puro·earth

Carbon Removals:

Achieving a Net-Negative Economy

00

Executive summary

Climate change is the greatest threat to face humankind. From rising temperatures and sea levels, the impacts of climate change are becoming increasingly visible with the potential to profoundly impact the course of human history. To prevent the worst effects of climate change, we need to transition to a net zero emissions economy as soon as possible. However, achieving net zero is not enough. After net zero is reached, we need to continue to decrease the CO_2 concentration in the atmosphere to near the pre-industrial level through net-negative emissions.

In this ebook, we spoke to a variety of thought leaders, early-innovators and movers in the industry who have contributed to shaping the carbon removal market we see today. Their thoughts have shaped this ebook and extracts from their interviews are integrated throughout. Together, we explore the current state of climate change and the transition to defossilize our economy. We discuss how achieving a net zero emissions future and beyond requires a dual focus on both emission reductions and removals. While carbon removal should not be used to compensate for abatement shortfalls, these two solutions play complementary roles in accelerating the transition to a net zero economy.

We look at the available capture and storage types to remove carbon dioxide from the atmosphere. We also examine the importance of durability in carbon removal in compensating for fossil fuel emissions.

We sum up the parts that are needed to create an ecosystem to scale carbon removal to industrial levels needed to address climate change. Building trust and transparency, creating an economy that rewards negative emissions, and progressive players and long-term commitments are the three core pillars to scaling the market. All of which can be enabled through governments with collaboration from the industry to drive innovation and deliver.

And where does Puro.earth sit within all of this? A first-of-its-kind crediting platform for high-quality carbon removal that brings trust, integrity, and transparency to the market. Through collective action, innovation, and commitment across the entire ecosystem, we can build a sustainable future and give the next generation a fighting chance.

01

What's at stake: The current state of climate change

The impacts of a warming planet are already around us. Year-on-year record-breaking temperatures are becoming the norm. Catastrophic events such as the 2019-2020 bushfires in Australia and the Bangladesh floods in 2022 are a glaring reminder of just how extreme our climate is becoming.

In 2015, we saw the first significant strides toward addressing the climate emergency when 195 nations adopted the Paris Agreement at COP21. The agreement's goal is to limit global warming to well below 2°C above pre-industrial levels, and to pursue efforts to limit the temperature increase to 1.5°C. These temperature thresholds are considered by scientists to be critical, beyond such, the impacts of climate change are expected to be much more severe and difficult to adapt to. To stay within the 1.5°C limit, it is estimated that global greenhouse gas emissions will need to reach net zero by 2050[1].

Net zero means achieving a balance between the amount of greenhouse gases (GHG) emitted and the amount captured and stored from the atmosphere.

Within these emission is included carbon dioxide (CO_2), which is responsible for the largest share of global GHG emissions and is therefore the most critical gas to address to achieve net zero.

01.1 What future will we choose?

With the current global temperature increase of over 1°C, it is crucial to consider the different climate scenarios and their potential outcomes. We explore three scenarios, with 2°C and 3°C being the most likely scenarios based on current emissions and pledges, and highlight the possible futures and differences between them. As temperatures continue to rise, the impact of extreme events and irreversible consequences will only become more pronounced.

THE FUTURE THAT AWAITS US DEPENDS ON THE CHOICES WE MAKE TODAY.

1 https://www.iea.org/reports/net-zero-by-2050

The Future Choices

	TEMPERATURE INCREASE BY 1.5°C	TEMPERATURE INCREASE BY 2°C	TEMPERATURE INCREASE BY 3°C
EXTREME HEAT	50 days / 20 years 'Extreme extremes' hot days* across most locations	150 days / 20 years 'Extreme extremes' hot days* across most locations	500 days / 20 years 'Extreme extremes' hot days* across most locations
SEA LEVEL RISE	Impact over 75+ years: 0.44m Impact over 2000 years: 2-3 m	0.51m 2-6 m	0.61m 4-10 m
FOOD	8 million people will be exposed and vulnerable to crop yield change***	81 million people will be exposed and vulnerable to crop yield change***	406 million people will be exposed and vulnerable to crop yield change***
OCEANS	70–90% of global coral reefs at risk of long-term degradation due to coral bleaching**** 2% risk of endemic species† extinction in marine biodiversity hotspots	99% of global coral reefs at risk of long-term degradation due to coral bleaching**** 13% risk of endemic species† extinction in marine biodiversity hotspots	99% of global coral reefs at risk of long-term degradation due to coral bleaching**** 32% risk of endemic species† extinction in marine biodiversity hotspots

Even if temperatures stabilize after the 75 year period, sea levels will continue to rise for centuries or even millennia due to the delayed response of the oceans and ice sheets to warming temperatures.**

* 'Extreme extremes' hot days are determined by finding the temperature that only 0.1% of days in a certain area are hotter than during a specific time period in the past. Then, any day that is hotter than that temperature is considered a "hot day." Probability of 'extreme extremes' hot days with 1/1000 probability at the end of the 20th century (Vogel et al., 2020a): Global land. https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_Chapter11.pdf

** https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_Chapter09.pdf

*** Vulnerable was defined in the study as those living on less than $10/day. Population estimates based on Shared Socioeconomic Pathway 2 (SSP2) in year 2050. Byers et al., 2018 https://www.ipcc.ch/site/assets/uploads/sites/2/2022/06/SR15_Chapter_3_HR.pdf

**** https://www.ipcc.ch/site/assets/uploads/sites/2/2022/06/SR15_Chapter_3_HR.pdf

† Biodiversity Hotspots: Areas with many rare and unique species. Endemics species are only found in one place in the world. Climate change affects life at global scales and across systems but is of special concern in areas that are disproportionately rich in biological diversity and uniqueness. https://www.ipcc.ch/report/ar6/wg2/downloads/report/IPCC_AR6_WGII_CCP1.pdf

01.2 Are we doing enough? Global shortfalls and positive actions

According to the IPCC[2], while most wealthy countries and a growing list of developing countries have signalled an intention to achieve net zero emissions by mid-century, the data gathered on climate change show that most nations are missing their goals.

Despite the concerning state of global emissions, it must not be forgotten that many remarkable things are happening every day to fight back against climate change.

- The global energy transition is underway and the cost of fossil energy has reached a level in many countries where it clearly is less costly to switch to renewable energy than to continue on fossil energy[3]
- As global citizens become more aware of the planet's limitations, they are increasingly recognizing the importance of adjusting their behaviours to align with those constraints
- Many companies have voluntarily set bold climate targets independent of government pressure and policies pursued by their countries. Companies that have approved targets with Science Based Targets initiative (SBTi) have reduced their emissions by 29% between 2015-2022[4] which is a more ambitious rate than the 1.5°C trajectory
- Many current best practices are being re-evaluated. For example, regenerative agricultural practices are reversing soil depletion and decreasing dependency on industrial fertilizers
- A growing number of innovators are popping up remarkable projects spanning across the entire globe from ocean reforestation to physically removing carbon on permanent time scales from the atmosphere with methods such as direct air capture and enhanced rock weathering
- Currently, 130 countries have net zero targets[5] in place or planned for the future. This enables Governments to implement policy measures to support carbon removal methods essential to deliver the net in net zero

The year 2030 marks a critical milestone in our collective efforts to combat climate change and achieve the goals of the Paris Agreement. As we approach this deadline, it is essential that we redouble our efforts and take bold, decisive action to mitigate the worst effects of climate change.

We cannot afford to be complacent in the face of this crisis. Instead, we must seize the momentum that has been generated to date and push even harder to make radical strides for our climate in the next six years. By working together and committing to ambitious, science-based targets, we can build a more sustainable future for ourselves and for generations to come.

2 IPCC, Sixth Assessment Report, Climate Change 2022: Mitigation of Climate Change
3 https://www.irena.org/news/pressreleases/2022/Jul/Renewable-Power-Remains-Cost-Competitive-amid-Fossil-Fuel-Crisis
4 https://sciencebasedtargets.org/reports/sbti-progress-report-2021/science-based-targets-result-in-biggest-emissions-reduction-to-date
5 https://zerotracker.net/

02

Getting to net zero & beyond

All efforts should be focused on the goal of achieving net zero by 2050 to combat the worst effects of climate change. What concrete steps can we take to ensure we are on the right trajectory?

