

# Accelerating the Carbon Removal Market

## through Responsible Corporate Leadership

Market Insights  
and Recommendations  
for Corporate Leaders to  
**Make a  
Gigaton-Scale  
Climate Impact**

## ABSTRACT AND ACKNOWLEDGEMENTS

This Carbon Removal Market Insights Report presents the state of the carbon removal market and opportunities for business leaders to advance climate action.

The report is specifically geared to corporate leaders who are looking to incorporate carbon removal into their climate action plans. It highlights both the challenges and opportunities to be frontrunners in a growing effort to reverse the impacts of climate change. The report provides an industry-related snapshot in 2023, and of where the industry is heading in years to come. It concludes with recommendations for accelerating business leadership in carbon removal.

Developed by the BMW Foundation Herbert Quandt and the Carbon Business Council, this report is authored by Ben Rubin, Isabella Corpora, Bryan Scheler, and Julia Bläsius. It draws upon lessons learned from leading experts during Responsible Leaders Expert Workshops on carbon removal hosted in the last 12 months prior to its publication during New York Climate Week 2022, COP27, the World Economic Forum 2023, and other events. The authors are thankful to the dozens of experts who participated in the workshops and provided feedback on this publication. By working together and embracing Responsible Leadership, we can scale up the carbon removal industry.

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through Corporate Responsible Leadership



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# Executive Summary

This Carbon Removal Market Insights Report provides a playbook for business leaders who are interested in evaluating and purchasing carbon removals to achieve their climate goals and reduce climate-harmful emissions. It also aims to provide a better understanding of what carbon removal is and of the industry as a whole.



The UN's Intergovernmental Panel on Climate Change (IPCC) and other scientific bodies have determined that 10-15 gigatons of annual carbon removals will be needed from 2030 onwards to meet the goals of the Paris Agreement and avert the worst impacts of climate change. While reducing global emissions and transitioning towards renewable and low-emission energy options stays a priority, these pathways are no longer enough. Carbon has to be removed directly from the atmosphere and locked away to help reverse the impacts of climate change.

Carbon dioxide removal (CDR) refers to multiple approaches for removing carbon dioxide from the atmosphere and a variety of pathways that make up the carbon removal ecosystem. Each pathway offers a series of benefits and co-benefits ranging from the number of jobs created to the length of time carbon dioxide remains sequestered from the atmosphere. Co-benefits can also include a variety of ecosystem services ranging from biodiversity conservation to sustainable development and greater climate resilience.

To achieve the ambitious goals, carbon removal levels will have to more than quadruple in the next seven years from what they are in mid-2023. While more than \$225 million CDRs were purchased in 2022<sup>1</sup>, this was less than 0.0006% of the removals needed by 2050 for hard-to-decarbonize emissions

according to the State of Carbon Dioxide Removal report<sup>2</sup>. Business leadership is essential to accelerate the removal market, help companies achieve their climate targets, and protect the planet.

**Business leaders are needed to scale up the industry from where it is in mid-2023 to the levels required to meaningfully reach climate targets. Such leadership includes undertaking CDR purchases, charting the responsible deployment of removals by encouraging community engagement from the start, and engaging in policy to help form the frameworks needed to scale up carbon removal.**

To scale up the industry from where it is in mid-2023 to the levels required to reach our climate targets we need the involvement of business leaders. Such leadership involves undertaking CDR purchases now (rather than waiting), charting the responsible deployment of removals by encouraging community engagement from the start, and engaging in policy to help form the frameworks needed to accelerate carbon removal. Diving into topics like monitoring, reporting, and verification (MRV) can reinforce the efficacy and legitimacy of removals.

<sup>1</sup> CDR.fyi (2022): CDR.fyi 2022 Year in Review, <https://medium.com/cdr-fyi/cdr-fyi-2022-year-in-review-d095acd9a1a0>.

<sup>2</sup> Smith, S. M., (University of Oxford), Geden, O. (German Institute for International and Security Affairs, SWP), Minx, J. C. (Mercator Research Institute on Global Commons and Climate Change, MCC), and Nemet, G. F. (University of Wisconsin-Madison) (2022): The State of Carbon Dioxide Removal (first edition), <https://static1.squarespace.com/static/633458017a10e214f3772c76/v/63e3d4602156db24bc18c91c/1675875445298/SoCDR-1st-edition.pdf>.



## Challenges and Opportunities

We are at a unique moment in time to confront climate change through CDR purchases by companies worldwide. Business leaders wanting to scale up the carbon removal industry and create a gigaton-scale climate impact face certain challenges, but there are also great opportunities to address them and break new ground.

### PHASE ONE CHALLENGES

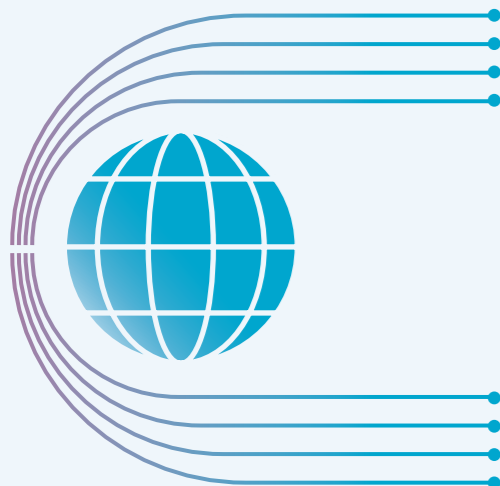
COMPANIES BEGINNING THEIR CARBON REMOVAL JOURNEY

- Limited Awareness
- Missing Mandate and Regulatory Guidance
- Concerns About Technological Readiness
- Mixed Civil Society Support

### PHASE TWO CHALLENGES

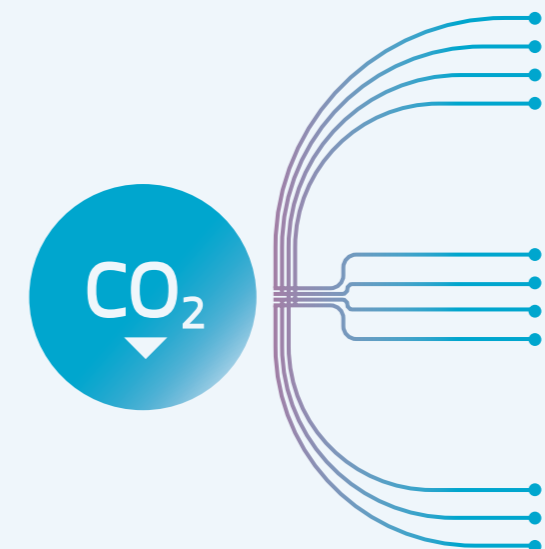
COMPANIES GETTING READY TO PURCHASE

- Trust and Transparency
- Lack of Existing Resources and Experts
- Cost of Carbon Removal
- Lack of Supply



## Pathways and Resources

Besides the major opportunities opening up for carbon removal, there are also multiple pathways to help accelerate the removal ecosystem for companies that are not yet ready to make a carbon removal purchase.



### PHASE ONE OPPORTUNITIES

SETTING THE STAGE FOR PURCHASING

- Establish twin targets
- Support education and build awareness
- Increase ambition in net-zero pledges
- Set an internal carbon price

### PHASE TWO OPPORTUNITIES

ECOSYSTEM BUILDING

- Support responsible deployment and leadership
- Join industry associations
- Support RD&D
- Engage in policy and encourage mandates

### PHASE THREE OPPORTUNITIES

CARBON REMOVAL PURCHASING

- Buyer clubs
- Direct purchasing
- Advance market commitments

## Next Steps

Business has a critical role to play in scaling up the carbon removal market. Increased corporate engagement creates a win-win situation by allowing private-sector companies to realize their net-zero targets, support a growing industry, and help restore the climate.

While business leadership is integral to advancing carbon removals, this work cannot happen in a vacuum. Scaling up the ecosystem also requires capital from

the private and public sector, as well as continued support and engagement with civil society.

Collaboration can help to expedite the pathway to gigaton-scale carbon removal, though this cannot replace the important work of reducing emissions. It is critical to ensure both move forward in tandem. Right now, responsible business leaders have the chance to accelerate the journey to gigaton-scale carbon removal.



## FOREWORD

# Responsible Leadership for Climate Action

This is a decisive decade for climate action. To meaningfully address climate change, the world needs to upgrade leadership, governance, and collaboration to address the challenge of climate change and global warming. The BMW Foundation Herbert Quandt has thus strengthened its climate action activities in line with the UN 2030 Agenda and the Paris Agreement. We cannot solve the problems we face today with the same mindsets and practices that created them. We need a different type of leadership: Responsible Corporate Climate Leadership for carbon removal.

"Climate change is now affecting every country on every continent. It is disrupting national economies and affecting lives, costing people, communities and countries dearly today, and even more tomorrow. (...) The poorest and most vulnerable people are being affected the most. Affordable, scalable solutions are now available to enable countries to leapfrog to cleaner, more resilient economies. Climate change is a global challenge that does not respect national borders. It is an issue that requires solutions that need to be coordinated at the international level to help developing countries move toward a low-carbon economy."

WORLD ECONOMIC FORUM<sup>3</sup>

The BMW Foundation believes that every human being can make a crucial contribution to positive social change. It sees the individual commitment of leaders as a unique lever for positive change. The organization's guiding vision is a new inclusive leadership paradigm, in which leaders across the world enable the transformation toward a peaceful, just, and regenerative future. Through its work and within diverse communities across sectors, it encourages and empowers leaders to pursue this vision.

