, the outlook for registry services, and the emergence of risk management products.

Underlying network effects and economies of scale and scope suggest a central long-term role for large and efficient exchanges and a coherent global registry framework that connect globally-dispersed and diverse suppliers and buyers. This is in contrast with existing current highly-fragmented markets dominated by brokers and over the counter trade (OTC).

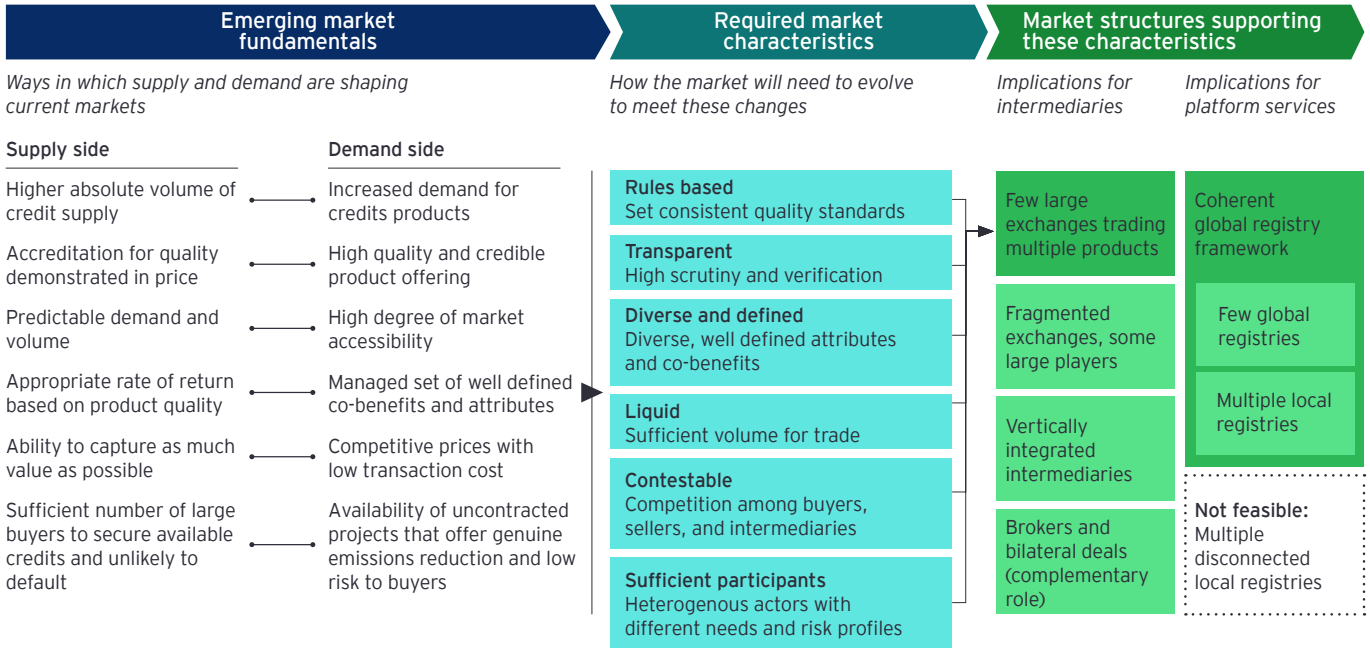
Market fundamentals are not the only force in play, however.

There is a risk that national governments will act to favour local markets (particularly registries) and constrain cross-board credit trading, increasing the costs and complexity of credit delivery.