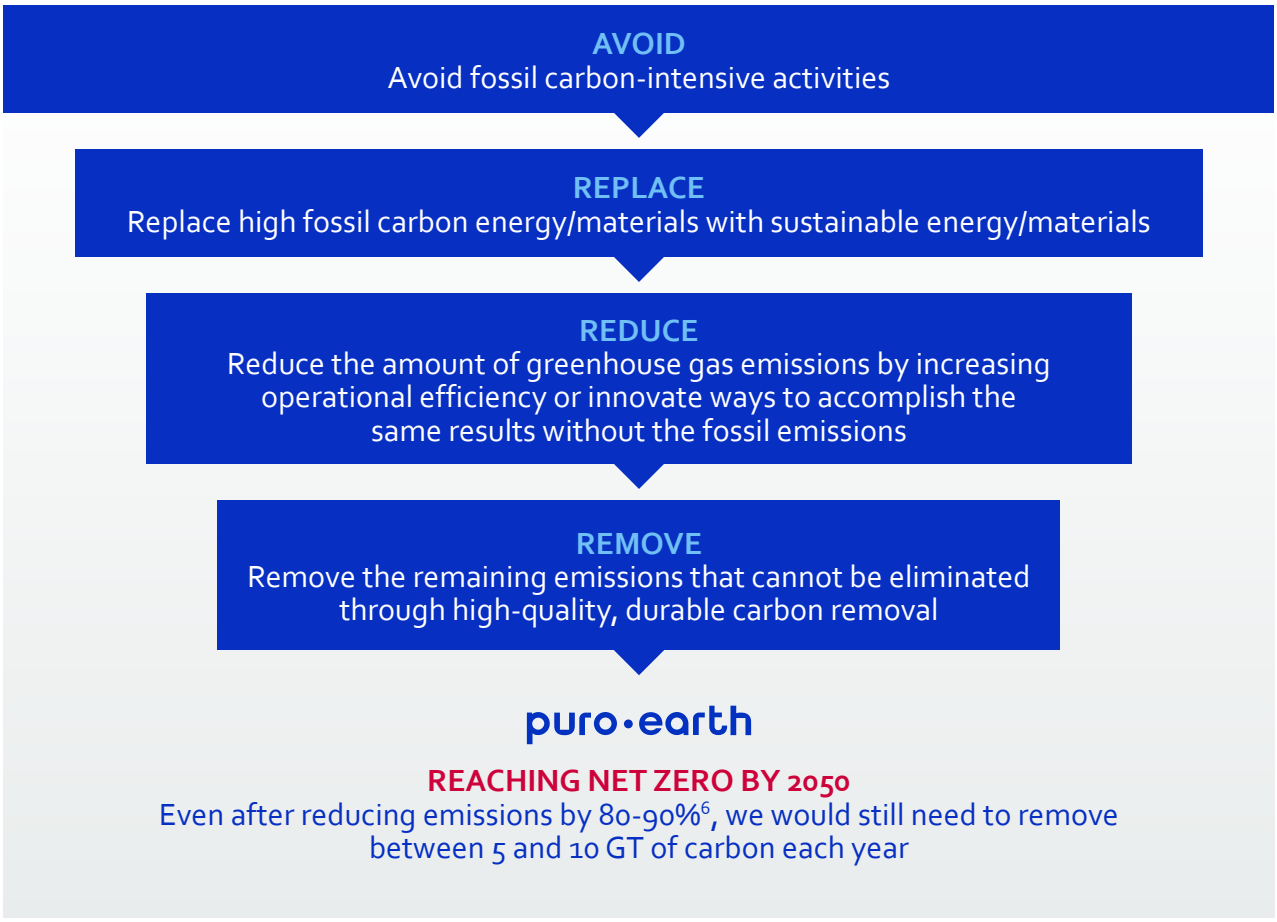
02.1 The transition to a defossilized economy

To reach net zero we need to **defossilize** our economy. We have benefited from the fossil carbon powering our economy since the industrial revolution but now we need to shift away from activities that rely on unsustainable carbon sources such as oil and gas. While the term "decarbonize" is often used to describe this process, it's not entirely accurate in emphasizing what needs to happen. There are two types of carbon activities: biogenic carbon and fossil carbon. Biogenic carbon comes from renewable sources such as plants and is an important feedstock for food and many products and applications, while also providing benefits for the environment through the long-term storage of carbon. Fossil carbon, on the other hand, is the primary source of anthropogenic greenhouse gas emissions, and using it is responsible for disrupting the balance of the long/short-term carbon cycle.

To achieve a net zero emissions future, we need to focus on eliminating the fossil carbon activities that disrupt the carbon cycle and accelerate climate change, while in parallel, protecting nature from destructive activities such as deforestation, which not only releases carbon into the atmosphere but also leads to the loss of critical biodiversity and ecosystem services.

02.1.2 Reaching net zero must start with emission reductions

The defossilization hierarchy offers a framework that prioritizes the actions needed to defossilize the economy and transition away from fossil-emitting practices.



By focusing on the most impactful actions first, such as focusing on reducing emissions at the source rather than relying solely on removal technologies, progress can be made toward achieving net zero.

02.2 Net zero is not possible without carbon removal

To drastically defossilize our economy, it is clear we need to prioritize reducing emissions and that needs to be as much as 80-90% reduction in emissions by 2050. **But this alone is not enough**. There are still unavoidable (residual) emissions to contend with and the only way to manage those in a durable way is with high-quality carbon removals. To reach net zero we need to remove 5-10 Gt of CO_2 each year.

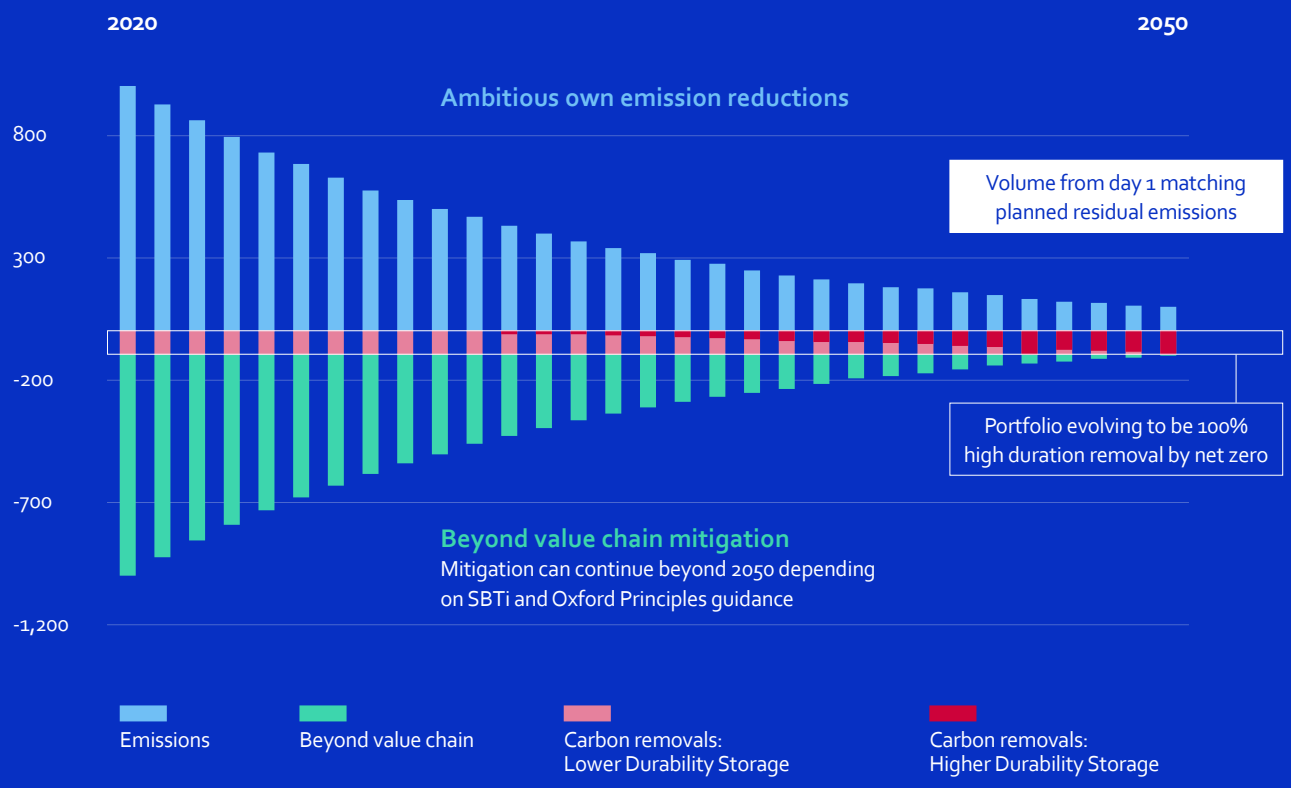
6 In line with SBTi https://sciencebasedtargets.org/net-zero

02.2.1 Carbon removal must begin today

Different ways to reach net zero delay the integration of carbon removals until short-term emission reductions have been achieved. While it's important to prioritize reducing emissions first, it's also crucial to acknowledge that establishing a carbon removal sector takes time and investment. We need to invest today to build the capacity needed for achieving net zero emissions in the future.