Since 1970, the Foundation has sought to address challenges, whether global or local, by breaking sectoral silos and working with leaders to strengthen cross-sectoral dialogue. Its purpose, as stated in our statute, has always been to bring people of different cultures together, exchange ideas across borders, and build mutual trust and international understanding in the search for sustainable solutions to complex global challenges.

Solutions to many of the immediate climate challenges already exist. But implementation is lacking as a result of policy or funding issues caused by poor or non-decisions. While our world is rich in data, knowledge, innovation, frameworks, and potential, we are stuck in the implementation phase. We need more than just solutions; we need Responsible Leadership to make them a lived reality.

Moving the negotiations' pathway forward requires enabling environments of mutual understanding grounded in trust and respect. We work with partners like the Carbon Business Council to create this environment and equip leaders across sectors with the tools, connections, and sense of community to implement these solutions and act collectively.

Over the past couple of years, the BMW Foundation has been working more actively on climate action, including a strategic partnership with the UN Framework Convention on Climate Change (UNFCCC). The BMW Foundation's activities aim to strengthen motivation, spur innovation, and catalyze further change toward a low-emission, high-resilience future.

To tackle climate change, we need leaders pushing for transformation in all industries and sectors. That is why we encourage business leaders to embrace their responsibility beyond their professional and personal duties, across and within societies, sectors, communities, cultures and countries to drive influence for a better world.

<sup>3</sup> World Economic Forum (2022): Global Risks Report, <https://www.weforum.org/reports/global-risks-report-2022/>.

# Why Carbon Removal Matters

According to the United Nations' Intergovernmental Panel on Climate Change (IPCC), gigatons of carbon will have to be removed to protect the planet and avoid the worst impacts of climate change.<sup>4</sup> Carbon removal provides an opportunity to not only bring emissions down to zero, but also to make them net-negative. This goes further than the goal of zero emissions in that it removes legacy emissions.

## STAYING BELOW 1.5 DEGREES OF GLOBAL WARMING

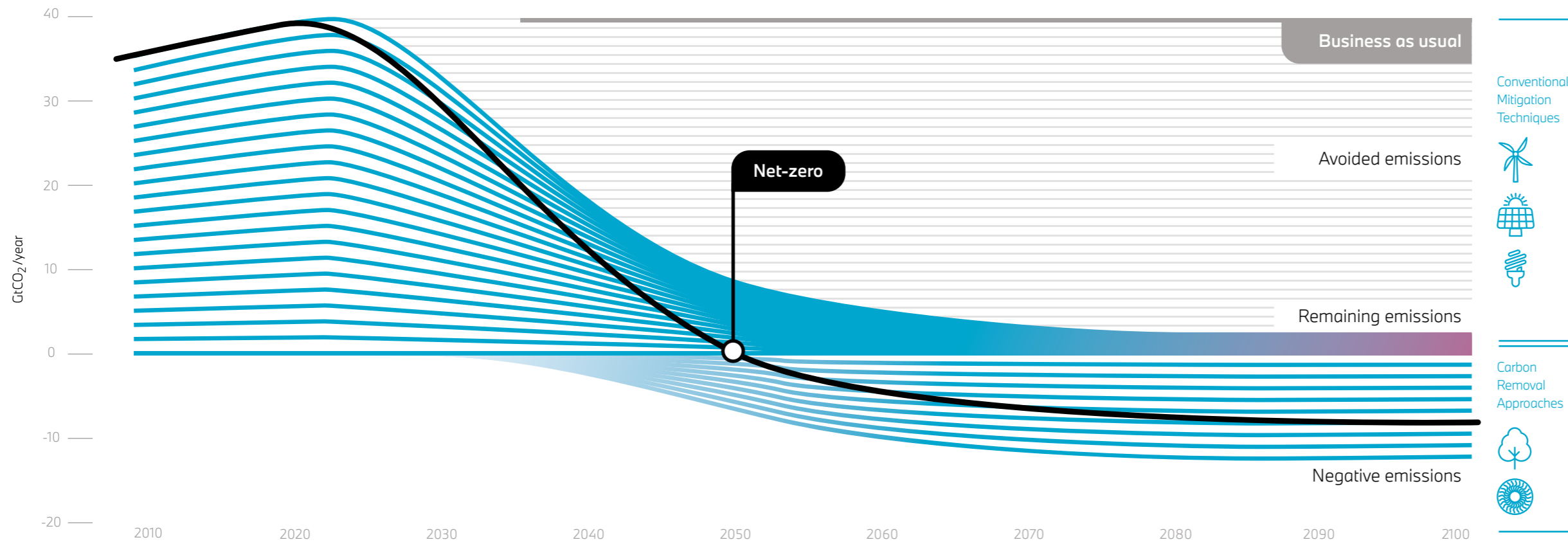


Figure 1: Impact of avoided emissions and net negative emissions pathways up to 2100<sup>6</sup>  
Source: Adapted from IPCC 2018

Carbon removal is the process of removing legacy carbon dioxide from the atmosphere and storing it in a variety of ways ranging from deep underground storage on land to storage in the ocean<sup>5</sup>. It is a crucial component of realizing a net-zero future. Figure 1 below presents the World Resources Institute's assessment of how the world can stay below 1.5° C. of global warming with reference to avoided emissions and mitigation techniques versus negative emissions with carbon removal approaches.

While emissions reductions remain the overall priority, carbon removal levels need to be increased. This is why companies the world over must be involved in growth of the carbon removal market – from leadership in purchasing removal credits to helping fund novel technological developments as part of net-zero commitments, as well as subsequently

strengthening efforts to decarbonize their own portfolios.

Achieving net-zero pledges is a big driver for carbon removal purchasing. Net zero, aka carbon neutrality, focuses on ensuring a balance between carbon dioxide emissions entering the atmosphere and those being removed from it. Thousands of companies have committed to net-zero pledges, including almost one third of Europe's largest companies<sup>7</sup> and over 400 of the largest companies in the U.S<sup>8</sup>. The European Union has become the first continent to commit to climate neutrality by 2050<sup>9</sup>, with ample opportunities provided for individual states to widen and facilitate companies entering the CDR market. Carbon removal is especially important for hard-to-decarbonize sectors of the economy, such as aviation and steel production.

<sup>4</sup> Intergovernmental Panel on Climate Change (2022): Climate Change 2022: Mitigation of Climate Change, [https://www.ipcc.ch/report/ar6/wg3/downloads/report/IPCC\\_AR6\\_WGIII\\_FullReport.pdf](https://www.ipcc.ch/report/ar6/wg3/downloads/report/IPCC_AR6_WGIII_FullReport.pdf).

<sup>5</sup> Institute for Carbon Removal Law and Policy, American University (2020): Explainer: Carbon Removal [https://www.american.edu/sis/centers/carbon-removal/upload/carbon-removal-explainer\\_icrip\\_accessible.pdf](https://www.american.edu/sis/centers/carbon-removal/upload/carbon-removal-explainer_icrip_accessible.pdf).

<sup>6</sup> Leslie-Bole, H., Lebling, K., and Bridgwater, E. (2022): What to know about 5 big plans for U.S. carbon removal, Greenbiz, <https://www.greenbiz.com/article/what-know-about-5-big-plans-us-carbon-removal>.

<sup>7</sup> Accenture (2021): Almost One-Third of Europe's Largest Listed Companies Have Pledged to Reach Net-Zero by 2050, Accenture Study Finds, <https://newsroom.accenture.com/news/almost-one-third-of-europes-largest-listed-companies-have-pledged-to-reach-net-zero-by-2050-accenture-study-finds.htm>.

<sup>8</sup> McKinsey (2022): Navigating America's net-zero frontier: A guide for business leaders, <https://www.mckinsey.com/capabilities/sustainability/our-insights/navigating-americas-net-zero-frontier-a-guide-for-business-leaders>.

<sup>9</sup> European Parliament (2021): EU Climate Law: MEPs confirm deal on climate neutrality by 2050, <https://www.europarl.europa.eu/news/en/press-room/20210621IPR06627/eu-climate-law-meps-confirm-deal-on-climate-neutrality-by-2050>.



Action by business leaders can spur innovation, encourage the carbon removal market, and rapidly shape an industry that is ripe with opportunity. Responsible Leadership in carbon removal will be key to charting the successful growth of the industry, with important variables such as ensuring co-benefits are maximized in communities where projects are taking place.

But while carbon removal is vital to achieving net-zero pledges, it is not a silver bullet. The same scientists who affirm the need for gigatons of carbon removal also warn that it cannot replace the important work of reducing emissions. Twin targets, a concept proposed for net-zero pledges to establish clear targets on removals and reductions, provides transparency on how much carbon removal is taking place<sup>10</sup>. Clarity on the amount of removals being used is one element of transparency; overall transparency is an important element of net-zero pledges to ensure efficacy in their delivery.

**Continuing the crucial work of reducing emissions is more critical than ever and must continue to be the top priority. But to realize net-zero pledges, this must be increasingly accompanied by removing carbon dioxide from the atmosphere.**

This Carbon Removal Market Insights Report addresses companies interested in purchasing and evaluating carbon removal credits, and facilitates a better understanding of carbon removal and the industry as a whole. The report's findings are drawn from industry leaders and experts in the carbon removal field and corporate ecosystems. The report builds on a series of workshops hosted throughout the world with a focus on what could be done to accelerate corporate action on climate change. Many of these conversations took place during

Climate Week in New York City in 2022, COP27 in Egypt in 2022, and the World Economic Forum in Davos in 2023. In each workshop, dozens of experts shared their ideas and expertise about what can be done to accelerate the carbon removal market.