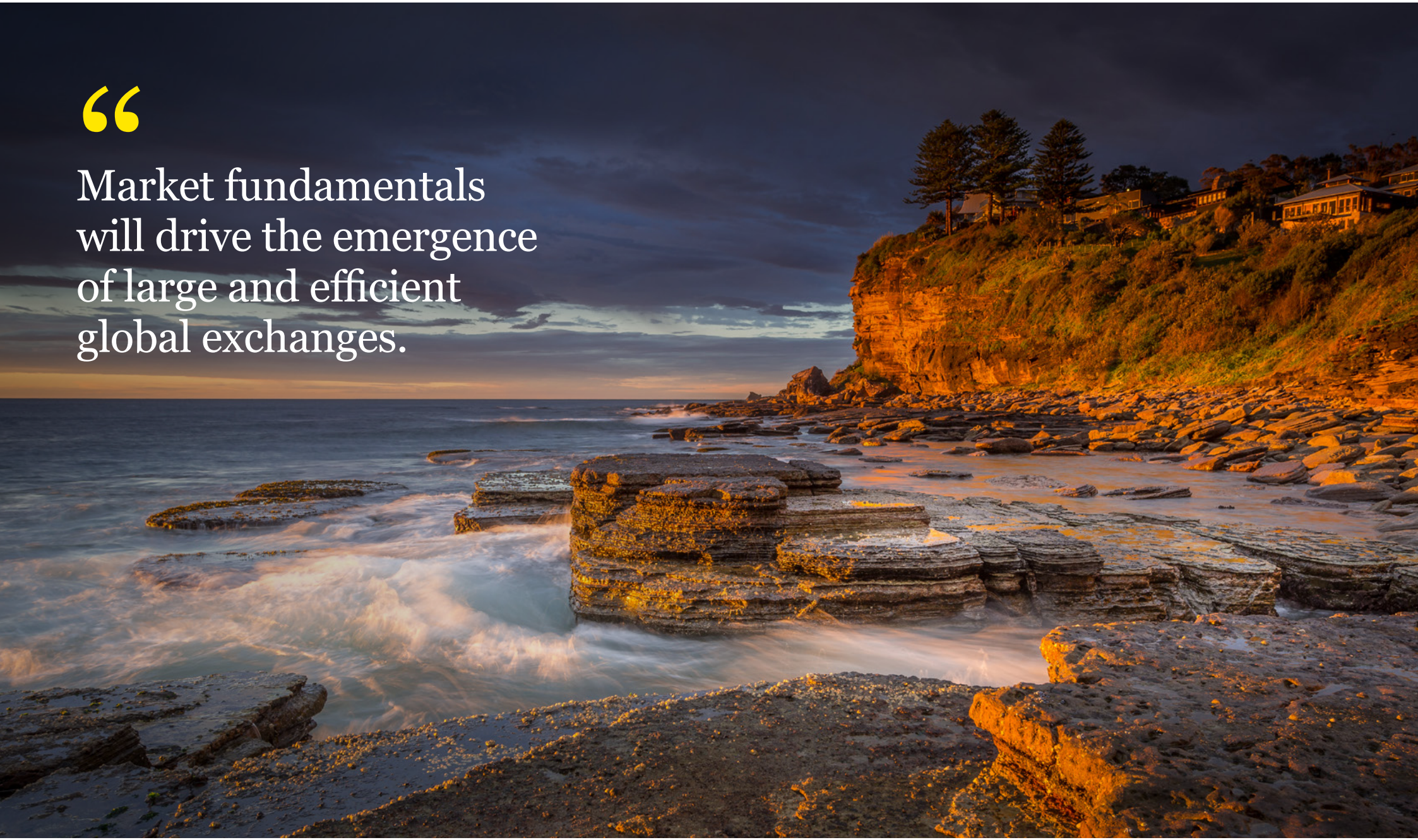
The combination of low credit volumes and ongoing uncertainties about demand, supply and prices also implies that markets may be slow to provide future price visibility and accessible risk management options for buyers and sellers. In the absence of market offerings to secure appropriate future supply and manage price risk, some buyers are likely to consider direct project participation to manage these material business risks.

Underlying supplier and buyer needs are likely to drive emergence of large and efficient exchanges and a coherent global registry framework

Key drivers of market evolution



Source: EY Net Zero Centre analysis



> Market fundamentals will drive the emergence of large and efficient global exchanges.

The balance of forces favours the emergence of more efficient markets, trading high integrity carbon credits through a small number of exchanges linked to multiple registries in a coherent global framework

The importance of competitively priced carbon credits to a large proportion of the business community will drive more efficient markets and supply chains, notwithstanding the likely actions of government and other actors. The shared interests of governments and international standards bodies will shape the landscape for registries, with national governments limiting the extent of global consolidation of registry functions.

This outcome will be driven by the mutual interests of businesses creating and suppling offset credits, and businesses buying and retiring these credits to meet a range of commitments and obligations.

