Coalition for
Negative Emissions

Delivering the 'Net' in Net Zero

The Route to Delivering the Negative Emissions Market

MARCH 2022

Produced by the Coalition for Negative Emissions
The Coalition for Negative Emissions is responsible for the conclusions and recommendations of the research.

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Our Purpose

Our Purpose

The Coalition for Negative Emissions (CNE) is a growing industry body of negative emissions project developers, potential CO_2 capturers, companies who may look to purchase negative emissions to mitigate their emissions, and companies critical to the supply chain, as well as other industry supporters. Our members are aligned with the aim of accelerating the development of a negative emissions market.

We commonly agree:

1. All businesses must have a clear plan to reduce carbon emissions and decarbonise their operations.
2. To stay within the Paris Agreement target of less than 1.5 degrees of global warming will require not only huge reductions in emissions in the next decade, but also substantial negative emissions which deliver permanent carbon removals for areas that are prohibitively expensive or impossible to decarbonise quickly.
3. Investing in negative emissions will allow visionary companies to become either carbon neutral or net negative within the next decade and allow companies with impossible-to-reduce emissions to become carbon neutral.
4. Private sector participation in negative emissions markets will help provide the funding to ramp up the infrastructure needed to deliver permanent carbon removals.
5. Companies have a crucial role to play in meeting carbon targets: the more companies that invest in negative emissions to achieve their Net Zero targets early and proactively, the greater the likelihood we have of staying within 1.5 degrees.
6. Investors need the confidence that carbon removals are high quality, verifiable, permanent, and additional.
7. Robust standards and business models are needed to underpin this developing market.

The purpose and benefits of the Coalition are to bring together a growing industry, to expand interest in the sector, and to make it easy for members to understand and have confidence in the negative emissions market. The Coalition will also give clear business perspectives to governments, regulators, and standard setters to help develop a large and reliable market in carbon removals.

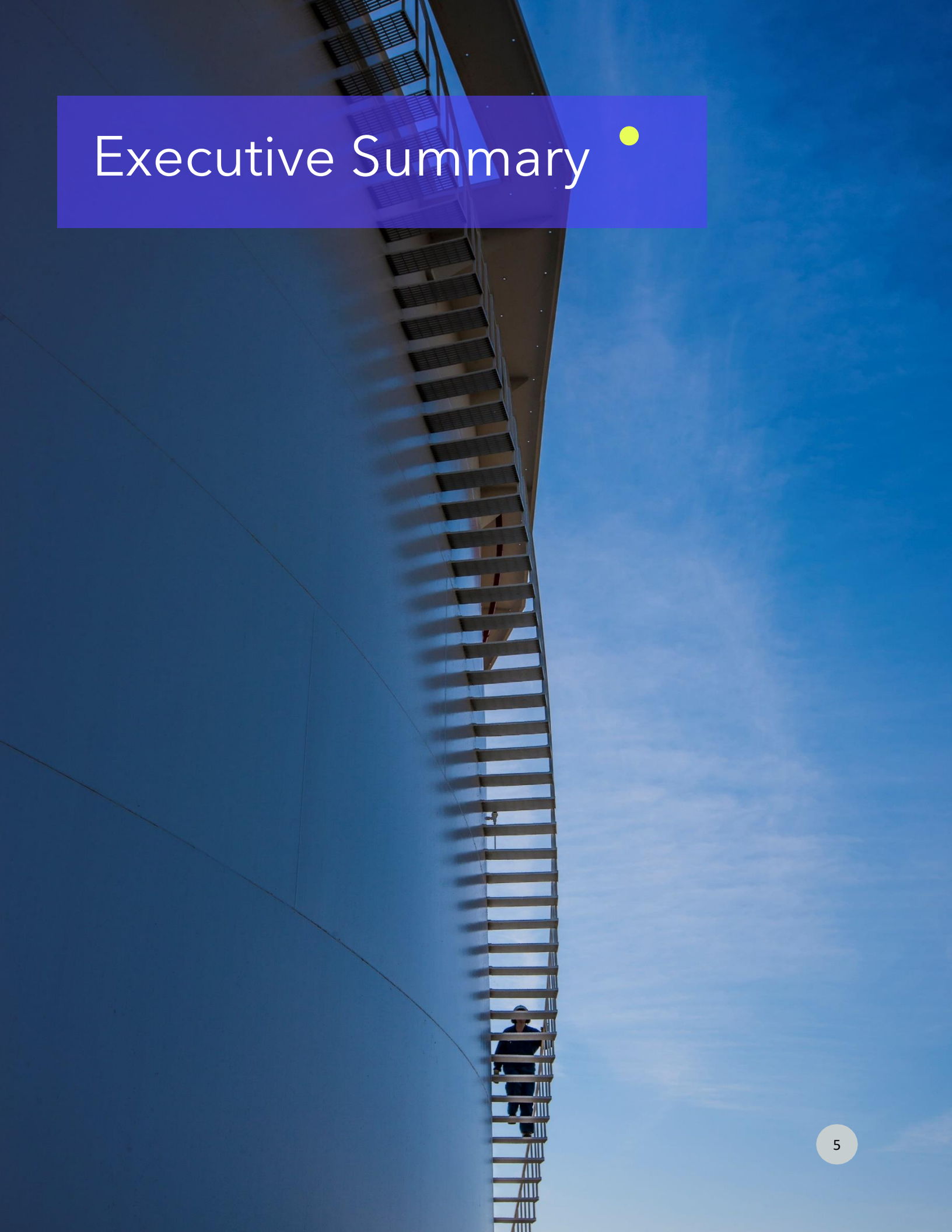
The Coalition has set clear objectives for 2022 to foster alignment of views between members and to increase its effectiveness:

- Widen our membership to attract a broader set of companies who are committed to achieving carbon neutrality and recognise negative emissions are essential to delivering and accelerating their path to full decarbonisation
- Deliver industry recommendations on emerging global standards and monitoring
- Deliver recommendations on a range of business models, both private and public, to underpin the global market's development

Because the status of carbon removals and associated policy are changing rapidly, the Coalition will continue to review and evolve these objectives. Our aim is to continue to focus on areas where our members can contribute the most to the development of the market.

This paper introduces the sector and describes the urgent need to develop a robust negative emissions market and gives prospective members a detailed outline of our priorities as well as the benefits of membership. The paper builds on the landmark Coalition report, The Case for Negative Emissions, released in June 2021, which was produced in conjunction with McKinsey. The Coalition's 2022 objectives align with the longer-term market objectives outlined in that full report (see "Five Substantive Actions" page 105 of the report). More information is available on the Coalition website.

Executive Summary



Executive Summary

> *There is a clear consensus around the need to develop a global CO_2 'negative emissions' (NE) industry that delivers permanent carbon removals to balance emissions from hard-to-abate industries, stabilise global CO_2 levels, and address historic emissions. Recent forecasts from the Intergovernmental Panel on Climate Change (IPCC), which cast doubt on our ability to remain within the Paris target of 1.5 degrees global warming, add to the urgency to develop the negative emissions market as one of the few ways we can stay within those climate ambitions when coupled with robust emissions reduction programmes.[1] In recent forecasts, the IPCC state that engineered removals of CO_2 may need to range from 3,500 to 16,000 metric tons of carbon dioxide equivalent ($MtCO_2e$) a year by 2050.*

At either end of that envelope, negative emissions need to scale up significantly, and that process needs to start now. Technologies to deliver negative emissions do exist, and their costs will fall materially through investment, scale, and R&D. But currently, the biggest barriers to deploying engineered removals are commercial and financial, where we lack the business models, agreed standards, regulations, and demand from confident purchasers or governments to underpin a nascent market.

Despite these constraints, it is encouraging to see the UK Government supporting the negative emissions industry by enabling CO_2 transport and storage networks; funding early innovation projects; developing the bioenergy with carbon capture and storage (BECCS) business model; exploring the inclusion of negative emissions in the UK emissions trading scheme (ETS); contributing to the monitoring, reporting and verification of greenhouse gas (GHG) removals; and developing the Voluntary Carbon Market initiative, which are all discussed in this paper. In addition, several governments and regional partnerships have signalled their long-term support for negative emissions, including:

- The UK Government's ambition to deploying at least 5 million tonnes per annum (mpta) of engineered removals by 2030.
- The European Union's ambition to deploy at least 5 mtpa of negative emissions by 2030.