## Progress in Carbon Removal

Buoyed by record-levels of public-sector investment, the private sector is helping to grow the carbon removal market. The first half of 2023 included record carbon removal purchases by corporate buyers across Europe and around the world<sup>11</sup>. This included companies like South Pole, SwissRe, UBS, and Mitsubishi joining together in the NextGen CDR Facility to purchase 200,000 tonnes of carbon removal credits to permanently lock away carbon dioxide. Together, these companies have pledged to purchase

one million tonnes of carbon removal credits by 2025.

An increasing number of companies are turning to carbon removal to complement their decarbonization efforts and realize their net-zero climate pledges. Despite the critical role that carbon removal is positioned to play in stabilizing the climate, removals' engagement by business is just in its early stages, as the removal market itself continues to grow. Whereas several challenges have limited carbon removal purchasing by business, there are also great opportunities for high impact and success. Companies<sup>12</sup> like Microsoft have established net-negative pledges to remove historic emissions from the atmosphere<sup>13</sup>. Carbon dioxide removal (CDR) can be used to counterbalance hard-to-decarbonize emissions, reduce historic emissions, and lead the way on climate action. In the following section, we look at the various approaches to removing carbon from the atmosphere.



<sup>10</sup> Dorndorf, T., Lund, J. F., and Carton, W. (2021): Carbon removal experts support splitting "net zero" into twin targets, Climate Change News, <https://www.climatechangenews.com/2021/05/11/carbon-removal-experts-support-splitting-net-zero-twin-targets>.

<sup>11</sup> Gordon, O. (2023): Carbon removal market has lift-off, Energy Monitor, <https://www.energymonitor.ai/tech/carbon-removal/carbon-removal-has-lift-off/>.

<sup>12</sup> In using the term "companies" we are referring to any private-sector company, large or small.

<sup>13</sup> Microsoft (2020): Microsoft will be carbon negative by 2030, <https://blogs.microsoft.com/blog/2020/01/16/microsoft-will-be-carbon-negative-by-2030/>.



# How Carbon Can Be Removed

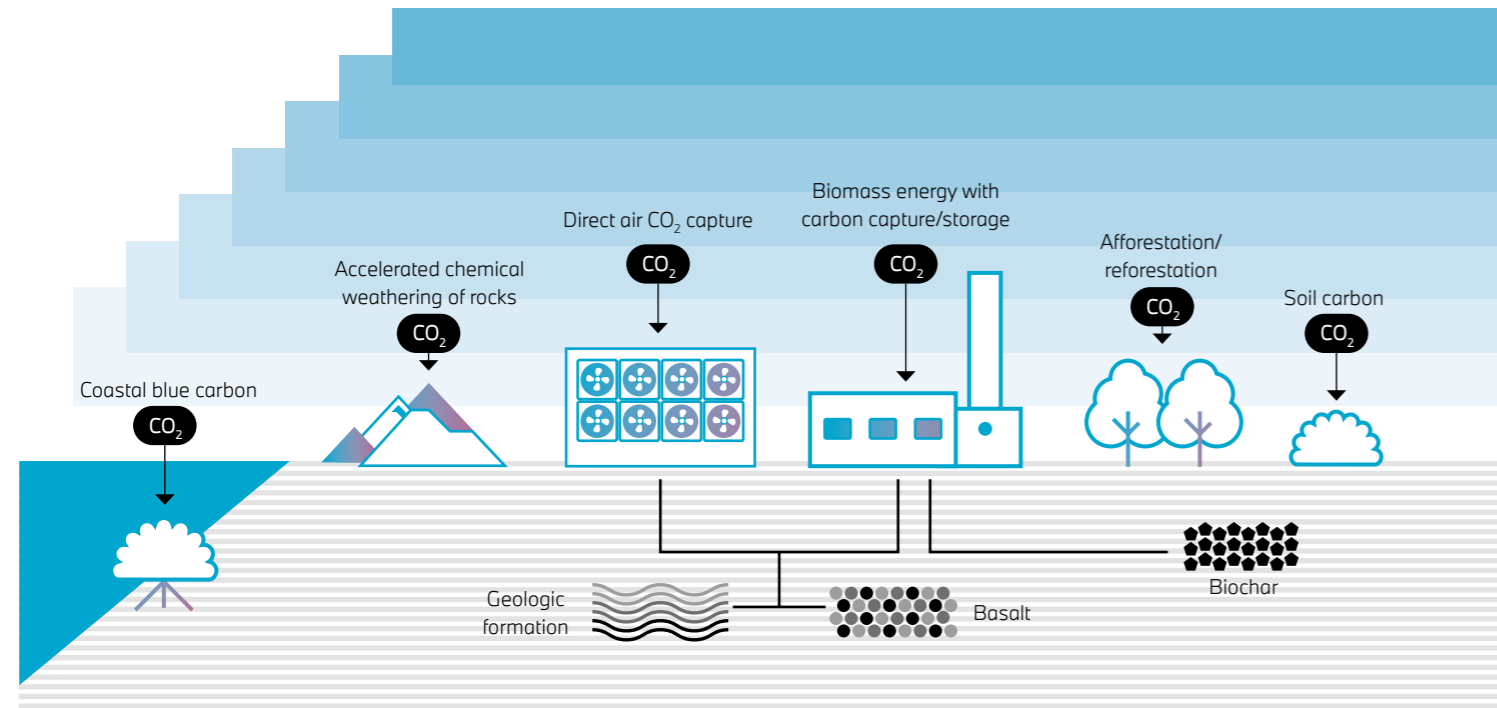


Figure 2: The spectrum of carbon dioxide removal approaches<sup>16</sup>

There are various pathways that businesses can follow in the overall carbon removal ecosystem. Each pathway provides a series of benefits and co-benefits ranging from the number of jobs created, biodiversity conservation, and greater climate resilience to the length of time carbon dioxide remains sequestered from the atmosphere. Many companies have been taking a portfolio approach to purchasing carbon removal credits or investing in carbon removal companies. Portfolio approaches involve investing in or purchasing from a variety of carbon removal approaches.

The Institute for Carbon Removal Law and Policy at Washington's American University has published a series of fact sheets with more information about each carbon removal pathway<sup>14</sup>.

Historically, carbon removal has been divided into nature-based versus engineered or technological solutions, along with many hybrid approaches<sup>15</sup>. From the more-engineered side stem approaches like direct air capture (DAC) and bioenergy carbon capture and storage (BECCS). DAC uses a mechanical process of sucking ambient air

through fan-type machines containing a chemical that binds with carbon dioxide. The sequestered carbon dioxide can then be separated from the binding agent to become a purified stream of carbon dioxide, which can be injected into underground sequestration areas such as saline aquifers or basalt formations, or into everyday products for use in greenhouses or beverage carbonation, for example. BECCS processes biomass into bioenergy while capturing carbon dioxide along the way. Approaches such as enhanced weathering and mineralization use minerals like basalt and olivine to remove carbon dioxide from the atmosphere via chemical processes.

Biochar involves burning different biosolids via pyrolysis to create a charcoal product that works well at sequestering carbon and as a soil amendment. Biochar processes can also generate renewable electricity. Other approaches, like mangrove restoration (a form of coastal blue carbon), reforestation (planting trees where trees used to grow) and afforestation (planting new trees), and agricultural practices that enhance soil carbon sequestration all use natural photosynthesis processes to remove and store carbon dioxide. There are even technologies for repurposing sequestered carbon into products like plastics or synthetic air fuels. Other approaches use the ocean to help remove carbon, e.g., through ocean alkalinity enhancement (which simultaneously combats ocean acidification), seaweed cultivation or sinking. Figure 2

on the left page illustrates the different carbon removal approaches. However, it is important to remember that nascent technologies are continually emerging.

## Entering a Net-Negative World

With these varying approaches come questions: Why should carbon be removed, and how can this be accomplished? What's the difference between the different carbon removal approaches and which of them should I choose? In answering these questions, it is important to distinguish between "net zero" and "net negative" pathways for managing carbon, i.e., purchasing carbon for a value on the market to compensate for emissions generated. "Net zero" means that a company is purchasing credit allotments equal to their emissions per year. This adds up to "no" emissions as all of them have been offset. "Net negative" means striving to go beyond the emissions produced by a company, so that rather than applying a 1:1 approach, the goal would be to remove carbon beyond 1. A white paper published by the Carbon Business Council in 2022 - Unlocking Carbon Dioxide Removal with Voluntary Carbon Markets - details in more depth the differences between offsets and removal credits in the voluntary carbon market. Figure 3 below reflects the different pathways that use carbon removals to reduce emissions.

<sup>14</sup> American University: Carbon Removal Fact Sheets & Resources, <https://www.american.edu/sis/centers/carbon-removal/fact-sheets.cfm>.  
<sup>15</sup> More information can be found here: Carbon Business Council (2023): Policy Brief: Defining Carbon Removal for Policy, <https://www.carbonbusinesscouncil.org/news/definingcdr>.  
<sup>16</sup> National Academies of Sciences (2019): Negative Emissions Technologies and Reliable Sequestration, <https://nap.nationalacademies.org/catalog/25259/negative-emissions-technologies-and-reliable-sequestration-a-research-agenda>.

