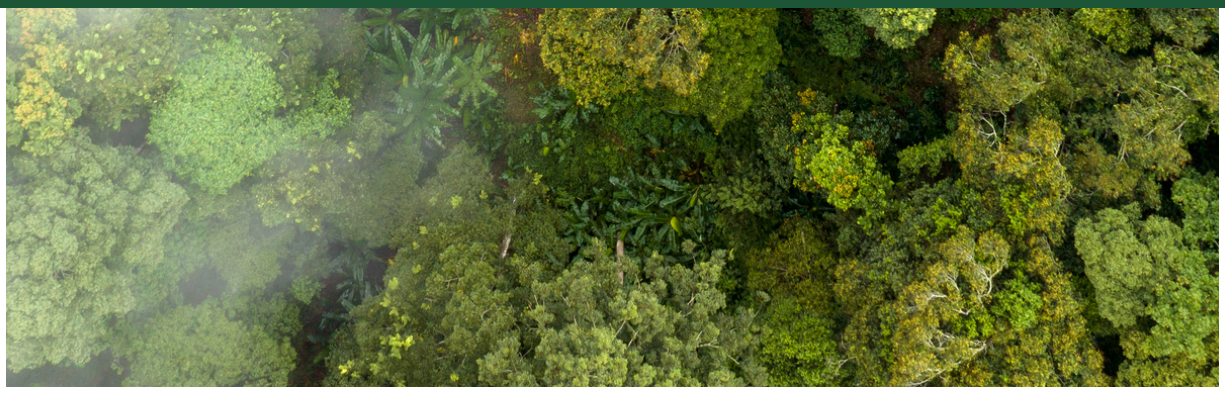
CLIMATE IMPACT

The Carbon Report

JUNE 2024



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Introduction - The Carbon Report

We are now midway through a critical decade in the history of humanity. To remain below 1.5 degrees of warming, global annual emissions must halve by 2030, and attain net zero by 2050.[1] The world is way off-track to achieve that, remaining – in the words of the UN Secretary-General – on a "highway to climate hell, with our foot on the accelerator".

At this moment, companies are faced with a dual imperative for change. Business activity comprises the vast majority of global emissions, and climate leadership from the private sector is essential to avoid catastrophic environmental changes that would cause suffering to millions of people. That represents an unambiguous ethical obligation. But climate action is also, increasingly, a **strategic business necessity** – key to mitigating risk from new waves of regulation, retaining environmentally conscious consumers, and attracting investment. In other words, being a business of the future, not the past.

Many corporations are embracing the mandate for change. Companies representing more than half of global market capitalisation now disclose data on climate change, deforestation and water security.[2] 66% of the revenue of the 2000 largest companies in the world is covered by a net-zero target.[3] However, when scrutinised closely, the majority of those targets fail to meet minimum quality checks, and one-third of the largest publicly-listed companies in the world still have not set an emissions reduction target at all.

There is thus a clear and urgent need to accelerate uptake of net zero targets, and to improve the robustness and credibility of those targets. This report aims to support those objectives, by offering an insight into two critical elements of climate strategies: **carbon accounting** and use of **carbon credits**. The following chapters lay out the basic concepts underpinning both, the pitfalls that companies can fall into, and what **best practice** looks like. Contributions from industry leaders build on those basic concepts with cutting-edge **thought leadership** in the space, getting to the root of areas of active debate.

What is the difference between good and bad carbon accounting? How can carbon credits fit into a climate strategy without **greenwashing**? And what are the best climate solutions out there to invest in?

We hope that The Carbon Report, written by ClimateImpact researcher James Miller, will shed some light on these important questions, and help provide companies with a solid grounding from which to build their sustainability strategy.

Stephen Murphy
Founder & CEO, ClimateImpact

Carbon Accounting

Quantifying the amount of Greenhouse Gases (GHGs) produced by your business is an essential first step for any company wanting to decarbonise. Without thorough carbon accounting, you cannot identify emissions sources, set appropriate targets or track progress. However, doing it properly is not simple, particularly when it comes to estimating indirect emissions from your value chain. This chapter introduces the global standard framework for carbon accounting, the Greenhouse Gas Protocol, and some of the complexities and considerations involved in measuring your GHG inventory.

It also discusses key regulations and voluntary standards relating to disclosure, and offers a glimpse into what the future of carbon accounting may look like.

THE GREENHOUSE GAS PROTOCOL

The Greenhouse Gas Protocol (GHG Protocol)[4] is the global standard for corporate emissions measurement, serving as a consistent guide for navigating the complexity and choices involved in carbon accounting. Whatever your motivation for measuring emissions, following the GHG Protocol is essential.

EQUITY OR CONTROL

As a first step, it is important to decide how to delimit which emissions you have responsibility for. This can be challenging in more complex business relationships where your company may not have total ownership and control over a project. The GHG Protocol outlines a framework for approaching this, allowing a company to choose to either account for emissions in proportion to its share of equity in a project, or instead to assume responsibility for 100% of the emissions for operations over which it has financial or operational control.

OPERATIONAL BOUNDARIES

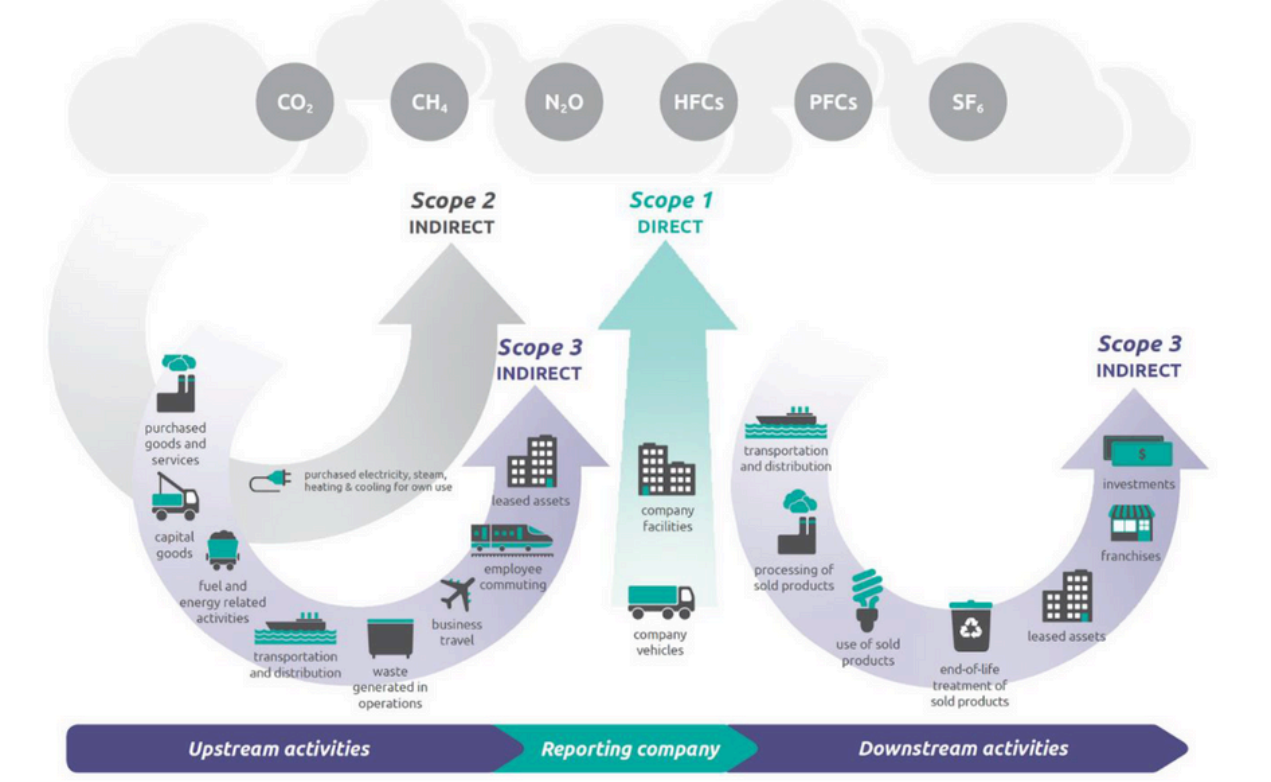
The next step is to define different sources of your emissions – your 'operational boundaries'. The GHG Protocol separates emissions into several categories or 'scopes':

SCOPE 01 **Direct emissions from sources owned or controlled by the company.**

SCOPE 02 **Indirect emissions from generation of purchased electricity.**

SCOPE 03 **Other indirect emissions, produced by company activity but occurring from sources not owned or controlled by the company. They can be upstream or downstream.**

While Scope 1 and 2 emissions are relatively straightforward, Scope 3 emissions are more complex, consisting of 15 categories.



Caption: Overview of the GHG Protocol scopes and emissions across the value chain

Credit: Technical Guidance for Calculating Scope 3 Emissions, Greenhouse Gas Protocol

SCOPE 3

Scope 3 is not currently mandatory to assess under the GHG Protocol. However, it often constitutes the majority of a company's emissions, and increasingly it will be required under disclosure schemes. Already companies that fail to account for Scope 3 emissions will struggle to justify any climate claims, and certainly any company setting a credible net zero target must include them.

> *Only 37% of corporate net zero targets fully cover Scope 3 emissions.*
> **Net Zero Tracker Report**

Because Scope 3 emissions encompass the entire value chain, the GHG Protocol does not require a company to do full accounting, but instead simply focus on a few chosen subcategories (those which are the most important sources of emissions). For transparency, companies should provide a general description of the entire value chain and associated GHG sources, and justify any exclusions from their accounting. Similarly, it is accepted that Scope 3 accounting may initially be less accurate, but still useful despite that. However, companies setting net zero targets will need to reach higher standards of completeness and accuracy to make credible claims.

CALCULATION

After drawing the boundaries of your emissions inventory, there are several approaches to calculating emissions. Direct measurements of GHGs by concentration and flow rate can be used, as can mass balance and stoichiometric approaches – these are most accurate, but are effort-intensive and unrealistic to apply to the whole value chain. Most often an emissions factor is used – a ratio relating GHG emissions to a measured activity or fuel use. Choosing a reliable emissions factor is important; small variations can multiply up to substantial differences in estimations. More sophisticated calculation tools are also available, both general in application and specific to sectors and processes.

> *We desperately need much greater consistency around the carbon boundaries and use of conversion factors, particularly technical issues like the use of radiative forcing, grid factors and spend-based carbon intensities. There's so much inconsistency now that company footprints are radically different, depending which conversion set we use. I think everyone seems to be converging around DEFRA's figures[5] but we've still got a long way to go on what's in a Net Zero Transition Plan or a Scope 3 footprint.*
>
> **Ben Wielgus, Informa**

The Protocol covers six GHGs beyond CO_2 – these must all be measured and reported by companies. They are incorporated into targets and claims using their 'warming potential', which can be calculated as a CO_2 equivalent – CO_2e.