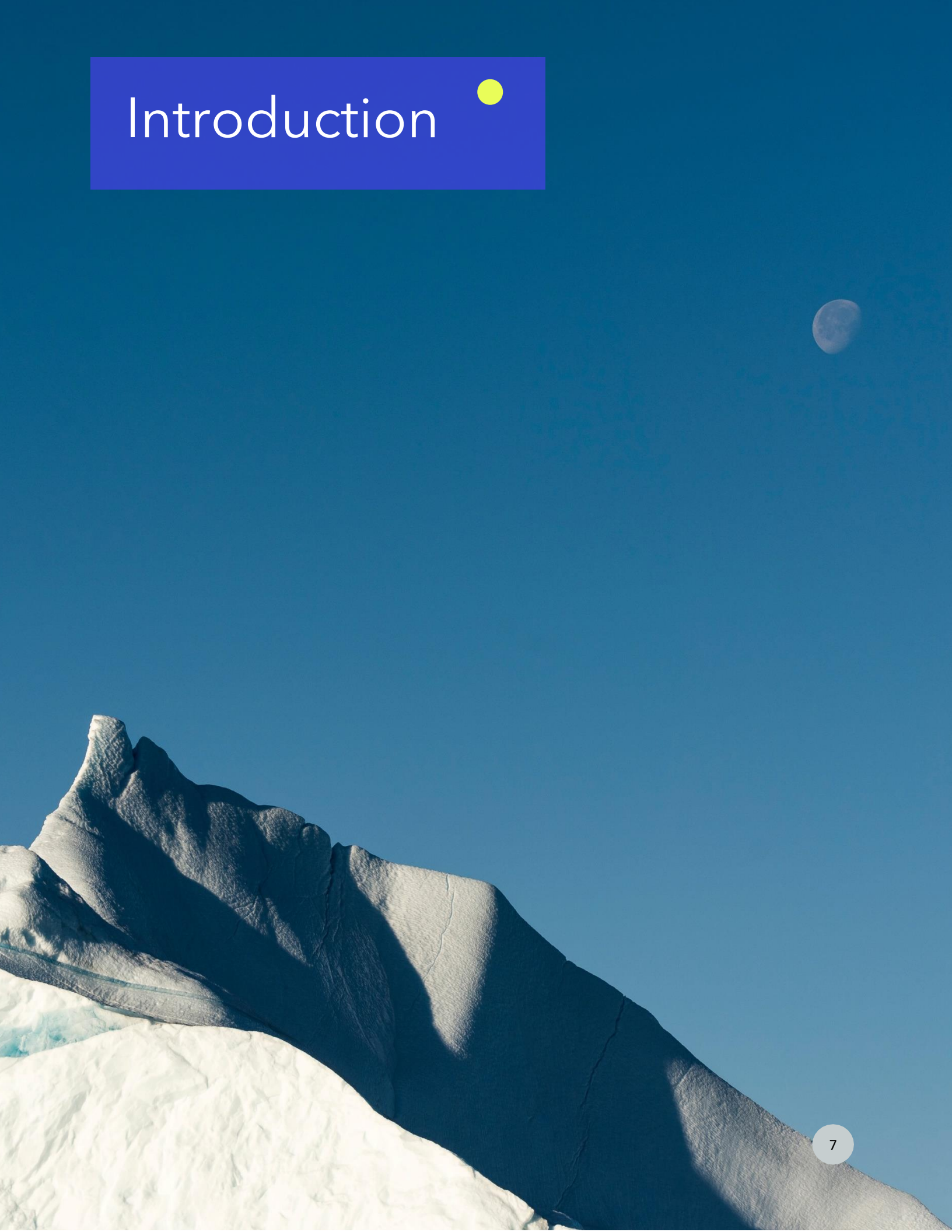
To facilitate further progress, the Coalition aims to give insight to its members across a complex and fast evolving sector, while contributing to the development of the industry and giving an industry perspective and voice on developing standards, regulations, and business models, as well as championing new projects to create a global market for negative emissions. The Coalition welcomes the opportunity to work closely with the government and regulators on the development of the framework and models to support the industry.

This paper is written for prospective Coalition members and those interested in the sector. In the following pages, the Coalition outlines:

1. The urgent need to accelerate a robust negative emissions market;
2. Three pillars of support required, i.e., voluntary, regulated and government-supported markets;
3. Challenges to scale the negative emissions markets; and
4. The role of the Coalition in navigating global initiatives, regulations, and standards, and providing industry insight.

[1] "Climate change is a threat to human well-being and planetary health. Any further delay in concerted anticipatory global action on adaptation and mitigation will miss a brief and rapidly closing window of opportunity to secure a liveable and sustainable future for all." IPCC Climate Change 2022 Report

Introduction

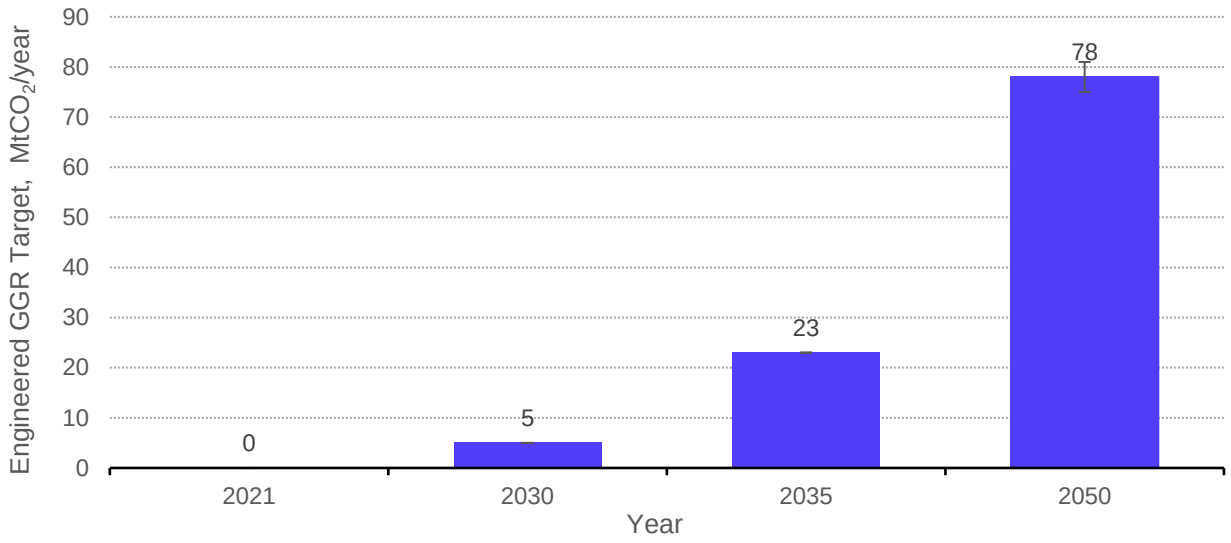


Introduction

> *At the international level, there is a growing acceptance of the need for negative emissions as an essential tool for achieving our climate targets, alongside emissions reduction. While the primary focus must be to ensure that existing emissions fall, a well-developed negative emissions market will be essential to meeting Net Zero targets and enabling corporations and countries to go net negative. It also creates the foundation of a market that can be quickly accelerated if society is unable to meet reduction targets elsewhere. This explains the very wide range the IPCC gives to this market's potential.*

In this context, both the support of the National Infrastructure Commission in their reports on engineered GHG removals and the 2022 infrastructure progress review, as well as the UK Government's ambition to deliver negative emissions as set out in the Net Zero Strategy, are welcomed first steps. [1] [2] The negative emissions targets implicit in the UK Net Zero Strategy are shown below.