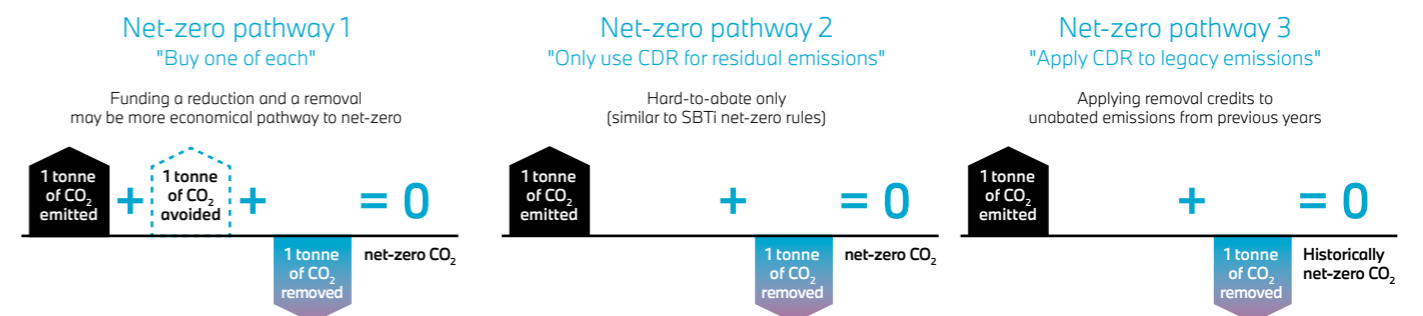


Figure 3: Effective pathways to net-zero emissions using carbon removal credits. Source: Adapted from Swiss Re

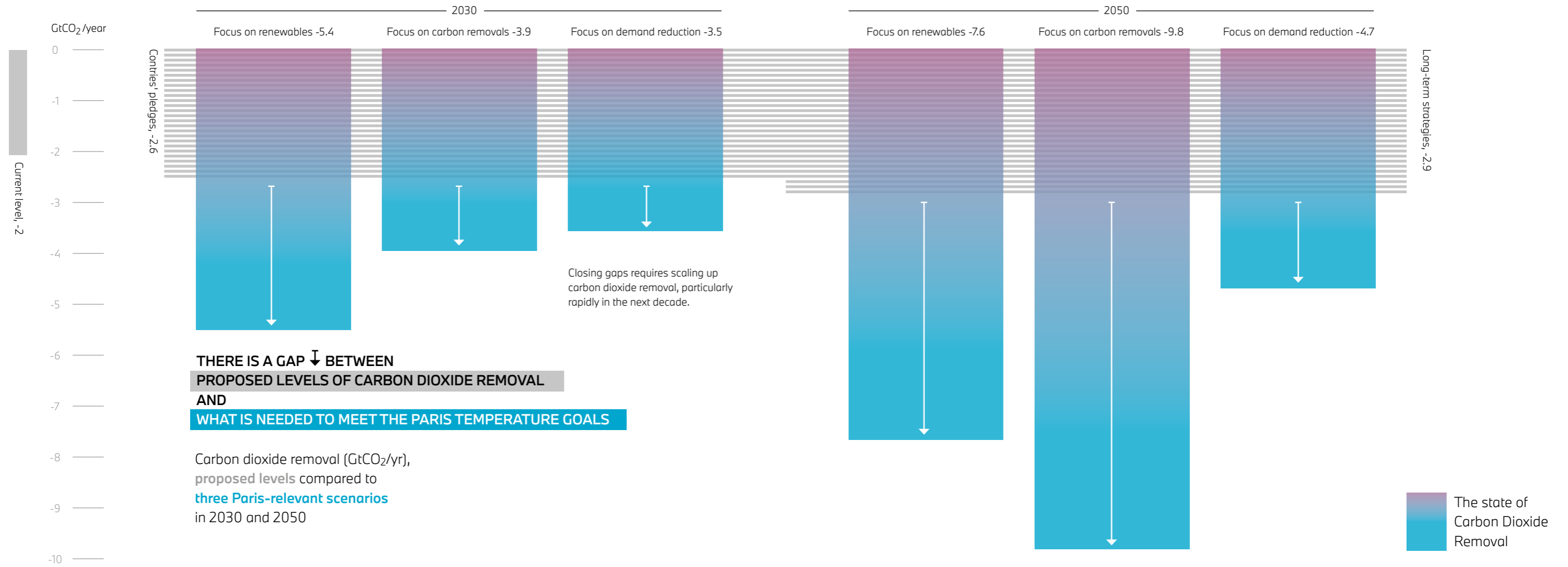


Figure 4: Scenario gaps between carbon removal usages and achievement of Paris Agreement target goals for 2030 and 2050<sup>19</sup>

# Where Carbon Removal Needs To Be Heading

The carbon removal market is growing rapidly, but more work is needed. The State of Carbon Dioxide Removal Report analyzed the gaps between proposed levels of removals and the amount needed to meet the Paris Agreement, as detailed in Figure 4 above. By August 2023, an analysis conducted by cdr.fyi, a website data analytics tool for the carbon removal industry, had revealed that over 4 million tonnes of carbon removals had been purchased up to date. Nevertheless,

as just 1.9% of these purchases had been delivered, it is clear that a rapid scale-up is needed in the removal industry from now onwards. Although business leaders are breaking new ground through CDR purchases which help to scale up the market, there is an urgent need for much greater engagement.

When cdr.fyi examined the market in 2022 it discovered rapid growth: 337% from 2020 to 2021 and 533% from 2021

to 2022<sup>17</sup>. While this growth points to the carbon removal industry's potential, the numbers are still small. Only 592,969 tonnes of CDRs were purchased in 2022 and 67% came from a single pre-purchase from the hard-to-decarbonize aviation sector. 87% of the CDRs purchased were of just one type, biochar carbon removal. More than \$225 million was spent on CDR purchases in 2022 alone<sup>17</sup> but this amounted to less than 0.0006% of the amount needed by 2050 for hard-to-de-

carbonize emissions. According to the State of CDR report conducted by a hub of UK universities dedicated to studying carbon removal, more than two billion tonnes (or two "gigatons") of carbon dioxide are being successfully removed from Earth's atmosphere each year<sup>18</sup>. While much of this comes from nature-based type reforestation and afforestation projects, only 0.1% is from novel technologies such as direct air capture.

<sup>17</sup> cdr.fyi (2022): CDR.fyi 2022 Year in Review, Link <https://medium.com/cdr-fyi/cdr-fyi-2022-year-in-review-d095acd9a1a0>.

<sup>18</sup> See footnote 16.

<sup>19</sup> Smith, S. M., (University of Oxford), Geden, O. (German Institute for International and Security Affairs, SWP), Minx, J. C. (Mercator Research Institute on Global Commons and Climate Change, MCC), and Nemet, G. F. (University of Wisconsin-Madison) (2022): The State of Carbon Dioxide Removal (first edition), <https://static1.squarespace.com/static/633458017a1ae214f3772c76/t/63e3d4602156db24bc18c91c/1675875445298/SoCDR-1st-edition.pdf>.

The IPCC and other scientific bodies have determined that 10-15 gigatons of annual removals will be needed from 2030 onwards to meet the goals of the Paris Agreement and avert the worst impacts of climate change. To protect the planet, carbon removal will have to more than quadruple from present levels in little more than seven years – in the context of over 35 billion tonnes of carbon dioxide per year being emitted globally, a figure that is constantly rising. This highlights the acute need to scale up the removal market.

According to the State of CDR report, more than two billion tonnes (or two “gigatons”) of carbon dioxide are being successfully removed from the Earth’s atmosphere each year. But removals will have to increase rapidly to be aligned with the findings of global climate science.<sup>20</sup>

Ongoing investment and forward-facing purchases are needed to enable novel technologies to expand. Business has a tremendous opportunity to impact global emissions by adopting portfolios that include carbon removal approaches. Purchases undertaken today – whether through a portfolio approach, via a marketplace, and/or in bilateral purchases – mean that multiple CDR pathways can receive the funding needed to grow and help companies to achieve their climate targets. This clearly creates a win-win situation. Portfolio approaches can also facilitate a blended price point for carbon removal. Pathways that remove carbon dioxide for 100,000 years have a different price tag than pathways with less duration, and both have important roles to play. Some examples of the types of corporate carbon removal purchases companies have made are detailed here.

## Examples of Corporate Carbon Removal Purchasing

Many companies in the European Union and worldwide are leading the way in carbon removal purchasing. Some of the major purchases are detailed below. These case studies highlight the variety of pathways to purchase carbon removals and support the ecosystem.

### SWISS RE DIRECT PURCHASING

Swiss Re, a reinsurance company based in Europe, has entered into a 10-year agreement with Climeworks for direct air capture to remove carbon from the atmosphere.<sup>21</sup> Swiss Re has also supported ecosystem building by publishing reports and market insights about the lessons learned from carbon removal and insurance opportunities.<sup>22</sup> Swiss Re is also a founding buyer of the NextGen Facility.

### SOUTH POLE'S NEXTGEN FACILITY PORTFOLIO PURCHASING

South Pole and Mitsubishi's NextGen facility for carbon removals aims to purchase over one million certified carbon removal credits by 2025 and thus help to normalize CDR purchases.<sup>23</sup> The recently completed purchase of 200K tonnes of carbon dioxide came via a portfolio approach, with three different projects selected for purchasing credits. The technology types and storage durations varied. As portfolios help to scale up individual technology types by spreading resources and thinning out risk, many companies see this as a valuable approach. As others feel comfortable working directly with a supplier, the choice of the approach that feels best for their organization and climate goals is ultimately up to the purchaser.