TRACKING EMISSIONS

To track progress towards decarbonisation targets, companies must first identify a baseline year from which emissions can be measured. This should be the earliest available year for which there is reliable data, although sometimes an average of several years can be used to smooth out unrepresentative time points.

Structural changes in companies, like acquisitions, mergers, divestments, as well as outsourcing and insourcing of polluting activities, can all add complexity to tracking meaningful changes in emissions profiles over time. The GHG Protocol provides guidelines for dealing with this, including appropriate adjustment of baselines to reflect these changes transparently and responsibly.

> *Just get started collecting data. Don't worry too much about accuracy at first, because there are going to be a lot of assumptions involved initially. But in the process of starting to gather data you'll probably discover that 20 percent of your activity is at least 80 percent of your problem – that gives you an indication on where to focus, and the material risks and opportunities for your organisation. Then view it as an annual process of gathering better and better data and improving accuracy.*
>
> **Julia Groves, formerly of British Business Bank**

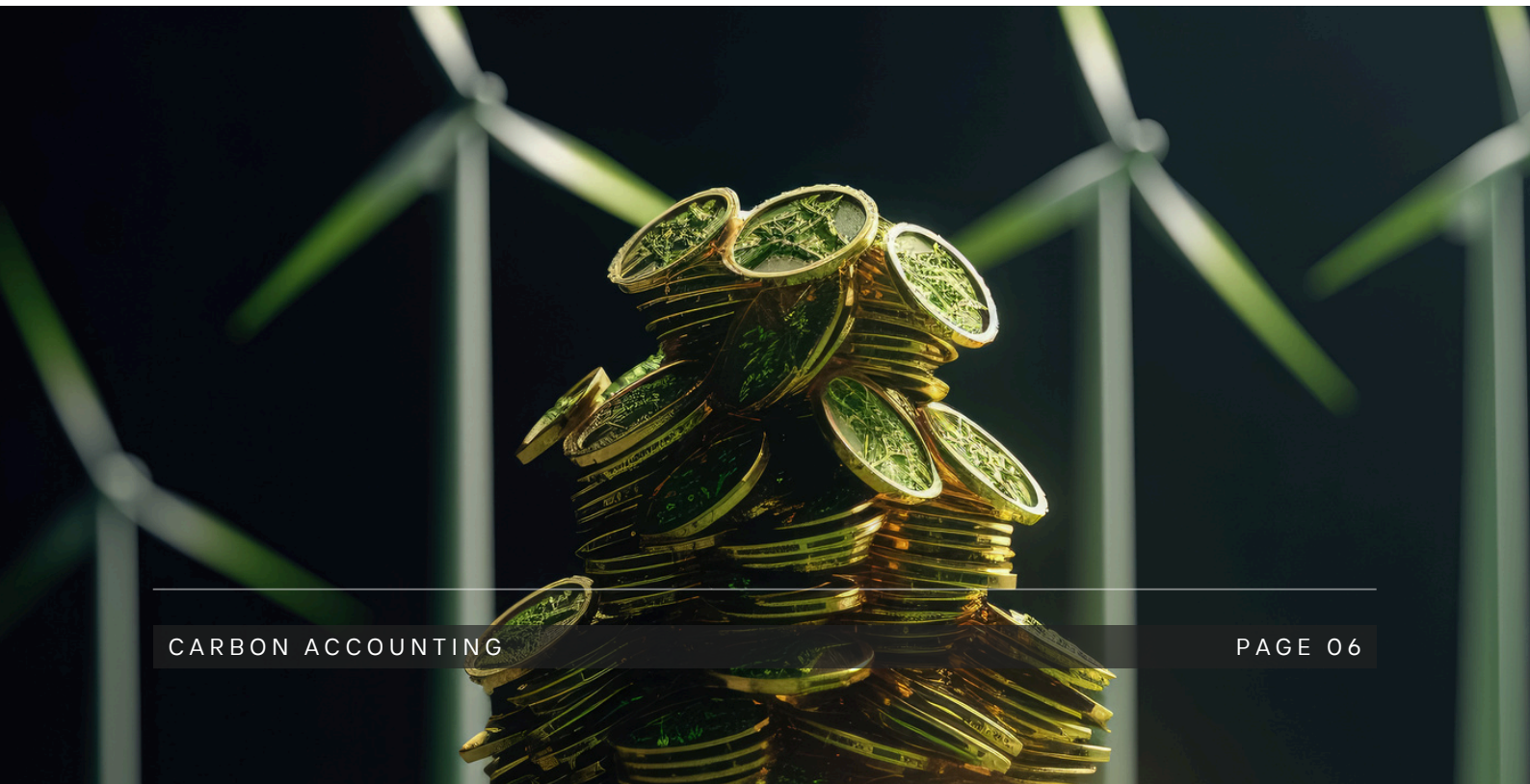
SPOTLIGHT: INTERNAL CARBON PRICING

Many organisations choose to set an Internal Carbon Price (ICP) once they have accounted for all their emissions. This tool is used to factor in the cost of CO2 emissions to financial decisions, which can serve many purposes:

- **To manage climate risk from upcoming regulations and investor pressure, by accounting for potential future costs in current decision-making.**
- **To incentivise devolved decarbonisation agendas for business departments and divisions, by taxing their emissions.**
- **To raise funds that can be reinvested into internal decarbonisation or to purchase carbon credits.**

Prices can be real internal taxes or hypothetical ('shadow pricing'). The former is most useful for driving internal change and fundraising for climate action, but the latter still serves as a useful performance indicator and decision-making tool.

When choosing a shadow price, most companies select a price reflective of real future risks (for example based on figures given in the HM Treasury's Green Book[6] guidance or the Carbon Disclosure Project's Carbon Pricing Corridors[7]), while for internal taxes, a bespoke price accounting for business realities and sensitivities is usually more appropriate. If the goal is to generate funds for carbon credits, many companies will set the carbon price to match the cost of the credits they purchase. Businesses could further choose to set a uniform price across the business, differentiate it between different locations or business units, or choose an evolutionary price that changes over time to continue to drive decarbonisation in the face of increasing abatement costs.



REGULATION AND DISCLOSURE

The UK, US and EU have a number of regulations pertaining to disclosure of GHG emissions. Here are some of the most important to be aware of:

UK

Streamlined Energy and Carbon Reporting Policy[8]

Since 2019, large UK companies have been required to disclose UK energy use and Scope 1 and 2 emissions in their Directors' Report.

EU

Corporate Sustainability Reporting Directive (CSRD)[9]

A regulation amending the existing Non-Financial Reporting Directive, increasing both the number of companies within its coverage, and the reporting requirements on companies. It requires identification of business impacts on people and environment (including the full Scope 1-3 emissions footprint), as well as the setting of targets and reporting on progress towards them.

Sustainable Finance Disclosure Regulation (SFDR)[10]

A regulation introduced to improve market transparency for sustainable investment products. It provides ESG disclosure requirements for financial market participants including investment firms, pension funds, asset managers and others. It covers both European funds and funds that are marketed in Europe.

US

Securities and Exchange Commission (SEC) Regulations[11]

The SEC has introduced climate disclosure rules covering Scope 1 and 2 of publicly traded companies, with Scope 3 for some companies.

California laws SB253 and SB261

California has introduced two important regulations relating to disclosure. SB253 is the California ESG Disclosure Law, requiring companies making more than $1 billion/annum to report Scope 1-3 emissions. SB261 is the Climate Related Financial Risk Act, requiring companies making more than $500 million per year to submit reports describing climate-related financial risks, including measures to address the risk through mitigation and adaptation.

Voluntary Disclosure Initiatives

There are also strong advantages to participating in voluntary disclosure initiatives: increasing trust, reputation, and access to investment. The Carbon Disclosure Project (CDP)[14] runs the global environmental disclosure system for state and non-state actors. They cover more than 23,000 companies representing 2/3 of global market capitalisation, and are the most important disclosure scheme to participate in.

Note: Many regulations and disclosure schemes are designed to align with the Task Force on Climate-related Financial Disclosures (TCFD)[15]. The task force sets out recommendations for companies to disclose information on climate risk, including governance, impacts of climate change on business and strategy, identification and management of risk, and target-setting. The UK has planned mandates for disclosure in line with the TCFD by 2025.

It's inevitable that all major companies will disclose emissions in the future. There is regulatory pressure, but also pressure from investors, and from customers. If you're selling to a big company, they're going to be asking you for your carbon emissions, sooner or later. If you think about all the different angles from which this pressure is coming, the direction of travel is obvious.