Engineered GGR to balance residual emissions to achieve Net Zero (Figure 1)



This paper considers the benefits of negative emissions, why there is an urgent need to accelerate the development of the negative emissions market and a swathe of technologies within it, the three pillars of market development – the voluntary, regulated and government-supported markets – and the role throughout that the Coalition will play in helping their development.

1 https://nic.org.uk/studies-reports/greenhouse-gas-removals/engineered-greenhouse-gas-removals/

2 https://www.gov.uk/government/publications/net-zero-strategy

About Negative Emissions

> *Negative emissions are created when carbon dioxide is extracted from the atmosphere, using nature- or technology-based capture methods, and stored permanently, leading to a net reduction in atmospheric CO_2. This goes beyond just the reduction in CO_2-emitting activity, which is only ever carbon neutral at best.*

As outlined in our report, The Case for Negative Emissions released in June 2021, negative emissions include:

- **Natural Climate Solutions/Nature Based removals (NCS)** - restoring or improving ecosystems to remove CO_2 from the atmosphere. These may involve afforestation, habitat restoration, and soil sequestration. NCS typically involve not just carbon dioxide removal, but a wider range of environmental benefits, including enhancing biodiversity and flood risk mitigation, such as through the expansion of mangrove swamps. NCS deliver carbon removals in the land use, land-use change, and forestry (LULUCF) sector.
- **Bioenergy with Carbon Capture and Storage (BECCS)** - technologies that use organic material (which have captured carbon dioxide as they grow) to produce electricity, biofuel, heat, or hydrogen, where the carbon dioxide produced in the process is captured and permanently stored. BECCS projects may use biomass residues or wastes from agriculture or forestry, or purpose-grown biomass feedstocks. Alternatively, in the example of Energy from Waste plants with CCS, typically 50 percent of the CO_2 produced in incineration is from biogenic sources and therefore deliver negative emissions.
- **Direct Air Carbon Capture and Storage (DACS) -** technologies that pass air through a filter where chemicals (such as amines and sodium hydroxide) capture carbon dioxide from the air, which is then stored.

With NCS, the captured CO_2 is stored either in the plants themselves or in the soil. With BECCS and DACS, the CO_2 is typically geologically stored, such as in depleted gas fields, saline aquifers, or increasingly permanently stored within new carbon products like carbon-enhanced cement.

The common feature is they all lead to an actual reduction in CO_2 in the atmosphere, creating negative emissions that compensate for those sectors that cannot decarbonise at pace, stabilising CO_2 emissions, and addressing historic carbon emissions. They represent the 'net' in achieving a government's 'Net Zero' target.

The huge challenges to achieve our global goal of limiting climate change to 1.5 degrees means we will need a diverse and global negative emissions industry. Previous analysis by the Coalition suggests as much as 10 gigatonnes of negative emissions could be required mitigate the worst impacts of climate change. The speed at which the industry develops, with support from the public and private sectors, will ultimately determine whether we have any hope of meeting those climate goals.

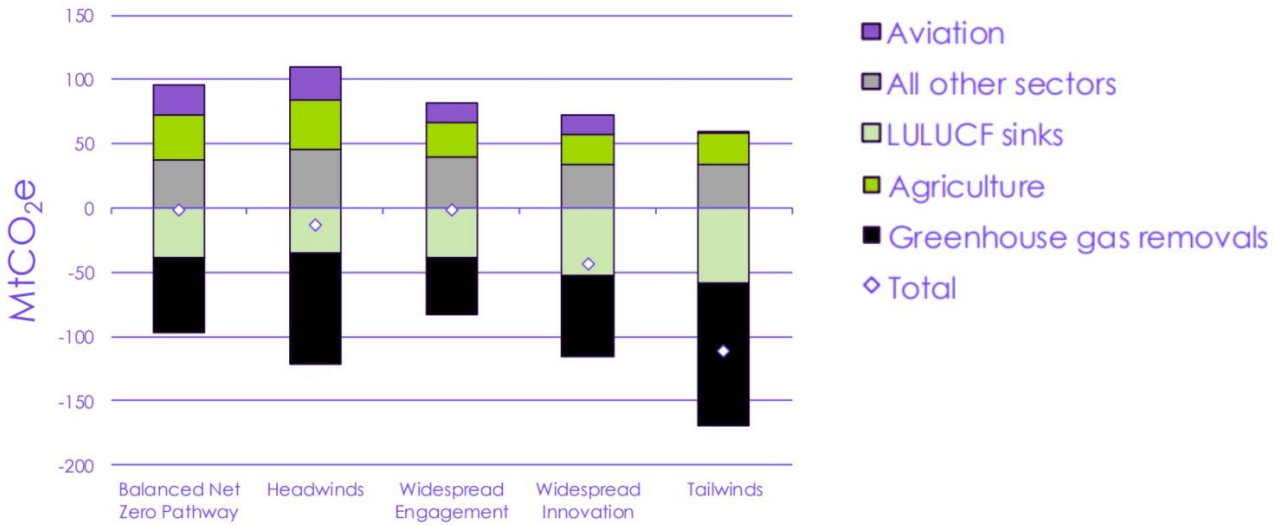
The Coalition represents a broad alliance of capturers across both nature-based and technological solutions, as well as companies integral to the supply chain, and a growing number of potential purchasers looking to buy high-quality carbon removals and invest in negative emission projects to accelerate their path to zero or even net negative emissions.

What are the benefits of Negative Emissions?

- **They are negative –** Negative emissions are the only means of reducing CO_2 that is already in the atmosphere.
- **They support clean growth and levelling up** – Previous analysis from the Coalition indicates that the negative emissions could create four to 10 million new jobs and safeguard existing roles in hard-to-decarbonise industries.
- **They compensate for unavoidable emissions** – key sectors like agriculture, cement, and aviation will be technically difficult or uneconomic to decarbonise at a pace compatible with the 1.5-degree target. The ability of companies in these sectors to purchase compensating negative emissions will be the only way for those sectors to achieve carbon neutrality in the near term.

The following scenarios in the 2020 UK Climate Change Committee's advice to government on the Sixth Carbon Budget[3] show how they envisage several sectors will have residual emissions, even in 2050. For the UK to achieve its Net Zero commitment, negative emissions are required (shown in the table below in its two forms of natural climate solutions (NCS), and land use change and forestry (LULCF) and engineered greenhouse gas removals (BECCS and DACS)).

Emissions scenarios for 2050 are most sensitive to the balance of action across aviation, agriculture, LULUCF and greenhouse gas removals (Figure 2)



- **They allow net negative ambition –** Both companies and, critically, governments can increase their climate ambitions. Without significant global progress on emissions reductions, our 1.5-degree maximum global warming ambition may soon become untenable, with the recent IPCC report forecasting it will be exceeded by 2040 on the current trajectory. Negative emissions could allow particularly the richest countries, who have contributed the most to cumulative emissions, to increase their targets to be net negative, or accelerate the date by which they can achieve Net Zero through more immediate removals and enable companies (and countries) to address their historic emissions. For instance, should the UK achieve the CCC's highest estimate of negative emissions of 170 Mtpa by 2050, it might actually achieve Net Zero five years earlier. **Similarly, a deep negative emissions market will allow leading companies to achieve carbon neutrality or become net negative within this decade; a key target for the Coalition.**

- **Negative emissions can minimize the cost of decarbonisation and promote a just transition –** By allowing sectors that are difficult to decarbonise the option to mitigate their climate impacts, this provides time to innovate and transition to low-carbon technologies whilst remaining affordable in the interim. This is particularly key for the aviation sector due to the long lead-times and limited availability of new low-carbon technologies, which could fully mitigate its residual emissions through negative emissions from DACS, at a lower cost to passengers and wider society.
- **Projects can become self-funding –** The revenue from companies purchasing negative emissions will fund new projects sustainably, without the need for ongoing government support.
- **Negative emissions deliver optionality –** As Figure 2 demonstrates, negative emissions are the necessary balancing figure to meet carbon reduction targets; the level we will ultimately need will depend on the progress of decarbonisation elsewhere in the economy. It is important that the negative emissions industry is well developed early, so it has a low-cost base and can be rapidly scaled up to compensate where and when other sectors are slow to decarbonise.