### SIEMENS SPECIAL FINANCING BRANCH

Companies can purchase carbon removal credits and also invest directly in innovators that are leading the way. Siemens Financial Services is investing in carbon removal technologies (“negative-emissions technologies” in this article), such as UK-based 44.01, a mineralization company, and Neustark, a Swiss negative-emissions concrete developer<sup>24</sup>.

<sup>20</sup> See footnote 16.

<sup>21</sup> Swiss Re (2021): Swiss Re and Climeworks launch partnership by signing world's first ten-year carbon removal purchase agreement, <https://www.swissre.com/media/press-release/nr-20210825-swiss-re-climeworks-partnership.html>.

<sup>22</sup> Swiss Re (2021): The insurance rationale for carbon removal solutions, <https://www.swissre.com/dam/jcr:31e39033-0ca6-418e-a540-d61b8e7d7b31/swiss-re-institute-expertise-publication-insurance-%20rationale-for-carbon-removal-solutions.pdf>.

<sup>23</sup> South Pole (2023): NextGen - a South Pole/Mitsubishi Corporation joint venture - establishes world's largest diversified portfolio of permanent carbon dioxide removals to scale the market, <https://www.southpole.com/news/nextgen-establishes-worlds-largest-diversified-portfolio-of-permanent-carbon-dioxide-removals>.

<sup>24</sup> Siemens: Reversing the tides: Investing in carbon capture technologies, <https://www.siemens.com/global/en/products/financing/siemens-financial-insight-center/investing-in-carbon-capture-technologies.html>.

### KLARNA AND MILKYWIRE INTERNAL PRICE ON CARBON

Milkywire's Climate Transformation Fund has seven dedicated CDR projects and funding from companies like Spotify and Klarna, while Klarna's internal tax is helping to fund many CDR developers<sup>25</sup>. Klarna, a global payments network, was able to leverage this tax internally and use its proceedings to invest in smaller carbon removal companies across a variety of approaches. Creating an internal price on carbon (where applicable) is one way businesses can gain funding to support CDR developers.

### FRONTIER ADVANCE MARKET COMMITMENTS

The private sector has started to pool funding for carbon removal projects. Frontier, an advance market commitment (AMC) initiative created by companies including Stripe, Shopify, Meta, Alphabet, and the consulting company McKinsey, currently hosts almost \$1 billion in funding for CDR projects. Another \$100 million was recently announced through contributions from H&M, JP Morgan, and Workday<sup>26</sup>. Frontier's AMC approach specifically specializes in carbon removal and providing CDR funding upfront to help the market grow. Smaller innovative companies may well have an impactful design but lack the funding to execute the project in question. Yet without a project and the technological readiness to demonstrate to investors, they can also miss out on funding opportunities. The AMC approach helps provide upfront funding so such companies can expand and later deliver.

### APPLE CLIMATE INVESTMENTS

Apple runs a \$200 million Restore Fund that includes some CDR projects and specifically targets nature-based solutions<sup>30</sup>. As their website states, "The Restore Fund is part of the company's comprehensive roadmap to become carbon neutral for its entire supply chain and life cycle of every product by 2030." The fund helps Apple meet its climate goals by removing full supply chain emissions, and also helps nature-based companies to grow.

### MICROSOFT FUND ALLOCATION AND PROCUREMENT

Microsoft runs a Climate Innovation Fund and operates a \$1 billion USD procurement process that allows direct investment by project developers rather than purchasing through a marketplace. Their investments and direct project financing can help scale up individual project developer companies. This funding goes toward project developers in the form of investments and is entirely different from Microsoft's purchasing of credits from a project developer, as exemplified via their agreement with Climeworks<sup>27</sup> for a 10-year offtake agreement<sup>28</sup>.

### BOSTON CONSULTING GROUP CARBON REMOVAL CREDIT AGREEMENT

Boston Consulting Group (BCG) signed a 40,000-tonne carbon removal credit agreement with a direct air capture company in June 2023<sup>31</sup>. In this bilateral partnership, BCG has both purchased removals to cover part of its emissions while agreeing to help the direct air capture company with their business strategy as a consulting firm. In other words, BCG is contributing not only to tackling emissions, but also to the development of emerging companies. BCG is also a member of the NextGen CDR Facility.

### ZENDESK OFFTAKE AGREEMENTS

Zendesk has partnered with other companies to create contractual commitments to purchase carbon removal credits in the future, since many projects are still in their piloting phases. Zendesk is part of a \$53 million purchase to help Charm Industrial, a bio-oil carbon removal approach, remove and permanently store 112,000 tonnes of CO<sub>2</sub> underground<sup>29</sup>.

<sup>25</sup> Klarna (2023): Klarna announces multi-million contribution from internal carbon tax for game-changing climate impact solutions; shares progress on emissions reduction, <https://www.klarna.com/international/press/klarna-announces-multi-million-contribution-from-internal-carbon-tax-for-game-changing-climate-impact-solutions-shares-progress-on-emissions-reduction/>.

<sup>26</sup> Clifford, C. (2023): JPMorgan and H&M join tech giants in buying \$1 billion of carbon dioxide removal, CNBC, <https://www.cnbc.com/2023/04/12/jpmorgan-hm-workday-join-frontier-co2-removal-program.html>.

<sup>27</sup> Climeworks is a Swiss direct air capture company. More details on their partnerships with Microsoft here.

<sup>28</sup> Climeworks (2022): Climeworks becomes first supplier of long-term, technology-based carbon removal to Microsoft, as the companies sign a 10-year offtake agreement, <https://climeworks.com/news/climeworks-extends-collaboration-with-microsoft>.

<sup>29</sup> Zendesk (2023): Our climate commitment: Zendesk signs its first offtake agreement to scale carbon removal technology, <https://www.zendesk.co.uk/newsroom/articles/our-climate-commitment-zendesk-signs-its-first-offtake-agreement-to-scale-carbon-removal-technology/>.

<sup>30</sup> Apple (2023): Apple expands innovative Restore Fund for carbon removal, <https://www.apple.com/newsroom/2023/04/apple-expands-innovative-restore-fund-for-carbon-removal/>.

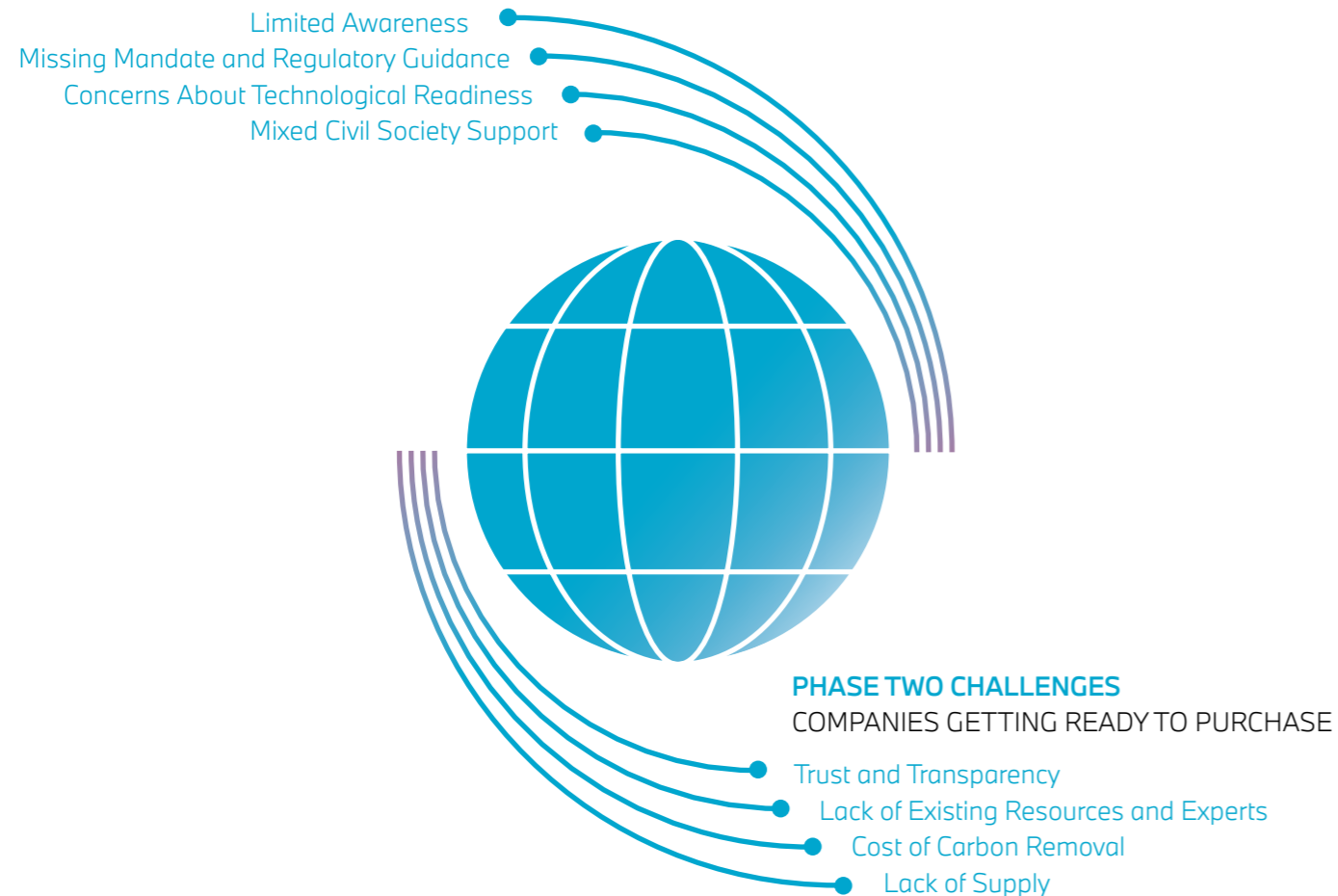
<sup>31</sup> BCG (2023): Boston Consulting Group Enters 40,000-ton Carbon Removal Credit Agreement with CarbonCapture Inc., <https://www.bcg.com/press/21june2023-bcg-enters-carbon-removal-credit-agreement-with-carboncapture>.