Mark Fischel, Novata

THE FUTURE

REGULATIONS

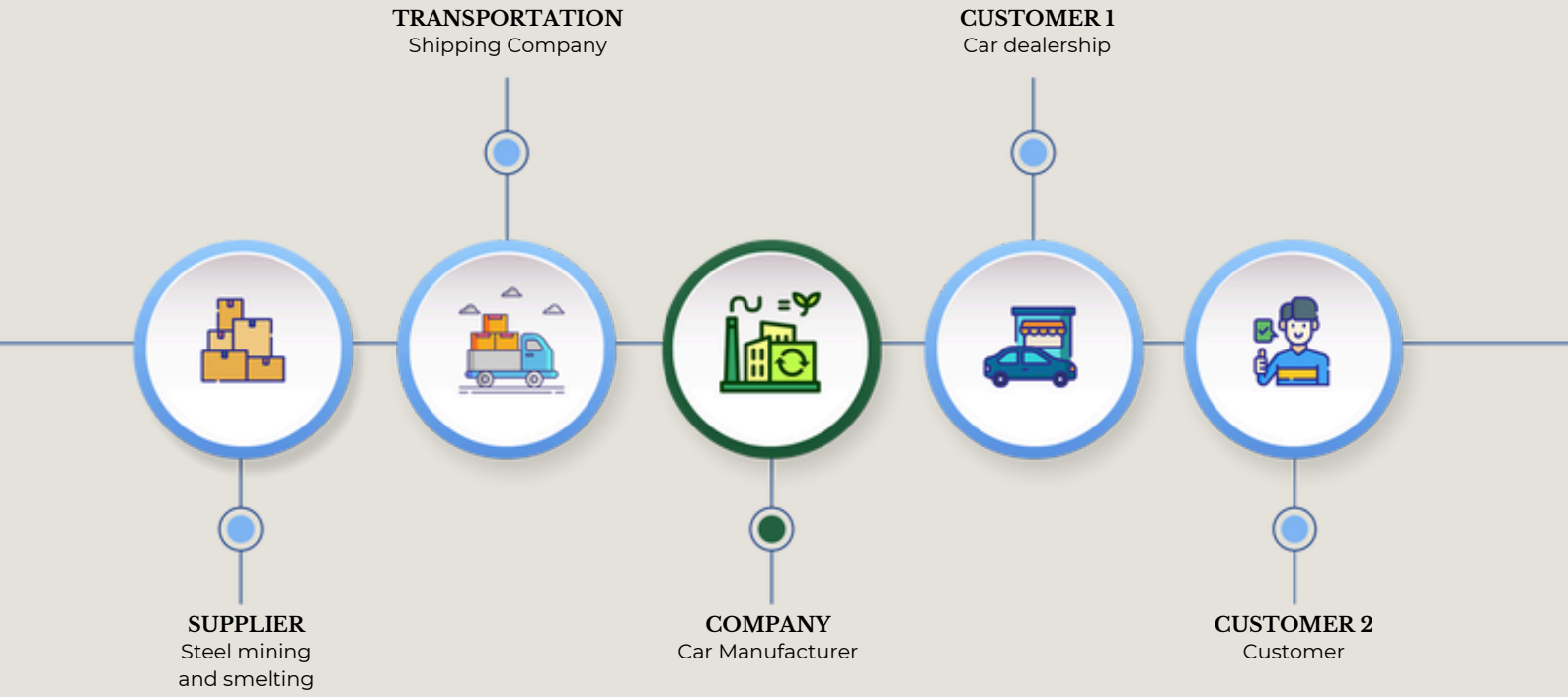
With increasing coverage and stringency of regulation, as well as pressure from investors and the public, the number of companies expected to measure and disclose emissions will increase considerably in the coming years. Currently, disclosure standards vary in the types of data they collect, but there are efforts to harmonise standards globally,[16] which will better facilitate reporting and data sharing, and allow meaningful comparison between companies.

The International Sustainability Standards Board (ISSB) is prominent among these, issuing in 2023 the 'IFRS Sustainability Disclosure Standards' to provide a global baseline of standards for capital markets.[17]

Greater attention will also be paid to Scope 3 emissions, which are not currently mandated under many disclosure schemes, but are increasingly recognised as an important component of a company's footprint. More accurate and efficient Scope 3 data collection will be enabled by improvements in supply chain tracking technology, and tools for data-sharing and integration with suppliers and clients.

E-LIABILITY

'E-liability'[18] is a new concept that has been proposed as an alternative system to improve accounting for value chain emissions. It differs from traditional Scope 3 accounting by measuring GHG emissions at the product level rather than the entity level. As a product progresses down a supply chain, the emissions associated with each stage of its production are tracked as they accumulate. The liability for that cumulative footprint is passed on from one entity in the supply chain to the next, along with the product.



Caption: Sample value chain
Credit: Adapted from the E-Liability Institute

A transparent record of the purchase, addition and 'disposal of the E-liabilities of each company would be available for auditing, such that companies don't escape scrutiny as soon as they sell on their E-liabilities to the next link in the supply chain.

The framework hopes to address many of the difficulties associated with Scope 3 emissions calculations.

It would improve the completeness and reliability of estimations, avoid double-counting (currently one company's Scope 1 emissions is classed as another's Scope 3), and move away from industry average emissions factors that can disincentivise individual corporate climate action. However, there are potential criticisms, including the implication that it would negate responsibility for downstream emissions, potentially letting the likes of fossil fuel companies off the hook.[18]

AI IN CARBON ACCOUNTING

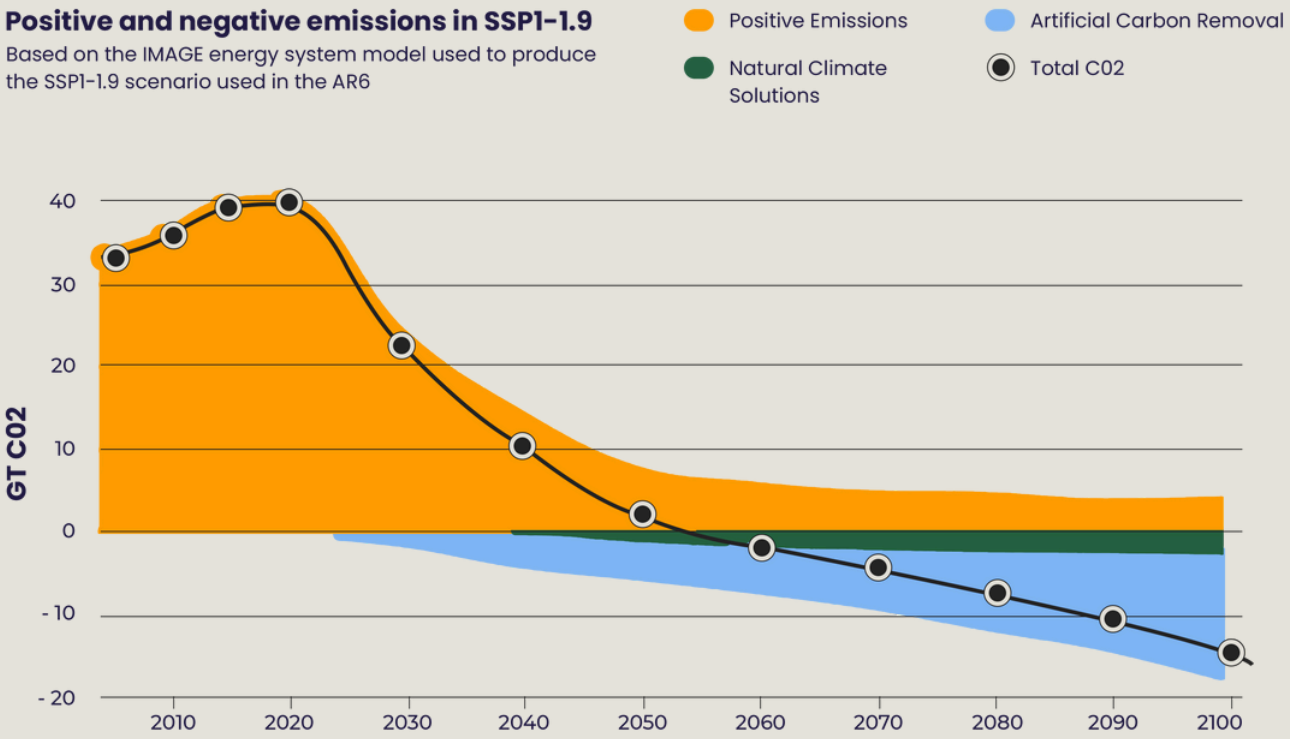
Carbon accounting is mostly an exercise in data collection and management. Traditionally, data is collected via manual entry into spreadsheets, supplier surveys for Scope 3 and utility bills. This entails many challenges; there can be complexity and inconsistency in data collection across different locations within a company, a lack of standardisation and an overwhelming volume of data from suppliers, and significant time consumed in the process of inputting and checking the data.

This lends significant potential for AI intervention.[19] Automating data verification (by cross-referencing collected data against existing databases and industry standards) can save time and reduce human error. AI-driven sensors can replace utility bills with real-time emissions data collection. Through creating direct interfaces with supplier systems via API connections, a company can obtain regular, automated Scope 3 updates.

> *We should be harnessing powerful AI technology for good; if we can liberate humans from the admin-heavy work of ESG reporting and disclosure, they will have more time to focus on the important things – like implementing radical transformative change.*
>
> **Mark Fischel, Novata**

Carbon Credits

A carbon credit is a transferrable token representing a tonne of carbon dioxide emissions reduced or removed from the atmosphere. The central idea is that they could facilitate the direction of finance towards the easiest emissions reduction opportunities globally, and to the development of carbon removal capacity to achieve Net Zero emissions by 2050.



Caption: The scale of carbon removal required in the energy system model used to create the IPCC SSP1-1.9 scenario
Credit: Adapted from Zeke Hausfather, The Breakthrough Institute, with data from the AR6 scenario database.

This has real scientific substance to it; the IPCC has concluded that a substantial degree of carbon removal will be necessary by that date should we wish to remain below 1.5 degrees of warming long-term[20]. Further, Global North states are failing to transfer sufficient finance to the Global South to support their decarbonisation, and to compensate for protection of their natural resources. In all of these cases, a substantial flow of private capital is almost certainly necessary to bridge the financing gap, and carbon credits remain the most established market mechanism for doing so.

However, carbon credits are also frequently subjected to a wealth of well-justified criticism. The majority of credits on the market are poor quality, with exaggerated climate impact, and many confer no additional benefit at all – as exposed by a high-profile Guardian investigation last year[21]. Projects have been associated with human rights abuses, land-grabbing, and adverse impacts for biodiversity. And the term 'carbon-neutral' has been exploited to greenwash; with cheap, ineffectual credits, polluters carry on business as usual.

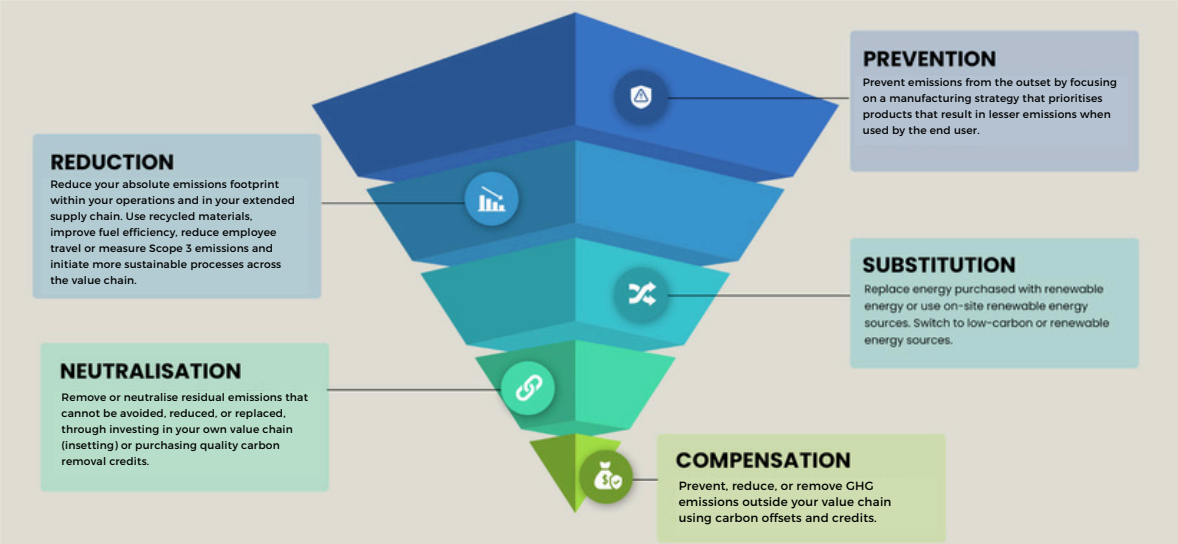
While these risks are very real, they can also be effectively managed if the carbon market is approached with the right understanding and expertise. This chapter will set out best practice in the use of carbon credits, to guide your business to maximising positive impact on the planet and minimising risk to business credibility.