This pathway to net zero illustrates how a corporation can set ambitious targets to reduce emissions and compensate for any remaining emissions by building the necessary capacity for carbon removal technologies/methods. The approach involves using a combination of methods that store carbon for extended periods. The goal aligns with the Oxford Principles, aiming to enhance the durability of carbon storage by 2050. Additionally, this approach supports adaptation, biodiversity, Sustainable Development Goals (SDGs), and local community projects, extending beyond emission reductions with nature-based solution investments that fall outside of a company's value chain.

Example pathway:
Corporate emissions and compensation between 2020-2050



According to the IPCC,

"This century we'd need to build a CDR industry that rivals the scale of today's global automobile sector to put us on track to achieve the Paris Agreement Temperature Goals."

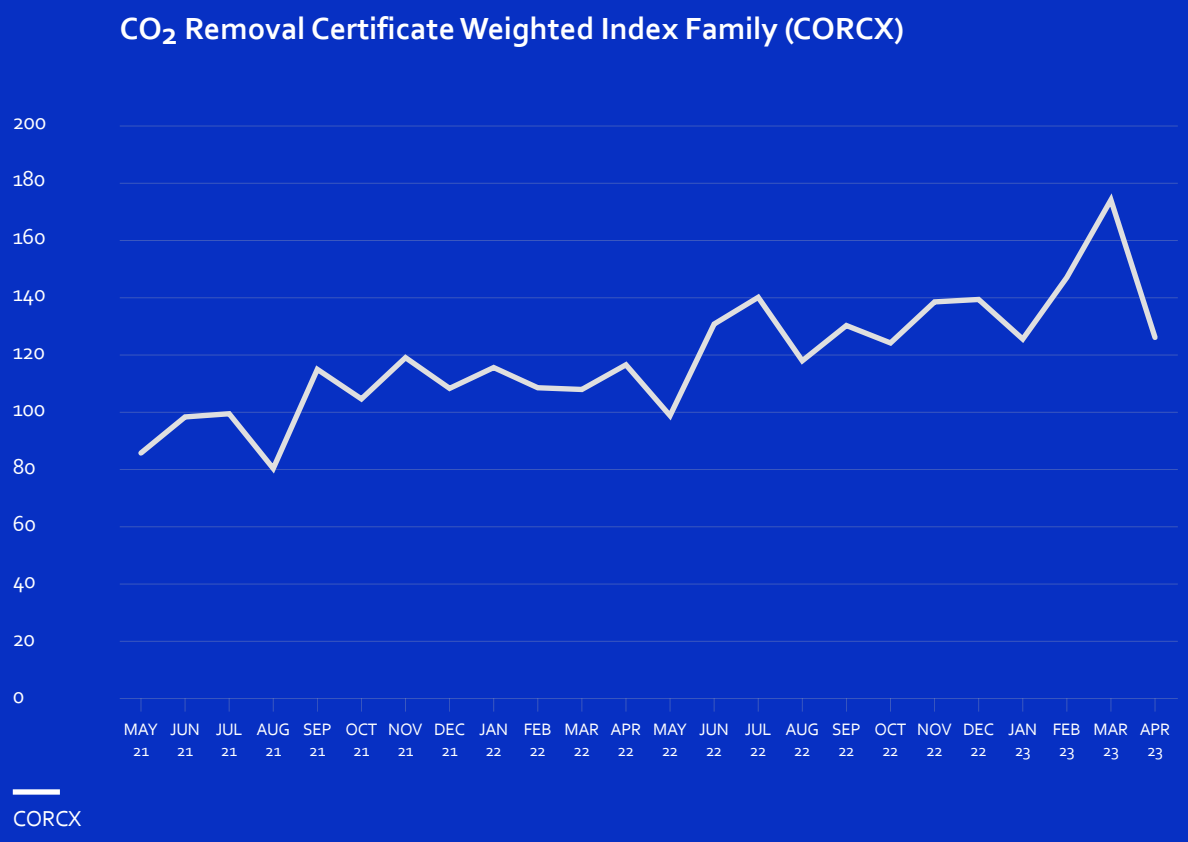
Professor Myles Allen, a climate scientist at the Oxford Net Zero initiative & Chairman of Puro.earth's Advisory Board has also emphasized the urgency of the situation to remove emissions as (and not after) the world works towards phasing out the use of fossil fuels altogether: **"We have to stop fossil fuels from causing global warming before the world stops using fossil fuels."**

By setting clear emission reduction targets and incorporating high-quality, durable carbon removal into net zero pathways today, companies will facilitate the growth of the industry and accelerate the critical transition to net zero.

02.2.2 No risk of moral hazard: Understanding the economics and role of carbon removals

The role of carbon removals in addressing the climate crisis is a hotly debated topic. There is understandable concern that investing in carbon removals creates a 'moral hazard' that allows companies to avoid the transition to renewable energy and instead rely solely on offsetting their emissions. Others see carbon removal as not just an opportunity but a necessity to put the world's climate back on track.

While **Paul Ferguson**, CEO of Accend sympathizes with such concerns, he states that **"I disagree with people who say you should only be reducing emissions, that creates a false dichotomy, its not either/or, we need to do both [emission reductions and removals]."** Sharing this sentiment is Fredrik Ekström, President of Nasdaq Stockholm and Chairman of Puro.earth, **"I think sometimes within this industry, too much time is spent on debating if you should reduce or remove emissions. We just have to do everything."**



Most companies that purchase high-quality, durable carbon removal credits are likely to be painfully aware of the high cost per metric ton removed. As of April 2023, the CORC Carbon Removal Indexes tracked by Nasdaq and Puro.earth show that the price of removing carbon through technology-based carbon removal based on Puro Standard methodologies has ranged between €100-180 per metric ton of CO_2 in 2023 to date.

Paul Ferguson, CEO of Accend, argues,

"It is much cheaper for companies to reduce their emissions than remove them, if not, it doesn't hold true that they are easier to do. At these [carbon removal] price levels, there is no risk of carbon removal being preferred. Instead, it bridges a gap to emissions that are hard to abate and aren't easy to control."

Co-founder and Head of Carbon Crediting at Puro.earth, **Marianne Tikkanen** thinks we should look at the relationship between emission reductions and carbon removals a bit differently:

"Carbon removal is not a 'get out of jail' card, it is a tool that motivates companies to explore the more economical emission reduction strategies that need to happen."

Through such high price points, carbon removals can serve as a glaring reminder, there is no easy way out of the climate crisis and that the work to transition away from a fossil-fuel dependent economy is essential and always cheaper than removing the already emitted carbon to long-term storage.

Furthermore, testing the popular belief that carbon removal and other carbon credits provide a license to pollute, a recent report by Sylvera[7] found that companies purchasing carbon credits achieve a more significant reduction in their actual emissions compared to companies that do not engage in offsetting or carbon removals.

02.3 Going beyond net zero: Net-negative emissions

Achieving net zero by 2050 is a crucial milestone but the journey will not end there. After reaching net zero, the excess greenhouse gas emissions already present in the atmosphere will continue to warm the planet for decades to come. The only way to deal with these is to become net-negative in annual carbon accounting. Net-negative emissions is when anthropogenic greenhouse gas removals exceed anthropogenic greenhouse gas emissions for a defined region or entity over a set time period (IPCC AR6 WGIII).

As **Dr Gabrielle Walker** inspirationally put it on TED Talks:

"Carbon removals are our only chance, not just to stop the problem getting worse, but to make it better."

Microsoft, a shining example in the voluntary carbon markets, has committed to achieving net-negative emissions by 2030. While no easy feat, Microsoft aims to achieve this by removing residual emissions from their supply chain as well as compensating for all historic emissions dating back to their founding in 1975. Will Microsoft's efforts serve as a catalyst for others to follow?
Only time will tell. But it certainly sets the right precedent.

7 Carbon Credits: Permission to Pollute, or Pivotal for Progress? (sylvera.com)

03

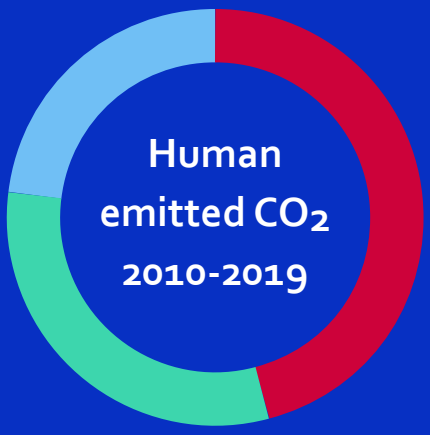
An introduction to carbon removal

03.1 What is carbon removal?

Carbon removal is the process of physically drawing down carbon dioxide from the atmosphere and durably storing it. According to the IPCC, carbon removal is more than capturing CO_2 from the atmosphere.