# Challenges of Scaling Up Carbon Removals

Although the carbon removal market is growing, the level of carbon removal purchasing is still too low for the industry's desired growth. With only a modest amount of removals having been purchased to date, business leaders now have the opportunity to break new ground. This may involve overcoming the challenges at the intersection of available supply and growing demand, as well as seizing the opportunities that are opening up. The challenges and opportunities for companies looking to learn about carbon removal or getting ready to make a purchase are analyzed in more detail below.

## PHASE ONE CHALLENGES

COMPANIES BEGINNING THEIR CARBON REMOVAL JOURNEY



## PHASE ONE CHALLENGES

### Companies Beginning Their Carbon Removal Journey

#### LIMITED AWARENESS

It took many years and international climate agreements for the voluntary carbon market to grow alongside the compliance markets. As carbon removal credits are still taking shape, there is less awareness of removals as opposed to offsets and how they fit into companies' net-zero portfolios and/or environmental, social and corporate governance (ESG) commitments. Companies such as Swiss Re have already invested in carbon removal, but overall purchases remain at low levels. Limited awareness was cited as a challenge in the listening sessions conducted by the BMW Foundation and Carbon Business Council with different actors from the carbon removal ecosystem. This knowledge gap can be overcome through coupling private and public knowledge development and dissemination of information about CDR.

#### MISSING MANDATE AND REGULATORY GUIDANCE

While an increasing number of companies are turning to carbon removal, some point to the lack of a clear mandate as an impediment for carbon removal purchasing. The Science Based Targets Initiative (SBTi) includes carbon removal in tandem with emission reductions. Their proposal is that net-zero pledges should be 90% reductions and 10% removals to spur carbon removal purchasing. However, there have been calls for SBTi to go even further and provide greater levels of clarity<sup>32</sup>. Another issue is that not all guidance bodies have been supportive of carbon removal. The Net Zero Asset Owner Alliance, which represents more than \$11 trillion in assets, recently updated a protocol with guidance that carbon removal should not be used until 2030<sup>33</sup>. All of these efforts are voluntary in view of the absence of a price on carbon or other legislative mandates that

could help spur private-sector carbon removal purchasing.

The Science Based Targets Initiative (SBTi) includes carbon removal in tandem with emission reductions. SBTi proposes that net-zero pledges should be 90% reductions and 10% removals by 2050 to spur carbon removal purchasing.

#### CONCERNS ABOUT TECHNOLOGICAL READINESS

Some prospective buyers have expressed a concern about "technological insecurity" in purchasing removals and whether they will work. It has to be said, however, that many removal practices existed long before the current growth of the carbon removal market. An increasing number of demonstration projects already point to their efficacy and the success of novel approaches, while a portfolio purchasing approach for a company can help to distribute any potential risks.

#### MIXED CIVIL SOCIETY SUPPORT

While carbon removal has strong support from many facets of civil society, some communities, nonprofits and academics are still expressing their concerns. Critiques include that carbon removal may deflect from the important work of reducing emissions and that some of the approaches are not proven. This mixed support from civil society can impede action by business, especially with respect to concerns that the purchase of carbon removal could lead to claims of greenwashing. Initiatives such as community engagement or MRV methodology development can help to provide transparency and accountability to the public.

<sup>32</sup> Hausfather, Z., Chay, F., Freeman, J., and Cullenward, D. (2022): The SBTi net-zero standard should include guidance on carbon removal, Carbon Plan, <https://carbonplan.org/research/sbti-carbon-removal>.

<sup>33</sup> An open letter requesting separate carbon removal targets to Net Zero Asset Owners Alliance (NZAOA) was published in response, with the Carbon Business Council as signatory, <https://puro.earth/articles/open-letter-requesting-separate-carbon-removal-targets-to-ne-796>.

## PHASE TWO CHALLENGES

### Companies Getting Ready to Purchase

#### TRUST AND TRANSPARENCY

As many approaches to carbon removal are still under development, business leaders may not trust the efficacy of carbon removal pathways. The carbon removal industry is actively working to tackle this challenge through monitoring, reporting and verification (MRV) frameworks, such as clear methodologies (protocols) on how carbon removal should be and actually is taking place, as well as complete internal life cycle assessments (LCAs). To date, many of these protocols are being developed by individual companies. External validators can then review the methodologies to ensure that carbon is being accurately removed from the atmosphere, which will legitimize the project and the generation of the carbon credit for the market. To scale up carbon removals, a more cohesive and standardized approach to MRV is viewed as an important part of the equation, as was highlighted in a recent issue brief published by the Carbon Business Council<sup>34</sup>.

#### LACK OF EXISTING RESOURCES AND EXPERTS

Business leaders who want to purchase removals may run into a challenge of not knowing where to move forward. An increasing number of buyer clubs, such as NextGen CDR Facility and Frontier, can help to streamline this process. Moreover, consultants can help companies in their journey and program a customized portfolio approach.

#### COST OF CARBON REMOVAL

The cost per tonne of carbon removal varies significantly from approach to approach, ranging from tens to hundreds of US dollars. While higher-priced removals often reflect longer

levels of permanence, this pricing may well be higher than some companies are willing to pay today. As carbon removal research, demonstration and deployment (RD&D) progresses, it is likely to follow a technology cost curve similar to solar energy, where costs fell significantly as technological production evolved with economies of scale. Investing in carbon removal today will help to bring down the technology cost curve. Overlaying carbon removal with an internal price on carbon is being used as one guidepost and pathway forward. This means that the cost of removing carbon as a service and the benefits from it would be taken into account in corporate decision-making and future actions.

#### LACK OF SUPPLY

The demand for carbon removal is growing, but the number of removal solutions on the market is still relatively small. According to cdr.fyi, some carbon removal orders are taking more than 30 months to deliver, though other forms of CDR, such as biochar, can be fulfilled within five months<sup>35</sup>.

This lack of supply may also be due to other inhibiting factors, such as CDR regulations. In the United States for example, many carbon removal companies that are seeking to inject carbon dioxide for underground storage are facing permitting backlogs of up to two years from the United States Environmental Protection Agency. Policies are actively being developed to help accelerate the growth of carbon removal, while others need updates to hasten CDR growth. The situation in the European Union is similar, where policy proposals for CDR frameworks have not yet decoupled underground storage from sequestration practices.



<sup>34</sup> Carbon Business Council (2023): Monitoring, Reporting, & Verification: Issue Brief, <https://www.carbonbusinesscouncil.org/news/mrv>.

<sup>35</sup> cdr.fyi (2022): cdr.fyi 2022 Year in Review, <https://medium.com/cdr-fyi/cdr-fyi-2022-year-in-review-d095acd9a1a0>.

# Opportunities for Increasing Carbon Removal Purchasing

As the challenges detailed above indicate, there are some aspects of the carbon removal market that business leaders cannot change. However, there are still major opportunities for responsible leadership to scale up the carbon removal industry and create gigaton-scale climate impact. The pathways and resources listed below chart the road forward for companies looking to make a carbon removal purchase. And even if a company is not yet ready, various pathways still exist for responsible business leaders to accelerate the removal ecosystem.



## PHASE ONE OPPORTUNITIES

### SETTING THE STAGE FOR PURCHASING

- Establish twin targets
- Support education and build awareness
- Increase ambition in net-zero pledges
- Set an internal carbon price

## PHASE TWO OPPORTUNITIES

### ECOSYSTEM BUILDING

- Support responsible deployment and leadership
- Join industry associations
- Support RD&D
- Engage in policy and encourage mandates

## PHASE THREE OPPORTUNITIES

### CARBON REMOVAL PURCHASING

- Buyer clubs
- Direct purchasing
- Advance market commitments

## PHASE ONE OPPORTUNITIES

### Setting the Stage for Purchasing

#### SUPPORT EDUCATION AND BUILD AWARENESS

Globally speaking, education on carbon dioxide removal is generally limited. However, many academic institutions have started expanding this research and presenting it to governments and the public at large. The CO2RE hub at Oxford University (which spearheaded the State of Carbon Dioxide Removal Report), the Institute for Carbon Removal Law and Policy at American University, and the Center for Negative Carbon Emissions at Arizona State University are some of the many academic bodies that have developed helpful resources on the subject. Although this development work is ongoing, the current gap may well hold back business leaders from carbon removal purchases.

Companies, for their part, could invest in more resources to augment the public domain and help close this knowledge gap, both internally and externally. Such measures may include disseminating the wealth of existing resources and investing in the creation of new ones. This will help to educate the general public and key stakeholders about carbon removal and how it fits into climate portfolios.

#### INCREASE AMBITION IN NET-ZERO PLEDGES

As carbon removal is critical for realizing net-zero pledges, increasing the ambition of net-zero pledges can be paired with carbon removal purchasing. This includes transparency in a net-zero pledge for what amount of removals will be required in tandem with mitigation practices. Extending a net-zero pledge may also include having a guidepost to be net-zero by 2030 instead of 2050 or setting stronger interim targets on the journey to being net-zero.