How should carbon credits fit within a decarbonisation strategy?

> *A clear and consistent carbon offset policy is important, and offsetting done well is a very important part of a legitimate CO2 reduction programme. In the sustainability industry, my concern is that we're debating semantics around carbon neutral whilst the world burns. That prevents vital carbon and developmental finance being deployed to decarbonise as fast as possible, as cost effectively as possible.*
>
> Ben Wielgus, Informa

1. Set Science-Based Targets, prioritising internal decarbonisation

The crux of using carbon credits responsibly is to ensure that they do not substitute for 'real' internal decarbonisation of your operations and value chain. Action should be prioritised according to the 'mitigation hierarchy':



Caption: The mitigation hierarchy
Credit: Adapted from Terrascope

Prevention

Change business models, products or operations to prevent emissions.

Reduction

Cut internal value chain emissions through efficiency measures.

Substitution

Adopt renewable energy resources and low-carbon technologies.

Compensation

Compensate for residual emissions through carbon removals/reductions outside of the value chain.

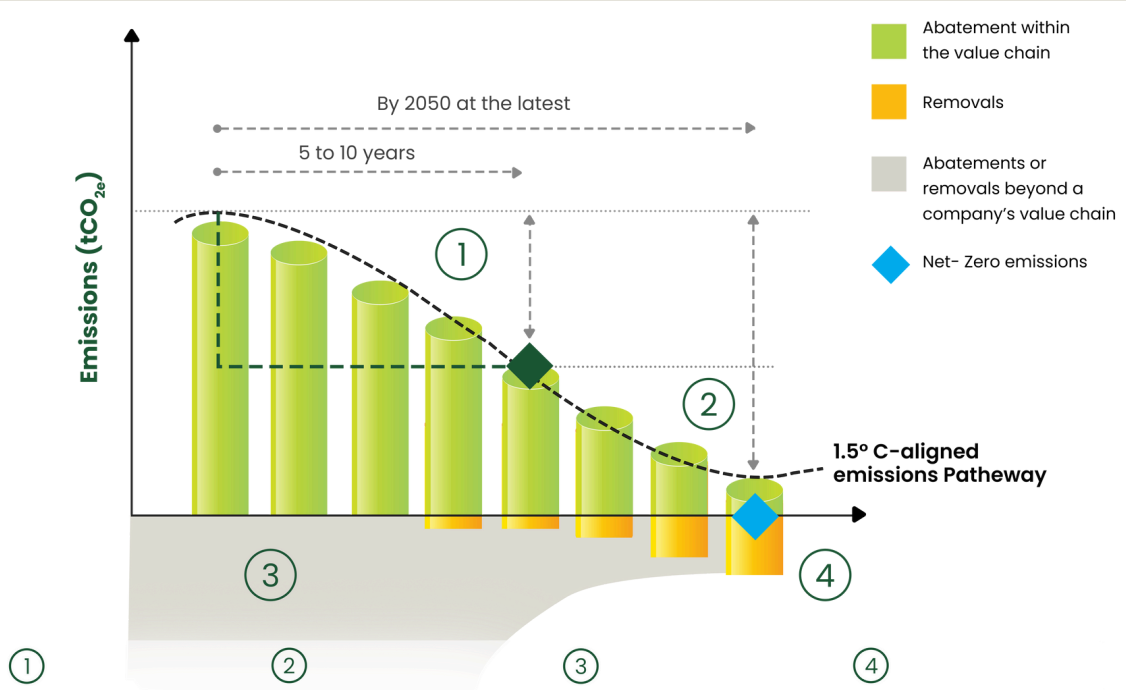
This is both the most responsible approach, and ensures that your business is not left behind with out-of-date processes in the transition.

Just as the GHG Protocol is the global standard for carbon accounting, the Science Based Targets Initiative (SBTi)[22] is the global standard for setting robust corporate decarbonisation targets aligned with a 1.5 degree pathway. Signing up to the initiative and following its guidance facilitates a credible and plausible pathway to net zero.

> *We always start with efficiency, then electrification, zero carbon fuels and then lastly carbon removal. These are the four key areas we see as being vital to any decarbonisation plan.*
>
> **John Ostergren, Smiths Group**

2. Compensate for residual emissions

Having set out a decarbonisation pathway that is aligned to SBTi standards, the opportunity arises to maximise your impact by purchasing carbon credits. The SBTi framework allows for removals to neutralise a remainder of up to 10% residual emissions at the very end of a company's decarbonisation journey, but it also encourages use of carbon credits as 'compensation' earlier. This involves businesses investing in carbon reductions and removals outside of their value chain, up to or beyond the equivalent of their residual emissions.



1 **To set near-term SBTs**
5-10 year emission reduction targets in line with 1.5°C pathways.

2 **To set long-term SBTS**
Target to reduce emissions to a residual level in line with 1.5°C scenarios by no later than 2050.

3 **Beyond value chain mitigation**
In the transition to net-zero, companies should take action to mitigate emissions beyond their value chains. For example, purchasing high-quality, jurisdictional REDD+ credits or investing in direct air capture (DAC) and geologic storage

4 **Neutralization of residual emissions**
GHGs released into the atmosphere when the company has achieved their long-term SBT must be counterbalanced through the permanent removal and storage of carbon from the atmosphere.

Caption: Key elements of the Net Zero Standard
Credit: Adapted from SBTi Corporate Net Zero Standard

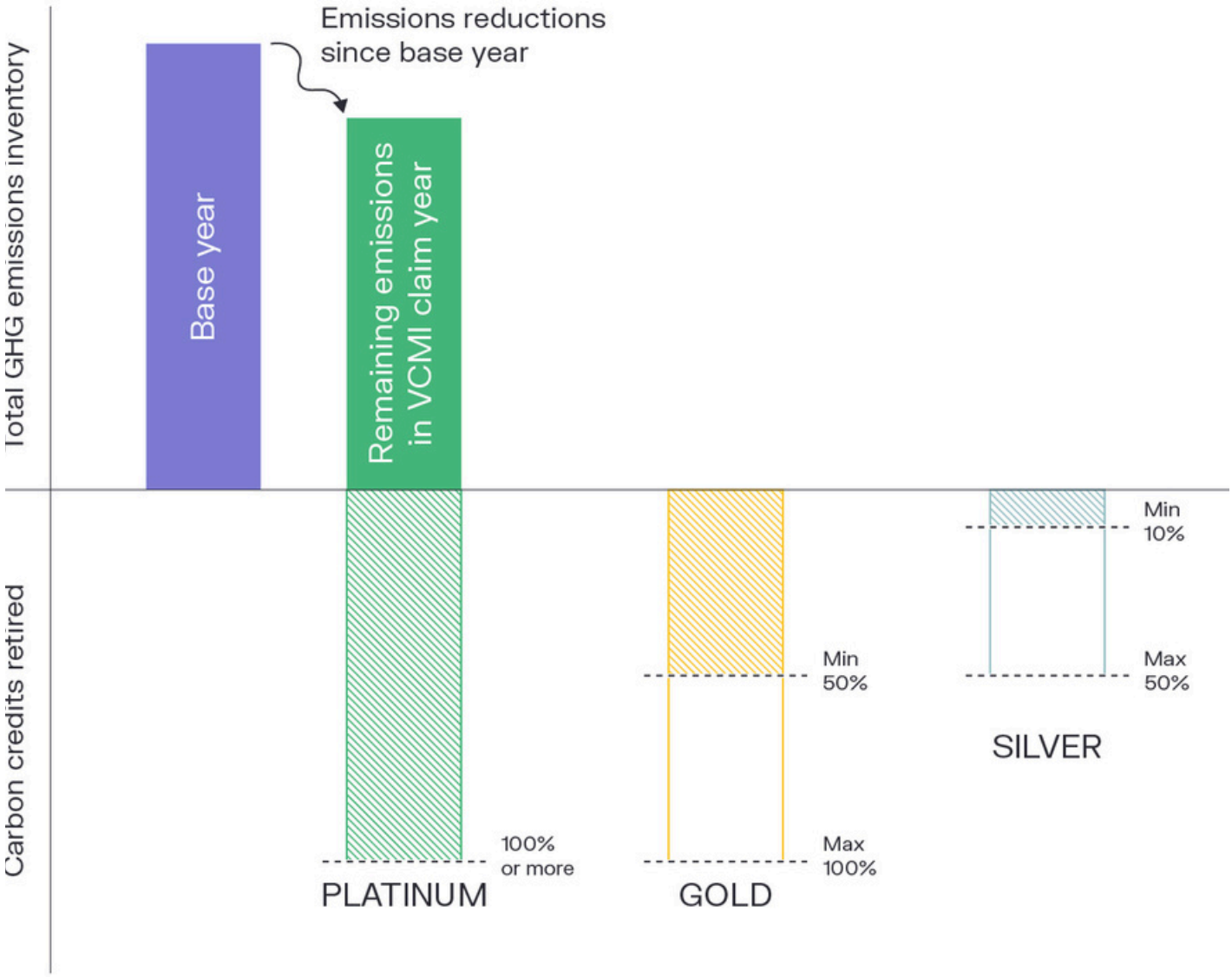
What might influence whether additional finances should be prioritised towards further investment in internal decarbonisation beyond what is needed to achieve Science-Based Targets, or instead in investment in decarbonisation outside of the value chain via carbon credits?

> *The internal project could be more transformational for the company, especially if decarbonisation also generates additional strategic benefits such as a competitive market advantage. This should be prioritised subject to demonstrable progress. It is therefore important to evaluate the decarbonisation levers on a case by case basis.*
>
> **Wei Ng, formerly at KPMG**

3. Making Claims

Active debate persists around how that 'compensation' should be communicated to stakeholders and the public, and what claims a company should be able to make. While many advocate strongly against the use of the term 'carbon neutral',[23] others argue that we need some kind of incentive for companies to undertake additional climate action beyond their value chain. As a business, how can you benefit from communicating the positive action you are taking, without making misleading claims or being accused of greenwashing?