It's also about: **"durably storing it in geological, terrestrial, ocean reservoirs, or in products."**

When we emit carbon dioxide to the atmosphere, it ends up in the Earth system:



46 %

REMAINS IN THE ATMOSPHERE

31 %

STORED BY PLANTS AND VEGETATION ON LAND

23 %

TAKEN UP BY THE OCEAN[8]

8 Chapter 5: Global Carbon and Other Biogeochemical Cycles and Feedbacks (ipcc.ch)

03.1.1 Carbon removal methods

When we emit carbon dioxide to the atmosphere, it ends up in the Earth system:

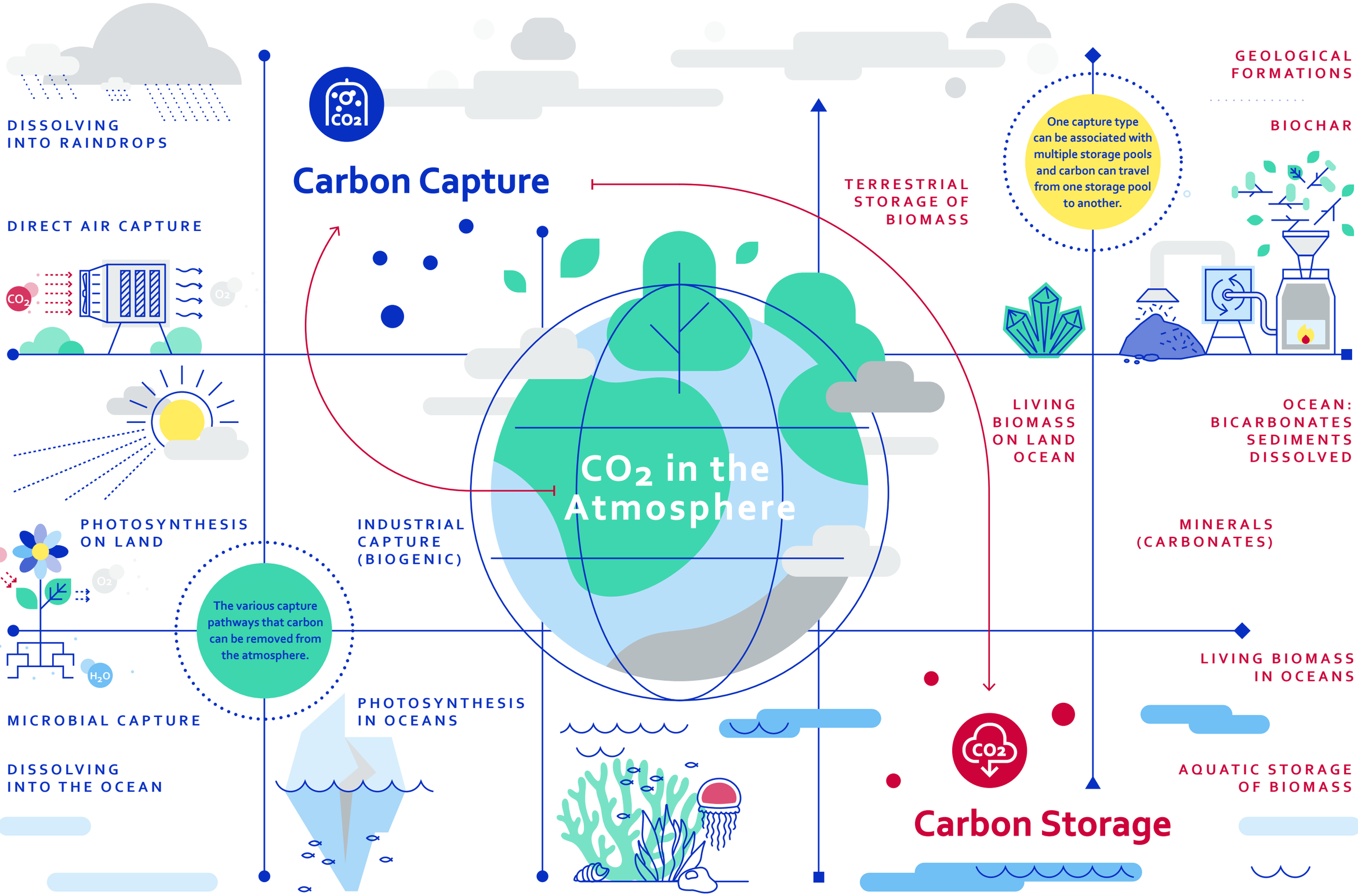
Out of the CO_2 emitted from human activities during the decade of 2010–2019, 46% remains in the atmosphere, 31% was stored by the plants and vegetation on land and 23% was taken up the ocean[8]. However, the latter carbon removal process has the adverse impact of increasing ocean acidification – one more reason to use and increase other carbon removal methods.

Carbon removal methods encompass a range of carbon capture and carbon storage types. Removal processes or pathways are commonly grouped into methods that are natural and those that are technological or engineered. This categorization is, however, blurred, and many end-to-end carbon removal pathways combine both natural and technological phases in the process. Between capture and ultimate storage, carbon may be converted and transferred through a number of carbon storage pools[9]. In a Carbon Dioxide Removal (CDR) method both capture and the ultimate storage pool together determine the sustainability of the carbon removal and how securely and for how long the carbon is locked away from the atmosphere.

On the next page is an illustration of the numerous carbon capture types and carbon storage pools involved in the known and yet-to-be-discovered carbon removal pathways.

46% of the CO_2 emitted from human activities between 2010-2019 remains in the atmosphere

8 Chapter 5: Global Carbon and Other Biogeochemical Cycles and Feedbacks (ipcc.ch)
9 https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_Chapter05.pdf


DISSOLVING INTO RAINDROPS
Carbon Capture
DIRECT AIR CAPTURE
TERRESTRIAL STORAGE OF BIOMASS
One capture type can be associated with multiple storage pools and carbon can travel from one storage pool to another.
GEOLOGICAL FORMATIONS
BIOCHAR
LIVING BIOMASS ON LAND OCEAN
OCEAN: BICARBONATES SEDIMENTS DISSOLVED
CO2 in the Atmosphere
PHOTOSYNTHESIS ON LAND
INDUSTRIAL CAPTURE (BIOGENIC)
MINERALS (CARBONATES)
The various capture pathways that carbon can be removed from the atmosphere.
LIVING BIOMASS IN OCEANS
MICROBIAL CAPTURE
PHOTOSYNTHESIS IN OCEANS
DISSOLVING INTO THE OCEAN
AQUATIC STORAGE OF BIOMASS
Carbon Storage

03.2 Durability of carbon removal

One vital component of carbon removal is durability

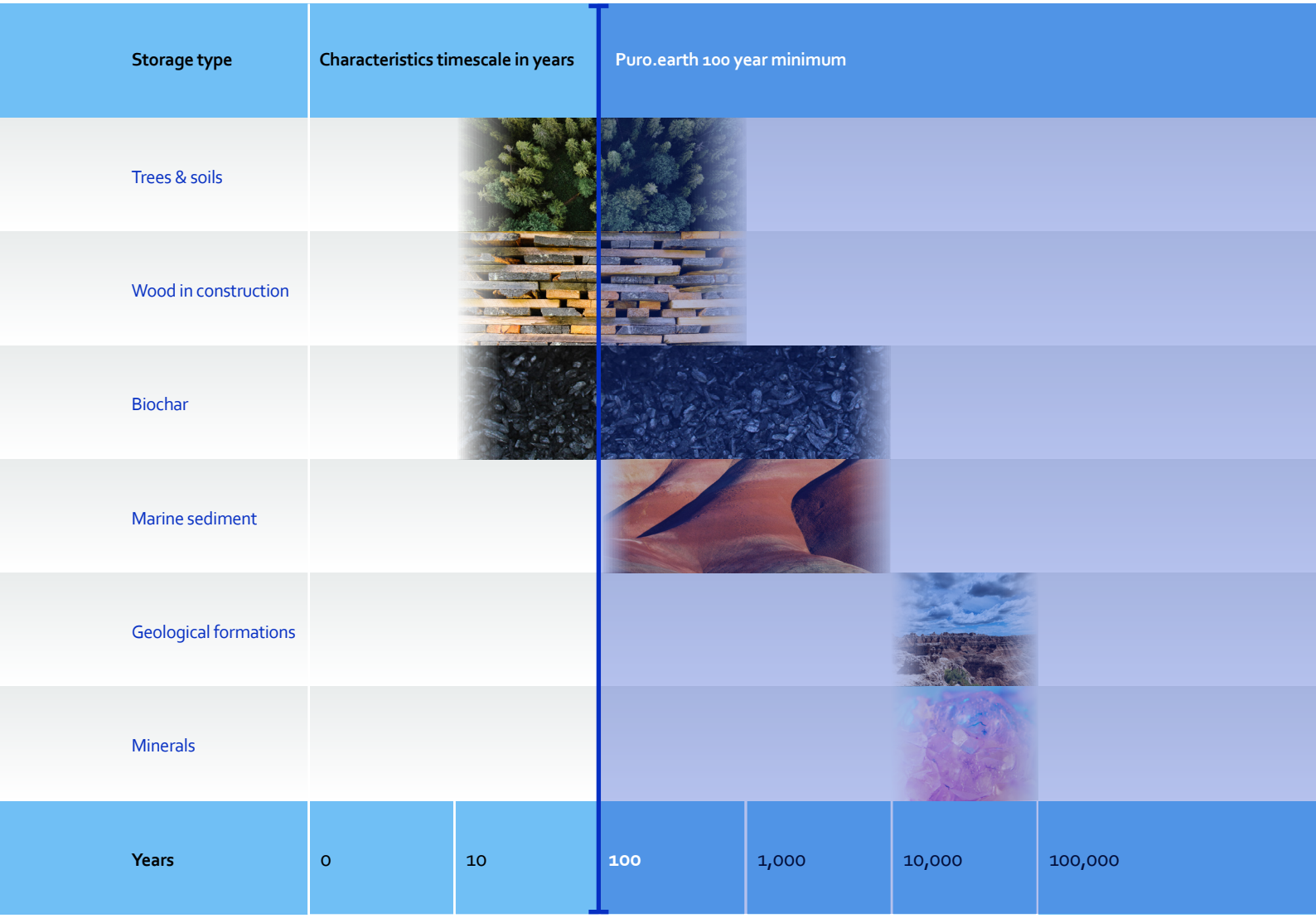
The durability of the storage refers to the time the carbon has been locked away. This can vary because the carbon pool in which the carbon is stored can be an open system (biological carbon pools on land and in oceans), or a closed system (physical storage like a geological formation underground or a chemical storage like biochar, minerals or carbonates). As stated by the IPCC;