> Near-term actions that limit global warming to close to 1.5°C would substantially reduce projected losses and damages
>
> **IPCC Climate Change 2022 Report**

UK and US leadership in developing negative emissions markets

The IPCC has recommended all countries include negative emissions targets in their climate targets, thereby committing countries to CO_2 reduction and CO_2 removal; the negative emissions market needs to be developed on a global scale to have any material contribution to meeting climate targets. The EU has a similar interest, with the Commission setting an aspirational target of 5Mt of CO2 per year to be removed and permanently stored through front-runner projects by 2030.

Despite this global imperative, there is both a moral case for the United Kingdom and the United States to take the lead in developing the market, given their historic emissions, but also practical reasons why these two markets might be at the forefront. As such, the initial phase of the Coalition, as well as its growing membership, will focus on these markets, while working with complementary groups and initiatives globally.

The UK has already announced negative emissions targets and is a natural area to champion the development of a negative emissions market because of its:

- Natural availability of storage
- Proven leadership in the regulatory and concession models, which will be needed to underpin the sector's growth
- Leading centre of carbon markets and green finance – both in the legal and financial sectors
- Strong global assurance and audit firms' presence to drive the development of the assurance
- Regime required to underpin the integrity of the sector
- Underlying assets (e.g., power plants, energy from waste facilities) which are already developed and can link to CCS facilities to store CO_2
- Strong links into Europe and a similar EU Emissions Trading Scheme

Likewise, the United States has the potential to become a hugely influential contributor to the development of the negative emissions market because of its:

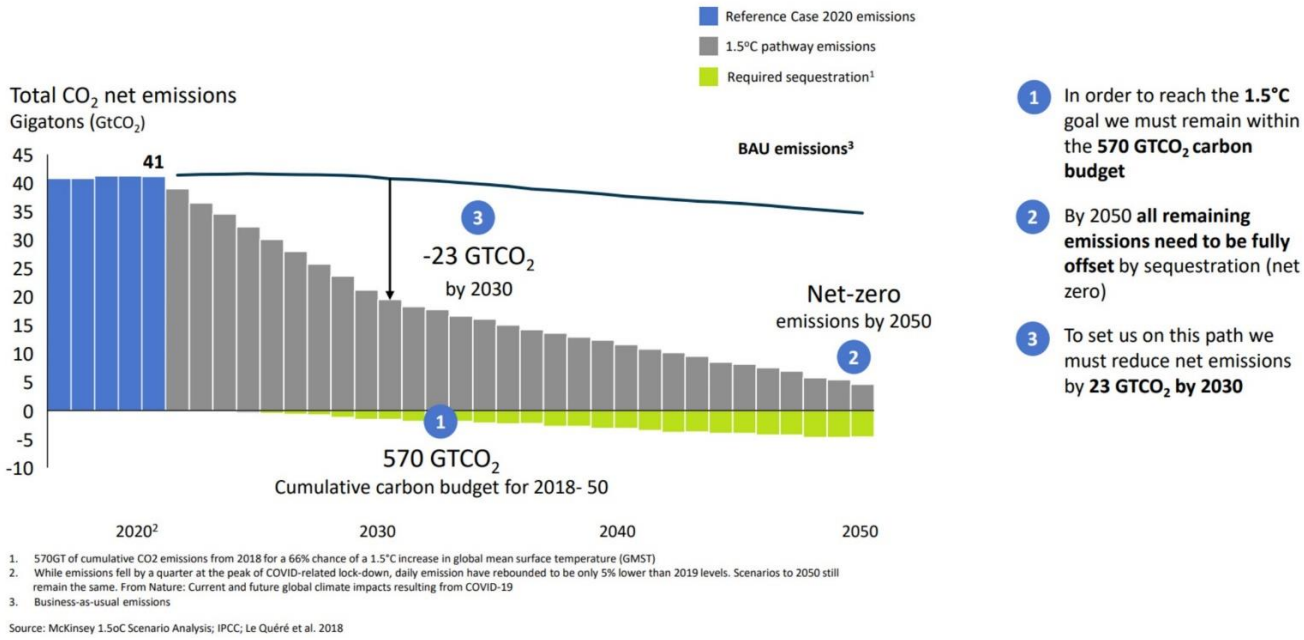
- Existing commitment to reduce the cost of carbon removal and storage to less than $100/net metric ton of CO_2e through its Carbon Negative EarthShot
- Position as centre for developing wider carbon markets, including the trading of carbon instruments
- Tax-based approaches, which support investment into CCS, and regulatory interventions that encourage negative emissions investment (in contrast to the UK concession model approach)
- World's leading corporates – making the US the obvious first centre for the development of corporate demand for negative emissions in the voluntary and regulated markets (discussed below)

While longer term, the aspiration of the Coalition is to see a global market for negative emissions, an initial focus on membership and workstreams in the US and UK markets will help to give focus and set useful precedents to share globally.

Urgency – the pressing need for a negative emissions market

Figure 3 from a recent report of the Taskforce for Scaling Voluntary Carbon Markets shows the scale of emissions reductions needed to achieve a 1.5-degree pathway and also the growing and significant removals that must be made by negative emissions ('required sequestration').

Pathway emissions (Figure 3)



In this ambitious reduction scenario, negative emissions will still need to exceed 5 $GtCO_2$ by 2050, which is over 10 percent of current global emissions. In the likely event that global emission targets are not met or are slow to implement, only a further ramp up of negative emissions will keep us within the 1.5-degree pathway.

While the primary focus must be to ensure that existing emissions fall from 41 $GtCO_2$pa today to circa 5 $GtCO_2$pa by 2050, we will need a huge negative emissions industry, which will take several decades to establish at this scale. **This cannot be left to 2050.**

For instance, the Science-Based Targets Initiative, which is one standard for assessing corporate climate action that prioritises reductions in gross emissions reductions, emphasizes a key role for negative technologies. In their 2021 Corporate Net-Zero Standard Report, they accept 10 percent of reductions from negative emissions solutions to meet Net Zero goals in 2050.

The Coalition believes removals are a necessary and parallel addition to reductions in gross emissions. As the World Economic Forum stated in their Net-Zero to Net-Negative white paper, **"Removals are a complement to deep emission cuts, not a replacement for them."**

Negative emissions should not be afterthought, and we need to start now to enable the market grow to the size and scale needed to meet our mid-century targets. As long as a company has a plan for its emissions reduction, it should also start on its negative emissions. The sooner we start developing the negative emissions market, the more likely we are to meet 1.5-degrees.

In the UK alone, 60-170 $MtCO_2$ of engineered removals are likely to be needed per year by 2050 to meet Net Zero. Even by 2035, around 15-25 $MtCO_2$ of removals may be needed to meet the Sixth Carbon Budget, according to analysis from the Climate Change Committee.

The size and scale of negative emissions needed means the industry has to start now. There is an urgent need to develop standards and measurements to ensure integrity and have clear regulatory pathways that will underpin demand for negative emissions.

Early support will allow R&D into new technologies and cost reduction in existing ones through:

- Reductions in construction costs through learning by doing and investment;
- Economies of scale as supply chains develop;
- Development of competitive markets; and
- Lower finance costs as the risks of negative emissions industries become familiar.

> Government should ensure that there will be a portfolio of engineered removals providers by 2030 that includes both direct air carbon capture and storage and bioenergy with carbon capture and storage
>
> **The UK's National Infrastructure Commission 2021**

Building on existing industries will be key to delivering negative emissions. We have a plethora of hard-to-abate sectors which will need negative emissions to reduce their environmental impact. It will be important not to disregard these current industries and systems, but instead build upon them.

By way of example, sustained government support and private sector investment into developing windfarm technologies has led to a huge reduction in their cost; so much so that they have transformed from an expensive form of generation to being competitive with fossil fuel energy production.

We need to repeat the same success story for the negative emissions market, with sustained support to create a highly competitive, low-cost industry. It took over 15 years to embed these economies in the wind sector. Following a similar path for major negative emissions projects, with first plants perhaps in 2025, it could be well into the 2040's before the industry is at its most competitive.