One option has been developed by the Voluntary Carbon Markets Integrity Initiative (VCMI) – a body responsible for setting out how companies should use carbon credits within their strategy. In their 'Claims Code of Practice',[24] they propose that after setting science-based targets and showing evidence of meeting them, companies that compensate for residual emissions are eligible for their claims. These range from 'Carbon Integrity Silver', for a company that compensates for 10-50% of residual emissions, to 'Carbon Integrity Platinum', for one that compensates for 100% of residual emissions.



Caption: VCMI Carbon Integrity Claims
Credit: VCMI Claims Code of Practice

Another strategy is to not claim any simple label at all, but to invest in detailed communication of your actions to stakeholders and clients. Some companies do this via a publicly-available dedicated annual report (or in their Directors' Report). Doing so improves transparency and credibility, increases the visibility of your efforts, and allows you to showcase the co-benefits of your carbon credit purchases.

> *A label or a claim is important. However, I expect this to be supported with transparency and openness – we need to be sharing with each other the lessons of how this has been achieved.*
>
> **Stephen Thompson, Arup**

SPOTLIGHT: INSETTING

While ‘offsets’ refer to climate mitigation measures taking place outside a company’s value chain, ‘insets’ refer to actions taken within a company’s supply chain, but outside of its own operations. These projects can be removals, reductions or avoidance schemes. For example, a food sector company might fund regenerative farming projects on its suppliers’ land, or a manufacturing company might invest in the decarbonisation of the extraction or processing of the raw materials it is supplied with.

Insets have a key benefit in that they can sometimes facilitate reduction of a company’s Scope 3 emissions, rather than being counted as external compensatory actions. They can also help future-proof the supply chain, making it more resilient and mitigating against predicted long-term carbon credit price increases. There are, as always, potential downsides – foremost that many of the same quality problems as offsets can still apply, but without the same transparency and auditing that is now in place in the Voluntary Carbon Market (VCM).

HOW TO EVALUATE CARBON CREDIT PROJECTS

BUY HIGH QUALITY

The most critical consideration when purchasing carbon credits is quality. With no governmental regulation in the Voluntary Carbon Market, many credits fail to deliver the impact they claim to, and this carries significant reputational risk for investors. Far from being a few bad apples, over-crediting projects are thought to constitute the majority of the market.

So how to avoid them? The Integrity Council for the Voluntary Carbon Market (ICVCM), an initiative seeking to improve the integrity of the market, has recently issued its Core Carbon Principles (CCPs) to set out a threshold for what constitutes a high - integrity carbon credit. These cover all facets of quality, from transparency and independent validation to emissions impact and contribution to sustainable development .[25]

Examples of basic aspects to consider:

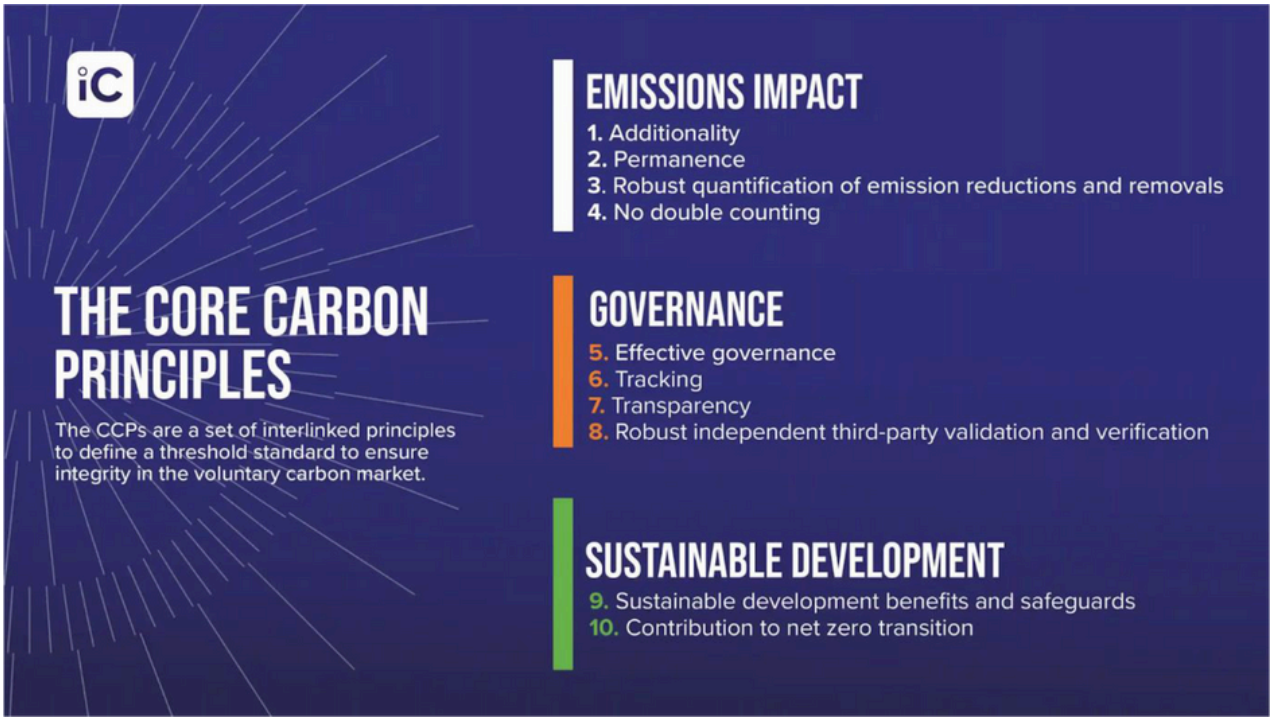
Additionality – Would the emissions avoidance, reductions or removals have occurred regardless of the addition of carbon credit finance?

Permanence – How long will the carbon be sequestered for? Is there a risk of reversal?

Leakage – Is the project inadvertently shifting emissions elsewhere?

Robust quantification – are measurements of reductions or removals robust, complete and conservative? Do they account for the whole life cycle of the project?

The ICVCM is currently in the process of reviewing and approving the methodologies applied by carbon crediting programs – the first cohort of CCP-Eligible programs and CCP-Approved categories has now been released. [26]



Credit: ICVCM

Many offsetting technologies are being explored but this does create tension between investing in the most cost-effective offsets that come with social cobenefits or investing in pump-priming emerging technology like direct air capture sequestration machines. The latter will reduce the cost for us in the long term as technology scales but it arguably means that we're getting 10 times less carbon reduction than we could be for the given budget. Neither is a wrong approach but it's an important consideration.

Ben Wielgus, Informa

CONSIDER CO-BENEFITS

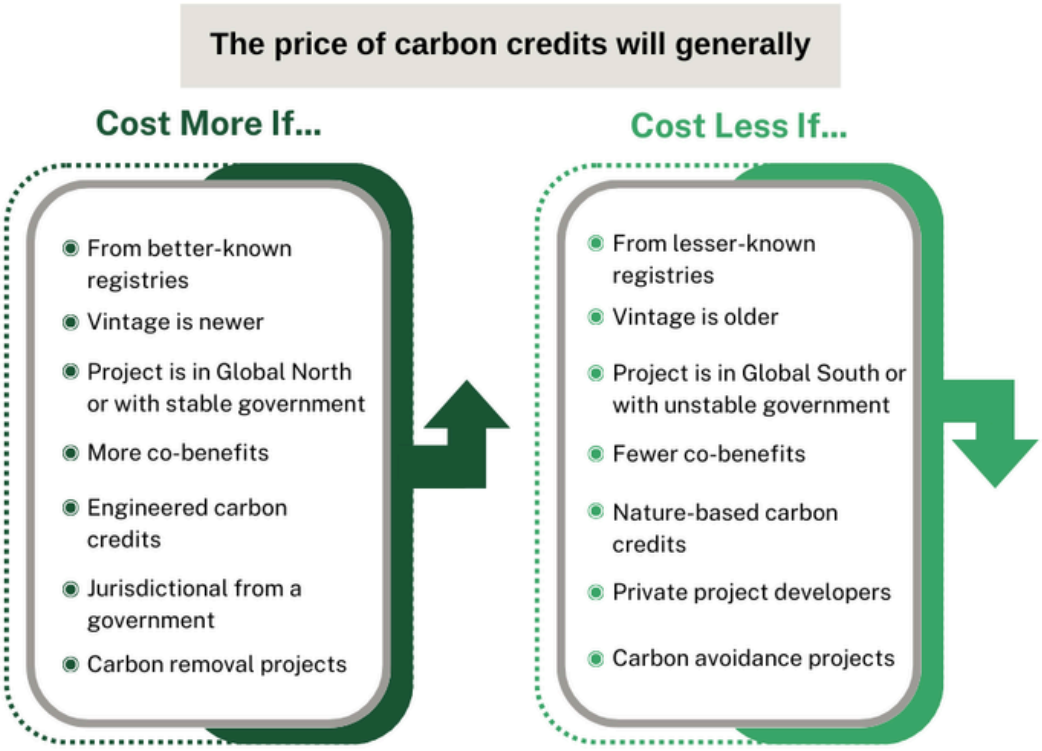
As a responsible business, it is important not to have carbon tunnel-vision, and to recognise that carbon projects also have the potential for substantial positive or negative consequences for people and nature. Selecting projects with positive additional outcomes -'co-benefits' - can contribute towards a broader ESG strategy and minimises the chance of regret. Celebrating the other outcomes of such projects mitigates against reputational risk.

Nature-based solutions generally have greater potential for delivering benefits to people and biodiversity, as do projects that improve clean energy access. It is also extremely important to ensure robust monitoring to prevent social injustices, and to choose credits where money reaches local people rather than being taken by middlemen.

PRICE

Carbon credit prices can vary by orders of magnitude, due to a number of factors. Some projects cost more to produce a single credit than others, for example early-stage tech solutions tend to cost hundreds of dollars per tonne.

Strong co-benefits can also increase the value of credits. Generally, buyers should be cautious of the quality of lower value credits, although the correlation is not universal.



Credit: Adapted from Thallo

Don't be fooled by using historic prices as a benchmark for the cost of offsetting moving forward. The vast majority of the historic market has been made up of low-quality credits. Moving forward we should plan for and expect to pay significantly more for durable removal credits, particularly as market demand exceeds available supply.

Stephen Thompson, Arup

SPECIALIST EXPERTISE IS A NECESSITY

The Voluntary Carbon Market, and the credits it comprises, require deep specialist knowledge to navigate properly. It is highly advisable to enter this space either with a team of dedicated internal experts that have specialist expertise, or to consult with an external partner.