"The time scale of storage is closely linked to the storage medium: carbon stored in ocean reservoirs and in geological formations generally has longer storage times and is less vulnerable to reversal through human actions or disturbances such as drought and wildfire than carbon stored in terrestrial reservoirs (vegetation, soil)."

For example, methods such as reforestation or mangrove plantations are dynamic open systems. The amount of carbon stored in these ecosystems fluctuates based on the growth and decay of vegetation, making it difficult to accurately determine the amount of carbon stored at any given time. Additionally, these ecosystems are vulnerable to natural events, such as fires, which can cause the release of carbon back into the atmosphere, and changes in land use or management practices, which can also impact the ability of these methods to effectively store carbon for a time that is meaningful from the perspective of the climate. The durability of these methods typically ranges from 10 to 100 years.

For carbon storage pools to reach 100-10,000 years durability, a closed storage pool with a chemical or a physical lock is needed. When CO_2 is carbonated, it is chemically transformed into minerals (also called carbonates) through industrial processes or rock weathering. These minerals store and lock down the carbon for "geological time scales" which is often expressed as 10,000 years. A physical lock on carbon storage can be equally durable when done right. This is the case when CO_2 is injected into a geological formation and locked there. Biochar is also a durable carbon pool, when "charred" to the point that the thermochemical reaction happens. In that reaction, the open-chain molecules are turned into closed-ring molecules that are highly durable and resistant to degradation over hundreds to thousands of years.

DURABILITY OF CARBON STORAGE POOLS

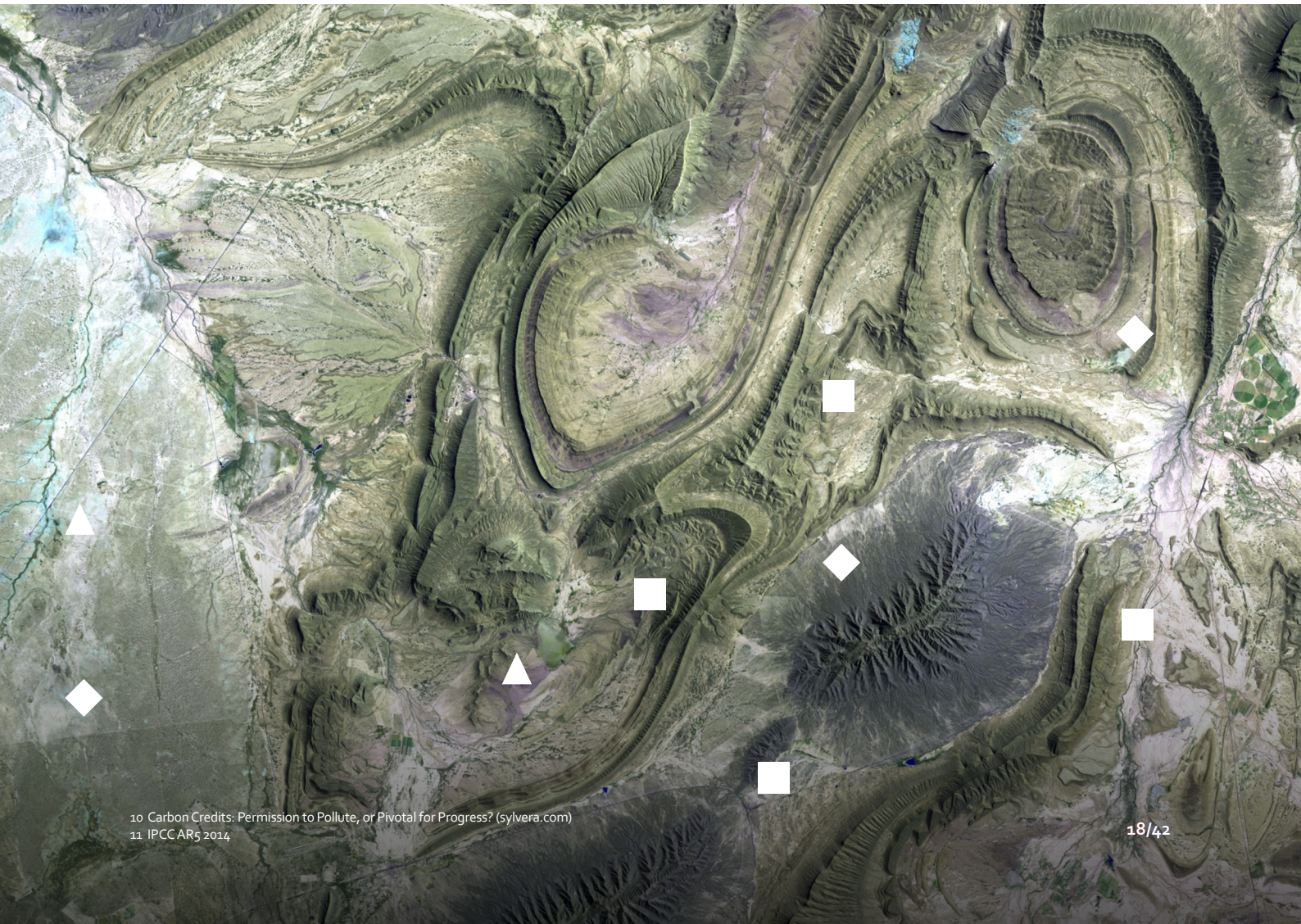


The durability of different carbon storage pools ranges from decades to tens of millennia. Note, that the timescales are indicative, assuming no premature disturbance. Adapted from The State of Carbon Dioxide Removal Report. Original source: IPCC WC3 AR6 Chapters 7 & 12.

03.2.1 Why does durability matter?

When we emit carbon into the atmosphere, it persists there for a hundred years or more. To effectively counteract the impacts of these emissions for a time that is meaningful from the perspective of the climate, it is necessary to use carbon removal methods that provide long-term storage of carbon, with durations of 100 years and over.

This like-for-like thinking is widely advocated for by the Oxford Net Zero and other scientists[10] and the 100-year storage durability is also aligned with the IPCC 100-year time horizon for global warming potentials (GWP100) for inventory and reporting purposes[11]. While not all methods meet a storage duration of 100+ years, their role will continue to play a significant role in the sustainable transformation. The importance of biodiversity and other nature-based solution benefits should not be overlooked. Furthermore, products such as 'bio-based construction materials' have the potential to reduce the carbon footprint of the construction industry and promote a more circular economy.



10 Carbon Credits: Permission to Pollute, or Pivotal for Progress? (sylvera.com)
11 IPCC AR5 2014

For Antti Vihavainen and **Marianne Tikkanen,** the co-founders of Puro.earth, the focus on methods that are stored for more than 100 years simply came from a process of elimination.