Government actions, driven by perceived national interest and a degree of populism, will have significant impacts on registries (which are often intrinsically national, serving specific pieces of legislation). Governments' interest in harnessing gains from trade and accessing competitively priced supply to meet their own needs for offsets imply that they are less likely to impede efficient trade and exchange. They may, at times, overreact to potential abuse of market power.

Evolving international norms and standard-setting bodies will also shape market structure and outcomes. These actors, including task forces such as the Network for Greening the Financial System (NGFS), have a crucial role in establishing and communicating the case for action on climate change, translating scientific insights into actionable business programs, and articulating desirable coordination frameworks that harness and guide market behaviour.

We consider the balance of forces favours a small number of exchanges linked to multiple registries in a coherent global framework

Countervailing drivers of market structure

Likely market structure resulting from the interplay of these drivers

Market structure evolution

Drivers	Exchanges	Registries
Market drivers	**Few large exchanges** ▸ Economies of scale and scope drive high degrees of consolidation	**Large global registries** ▸ Default registry for each type of unit ▸ Neutral platform for service
International standards and norms	**Exchanges play central role** ▸ Emphasis on competitive and efficient supply ▸ High product fungibility and liquidity	**Coherent global framework** ▸ Meta standards for registries ▸ Clear processes for transferring units between registries
Government policy and regulation	**More fragmented, some larger players** ▸ Highly localised exchange model, diverting some trade ▸ Alignment around country specific products and requirements	**Multiple registries in global framework** ▸ Increasing fragmentation around compliance regimes ▸ Strong government control

Source: EY Net Zero Centre analysis

Engage:
Implications for business leaders and strategy

Climate transition risks are best managed through early engagement

Stakeholder expectations, competitive pressures and carbon management options are all evolving rapidly.

Each of these trends amplifies the risks and opportunities associated with transitioning to a low carbon future and heightens urgency for business leaders to engage and act.

Pressures from stakeholders will increase and expectations will escalate. The scale and scope of emissions reductions will increase, while time frames contract. The goals and perspectives of customers, investors and employees will vary. Government regulation will evolve, including around reporting and transparency. Physical climate variability and extreme events will intensify, creating different risks and opportunities across sectors and locations.

Business context will also change, as peers and competitors adapt and position.

New technologies will become cost competitive, and the toolkit for managing emissions and carbon risks will evolve. Carbon credits are an essential part of this toolkit, but credits will become increasingly scarce and expensive, with prices likely to rise to US$80-150 per tonne by 2035.

Tightening national emissions budgets will result in more stringent regulatory obligations and increasing demand for removal-based carbon credits (which are typically more expensive). Changes in technology and policy context will narrow the space for avoidance-based credits.

While we are confident about the evolution of many aspects of how carbon markets will evolve, outcomes will be shaped by multiple megatrends, making the future inherently uncertain.

Business leaders who engage early will be most likely 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.

In the face of the defining challenge of our generation, every business will be expected to make a positive contribution. And every leader will need a clear decarbonisation strategy which recognises the role of offsets to create value and support thriving businesses in a rapidly changing world.

Five steps to position and prosper through disruptive change

The EY Net Zero Centre analysis presented in this report points to multiple disruptions that will transform how each business should frame and implement its climate transformation.

Business around the world is changing gear, signalling much deeper and faster emissions reductions in the future. Market forces and regulation will drive improvements in the integrity and quality of carbon credits, boosting their credibility and perceived legitimacy. This, along with strongly rising demand, will see credits become scarce and expensive, with the price of carbon credits increasing more than three-fold to US$80 or more per tonne by 2035. This will dramatically impact what internal abatement options are financially attractive, accelerating the pace and ambition of internal action and abatement, and driving changes in business context through the positioning of competitors and substitutes. Carbon markets and the mix of credits supplied will continue to evolve.

The decades ahead will thus be very different to previous years.

Business leaders who engage early will be most likely to achieve a successful climate transition.

We suggest business leaders consider the following five steps to position for disruptive change and the opportunities and challenges it will bring.

We provide more specific advice on developing a climate and energy transition strategy, including the role of carbon credits on pages 17,18 and 23-36 of this report.