> *I think it's important to identify partners and advisors who you trust and who have real experience. The carbon market is an incredibly complex and dynamic space – it can feel like the Wild West to those of us who don't live in it every day. Our approach is to combine building strong in-house capabilities alongside added support from trusted advisors to help navigate the more complex and fast-moving elements of the market.*
>
> **John Ostergren, Smiths Group**

DIRECT AIR CAPTURE

Direct Air Capture (DAC) is a technological solution that removes carbon dioxide directly from the atmosphere. It does this by reacting the carbon dioxide with chemicals, then releasing the captured carbon for collection by applying heat. That carbon dioxide can then be injected deep underground into geological formations, where it can be stored for thousands of years, or it can be sold for use in products like concrete or beverages.

Opportunities

- DAC is one of the only methods of removing carbon dioxide from the atmosphere and reliably storing it on a timescale of thousands of years. It is therefore thought to be essential in meeting long-term climate targets.
- Compared to NBS, it takes up little land and has siting flexibility, reducing risk of land use conflict and social justice issues.

Challenges

- While costs are beginning to fall, prices are prohibitive to scaling the technology, tending to cost between $250 and $600 per tonne today.[27] There is a pressing need for further research and development.
- The storage of the captured carbon remains a major concern. In situations where it is used in products like beverages, the carbon is quickly released back into the atmosphere. Meanwhile, the majority of geologically stored CO2 is used for Enhanced Oil Recovery,[28] where it aids further extraction of oil, putting into question the net removal figures.

The Cutting Edge

- Carbon Collect, in partnership with scientists at the University of Arizona, are developing a new form of DAC. It differs from other forms in that it utilises wind for passive capture of carbon dioxide, eliminating energy use associated with fans and offering considerable advances in scalability. Scientists at the University have estimated these 'mechanical trees' to be up to 1000 times as efficient as natural trees in removing atmospheric CO2.[29]

BIOCHAR

The majority of carbon removal projects globally are currently biochar projects. This solution involves taking biomass, ideally from waste products like wood chips or crop residues, and exposing it to high temperatures and pressures. This 'pyrolysis reaction' converts the biomass into biochar, a product similar to charcoal, which stores carbon in a chemically inert form that can last hundreds to thousands of years.[30] The biochar is most often applied to agricultural land, where it can increase crop yields by aiding water retention, soil structure and alkalinity.

Opportunities

- Biochar is a widely used removal method, as it benefits from longer durability than most NBS, and is more readily scalable than DAC.
- Biochar has additional climate benefits through increasing crop productivity, and the production of renewable syngas as a side-product

Challenges

- As a relatively nascent solution, biochar has not yet been subjected to the same scientific scrutiny as other methodologies, and questions remain about the reliability of storage and impacts on soil ecosystems.
- High temperatures required to complete the reaction can detract from the net carbon benefit of the process.
- While the additional revenue streams from biochar are a positive feature, they also demand careful scrutiny of the necessity of carbon credits to make projects financially viable.

The Cutting Edge

- Carbo Culture[31] have patented a new pyrolysis reaction – 'Carbolysis' – which is exothermic: rather than needing external heating to maintain the reaction, it generates heat itself. This can be used to provide clean heating or generate electricity, and allows scaling of the reaction chambers to an industrial scale.

AVOIDED DEFORESTATION

Avoided deforestation credits are one of the most prevalent carbon credits available on the market today. They are generated by forest protection schemes, where finance is directed to measures that reduce the rate of deforestation in a project area. Most often, they are 'REDD+' schemes (Reducing Emissions from Deforestation and forest Degradation).

Opportunities

- Rapidly increased flows of capital towards the protection of forests will be essential to achieve the UN's goal to halt global deforestation by 2030,[32] and avoid mass extinction of species.
- Protecting tropical forests remains one of the most cost-effective forms of climate mitigation, and far more readily scaled than most engineered solutions.
- Reducing deforestation can come with important co-benefits for people, through ecosystem services.

Challenges

- Avoided deforestation credits have been subject to high-profile media scandals, finding that many projects did not achieve significant reductions in deforestation, and that most of those that did considerably overestimated the carbon savings.[21]
- Given associations with land-grabbing and abuse of local people, scaling up protected areas while ensuring robust guardrails for human rights will be challenging.
- One UAE-based company alone is planning to lease 10% of Tanzania, Zambia and Liberia, and 20% of Zimbabwe for carbon credit schemes.[33]

The Cutting Edge

- The Cambridge Centre for Carbon Credits is developing new algorithms to restore trust in avoided deforestation credit measurements. By using satellite imagery[34] to compare rates of deforestation in the project area with randomly sampled 'counterfactual' forest areas outside the protected area, the scientists are able to more accurately determine additionality of impact above background levels of deforestation. The team are also at the forefront of research on measuring leakage and permanence, as well as co-benefits for people and nature.

BLUE CARBON

'Blue carbon' credits are a relatively new and exciting entrant to the carbon market. This term highlights the enormous potential for coastal and marine ecosystems to sequester carbon - in some cases, at a rate ten times higher than mature tropical rainforests. Established project types include avoided emissions credits for protecting mangroves, seagrass and salt marshes as well as removal credits for restoration of those same ecosystems.

Opportunities

- The full implementation of both established and emerging solutions could sequester 3 Gt of CO2 annually, equivalent to 7% of global emissions.[35]
- Projects often come with significant co-benefits: protecting some of the most biodiverse habitats in the world, improving coastal defence from storm surges and erosion, and supporting fisheries.
- In the absence of disturbance, blue carbon sinks can offer greater permanence, as carbon can accumulate in ocean sediments for hundreds to thousands of years.

Challenges

- Scientific research into many solutions is still underdeveloped, and large uncertainties still exist around quantification of additionality and permanence.
- There are threats to long-term viability of many projects from stressors like climate change.
- Protection of habitats is often more complex than on land, involving work with many stakeholders in commonly-owned waters to avert pressures on ecosystems.

The Cutting Edge

- Seaweed Generation is a company building automated robotics to realise the extraordinary potential of seaweed as a tool for Carbon Dioxide Removal (CDR).[36] Alongside trying to scale seaweed farming, they are also piloting the AlgaRay – a solar-powered robot that collects invasive Sargassum weed and transports it to the sea floor. If they succeed in producing a scalable solution, it could simultaneously address the significant damage caused by the weed and enhance a high- durability natural carbon sink.

ENHANCED ROCK WEATHERING (ERW)

In the natural environment, CO2 dissolved in rainwater reacts with minerals in rocks to form carbonates, locking away that carbon in a mineralised form on near-permanent timescales. Human intervention can enhance that process so that it operates on a scale of decades rather than hundreds of thousands of years. Projects generally take crushed basalt rock, a by-product of aggregate and mining industries, and spread it on agricultural land to increase the surface area of rock exposed to rainfall. Those carbonates are eventually leached from the soil and make their way into watercourses and the sea, where they are embedded in ocean sediments.

Opportunities

- ERW mostly relies on pre-existing materials and infrastructure, giving potential for rapid scalability.
- The basalt is applied to existing farmlands, so does not occupy any extra land footprint.
- It comes with co-benefits: when applied to agricultural land, it can deliver significant crop yield benefits through increasing nutrient availability, and as carbonates reach the sea, they can help to counter ocean acidification.

Challenges

- The science behind quantifying carbon removal is still developing, and substantial uncertainties remain.
- While there are no current causes for concern, it is not certain what impact the widespread application of weathered rock to soil and ecosystems will be.

The Cutting Edge

UNDO is a foremost company in ERW, aiming to be the first company to remove more than 1 million tonnes of CO2 from the atmosphere.[37] Alongside developing the science, technology and traceability to build confidence in ERW carbon credits, they are investigating the potential for biological applications in agriculture to increase the speed of weathering further.

Creating a Broader Carbon Credit Strategy

ASSEMBLE A DIVERSE PORTFOLIO

One of the best ways to mitigate risk is to diversify your carbon credit portfolio. Each project should constitute only a small proportion of the portfolio, affording some protection against individual project risks. Diversification of project types reduces risk from certain categories of credit being devalued or discredited, and allows investment in both solutions with strong co-benefits and those with higher permanence value.

> *What projects do you want to invest into and in which destinations? Do you have high expectations around 1000-year plus permanence? Get started with direct air capture and engineered solutions with high levels of durability. Do you want to create co-benefits in the communities that you serve aligned to UN SDGs? Then bring the right engineered and nature-based solutions into your portfolio.*
>
> **Ross Sheil, Cloverly**

A GOOD PORTFOLIO SHOULD CHANGE OVER TIME

We currently need to cut CO2 emissions as quickly as possible. But to attain Net Zero by 2050, we will also need to *remove* carbon dioxide from the atmosphere to neutralise residual emissions. Nor is Net Zero the end destination; it simply marks the moment we transition into a phase of 'net drawdown' of CO2, enabling us to return to safer atmospheric concentrations.

> *All pathways that limit global warming to 1.5 degrees with limited or no overshoot project the use of carbon dioxide removal on the order of 100-1000 GtCO2 over the 21st century*

IPCC Special Report: 1.5 Degrees of Warming

Currently, it is often more cost-effective to reduce emissions than to remove them. However, it is critical that more investment is poured into removals now to scale up their supply sufficiently by 2050. A carbon credit strategy should reflect this, investing more heavily in avoided emissions and emissions reductions today but gradually increasing the percentage of carbon removal offsets purchased with time, until credits are exclusively removals-based in 2050.[38]