"From the beginning, we [Puro.earth] have taken the stance that to effectively deal with climate change, carbon removal must be quantifiable, it must be verifiable, it must be scalable to industrial levels, and it must be durable"

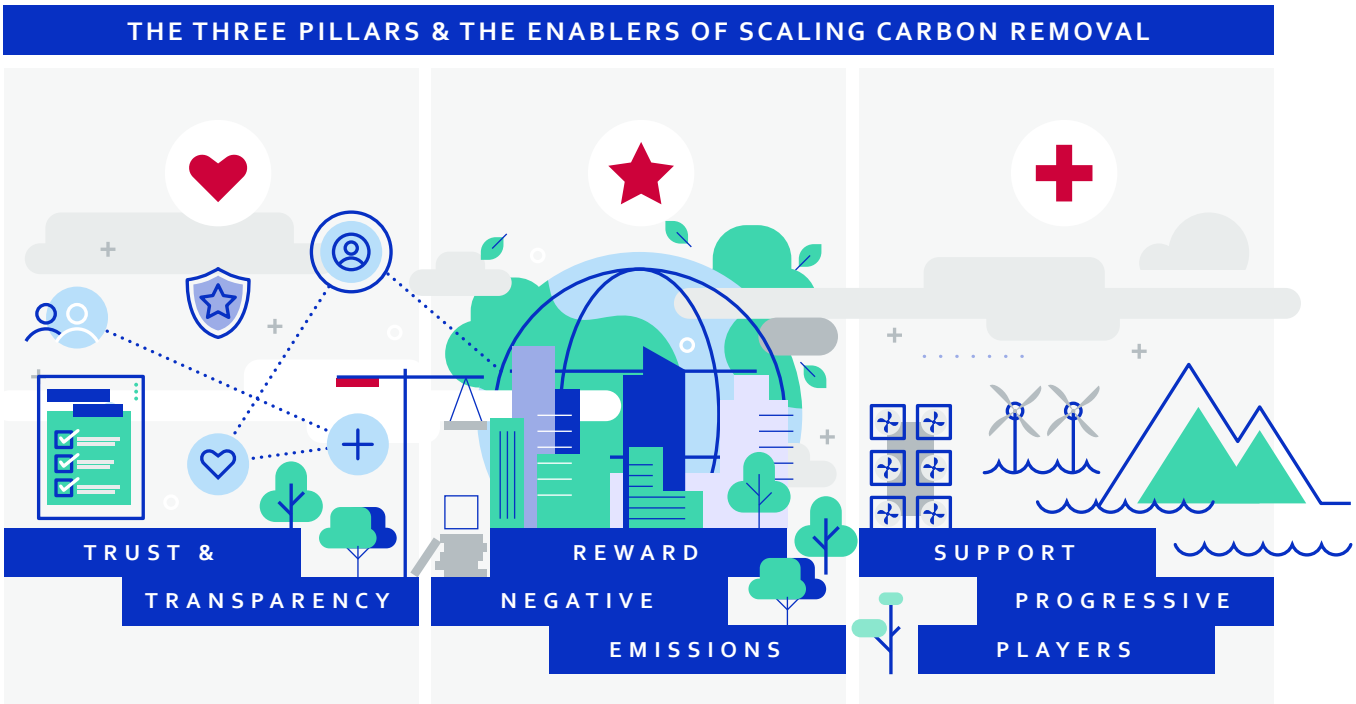
explains Marianne.

Puro.earth currently certifies carbon removal from 5 methods: **biochar** and **terrestrial storage of biomass,** geologically stored carbon through Bioenergy with **Carbon Capture and Storage (BECCS)** and **Direct Air Carbon Capture and Storage (DACCS),** and mineralization through **carbonated materials** and **enhanced rock weathering**.

04

Key factors that enable the scaling of carbon removal

Creating an ecosystem that can deliver durable carbon removals at an industrial scale is crucial to effectively address climate change. We share our experiences as part of the ecosystem in crediting high-quality, durable carbon removal and running a transparent and open-access registry on what is needed to sufficiently scale carbon removal.



04.1 Building trust and transparency

A new global survey[12] of over 500 Chief Sustainability Officers (CSOs) found that over 40% of them do not entirely trust carbon credits. Here the role of carbon standards based on high environmental integrity is key to building trust. It is crucial that carbon standards are held accountable to maintain high-integrity certification practices. This is where both governments and independent bodies, often referred to as rule setters, play a vital role.

According to **Helen Bray**, Vice President of Policy at Puro.earth:

"We are seeing both the supply of carbon credits and the use of carbon credits come under increasing scrutiny. This is a welcome trend."

Puro.earth is endorsed by the International Carbon Reduction and Offsetting Alliance (ICROA) providing quality assurance and guidance on emissions reductions and high-quality offsetting. As the VCM grows in importance we also support the work of the Integrity Council for Voluntary Carbon Markets (IC-VCM) focusing on origination of the credits and the Voluntary Carbon Markets Integrity Initiative (VCMI) which is looking at the use of carbon credits. Both initiatives will be providing more information this year (2023), and we look forward to working with these rule setters and other initiatives as they emerge.

Setting and enforcing definitive global standards will be fundamental in keeping standards honest and driving trustworthiness in the voluntary carbon market. Antti Vihavainen, co-founder and CEO of Puro.earth adds, **"Our approach has been to develop new carbon standards starting from the least disputable removal types – the likes where we can witness with simple logic and equipment that we are drawing CO_2 down and storing it for a known period of time."**

In addition to building trust, improved transparency is key to unlocking market growth. Public registries of carbon removal credit issuances and retirements such as the Puro Registry are essential for building transparency and accountability by ensuring the same credits are not claimed by multiple individuals or entities for the same activity. Additionally, having reliable price reference indexes, such as the CORC Carbon Removal Indexes, for carbon credits can provide insights for market participants. Better informed trading decisions help to lead to an increase in trading activity and market efficiency.

12 Over 40% of businesses do not trust carbon offsets - study (qcintel.com)

04.2 Carbon markets and creating an economy that rewards negative emissions

Carbon credits[13] are commodities that represent a unit of measurement of either avoided, reduced or removed CO_2 or other greenhouse gases from the atmosphere. Companies that produce negative emissions can certify their carbon removals with carbon credits from carbon standards, like Puro.earth. Such credits can be sold and retired by companies that have residual emissions that need to be counter-balanced.

Carbon finance from carbon credits enables various carbon removal activities, like biochar production, to receive payment for the carbon they remove, making them economically feasible.

Sampo Tukiainen, CEO of C-Fix and Founder of Carbofex, points out that:

"The revenue from biochar does not justify its existence as a standalone business concept. Carbon finance provides a means for biochar producers to receive payment for the carbon they remove and enables the economic viability of biochar production."

Leveraging the economy to reward net-negative emissions through carbon credits will be fundamental in driving the growth of carbon removal. Most of this trade is currently achieved through the voluntary carbon market (VCM) for carbon removal. The VCM saw an impressive growth rate of purchases by 553%[14] in 2022, but despite its growth, it is very much still in its infancy. The CDR.fyi[15] and the State of CDR report shows around 2 million tonnes of durable carbon removal have been delivered so far. Given that we need to scale to 5 to 10 Gt by 2050, this shows the size of the challenge at hand.

At Puro.earth we want to see more discussion around the role for carbon removals in compliance carbon markets. Helen Bray, VP Policy, says **"We welcome discussions at the United Nations level under the Paris Agreement and in other jurisdictions to incorporate durable carbon removals in compliance carbon markets."** These compliance carbon markets may be between countries (Parties to the Paris Agreement) or companies obligated under compliance carbon markets set by national or regional governments.

Any inclusion in compliance carbon markets will need to be well designed so that emission reductions are accelerated and not displaced, and carbon removal can be scaled this decade. We believe that these measures will need to be implemented by 2030 in order to deliver net zero globally by 2050.

13 Sometimes known as carbon offsets but for this report we use the term carbon credits
14 CDR.fyi 2022 Year in Review: Understanding the key trends in carbon removal | CDR-fyi (medium.com)
15 https://www.stateofcdr.org/

04.3 Progressive players and long-term commitments

The majority of carbon removal projects are still in the early stages of development. This is especially true for the industrial-engineered methods which require a varying degree of upfront costs just to get the projects started. As carbon removal technologies scale they will become more affordable. As it now stands, the market desperately needs more companies and investors to enable the scale of the market through commitments that support the next 10 years.

Puro.earth recognized early on that the organic growth of early-stage projects with the funding that is accrued by selling carbon credits on the spot market is not enough to grow the market to the magnitude that is needed. That is why we created Puro Accelerate. The program helps entrepreneurs lock in long-term commitments.

Puro.earth's Vice President of Supplier Funding Solutions, **Arnaud Defrance**, points out that;

"Long-term purchase commitments are crucial for the financial viability of carbon removal projects, particularly those involving innovative climate technologies. Not only do they demonstrate secured future cash flows to investors and financiers but also signal sustained demand, contributing strongly to the creation of a more mature market. As a result, carbon removal suppliers can ambitiously roll out their facilities in terms of speed and size. Durable commitments act as catalysts for market growth."

I'd like to see more companies willing to sign purchase contracts with Carbon Removal suppliers that match their long-term commitments to their stakeholders.