01 **Act now to create options and manage risks**

What early actions would provide non-carbon benefits as well as reduce your carbon risks? Where might you gain confidence or insight through learning-by-doing? How might you gain an advantage over your peers and competitors?

02 **Review your long-term strategy**

What are the implications of your stakeholder pressures, emissions intensity, and opportunity space for strategy and positioning? Is your strategy robust to a range of carbon credit price trajectories?

03 **Identify potential tipping points for pressures and opportunities**

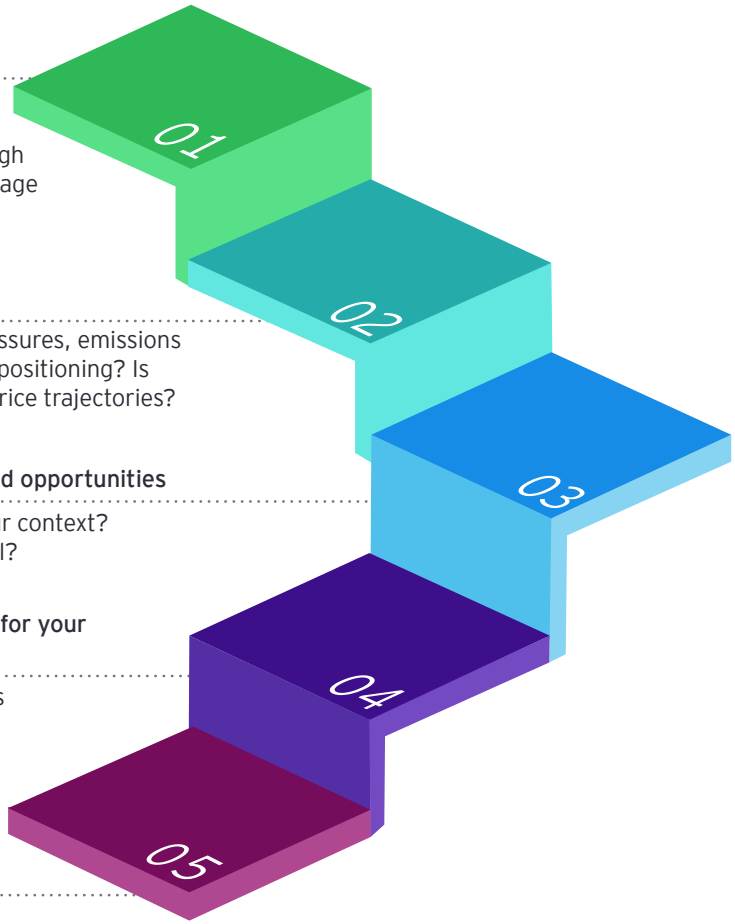
What swift shifts or surprises could transform your context? What new technology options would move the dial?