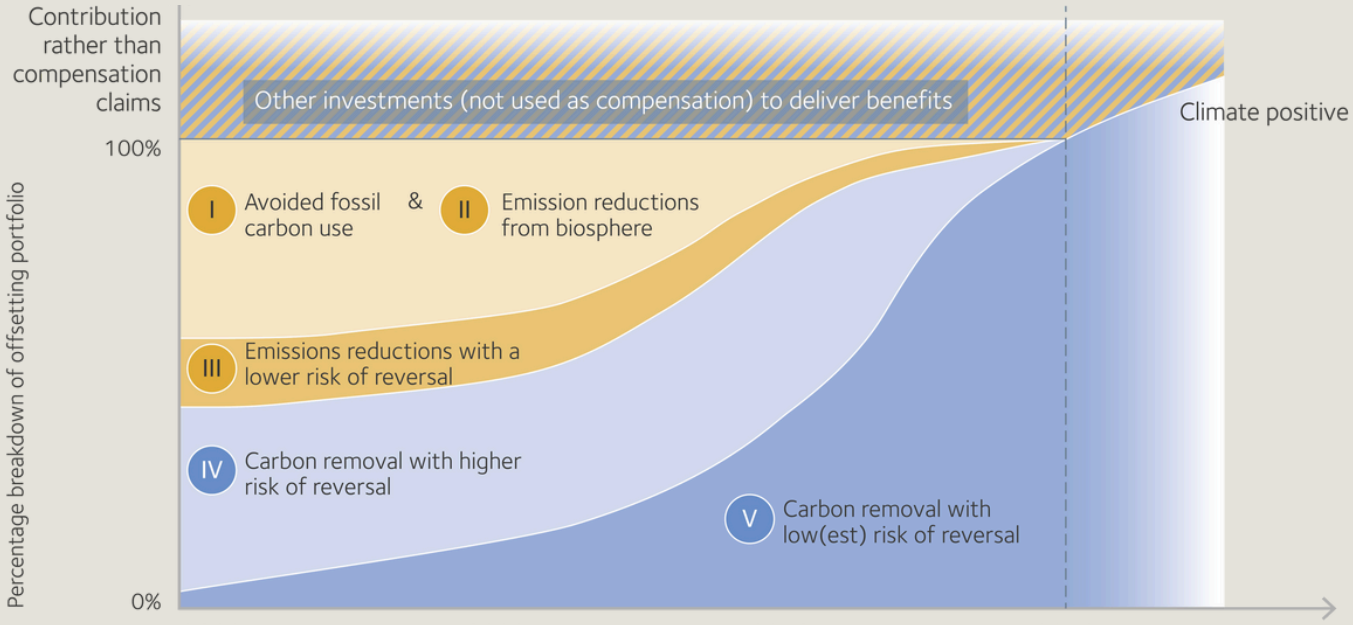
Simultaneously, organisations should plan to transition towards credits that store carbon permanently, with lower risk of reversal. For example, shifting from afforestation credits in areas which may be vulnerable to logging or wildfires, to CO2 capture and storage in geological reservoirs that may be stored for thousands of years.

Solutions that both remove carbon and store it in the long term (like Direct Air Capture) are challenging to procure due to limited supply and high costs in their early stage of development. Hence, they should be gradually phased in.

> *To close the carbon gap, it is likely we will need to increase global removal capacity in excess of 10 Gt CO2e/year by 2050. That staggering volume and supporting infrastructure doesn't appear overnight – we need to be taking action today to rapidly build our capacity, as many of these projects have significant lead-times"*

Stephen Thompson, Arup

The newly-released Revised Oxford Principles for Net Zero Aligned Carbon Offsetting provide important academic guidance to underpin responsible carbon credit strategies.



Caption: Example of a Net Zero aligned offsetting portfolio

Credit: Oxford Principles for Net Zero Aligned Carbon Offsetting (revised 2024)

Example of a Net Zero Aligned Offsetting Portfolio. An illustrative (not to scale) breakdown showing the proportion of different project types that could be used to address residual emissions between 2020 and 2050. This is not what the current market reflects but what an outcomes-based portfolio on the path to net zero could look like. It is not intended to be read precisely or prescriptively but shows a plausible net zero aligned offsetting pathway compatible with Principles 2 & 3. The figure demonstrates the move from projects based on emissions reductions (yellow) toward carbon removal (blue), and the shift from types with no storage or higher risk of reversal (lighter shades) to types with storage and lower risk of reversal (darker shades). The 100% line in Figure 4 indicates the total offsetting credit portfolio for the emissions attributable to the organisation's value chain, including Scope 1, 2 and 3 emissions.64 The striped area above the line is used to indicate that investments across all credit types may be valuable as a contribution to wider mitigation efforts beyond an organisation's value chain mitigation or net zero target, up to and beyond the net zero target date. Such contributions (not used for offsetting) may be particularly valuable to organisations that set climate-positive targets, especially from the perspective of beyond value chain or climate positive targets. Such targets and contributions are made for pragmatic and equity considerations in mind, acknowledging that some organisations will need to go further than net zero given equity considerations and the limited capacity of others to meet the target by the global net zero target date. An organisation may also have a nature or biodiversity target towards which investment in nature-based credits is appropriate, separate from efforts to counterbalance or compensate residual emissions.

DISCOUNTING AND PURCHASE AGREEMENT TYPES

To reduce risk from carbon credits having overstated benefits, many companies use a 'discounting' approach. This involves purchasing multiple 1-tonne credits to offset a single tonne of CO2e, by applying a 'discount factor' to all purchased credits.

Discounting serves to increase credibility, makes compensation estimates conservative, and allows investment in early-stage carbon projects that produce benefits which aren't yet reliably quantified.

Consider a variety of purchase agreement types, rather than simply purchasing credits on the spot market. For example, offtake agreements (where buyers pre-purchase credits yet to be produced) can protect against volatile market prices, secure longer-term supply, and provide critical support for early-stage developers to upscale.

SPOTLIGHT: CARBON INSURANCE

With Chris Slater, Oka

"Oka, The Carbon Insurance Company, was formed off the back of research into the voluntary carbon market – talking to buyers and sellers of credits, registries and developers. Everyone was talking about risk. If credits get impaired or invalidated, the corporations buying credits face financial, reputational, and increasingly regulatory risk. By bringing insurance into the market infrastructure, we can take some of that risk off the table, and give people the confidence to invest more into the space.

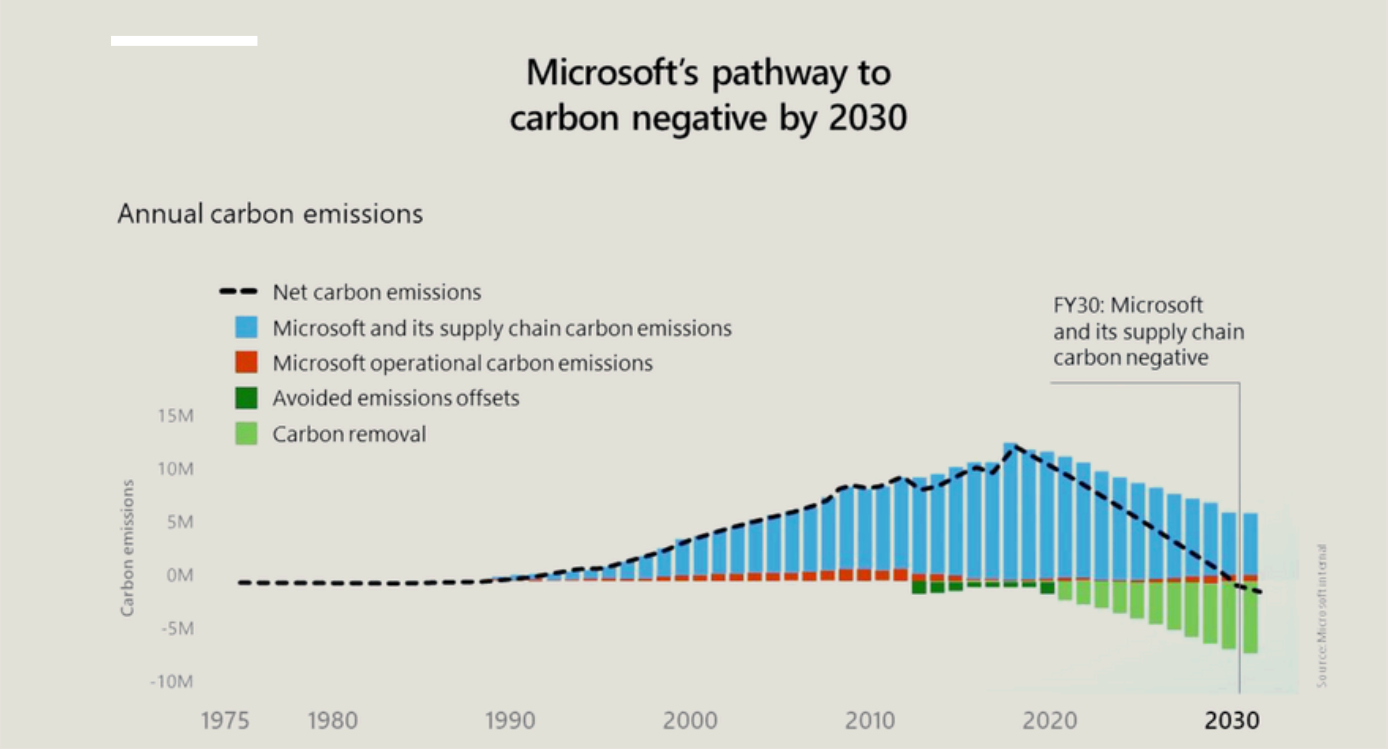
Without insurance, many registries mitigate risk using buffer pools – they take aside a portion of the credits produced and don't sell them, ringfencing it in case there is a need to compensate for any catastrophic event, like a wildfire destroying a forest. The problem with buffer pools is that they don't leverage many of the tools insurance has to assess risk– it's a very inefficient way to manage it. The risk also sits entirely with the developers, making the profit margins so thin for them that it's not stimulating enough investment in new projects.

When we provide insurance, it comes ready-packaged with a credit at point of purchase, but the cost is ultimately covered by the buyer. We cover both reversal risks, like wildfires or a leak in an air capture plant, and credit invalidation through, for example, over-crediting or project fraud. If something happens, we pay back the money so that it can be reinvested in credits. Ultimately, an insured credit will be more valuable. I see us as one component of what will hopefully become a much more well-developed ecosystem of financial players in the VCM, which will help bring real scale."

Case Study: Microsoft

In 2020, Microsoft announced an astonishing ambition to be carbon negative by 2030, and to have removed the equivalent of their entire historical Scope 1 and 2 emissions from the atmosphere by 2050.[39]

THE PATHWAY



Credit: Microsoft

To reach their ambition of being carbon negative by 2030, Microsoft are committed to reducing Scope 1 and 2 emissions to near zero by 2025, and more than halving Scope 3 emissions (which make up over 96% of Microsoft's total emissions) by 2030 from a 2020 baseline. This has been verified as aligned with 1.5 degrees by the Science-Based Targets Initiative[40]. Progress on implementation has been more successful in Scope 1 & 2 emissions, where a 23% reduction was achieved in FY22, but this has been confounded by increasing Scope 3 emissions, causing overall emissions to reduce by only 0.5% that year.[41]

In tandem with focusing on reduction efforts internally and in their supply chain, Microsoft are building a CDR portfolio that would remove more than 5 million metric tons of carbon dioxide per year by 2030 – a key step to becoming 'carbon negative'.

The use of an internal carbon price as an instrument has helped the company both to incentivise emissions cuts and to raise internal funds for their carbon removal program.

THE PORTFOLIO

Microsoft has a carbon credit portfolio entirely composed of removal credits,[42] and does not purchase avoided or reduced emissions credits. This choice is a product of their ambition to become carbon negative (necessitating investment in removals), their belief in the need to scale up global CDR capacity urgently, and their conviction that reduction efforts are best focused on internal emissions.