Standard contracts such as long-term market commitments, otherwise known as advance market commitments or off-takes, have been used by buyers like Microsoft, Shopify, Zurich Insurance Group, Boston Consulting Group, JP Morgan and Klarna, as well as joint ventures such as NextGen[16] and funds including Frontier. Accend's CEO, Paul Ferguson, urges more corporations to reconsider their short-term approach to purchasing carbon credits:

"Many organizations are short-term in their thinking. And that's challenging because they can't commit to 5-10 years, which the supplier needs. I'd like to see more companies willing to sign purchase contracts with Carbon Removal suppliers that match their long-term commitments to their stakeholders."

In taking such forward-looking measures, companies not only show an obligation to purchase removals in the future, they help turn their focus on future emissions while building a credible path to net zero or even net-negative emissions.

Progressive players can be public as well as private actors, and a recent policy tracker by Carbon Gap[17] shows long-term public procurement in a number of jurisdictions.

16 Mitsubishi Corporation - Press Room - 2023 - NextGen
17 Carbon Gap – Policy Tracker

04.4 The enabling role of governments

Voluntary purchases of carbon removal credits have played a fundamental role in driving the growth of carbon removals and will continue to play an important role in scaling these technologies. At Puro.earth, we also call on governments to:

1.
Set long-term plans with a clear role for durable carbon removals

2.
Develop the rules on what qualifies as durable carbon removal and consider the use of existing methodologies from carbon crediting programs

3.
Implement policies to support supply and demand and create the business case for investment

Antti Vihavainen, co-founder and CEO of Puro.earth stresses that;

"2023 is a pivotal year for carbon removal as many governments are moving to create policies to support the carbon removal sector. We need governments to put high-quality carbon removal in their long terms plans and implement policies so that companies can invest in supply and buyers can buy with confidence."

04.5 Concluding remarks: Fuelling innovation through collective effort

Running central to the three themes discussed above is innovation, which sits at the heart of building an effective and scalable market to address climate change.

One organization that is at the forefront of driving innovation in carbon dioxide removal (CDR) worldwide is the XPRIZE Foundation. The foundation, which advocates for "crazy ideas" to address global challenges, uses competitions to spur the development of carbon removal start-ups and speed up the technology development life-cycle.

According to XPRIZE Carbon Removal Executive Director and Puro.earth Advisory Board member **Nikki Batchelor**:

"In order to increase the global supply of carbon dioxide removal, we need more start-ups and innovators to get past the idea phase and start building pilot demonstrations to test the scientific and technical viability of their concepts."

"By bringing these new ideas out into the open and collecting more operational data, we will start to build a clearer picture of what works and what doesn't. So as an industry, and collectively as a society, we can start scaling the most promising approaches in a responsible and equitable way."

Supporting such a notion is **Marianne Tikkanen,** co-founder and Head of Carbon Crediting Program of Puro.earth: **"An industry like carbon removal starts like any other industry. Trial and error. So, there has to be support for that. We collectively need to do this, we need to have the industry developed and those who are brave enough to do it should get all of our support."** Marianne adds: **"CDR activities are like young athletes, you don't know who will be the world champion, but you need to give them a fair chance in becoming one."**

We're seeing new CDR technologies emerge across all areas which are offering new exciting possibilities to effectively store carbon. Innovation and deployment scale needs to develop at an incredible speed if we are going to make it to net zero by 2050.

Scaling carbon removal to relevant levels needed to combat climate change can be achieved through a combination of the solutions presented above. However, the ultimate success of these efforts hinges on a collective, industry-wide effort that prioritizes collaboration and partnership.

Fredrik Ekström, President of Nasdaq Stockholm and Chairman of Puro.earth adds;

"I think the key word is collaboration between different stakeholders in the market. All of us together need to work with a very clear target that the ultimate goal now is to scale this market and create maximum climate impact."

05

Puro.earth: Mobilizing the net-negative economy through trust & credibility

Puro.earth is the world's leading crediting platform for engineered carbon removal. We started developing the concept in August 2018 from the realization that we have the technologies available to remove the CO_2 from the atmosphere. However, a business model was missing.

05.1 The history behind the first-of-its-kind carbon credit

Fredrik Ekström, President of Nasdaq Stockholm and Chairman of Puro.earth explains, **"What Antti and Marianne [the founders of Puro.earth] saw was, activities within projects and industries developing solutions to remove carbon from the atmosphere, but there was really no way to monetize that for the suppliers. Without a model to reward them, not enough investments will be made into removing carbon from the atmosphere."**

They – together with the initial 22 supporting companies – turned the net-negative part of engineered carbon removal into a digitally tradable carbon asset – a critical mechanism for addressing climate change by incentivizing removal of carbon from the atmosphere. After many iterations on the name, the **CO_2 Removal Certificate or CORC**, was born.

05.1.2 A platform to support the highest carbon credit integrity

Back in 2018 in the absence of a regulated market, it soon became apparent that a common framework was needed for certifying carbon removal activities and ensuring net-negative activities were measured, reported and verified with scientific rigour. The **Puro Standard** was established to ensure the highest carbon credit integrity on the market and the **Puro Registry** was built to ensure the issuance and retirement of CORCs were recorded and tracked in a public and transparent manner.

As explained by **Marianne Tikkanen**, co-founder and Head of Carbon Crediting Program program at Puro.earth: **"[We built] a neutral platform for suppliers of negative emissions and buyers to come together and know there is a quality level they must meet and can expect. The platform eliminates any ambiguity or uncertainty, creating a clear and transparent process for everyone involved."**

Antti and Marianne envisioned a world where companies are part of the mitigation of climate change. But to make that happen, they needed to bring trust, integrity and transparency to the solution.

In 2021, Nasdaq acquired a majority share of Puro.earth, and together we will drive a global scale-up phase that will create a world where companies are part of the change.

05.1.3 What it takes to be a first mover

Puro.earth has brought the first carbon crediting methodologies for biochar, carbonated building elements, geologically removed carbon (BECCS & DACCS), woody biomass burial and enhanced rock weathering to the market. We have set a precedent for high-quality methodologies with contracted durability of more than 100 years ever since.

The Puro Standard is governed by a scientific Advisory Board, made up of six independent and diverse experts in carbon removal science and chaired by Professor Myles Allen, climate scientist at the Oxford Net Zero initiative. Speaking to Puro.earth Advisory Board member, Dr. Mai Bui, who has over 10 years of experience in research on carbon capture and storage (CCS) technologies, on the role of the Advisory Board in the development of methodologies, Mai, explains that Puro.earth has a collective approach in bringing key experts from around the world to help develop such frameworks. Mai goes on to add that; **"The detail for these methodologies gets presented to us as Advisory Board members, who are responsible for reviewing and looking at the technical understanding. This could go through multiple iterations, which has been the case for some of the versions of the methodologies, but essentially, we also understand that this is an evolving space, so even once a methodology is developed, there is potential for it to evolve and change down the track as science starts improving and we gain further understanding."**

On what it takes to be a first mover in this space, Mai adds:

"We [the Puro.earth advisory board] are going to be accountable for whatever decision is made. It could set the standard globally, so there's a lot of thought process behind decisions. It's good that there are multiple members with different backgrounds and experiences, I think that helps a lot with diversity in thinking."

Dr. Mai Bui

05.2

How does the certification process work at Puro.earth?

Carbon crediting certification is a process that ensures the credibility of carbon removal activities and provides transparency for buyers and sellers of CORCs. The process involves several steps, which starts with the Puro Standard setting the framework for carbon removal, methodology approval, independent verification, and issuance of CORCs in the Puro Registry. Let's take a closer look at each step of the certification process.

Carbon Crediting Certification Process

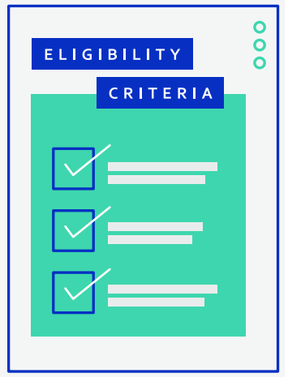
THE PURO STANDARD

Central to the certification process is the Puro Standard which consists of general rules for certification and a number of meta-level methodologies. The Puro Standard provides a stamp of high-quality for suppliers of carbon removal credits and for the buyers of engineered carbon removal activities alike. The Puro Standard and crediting rules are governed by the Puro.earth Advisory Board.

THE PURO STANDARD

STEP 1: METHODOLOGIES

A methodology refers to a comprehensive and often technical set of guidelines and procedures for a specific carbon removal method to be eligible for carbon removal credits. It outlines the methods for measurement, reporting, verification, and certification of the carbon removal process as well as criteria around durability, baseline, financial additionality, and social and environmental safeguards. For a methodology to be approved and on-boarded, it must adhere to the rules defined within the Puro Standard and go under the approval of the Puro Advisory Board. For a supplier to be on-boarded onto the Puro.earth platform, they must go through a stringent verification process by supplying evidence via a Life Cycle Assessment (LCA) and laboratory-based evidence (depending on the methodology) to confirm their process is carbon net-negative, as well as providing evidence regarding the environmental and social soundness of the CDR activity.