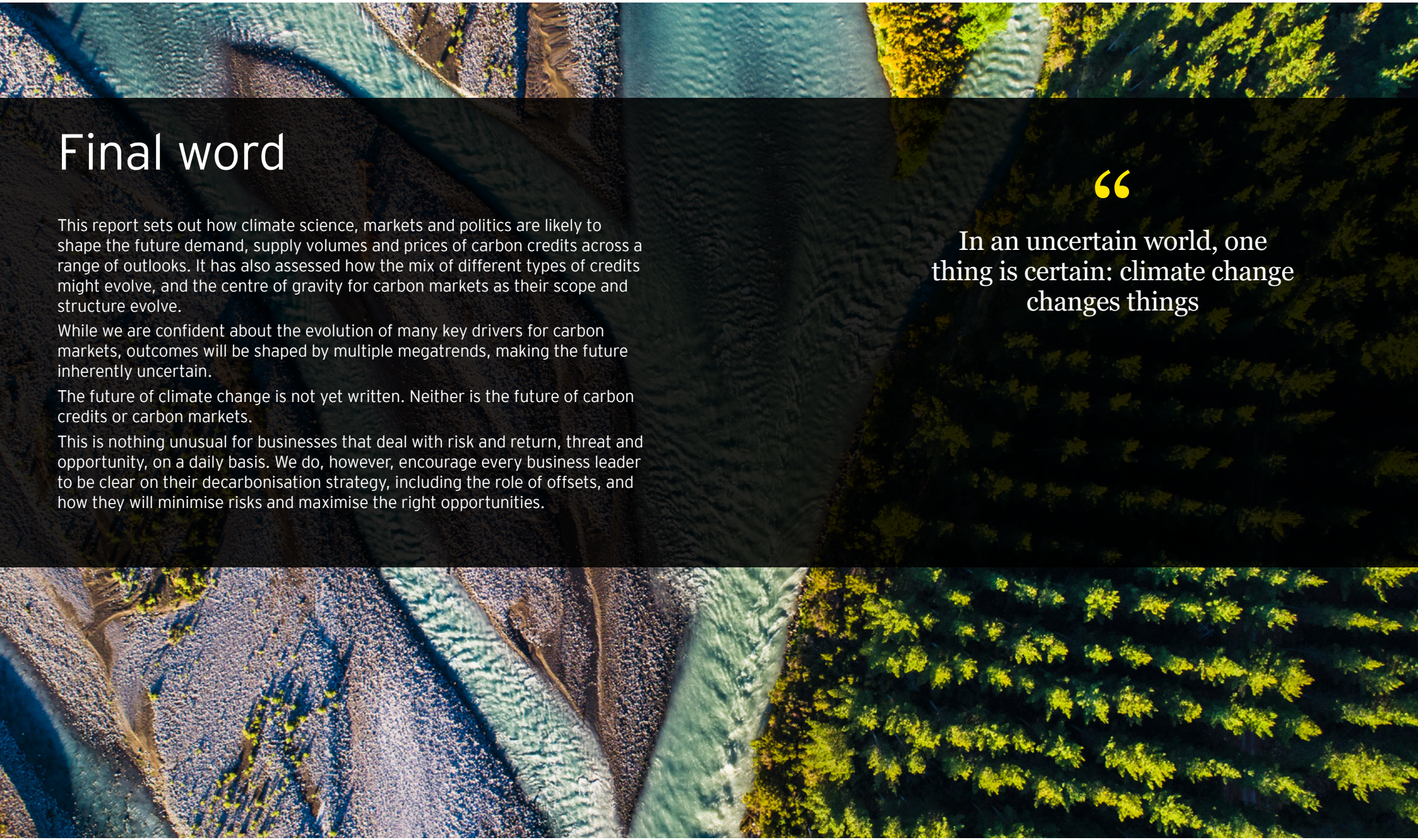
04 **Articulate several distinctive value propositions for your company in 2030-35**

What could be your distinctive offer? What factors would give weight to one option over another? How would these long-term value propositions be implemented and delivered?

05 **Act now to create options and manage risks**

What early actions would provide non-carbon benefits as well as reduce your carbon risks? Where might you gain confidence or insight through learning-by-doing? How might you gain an advantage over your peers and competitors?