#### ESTABLISH TWIN TARGETS

Transparency in net-zero pledges helps to build public support and provides clarity on the amount of removals needed to achieve a climate target. Companies getting ready to purchase removals need to identify how many tonnes of carbon removal credits they want to purchase – and if removals are being used for Scope 1, 2, 3 emissions, or all of them. One recommended pathway is to add twin targets to a net-zero pledge about how much of a climate pledge can be realized with emission reductions and how many removals are needed. As highlighted earlier, SBTi recommends 90% reductions and 10% removals as one guide post to consider, though the amount of removals will vary by sector and a company's individual situation.

Transparency in net-zero pledges helps to build public support and provides clarity on the number of removals needed to achieve a climate target.

#### SET AN INTERNAL PRICE ON CARBON

Establishing an internal price on carbon that reflects the social cost of carbon can help to unlock climate action and carbon removal purchasing. According to CDP, a global non-profit that runs the world's environmental disclosure system for companies, cities, states and regions, nearly half the world's biggest companies are factoring the cost of carbon into their business plans<sup>36</sup>. Even in regions where government policies have not established a price on carbon, an internal price can still be used to guide business decisions. Establishing a price on carbon, aka the social cost on carbon, helps to reflect the harm caused by emissions.

<sup>36</sup> CDP (2021): Nearly half of world's biggest companies factoring cost of carbon into business plans, <https://www.cdp.net/en/articles/media/nearly-half-of-worlds-biggest-companies-factoring-cost-of-carbon-into-business-plans>.

## PHASE TWO OPPORTUNITIES

### Ecosystem Building

#### SUPPORT RESPONSIBLE DEPLOYMENT AND LEADERSHIP

Business leaders who are already purchasing or getting ready to purchase removals can help to enshrine Responsible Leadership in their activities. For example, community engagement can be encouraged and may even be required by carbon removal project developers, or companies can specifically choose projects they know are engaging actively and responsibly with communities. The carbon removal industry has an opportunity for meaningful community engagement from the outset, and this can be encouraged by business leaders. Corporate MRV requirements can also help to ensure the efficacy of carbon removal pathways and the legitimacy of their impact delivery. By sharing the lessons learned on purchasing throughout their own journey, business leaders can help to build and support the overall ecosystem.

#### JOIN INDUSTRY ASSOCIATIONS

Joining industry associations that are working at the forefront of advocacy and supporting educational efforts helps to advance the carbon removal industry. Organizations such as the Carbon Business Council, Deutscher Verband für Negative Emissionen, and the Negative Emissions Platform are working towards these goals. By partnering with associations, business leaders can gain insights and learn lessons about the removals industry, rather than having to reinvent the wheel. Additionally, several nonprofits, such as Carbon Gap and Carbon180, can provide a wealth of information and resources relating to carbon removal.

#### SUPPORT RD&D

Business leaders can support CDR not only through direct procurement, but also by leveraging their own RD&D expertise. Companies can align their existing operations and explore how their areas of expertise can help to expedite the carbon removal market. Tailings from the mining industry, for example, can be used for ocean alkalinity enhancement. The opportunities are endless.

#### ENGAGE IN POLICY AND ENCOURAGE MANDATES

Interfacing between groups like the SBTi and governments is also crucial for creating greater clarity on the role removals can play. A transparent and accountable industry will help both society and the industry itself in many ways. The ongoing development of methodologies, standards, criteria, and certifications can facilitate this. Business leaders are invited to actively engage in such processes and encourage policies that include carbon removal incorporation and analysis at a local and political level.



## PHASE THREE OPPORTUNITIES

### Carbon Removal Purchasing

#### BUYER CLUBS

Business leaders who are ready to purchase removals do not have to do it alone. Some have already seen the opportunities opened up by joining buyer clubs, such as the NextGen CDR Facility or the Frontier Fund. This helps to spread the time intensity of sourcing and due diligence required for carbon removal purchases. Expanding existing buyer clubs and forming new ones can help to grow the removal market.

#### DIRECT PURCHASING

Business leaders can build up in-house expertise or hire consultants to lead on their own direct carbon removal purchasing. This includes evaluating what forms of removal best fit a specific company based on cost, geographic location, and other variables. Evaluating the monitoring, reporting and verification (MRV) of carbon removal pathways is important to ensure their efficacy. As highlighted earlier, the portfolio approach to carbon removal purchasing is trending with companies investing in a range of approaches to help achieve climate targets.

#### ADVANCE MARKET COMMITMENTS

Even if business leaders are ready to purchase removals, there is only a limited number of carbon removal credits on the market. However, they can still purchase removals and support the ecosystem through advance market commitments (AMCs), which can help catalyze the development of carbon removal technologies. These forward-facing commitments have been used for vaccine development and other emerging approaches to help provide market assurance. The goal here is to fund projects before they come to market in the hope that some of them will gain traction. Such projects may be facilitated via the private or public sector. The Frontier Fund, for example, operates as a buyer club with an AMC purchasing model. However, it is important to remember that companies can also directly make an AMC with a carbon removal supplier.



# Conclusion and Next Steps

Business leaders have a critical role to play in scaling up the carbon removal market. Increased business engagement will create a win-win situation by allowing private-sector companies to realize their climate targets, support a growing industry, and help restore the climate.



The carbon removal market is growing rapidly, with the first half of 2023 alone seeing record purchases for carbon removal credits across Europe and worldwide. Yet, the amount purchased is still far below the level of removals needed to meet the 2050 targets, particularly for hard-to-decarbonize sectors. Right now, business leaders have a window to scale up the removal market and achieve these targets.

While this report highlights the challenges for growing removals, each challenge can also be seen as an opportunity. Whether companies are beginning their carbon removal journey or getting ready to purchase CDRs, they face challenges such as limited awareness, missing mandates and regulatory guidance, and supply shortage.

Although business leadership is integral to advancing carbon removals, this work cannot happen in a vacuum. Growing the carbon removal market requires capital and innovation from entrepreneurs, governments, and the private sector, as well as the continued

support of and engagement with civil society.

Companies can lead the way not only by purchasing removals, but also by supporting growth of the ecosystem. Business leaders are uniquely positioned to help scale up the carbon removal market through activities ranging from investing in early-stage companies to purchasing carbon removal credits. This report outlines several pathways for business engagement. And even if a company is not yet ready to make a carbon removal purchase, the report details the various pathways that exist for responsible leadership in this field. They include internal practices, such as setting twin targets or a price on carbon, and external engagement, such as joining buyer clubs or industry associations.

Business leadership in carbon removal cannot replace the important work of reducing emissions, and the road ahead will include both reductions and removals. We hope this report proves to be a helpful resource on your carbon removal journey.

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## About the Organizations

### **BMW FOUNDATION HERBERT QUANDT**

The BMW Foundation Herbert Quandt promotes Responsible Leadership and inspires leaders worldwide to work toward a peaceful, just, and regenerative future. Through our activities, we aim to advance the goals of the UN 2030 Agenda. With its cross-sectoral, cross-industries approach, the Foundation sees its potential in bridging the gap between different stakeholder groups to accelerate the operationalization of decarbonization and carbon removal technologies. Through the series of workshops that resulted in this report, the Foundation wants to develop a collective understanding of which intersectoral market-making mechanisms and funding models can help in the transition to net-zero emissions, including an overview of promising innovation partnerships and market-making mechanisms, and how we can implement these solutions at scale.

**For more information please visit:**

<https://bmw-foundation.org/en/>

### **CARBON BUSINESS COUNCIL**

The Carbon Business Council (CO2BC), a member-driven and tech-neutral trade association of companies unified to restore the climate, is the pre-eminent industry voice for carbon management innovators. In all, the nonprofit coalition represents more than 100 companies across six continents with more than 16.5 billion USD in combined assets.

**For more information please visit:**

<https://www.carbonbusinesscouncil.org>

## Glossary

### **Advance market commitments**

A binding contract to guarantee a viable market for a product once it is successfully developed.

### **Buyer club**

A club designed to pool the collective buying power of buyers, helping them to purchase goods that could be difficult to buy independently, determine varying market prices, and in the case of CDR, provide opportunities for purchases via tools such as advance market commitments.

### **Carbon dioxide removal (CDR)**

Anthropogenic activities that remove carbon dioxide (CO<sub>2</sub>) from the atmosphere and durably store it in geological, terrestrial, or ocean reservoirs, or in products. For more resources see the Carbon Business Council's Issue Brief.

### **Direct purchasing**

Purchasing goods directly from the supplier, rather than going through a marketplace, for example.

### **Environmental, social, and corporate governance (ESG)**

An approach to screening investments by considering environmental, social, and governance areas, traditionally based on corporate policies.

### **Hard to decarbonize/abate emissions**

Industrial emissions from sectors that heavily rely on carbon as an integral part of their processes, usually sectors like cement, mining, and aviation.

### **Intergovernmental Panel on Climate Change (IPCC)**

An UN intergovernmental body working to advance scientific knowledge about anthropogenic climate change.

### **Internal price on carbon**

An internal estimate of the cost of emissions based on a carbon price and the social cost of carbon.

### **Life cycle assessment**

An analysis or methodology aimed at assessing environmental impacts at all stages of the life cycle of a project.

### **Net negative**

The process of removing more greenhouse gases from the atmosphere than are being produced.