There are a wide range of technologies and industries that need to develop to deliver negative emissions:

- Some of these technologies are available for deployment now, but business models and funding are not yet in place to support investment. We must start those industries down the path of scale and cost reduction;
- Natural climate solutions (NCS) are available now. The key issue to overcome is the question of permanence. Standards and monitoring regimes are needed to give purchasers confidence in the integrity and lower the risk of reversibility of NCS projects; and
- Some technologies are not well developed and are currently expensive. Support mechanisms are needed to fund these technologies in their development stage, as they look to reduce costs through innovation and scale and as increasing carbon prices makes them more competitive.

The Coalition for Negative Emissions has an important role to play in accelerating the development of the negative emissions sector. As a focal point for purchasers, capturers, the supply chain, and public bodies, it will help industry navigate through this complex area, and act as a platform to both understand and input into a complex and evolving sector. By bringing together the industry and widening the interest in and commitment to negative emissions, it will look to help establish a market, increase corporate investment into negative emissions as companies look to deliver on their decarbonisation commitments, and encourage investment in a range of negative emissions technologies.

Three Pillars of Support

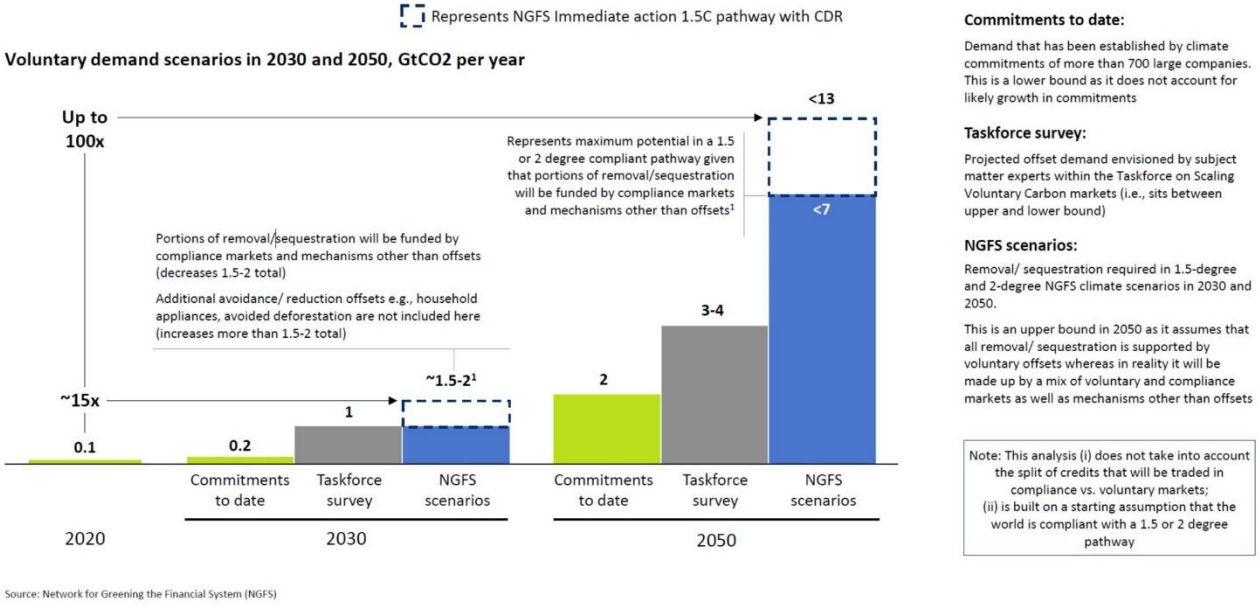
Three Pillars of Support

Support for the development of the negative emissions industry is needed from three key areas:

1. **Voluntary market** – a growing number of companies and investors are looking to buy high-integrity carbon removal credits to meet their own Net Zero targets. They will purchase carbon credits from projects that demonstrate high integrity, long-duration carbon removal;
2. **Government-supported market** – grant funding or long-term concessions will underpin early negative emissions investment where the negative emissions price alone is not high enough to underpin investment, or where less competitive technologies currently need support, e.g., a long-term concession to underpin investment in a DACS project; and
3. **Regulated/compliance market** – as negative emissions become accepted in regulation as an additional method through which companies can meet their emission reductions targets faster or compensate for emissions that are impossible to remove. They should be willing to pay up to their avoided regulatory/tax costs, or possibly higher if they want to both offset regulatory commitments and deliver on more exacting corporate decarbonisation targets.

The benefit of the **voluntary market** is that it is already underway. Companies are already looking for carbon removals to help achieve their decarbonisation targets, and efforts are already underway to develop the standards around integrity, additionality, and permanence of those negative emissions, which will benefit and are applicable to all three markets. Each will need to have common elements to ensure all three pillars can be used to support negative emissions.

Voluntary demand scenarios (Figure 4)



Source: Network for Greening the Financial System (NGFS)

The Taskforce for Scaling Voluntary Carbon Markets (whose remit considers voluntary emission reductions as well as negative emissions removals) foresee a negative emissions market of $30-50bn by 2030 alone, assuming demand of 1-2 Gt CO_2, with potential supply of 3 Gt from nature-based solutions or 1-3.5 Gt from BECCS and DACS.

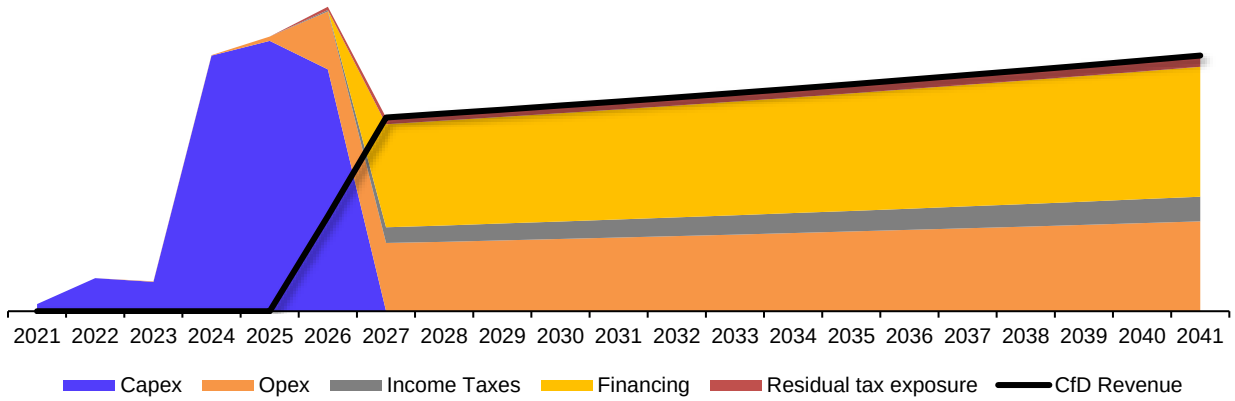
Around 30 percent of the Fortune 500 companies have made climate commitments to 2030, and there is potential demand for negative emissions from more than 700 of the world's largest companies whose emissions account for 20 percent of global emissions. The demand can be rapidly increased if the market fundamentals are in place.

Figure 4 highlights the potential range of negative emission demand from the voluntary sector according to different forecasts. However, ultimately the voluntary sector size will be limited by the propensity of corporates to pay to deliver their decarbonisation goals above any regulatory requirements that may be imposed on them.

In the near term, a **government-supported market** will be needed for the initial deployment of a portfolio of engineered removals, using policy mechanisms to bring providers to commercial readiness.

Figure 5 below is illustrative of a possible concession structure to support investment in BECCS or DACS projects. A new project is built – the capital expenditure in blue – and then a government contract is put in place (in the UK known as a Contract for Differences – CfD – the black line) which from the start of operations is sufficient to both cover the operating costs (shown in orange), tax, inflation (which is why the revenue rises over time) and the repayment of finance that was raised to pay for the capex (in yellow).

BECCS and DACS government-supported concession structure (Figure 5)



This was essentially the model used to underpin the early development of windfarms; the CfD covered the full cost of the windfarms, including repaying finance, at a time when their cost of electricity produced was uncompetitive.