Their portfolio already encompasses several million metric tonnes of CDR. It is built through an annual procurement process, where they put out a request for proposals, which are reviewed in partnership with third-party scientific experts from Carbon Direct and Winrock International.[43] They have created a set of criteria for CDR projects, broken down by typology, covering baseline standards for factors like additionality, leakage, and environmental justice.[44] Of the 55 million ton equivalent of projects submitted to their request in its first year, only 2 million tons met the requirements. They aim to update these criteria every few years in line with updated science and thinking.

The portfolio is currently heavily weighted towards forestry solutions, such as reforestation, improved forest management and agroforestry,[45] which are easily scalable, and relatively proven but have low durability. The remaining solutions are diverse and include biochar, reduced tillage, DAC, and concrete-based sequestration. The company plans to increase the proportion of solutions with higher permanence over time, which will most likely shift the dominance to engineered rather than nature-based solutions.

Alongside their procurement of CDR credits, Microsoft are trying to accelerate development of higher-permanence removal technologies through their $1bn Climate Innovation Fund.[46]

TRANSPARENCY AND COMMUNICATION

To communicate their environmental ambitions and progress, Microsoft release an Environmental Sustainability Report annually, which is reviewed by an independent third party. In addition, they provide more detail on their carbon removal strategy with dedicated annual reporting, and an interactive dashboard where interested parties can see a full breakdown of the CDR projects Microsoft has procured, the number of credits purchased, their contracted durability, and written summaries of the projects. The quality of their disclosure was scored 'A' by the Carbon Disclosure Project.[47]

Navigating the Future

A MATURING MARKET

The VCM is still a relatively nascent market, and hasn't yet developed the full infrastructure of a mature market. It is developing with the oversight of the Taskforce on Scaling Voluntary Carbon Markets (TSVCM), a collaborative effort to shape market infrastructure composed of more than 250 institutions globally.[48] There are expectations that the market will improve in several respects:

01 Increased transparency of projects and provision of information on registries, in combination with publicly listing and trading carbon credits, leading to better price differentiation

02 Increased liquidity through standardisation – similar projects will be traded together under single spot contracts

03 Harmonisation of standards will lead to better distinguishment of high-quality credits, and the emergence of a clearer price signal

04 Government intervention may occur in the form of regulation to ensure good practice

> *The market is going to scale significantly. If you look at estimates from Barclays by 2050, the market gets into trillions of dollars – we're talking about mainstream corporate adoption for every part of the value chain from FTSE 100, FTSE 500, Nasdaq listed businesses, Euronext listed businesses - this will be embedded in their day to day operations.*
>
> **Ross Sheil, Cloverly**

PRICES, SUPPLY AND DEMAND

Carbon market prices fluctuate all the time. This is because buy-side demand is behavioural – it changes considerably in response to consumer appetite and price. The supply side, meanwhile, is less elastic, being constrained by several factors.

However, it is expected that this will soon change as behavioural demand is overpowered by 'fundamental demand' – companies will increasingly be necessitated to purchase credits as net-zero targets near, and as the cost of reducing the remaining hard-to-abate emissions increases. Demand is thereby projected to increase dramatically, although estimates of how much vary. McKinsey and the TSVCM have estimated that annual global demand might reach a maximum of 1.5-2 GtCO2 by 2030, and 7-13Gt by 2050.

While the potential supply is ample, mobilisation challenges could considerably restrict supply in reality - for some classes of credit, like nature-based solutions, it could soon fall behind demand.[49] This, in combination with the phasing out of lower-quality credits, is expected to increase prices and reduce access to credits. Prices will also be influenced by investment in technology and trends in market preferences and standards for different types of credits.

FUTURE TECH

The future of carbon credits rests on advances in science and technology, which hold a number of promises:

Better MRV

Methodologies for measurement, reporting and verification (MRV) are in a state of constant improvement, through continuously developing scientific understanding. Technology can enhance MRV further; satellite imagery, drones, smart sensors and AI can enhance data collection, while data management and analysis can be automated and streamlined through digitalisation. This is critically important for building trust in the market, and ensuring the efficacy of the carbon credits.

Use of blockchain

Blockchain is a technology for information storage – it creates digitalised 'blocks' of data in a shared network of computers, acting as a distributed ledger. There are aspirations to apply it to carbon credit trading, to increase transparency and traceability while facilitating faster and less costly transactions.

Technological advances

With increasing investment in engineered solutions, the cost of those solutions will decrease and they will become more efficient and scalable. This will be critical should buyers wish to transition to an increasingly high-durability and removal-based portfolio.

New solutions

Carbon dioxide removal solutions all seem subject to trade-offs – there is no silver-bullet solution that is scalable, verifiable, permanent, cheap and with abundant cobenefits. With myriad research taking place globally, we will see the development of all kinds of exciting new solutions in a race to tick as many of those boxes as possible.

CONCLUSION

At this critical moment, our path forward is clear. We need to reduce emissions rapidly, and, simultaneously to that, build up the capacity to remove huge amounts of carbon dioxide from the atmosphere. What must businesses do to be on the right side of history?

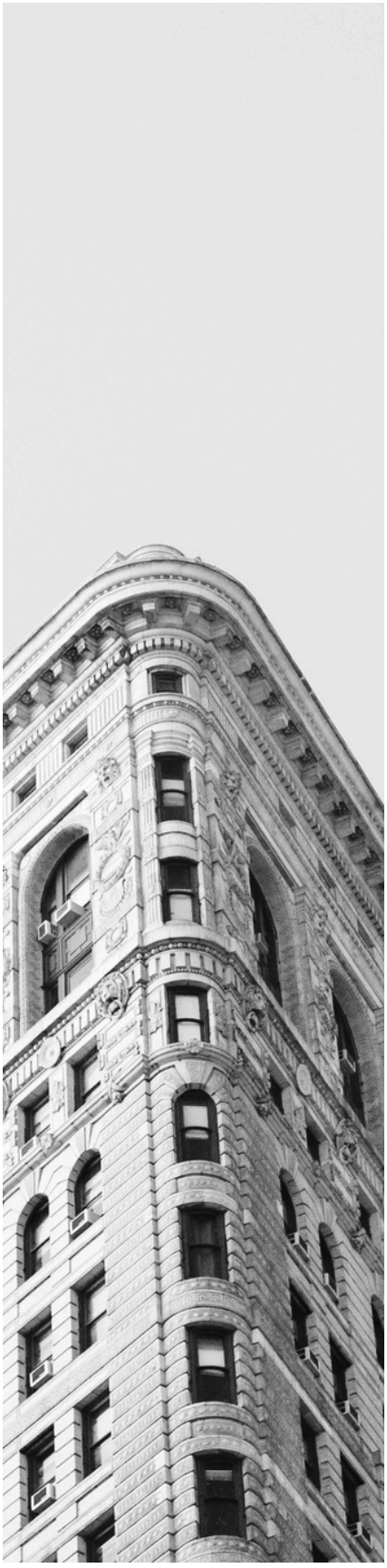
This report lays out the beginning of that path: vital steps that are still not yet well-trodden. To summarize the key action points:

- Accounting for emissions across Scopes 1, 2 and 3 according to the GHG Protocol;
- Committing to science-based short-term and 2050 targets for internal emissions reductions;
- Investing in additional climate mitigation beyond the value chain;
- Undertaking detailed due diligence on carbon credit purchases to ensure high-quality carbon benefits and uphold social justice;
- Forming a temporally dynamic portfolio that transitions towards high-permanence removal credits with time;
- Communicating progress in a clear, honest and transparent way to customers and stakeholders.

The reality is that guidance around best practice is in constant evolution, and it is essential to remain up-to-date on the latest thinking in the space.

While there are hurdles in technology that must be leaped, the greatest obstacles to a safe future are not in science but in leadership. The largest and most polluting corporations are still maximising profit at the expense of humanity. The time has come for bold companies to step outside the business-as-usual frame of thinking, and imagine radical change.

NOTES AND CREDITS



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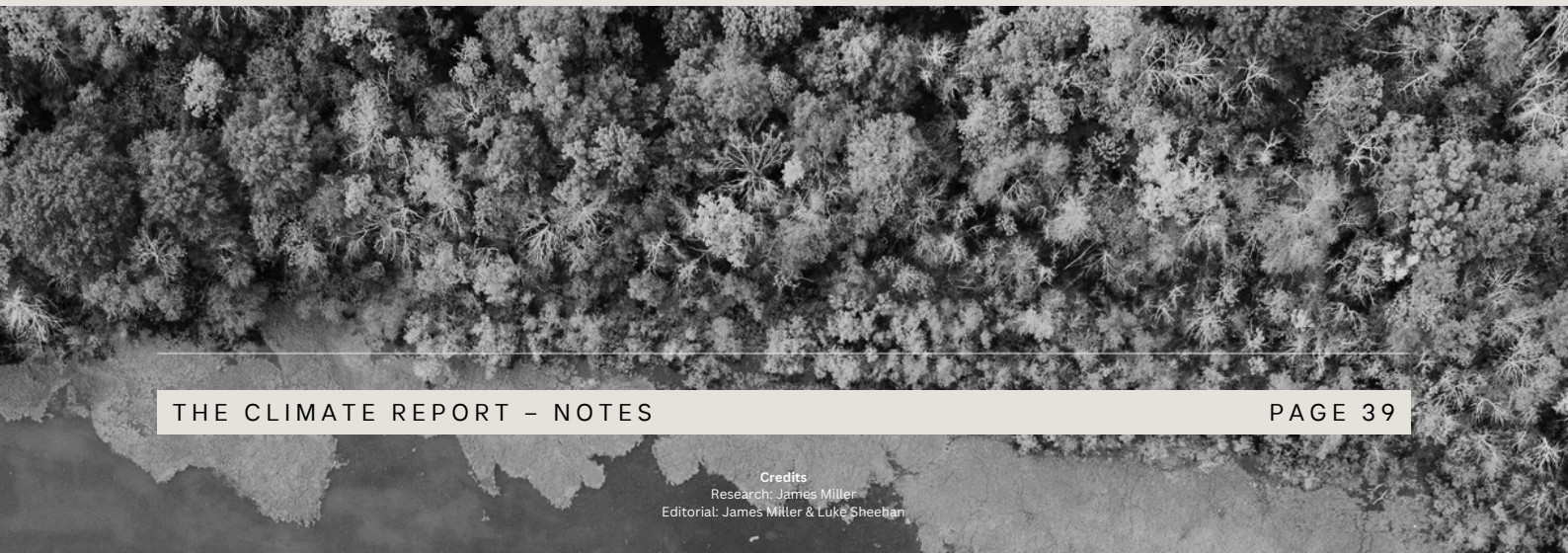

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