Final word

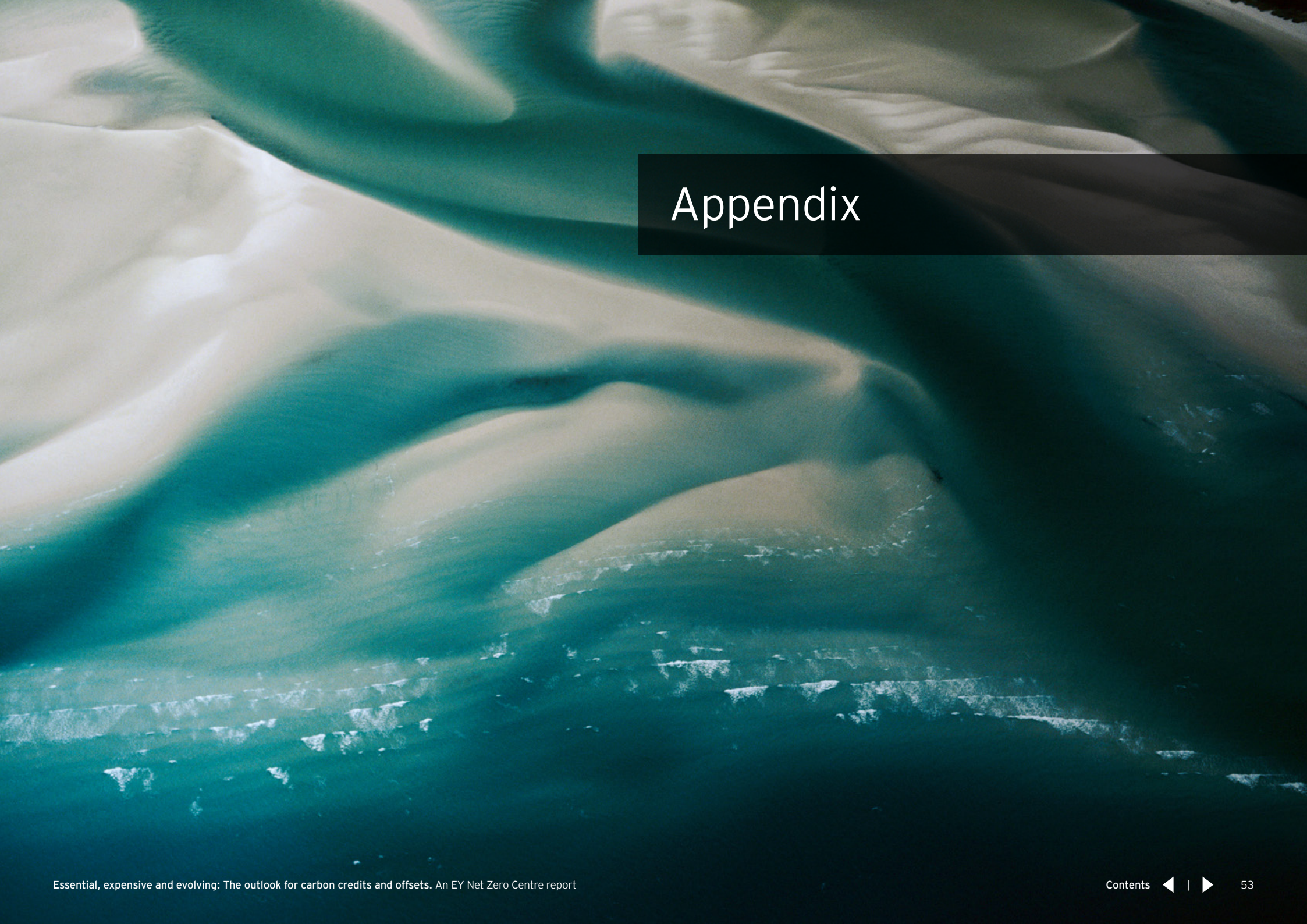
This report sets out how climate science, markets and politics are likely to shape the future demand, supply volumes and prices of carbon credits across a range of outlooks. It has also assessed how the mix of different types of credits might evolve, and the centre of gravity for carbon markets as their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

While we are confident about the evolution of many key drivers for carbon markets, outcomes will be shaped by multiple megatrends, making the future inherently uncertain.

The future of climate change is not yet written. Neither is the future of carbon credits or carbon markets.

This is nothing unusual for businesses that deal with risk and return, threat and opportunity, on a daily basis. We do, however, encourage every business leader to be clear on their decarbonisation strategy, including the role of offsets, and how they will minimise risks and maximise the right opportunities.

> “In an uncertain world, one thing is certain: climate change changes things



Appendix

Carbon credit modelling framework

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 55 shows the global abatement cost curve in 2022, 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

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 (NGFS 2021, Bertram et al 2021).

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 uncertainness 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

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

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

Method

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

Outputs

Show price outcomes:

- Price outlook for offsets
- Avoided cost of internal abatement

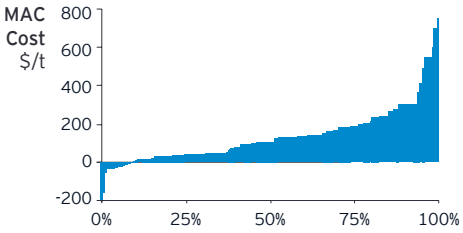
Supply-side outcomes:

- Issuances, retirements, and inventory
- Composition of offset supply by type, method and project region

Demand-side outcomes:

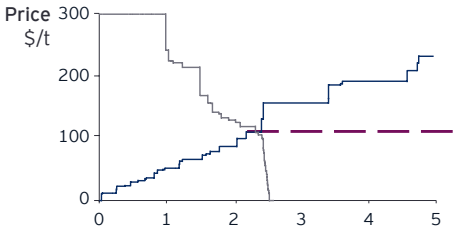
- Emission reduction trajectories and relative spending on emissions reductions by sector

Example: marginal abatement costs in 2034



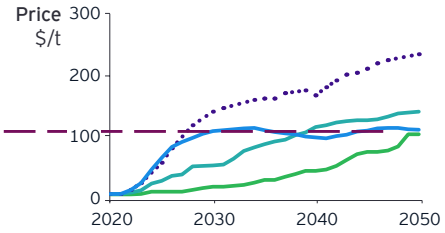
Share of Emissions; Percent

Example: market clearing price in 2035



Quantity; Gt-CO2e

Example: market clearing price in 2020-2050

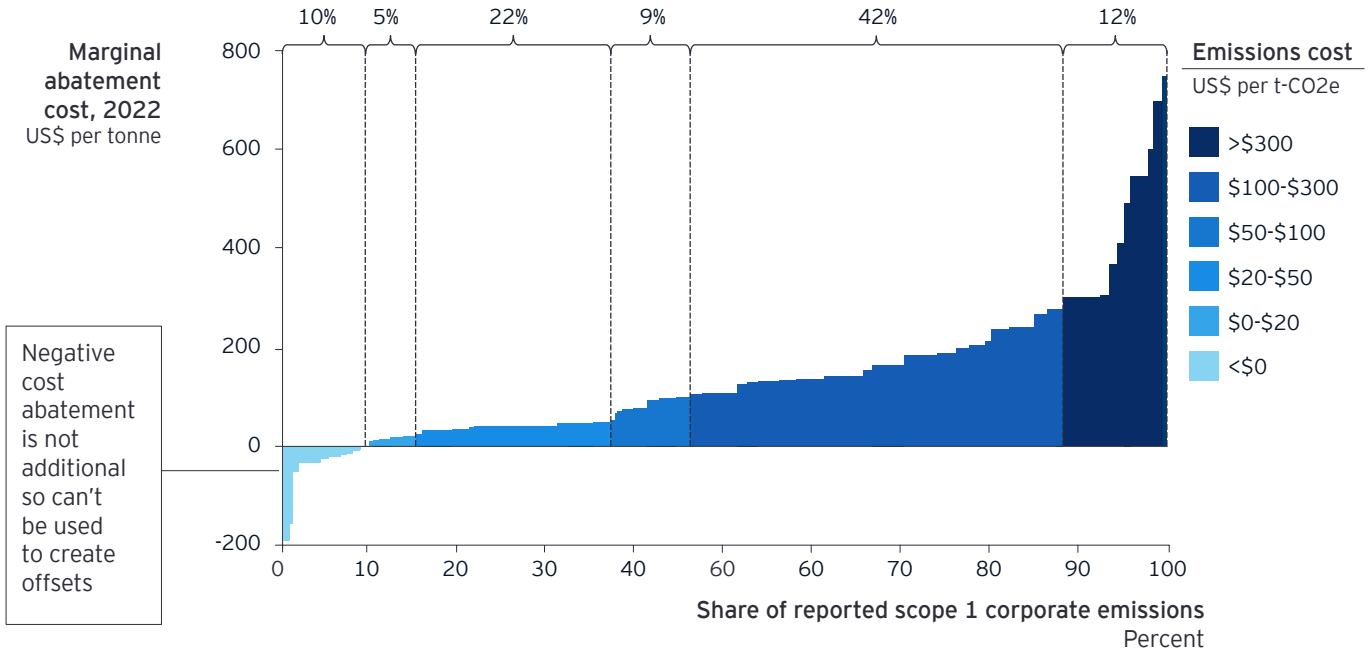


Source: EY Net Zero Centre analysis

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.

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

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About the EY Net Zero Centre

The EY Net Zero Centre brings together EY's strategic insight, expertise, intellectual property and deep knowledge in energy and climate change leadership to solve the big problems ahead as we move towards net zero emissions by 2050.

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