However, repeating this model in a series of competitions has led to large cost reductions, to the extent that wind power is now price competitive.

A similar approach is envisaged to support early BECCS, energy from waste and DACS projects. In time, just as it did for wind, government should support the transition to a competitive market through allocating funds for early projects prior to market development, to help reduce the cost of negative emissions, and will benefit from revenues from a developing negative emissions market (see Figure 6 below).

We anticipate the introduction of **regulated/compliance market** support over time, with governments introducing the ability to meet new and increasing decarbonisation taxes or CO_2 reduction targets by companies being able to purchase negative emissions, in addition to their emission reductions. The future costs of carbon taxes or regulatory controls could become prohibitively high in some sectors, as the cost of removing the last part of emissions is either technologically unavailable or prohibitively costly, then the inclusion of the ability to purchase negative emissions to help companies meet their CO_2 reduction obligations will unleash a very large amount of funding from the private sector to support investment in negative emissions projects. Virtuous companies who are technologically or economically unable to completely decarbonise in the short term can therefore buy negative emissions to ensure their residual emissions are fully compensated for elsewhere.

The Virtuous Relationship Between the Three Pillars

There will be a virtuous relationship between these three support pillars:

- The voluntary markets are focused on developing standards that can be adopted by the government and regulated markets in due course – quality, integrity, permanence, additionality, monitoring, and governance – key requirements of investors in the voluntary market, so that negative emissions are clearly of high integrity, which will bolster demand and confidence in the sector. This is a key area where the Coalition can contribute potential purchaser and investor insight;
- Government supported projects will create supply of negative emissions for investors and provide momentum to the inevitable fall in costs that comes with scale; and
- Voluntary and regulated/compliance purchase of negative emissions from projects will reduce the level of support required from government within an actual project in the long term.

BECCS and DACS government-supported concession structure – the increasing funding contribution from Negative Emissions (Figure 6)

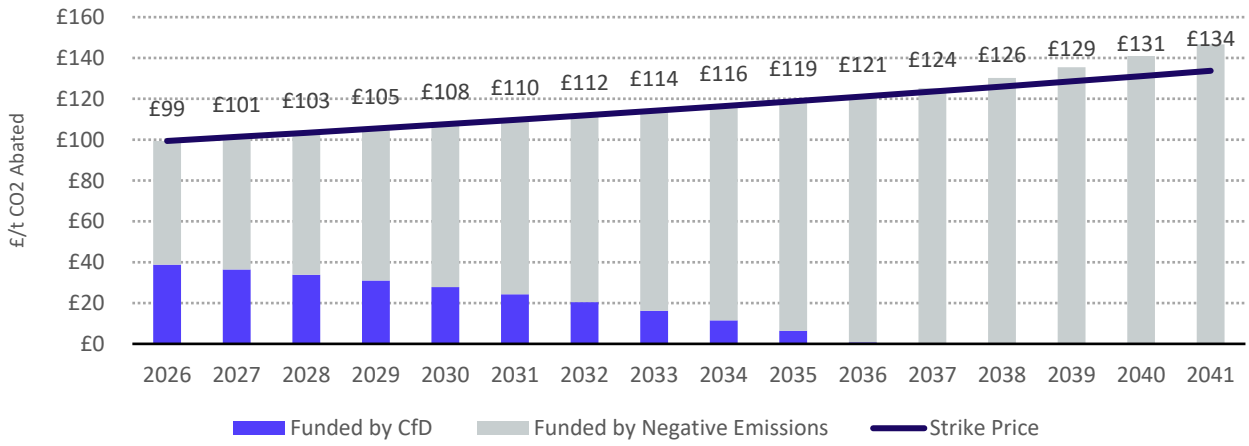


Figure 6 shows this virtuous relationship between government-supported projects and the voluntary and regulatory markets. Government support (the 'strike price' of the CfD of the earlier chart) is given at the outset of a project to allow a project to commence, but increasing revenues from negative emissions markets thereafter reduce the actual funding required from government. Government support is needed at the outset because the voluntary carbon market is not yet at sufficient scale, price, or reliability to underpin investment – but as both scale and price increase, we should expect government support to fall away.

This funding replacement of course will occur within a specific project or for a series of projects. Whole programmes of projects will become more affordable for government, just as they have done for windfarms.

Importantly, this shows the additionality of negative emissions revenues in government supported projects. Precisely because government knows that the projects it supports can become self-sustaining from negative emissions revenues over time, government is able to support a far larger number of projects and a far greater amount of negative emissions will be delivered.

The role of the Coalition and the three pillars

A key role of the Coalition will be to provide insight into how these three pillars can inter-relate and support one another:

- **Voluntary market** – working with leading bodies such as the TSCVM to help set standards and give industry guidance on purchaser requirements;
- **Government-supported market** – helping develop business models to underpin investment, new projects, and R&D into nascent technologies as well as to demonstrate the additionality of the link between government projects and negative emissions revenues; and
- **Regulated/compliance market** – industry input into developing policy and regulations on negative emissions and how these will increase the demand and supply of negative emissions projects

Developing the Regulated/Compliance Market

There is going to be an increasing need for industries to meet challenging emissions targets. It is likely carbon compliance schemes will be extended and the carbon price per unit of emissions will increase, as a result of emission reduction schemes such as the UK and EU Emissions Trading Schemes (which reduce over time the amount of carbon emission allowed) or by direct industry-specific obligations to reduce emissions. We must ensure strong incentives exist to decarbonise, and the society-wide costs of carbon are considered. At the same time, it is important to find cost-effective solutions and ensure industries remain competitive.

Traded sector emissions in 2023-30, based on current scope plus potential inclusion of engineered removals (Figure 7)

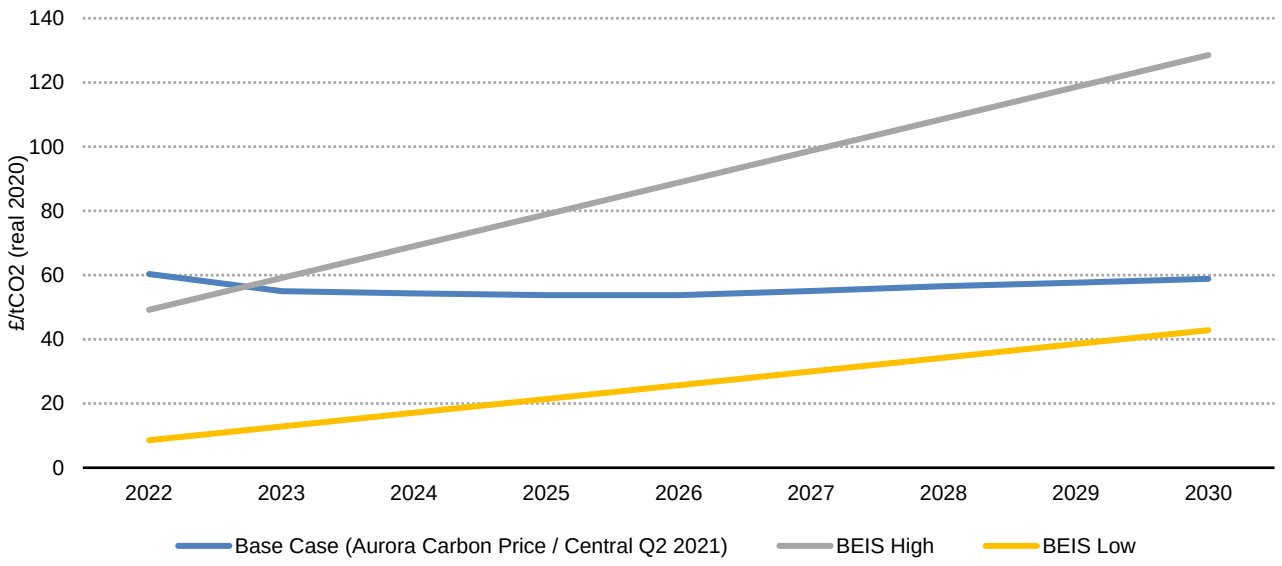
Traded sector emissions in 2023-30, based on current scope plus potential inclusion of engineered removals

$MtCO_2e$	2023	2024	2025	2026	2027	2028	2029	2030
Electricity supply	39	39	36	26	21	18	16	14
Industry (manufacturing, construction & fuel supply)	57	55	52	48	45	42	38	34
Domestic and intra-EU aviation	10	10	10	10	10	10	9	9
Proposed ETS cap (for currently traded sectors)	**106**	**104**	**98**	**84**	**76**	**70**	**64**	**57**
Engineered removals	0	0	0	0	-1	-1	-4	-5

Source: CCC analysis
Notes: Engineered removals not included in overall cap level in table.