### **Net zero**

The balance between greenhouse gas emissions that are produced and an equal amount taken back out of the atmosphere.

### **Scope 1-3 emissions**

These terms from the Greenhouse Gas Protocol, an international standard on greenhouse gas emissions, refer to three groupings of emissions: Scope 1 designates direct company emissions; Scope 2 indirect company emissions; Scope 3 emissions across the company's value chain.

### **Twin targets**

Setting dual goals of reducing and removing greenhouse gas emissions.

### **United Nations Framework Convention on Climate Change (UNFCCC)**

An international environmental treaty and secretariat built to address the global threat of climate change.

## Resources

This report draws on the following carbon removal resources:

- » Accenture (2021): Almost One-Third of Europe's Largest Listed Companies Have Pledged to Reach Net-Zero by 2050, Accenture Study Finds, <https://newsroom.accenture.com/news/almost-one-third-of-europes-largest-listed-companies-have-pledged-to-reach-net-zero-by-2050-accenture-study-finds.htm>.
- » American University: Carbon Removal Fact Sheets & Resources, <https://www.american.edu/sis/centers/carbon-removal/fact-sheets.cfm>.
- » American University: What is Carbon Removal?, <https://www.american.edu/sis/centers/carbon-removal/what-it-is.cfm>.
- » Apple (2023): Apple expands innovative Restore Fund for carbon removal, <https://www.apple.com/newsroom/2023/04/apple-expands-innovative-restore-fund-for-carbon-removal/>.
- » BCG (2023): Boston Consulting Group Enters 40,000-ton Carbon Removal Credit Agreement with CarbonCapture Inc., <https://www.bcg.com/press/21june2023-bcg-enters-carbon-removal-credit-agreement-with-carboncapture>.
- » CarbonPlan: CDR Verification Framework, <https://carbonplan.org/research/cdr-verification>
- » Carbon Business Council (2022): Unlocking Carbon Dioxide Removal with Voluntary Carbon Markets: Recommendations to Expedite Climate Solutions, <https://static1.squarespace.com/static/6054db4efc6c3622f12682fe/t/63299dd2cd504e71bb2e7d64/1663671763033/Unlocking+Carbon+Dioxide+Removal+with+Voluntary+Carbon+Markets.pdf>
- » Carbon Business Council (2023): Monitoring, Reporting, & Verification: Issue Brief, <https://www.carbonbusinesscouncil.org/news/mrv>.
- » Carbon Business Council (2023): Policy Brief: Defining Carbon Removal for Policy, <https://www.carbonbusinesscouncil.org/news/definingcdr>.
- » CDP (2021): Nearly half of world's biggest companies factoring cost of carbon into business plans, <https://www.cdp.net/en/articles/media/nearly-half-of-worlds-biggest-companies-factoring-cost-of-carbon-into-business-plans>.
- » CDR.fyi (2022): CDR.fyi 2022 Year in Review, <https://medium.com/cdr-fyi/cdr-fyi-2022-year-in-review-d095acd9a1a0>.
- » Clifford, C. (2023): JPMorgan and H&M join tech giants in buying \$1 billion of carbon dioxide removal, CNBC, <https://www.cnbc.com/2023/04/12/jpmorgan-hm-workday-join-frontier-co2-removal-program.html>.
- » Climeworks (2022): Climeworks becomes first supplier of long-term, technology-based carbon removal to Microsoft, as the companies sign a 10-year offtake agreement, <https://climeworks.com/news/climeworks-extends-collaboration-with-microsoft>.
- » Dorndorf, T, Lund, J. F., and Carton, W. (2021): Carbon removal experts support splitting "net zero" into twin targets, Climate Change News, <https://www.climatechangenews.com/2021/05/11/carbon-removal-experts-support-splitting-net-zero-twin-targets>.
- » European Parliament (2021): EU Climate Law: MEPs confirm deal on climate neutrality by 2050, <https://www.europarl.europa.eu/news/en/press-room/20210621IPR06627/eu-climate-law-meps-confirm-deal-on-climate-neutrality-by-2050>.
- » Global Carbon Removal Partnership: Resources, <https://www.carbonremovalpartnership.net/resources>.
- » Gordon, O. (2023): Carbon removal market has lift-off, Energy Monitor, <https://www.energymonitor.ai/tech/carbon-removal/carbon-removal-has-lift-off/>.
- » Leslie-Bole, H., Lebling, K., and Bridgwater, E. (2022): What to know about 5 big plans for U.S. carbon removal, Greenbiz, <https://www.greenbiz.com/article/what-know-about-5-big-plans-us-carbon-removal>.
- » Hausfather, Z., Chay, F., Freeman, J., and Cullenward, D. (2022): The SBTi net-zero standard should include guidance on carbon removal, CarbonPlan, <https://carbonplan.org/research/sbti-carbon-removal>.
- » Höglund, R. (2023): You can't wait with buying carbon removal, Marginal Carbon, <https://marginalcarbon.substack.com/p/you-cant-wait-with-buying-carbon>.
- » Institute for Carbon Removal Law and Policy American University (2020): Explainer: Carbon Removal [https://www.american.edu/sis/centers/carbon-removal/upload/carbon-removal-explainer\\_icrlp\\_accessible.pdf](https://www.american.edu/sis/centers/carbon-removal/upload/carbon-removal-explainer_icrlp_accessible.pdf).
- » Intergovernmental Panel on Climate Change (2022): Climate Change 2022: Mitigation of Climate Change, [https://www.ipcc.ch/report/ar6/wg3/downloads/report/IPCC\\_AR6\\_WGIII\\_FullReport.pdf](https://www.ipcc.ch/report/ar6/wg3/downloads/report/IPCC_AR6_WGIII_FullReport.pdf).
- » Intergovernmental Panel on Climate Change (2023): Climate Change 2023: Synthesis Report, [https://www.ipcc.ch/report/ar6/syr/downloads/report/IPCC\\_AR6\\_SYR\\_FullVolume.pdf](https://www.ipcc.ch/report/ar6/syr/downloads/report/IPCC_AR6_SYR_FullVolume.pdf)
- » Klarna (2023): Klarna announces multi-million contribution from internal carbon tax for game-changing climate impact solutions; shares progress on emissions reduction, <https://www.klarna.com/international/press/klarna-announces-multi-million-contribution-from-internal-carbon-tax-for-game-changing-climate-impact-solutions-shares-progress-on-emissions-reduction/>
- » McKinsey (2023): CO2 removal solutions: A buyer's perspective, <https://www.mckinsey.com/capabilities/sustainability/our-insights/co2-removal-solutions-a-buyers-perspective>.
- » McKinsey (2022): Navigating America's net-zero frontier: A guide for business leaders, <https://www.mckinsey.com/capabilities/sustainability/our-insights/navigating-americas-net-zero-frontier-a-guide-for-business-leaders>.
- » Microsoft (2020): Microsoft will be carbon negative by 2030, <https://blogs.microsoft.com/blog/2020/01/16/microsoft-will-be-carbon-negative-by-2030/>.
- » National Academies of Sciences (2019): Negative Emissions Technologies and Reliable Sequestration, <https://nap.nationalacademies.org/catalog/25259/negative-emissions-technologies-and-reliable-sequestration-a-research-agenda>.
- » Siemens: Reversing the tides: Investing in carbon capture technologies, <https://www.siemens.com/global/en/products/financing/siemens-financial-insight-center/investing-in-carbon-capture-technologies.html>.
- » Shopify (2022): Buying Carbon Removal, Explained - Carbon Removal Buying Guide, <https://cdn.shopify.com/static/sustainability/Shopify-Carbon-Removal-Buying-Guide.pdf>.
- » Smith, S. M., (University of Oxford), Geden, O. (German Institute for International and Security Affairs, SWP), Minx, J. C. (Mercator Research Institute on Global Commons and Climate Change, MCC), and Nemet, G. F. (University of Wisconsin-Madison) (2022): The State of Carbon Dioxide Removal (first edition), <https://static1.squarespace.com/static/633458017a1ae214f3772c76/t/63e3d4602156db24bc18c91c/1675875445298/SoCDR-1st-edition.pdf>.
- » South Pole (2023): NextGen - a South Pole/Mitsubishi Corporation joint venture - establishes world's largest diversified portfolio of permanent carbon dioxide removals to scale the market, <https://www.southpole.com/news/nextgen-establishes-worlds-largest-diversified-portfolio-of-permanent-carbon-dioxide-removals>.
- » Swiss Re (2021): The insurance rationale for carbon removal solutions, <https://www.swissre.com/dam/jcr:31e39033-0ca6-418e-a540-d61b8e7d7b31/swiss-re-institute-expertise-publication-insurance-%20rationale-for-carbon-removal-solutions.pdf>.
- » Swiss Re (2021): Swiss Re and Climeworks launch partnership by signing world's first ten-year carbon removal purchase agreement, <https://www.swissre.com/media/press-release/nr-20210825-swiss-re-climeworks-partnership.html>
- » Wilcox, J., Kolosz, B, and Freeman, J. (2021): CDR Primer, <https://cdrprimer.org/>
- » World Economic Forum (2022): Global Risks Report, <https://www.weforum.org/reports/global-risks-report-2022/>.
- » Zendesk (2023): Our climate commitment: Zendesk signs its first offtake agreement to scale carbon removal technology, <https://www.zendesk.co.uk/newsroom/articles/our-climate-commitment-zendesk-signs-its-first-offtake-agreement-to-scale-carbon-removal-technology/>.

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