Figure 7, for instance, gave the scale of the likely ETS cap reductions. This, in turn, will have an impact on the traded cost of carbon, with the Aurora 2020 and UK's Department for Business's current forecasts set out in Figure 8 below:

UK carbon price projections (Figure 8)



At present, most regulatory regimes do not allow for negative emissions to be used to meet emissions reduction obligations; it is the prospect of rising carbon prices that incentivises emission reductions. But inclusion, at the appropriate moment, of the ability to use negative emissions within those regulatory regimes to meet a portion of emissions reductions by paying for removals will allow hard-to-decarbonise sectors the time to decarbonise on an affordable basis and support development of carbon removal technologies.

The regulatory approaches to achieving this will be complex and could include:

- Formal recognition of carbon removals within ETS and similar carbon tax regimes, with a regulatory regime that ensures those negative emissions are high quality and permanent, and do not lead to a deceleration in emissions reductions;
- Linking national schemes to international regimes, so in the future, carbon removals could be reliably purchased internationally. This could have material distributional benefits, particularly for nature-based investments which are typically of greatest potential in less well-developed countries. This could mean countries with the greatest NCS potential can attract capital from countries with the biggest emissions to offset; and
- A key role of the Coalition will be to help its members understand and influence the emerging regulatory regimes, so projects can benefit from new corporate funding and purchasers are confident in the cost and availability of carbon removals.

> Government should create demand for engineered removals by placing obligations on industries that cannot mitigate all their emissions by 2050, such as aviation, agriculture and shipping, to pay for enough engineered removals to offset a growing proportion of their residual emissions.
>
> A market approach, where polluters choose from a range of providers for engineered removals, is likely to lead to the most efficient outcome – as the costs of engineered removals are high, most sectors will reduce or prevent emissions rather than use removals. Such a market could be delivered by bringing polluting industries and engineered removals providers into the new UK Emissions Trading Scheme

UK National Infrastructure Commission

Enablers of an Effective Negative Emissions Market and the Role of the Three Pillars

Given the size of the negative emissions global market we need to create, there is an urgency to accelerating the development of this market. But there are many enablers that need to be developed and put in place. These enablers are largely not technical but structural, financial, and commercial; getting the business models and regulations in place to underpin the negative emissions market will unleash both demand and supply for negative emissions.

Voluntary markets increasing numbers of companies are committing to be 'Net Zero' or even 'net negative.' The voluntary market has huge potential if purchasers have confidence that negative emissions are both measurable and additional. Joint public and private sector endorsement of projects and standards will be an important catalyst. Market enablers include:

- Clear definitions addressing additionality, sustainability and permanence and consensus on what constitutes high quality negative emissions;
- Creating a clear distinction between emission reductions and removal/negation, creating an asset class for negative emissions;
- Developing the TSVCM Core Carbon Principles in the context of negative emissions – high quality negative emissions need to be additional, measured against baselines, monitored, and verified, permanent, and having considered any environmental and social risks;
- Creating clear distinctions between short-term storage for 10 years (with risk of reversal) and long-duration (effectively permanent) removal for 10,000+ years, which will appeal to different classes of purchasers;
- Clarity over the way which companies can use negative emissions towards their Net Zero targets, including the benefits of sourcing a proportion of credits from permanent, engineered removals following the World Economic Forum's mitigation hierarchy;
- Establishing a robust market for trading – defining negative emissions as an asset class, with data, reference contracts and legal frameworks; and
- Developing measurement systems and monitoring governance to give confidence that negative emissions are achieved and irreversible.

Government-supported concessions will give capturers confidence to develop negative emissions projects and incentivise the development of negative emissions demand. That demand may ultimately fund the bulk of projects which are initially procured under concession contracts, reducing government support needed over time.

Market enablers include:

- Letting concessions in chosen industries that demonstrate governments' support of negative emissions – endorsing approaches developed in the voluntary markets;
- Developing business models that incentivise capturers to seek negative emissions revenues and encourage new purchasers of negative emissions;
- Governments committing to deploy engineered removals at scale; specified quantities by specified dates – Long-term national targets and concessions in individual negative emissions sectors will stimulate investment, innovation, and competitive cost reductions; and
- Inclusion in concessions of a robust, independent monitoring regime, benefitting from regimes developed in the voluntary market. These in turn will underpin the rollout of regulated markets.

Regulated markets recognising negative emissions as a possible offset to meeting company's carbon taxes and emission reduction commitments will unleash a large transfer of capital to the negative emissions sector. Companies supporting the development of negative emissions technologies could help expand the rollout of negative emissions technologies across the world as they integrate them into the global operations reducing costs, enabling a faster scale up, and broader reach. Market enablers include:

- Incorporating allowable, general or sector-specific carbon removals for the purchase of verified negative emissions should be as carbon tax and emission regimes are developed;
- Providing clarity to companies uncertain as to whether they get recognition for investing in negative emissions, giving clarity about the difference between reduction and removal;
- Creating obligations on polluting sectors to buy removals, which will guarantee demand for the negative emissions sector; and
- Developing international standards for negative emissions to allow corporates to buy international carbon removals, which will allow the development of aggregated NCS projects in the developing world to benefit directly from private sector funding from G7 countries.

The Role of the Coalition in Supporting the Market

While the potential of the negative emissions market is great, there are many initiatives that need integration and enablers to develop, which both need industry support and direction, as described in the Coalition's "The Case for Negative Emissions" in June 2021.

The role of the Coalition is to navigate through that complexity, bringing together a growing industry of capturers and purchasers with a shared commitment to a successful negative emissions market, to bring an industry voice to the developing market.

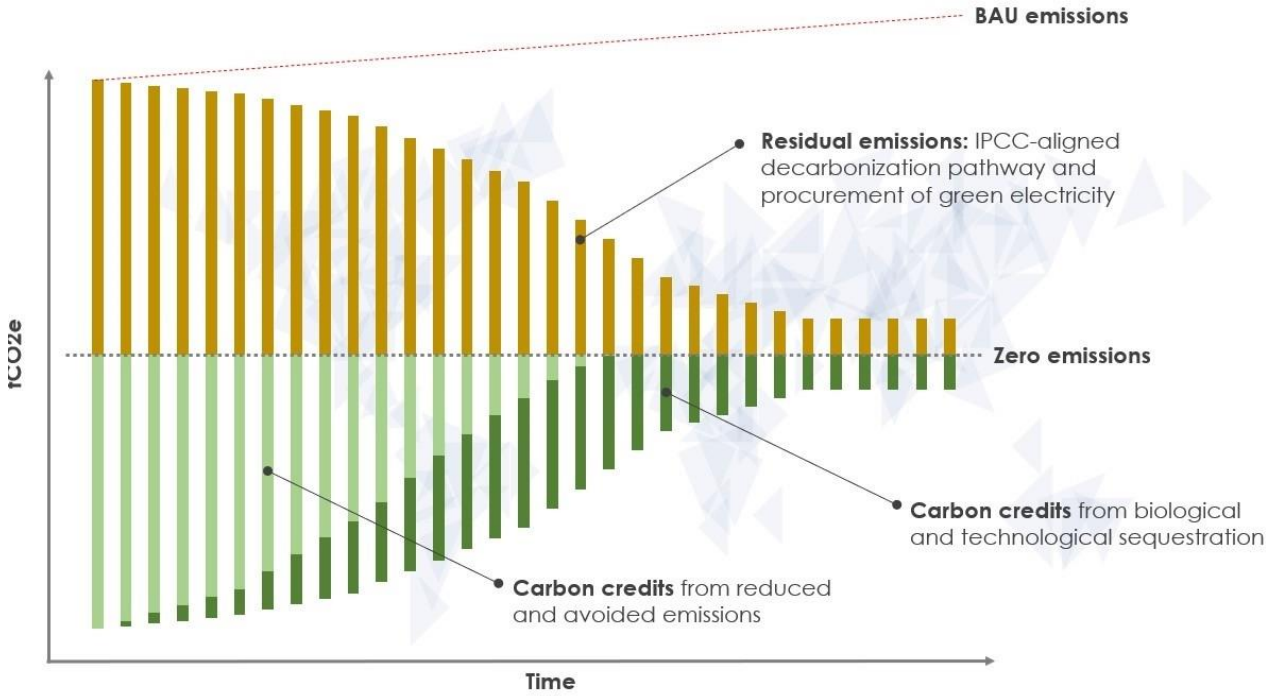
The Coalition can act as a focal point for the industry to understand market developments from a central hub and contribute to areas which most affect them.

Our immediate tasks include:

- Advocating clearly for negative emissions as long-term sustainable carbon removals and as the only way to meet 1.5-degree targets;
- Building extensive membership to increase the awareness and support for negative emissions;
- Encouraging companies to consider purchases of negative emissions on their path to Net Zero, both to accelerate reaching their targets and to bolster the negative emissions market which they may turn to for enduring carbon removals;
- Supporting the development of markets to broker and increase demand for negative emissions from emerging projects;
- Helping to inform potential purchasers of the negative emissions market;
- Convening leading bodies to build market consensus – For instance, the largest carbon registries (VCS, Gold Standard, American Carbon Registry and Climate Action Reserve) do not have consistent or existing standards for negative emissions;
- Inputting into the development of Core Carbon Principles for negative emissions, applicable across sectors;
- Ensuring the Coalition's membership is reflective of a broad portfolio of negative emissions projects, providers and potential acquirors, to demonstrate market capacity and success stories;
- Establishing governance that allows members to become informed on market developments and opportunities
- Developing a clear timetable for market developments, with milestones for delivering standards, regulations, legislation, and deals, focused on deliverables and first projects by 2025; and
- Delivering industry input into TSCVM, Government and regulatory policy and evolving business models.

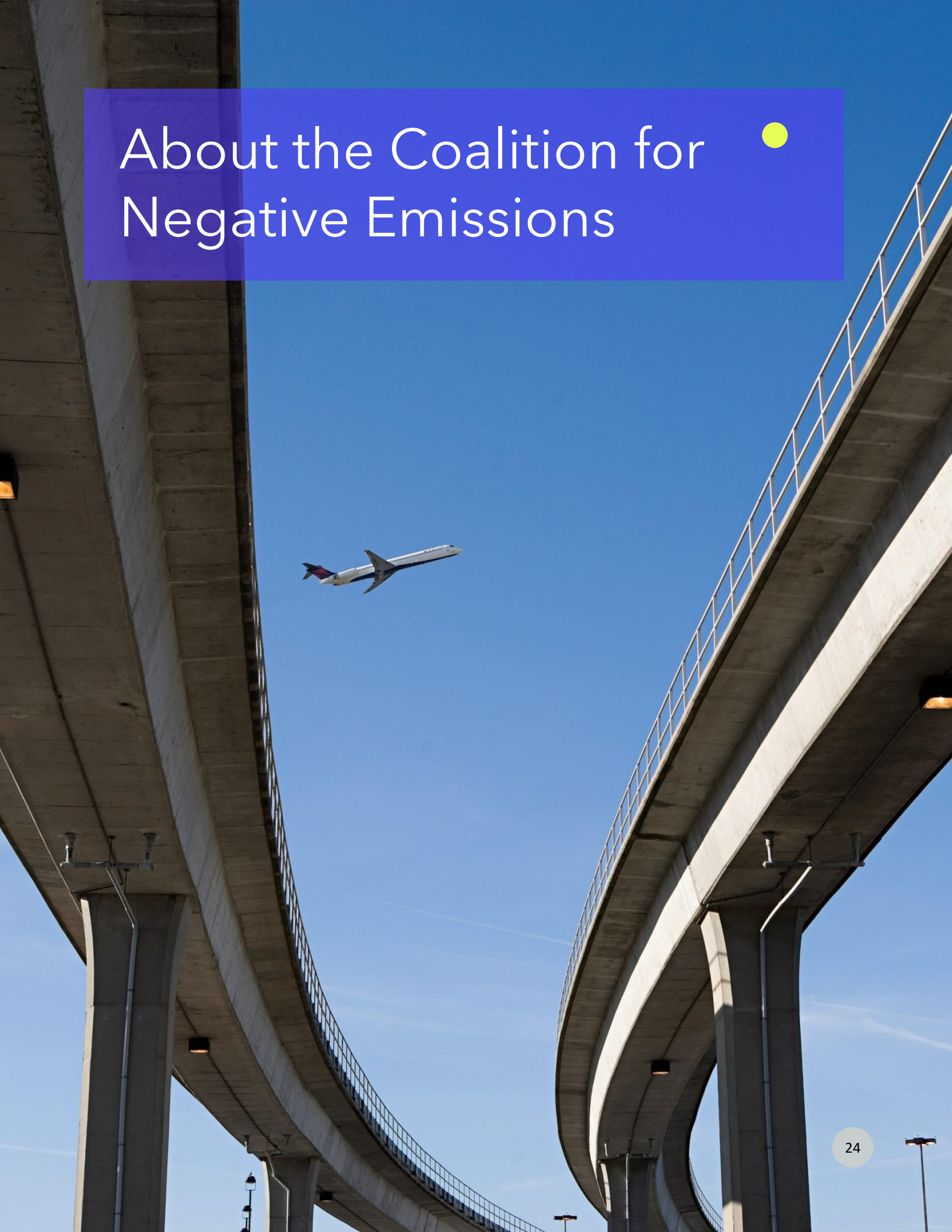
It will be through the combination of emission reductions and negative emissions that companies will be able to transition to a Net Zero or even net negative position, where the uptake of negative emissions will be influenced by access to voluntary, government-supported and regulatory markets that are yet to be developed. The immediate focus must be on emission reductions but over time there will be a longer- term increasing need for negative emissions to balance hard-to-abate residual emissions and remove historic emissions. This path is elegantly shown in Figure 9.

From Emission Reductions to Carbon Removals – the Path to Net Zero (Figure 9)



To enable the negative emissions to be used in support of climate targets, action is needed now to build the market structures that will scale up negative emissions for long term delivery. The Coalition will guide its members through evolving market initiatives across the voluntary, government, and regulated sectors, while providing a voice to the negative emissions industry and insight to the broader sector for interested stakeholders.

About the Coalition for Negative Emissions



About the Coalition for Negative Emissions

The Coalition for Negative Emissions includes potential CO_2 capturers, purchasers, supply chain actors, and industry bodies aligned to give insight and contribute to the development of standards, regulations, business models, and deals that are needed to urgently create a global market for negative emissions ("NE"), which will become a critical component of meeting global climate ambitions.

Our current capturer members include landowners and environmental stewards, large users, and generators of energy, technology start-ups, fuel providers, and large manufacturers and operators within aviation and agriculture, including two of the world's most prominent DACS companies, the UK's largest representative group for agricultural landowners, the UK's largest energy from waste operator, the world's largest sustainable biomass provider, and the sponsor of the world's largest planned BECCS project.

Our potential purchasers include the first airline group worldwide to commit to Net Zero emissions and the world's second-busiest airport.

The commercial insight we offer is complemented by influential trade groups, such as the UK's leading business organisation, representing 190,000 businesses, and the world's largest CCS organisation.

The Coalition is actively widening its membership to include capturers, potential purchasers, and organisations that share the urgent objective of developing a global market for negative emissions, and who will benefit from the insight, knowledge, and voice that the Coalition can deliver.

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To learn more, please visit www.coalitionfornegativeemissions.org/.