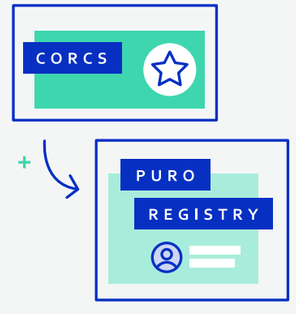


STEP 2: INDEPENDENT VERIFICATION

Independent or third-party verification provides a crucial two-step verification process. Its purpose is to ensure that the carbon removal process is being carried out accurately and in accordance with the rules under the Puro Standard and the procedures set within the process specific methodology. Having an independent, unbiased third-party organization verify the results of the LCA and other evidence provides transparency and credibility to the carbon removal activity and helps to ensure that the claimed carbon removal is genuine. Besides quantification of net-negativity, other criteria and concerns that are audited are durability, baseline, financial additionality, and social and environmental safeguards.

STEP 3: ISSUANCE

Once the volume of a supplier's carbon removal activities has been verified, it is then issued into a CO_2 Removal Certificate (CORC) in the Puro Registry. One CORC represents one metric ton of CO_2 that has been already removed and stored resulting in an "ex-post" credit. The Puro Registry serves as a central database for tracking and recording carbon removal activities issued under the Puro Standard. It provides transparency, accountability, and credibility for carbon removal efforts by allowing for the monitoring and verification of the carbon removal process. Change of ownership and retirements of CORCs are also recorded in the Puro Registry, preventing any possibility of double counting.



05.3 Not all carbon credits are created as equals: Behind the CORC

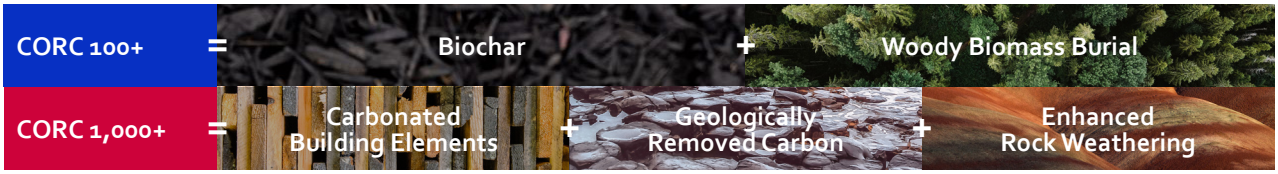
For carbon removal credits to be effective in mitigating climate change, it's crucial that they accurately reflect the amount of carbon removed from the atmosphere. And it's fair to say, not all carbon credits are created as equals. We take a deeper dive into what makes the CORC a premium carbon removal credit on the market.

05.3.1 Contracted permanence: 100 & 1,000 years

The Puro Standard, which is guided by recommendations from climate scientists such as those from the Oxford Net Zero initiative, requires a minimum durability of stored carbon of 100 years for carbon removal methods. The goal is to achieve long-lived removal storages that can effectively offset the effects of fossil emissions. The CORC is the only carbon removal credit that guarantees high-quality carbon removal with a contracted permanence of 100+ or 1,000+ years.

Contracted sequestration duration refers to the quantity of carbon that remains stored. We consider the potential degradation of the storage and only issue credits for the quantity that will still be sequestered at the end of the period. This eliminates the need for a buffer and ensures that CORCs can be trusted by organizations seeking to compensate their carbon emissions.

The CORC can be differentiated into two levels of contracted permanence.
They include the **CORC 100+** and the **CORC 1,000+**:



05.3.2 Quantifying carbon removal: It must be net-negative

The word net is important here. Carbon removal needs to result in a net removal of atmospheric CO_2 levels. This means that carbon removal activity needs to remove more CO_2 from the atmosphere than the activity produces. "Netting" means that the gross carbon stored or injected is reduced by the emissions caused by storing the carbon (carbon removed minus total emissions). Removal activities are "penalized" by the emissions they generate, and this gives them a long-term incentive to keep improving the net-negativity efficiency of their activity. Only the net-negative carbon removal is included in CORCs.

Rules under the Puro Standard state that carbon needs to be captured from the atmosphere, not from fossil sources.

05.3.2.1 **Calculating net-negativity with the Life Cycle Assessment**

Life Cycle Assessment (LCA) is a comprehensive and systematic analysis of the carbon footprint of a product, project or organization. It is a tool used to calculate the full scope of a project's emissions throughout its entire life cycle - from the extraction of raw materials to the production of the activity, and through to its disposal or end-of-life. At Puro.earth, we use the LCA to quantify the net carbon removal of an activity and this balance must be negative for the activity to be eligible to issue CORCs.

The importance of using an LCA in accurately identifying net-negativity can be explained by looking at the lifecycle of biochar. Biochar production will generate emissions at various stages of its lifecycle, from the sourcing of construction materials to build the production facility, to the energy consumption of the machinery involved in feedstock cultivation, to the fuel used in the biochar production site, transportation, and the spreading of biochar to agricultural fields. By adopting a comprehensive cradle-to-grave LCA approach that accounts for all sources of emissions, Puro.earth ensures that the net footprint of biochar is rigorously quantified and remains carbon net-negative, thus mitigating its potential to do the opposite.

Science and LCA advisor at Puro.earth, **Elias Azzi**, explains what makes Puro.earth different in its use of the LCA:

"A complete and project-specific assessment of the emissions generated entailed by a supplier's carbon removal activities is required. From infrastructure to application, we make no exclusions so that we can quantify the net carbon removal of an activity. We also require suppliers to submit the LCA results not as a single aggregated number, but rather presented as a breakdown of the different stages and greenhouse gases: so this way, we are able to verify and understand what has been included, how it was included what has not and why. It is all about adding transparency to the net-removal calculations."

The production of biochar through pyrolysis can generate more energy than it consumes. While the production of renewable energy in the process is considered a positive outcome this is not taken into account when calculating the CORCs under the Puro Standard. Instead, this is seen as an additional benefit of the project. As Elias explains;

"With Puro.earth, you are guaranteed that CORCs are laser-focused only on accounting for carbon storage. While the other benefits from the projects such as avoided emissions can be accounted for and valued in other ways, they will not end up in the CORC calculation." **Elias Azzi**, Science and LCA advisor at Puro.earth

05.3.3 Leakage

Leakage in carbon removal refers to the displacements of activities leading to an unintended increase of emissions. Carbon removal should not cause emissions at other geographical locations due to market or other shifts[14].

Puro.earth is vigilant in our efforts to promote true, long-term carbon removal. Our approach to leakage is that either we fully account for displaced emissions within the carbon accounting of a CORC, or if the levels of leakage surpass the limits established within our methodology, we disqualify the project.

Avoided emissions, which is sometimes referred to as positive leakage, must sometimes take place but this is not included in the calculation of CORCs. Instead, it is seen as additional benefit of the project.

05.3.4 Going beyond business as usual: Additionality

Carbon additionality is when a carbon removal project goes beyond standard practice. At Puro.earth, this is tested by ensuring the project would not take place without the CORC revenues. If a carbon removal activity is economically viable without the carbon removal credits, it is not additional.

05.3.5 Minimizing risks and maximizing benefits

Puro.earth operates under the principle that carbon removal should not come at the cost of safety or harm to the environment and communities. We firmly believe that the benefits of carbon removal must be pursued in a responsible and sustainable manner, without causing harm to the environment or the people who live in it.

We use methodology-specific environmental and social safeguards to minimize the potential negative impacts on the environment and local communities during the development and implementation of carbon removal projects. They include measures such as conducting environmental impact assessments, engaging in stakeholder consultation, and implementing monitoring and evaluation systems to track the project's environmental performance. The purpose of environmental safeguards is to promote safety, transparency, accountability, and responsible stewardship in carbon removal efforts, so that they are not only effective in reducing carbon emissions but also do no harm in the process.

While minimizing risks it is also widely recognized that it is important to maximize the benefits of carbon removal projects. Often, carbon removal methods such as biochar are designed to address multiple environmental and social challenges beyond simply reducing carbon emissions. Biochar, for example, is a product that improves soil health, increases food security, and generates renewable energy, among other things. While these benefits are not accounted for in the calculation of a CORC and are treated as simply co-benefits, these additional benefits are essential in attracting local communities, investors, buyers, and improving public support for carbon removal. Such co-benefits enable carbon removal projects to play a significant role in the sustainable transformation.

06

Conclusion – Achieving a net-negative economy starts today

The Puro.earth framework was established to mobilize carbon removals and mitigate climate change. Such efforts will be a marathon effort spanning over 100 years. The aim is to reduce CO_2 levels to meet net zero by 2050 and work towards bringing them back to pre-industrial levels between 2050 and 2100.

It is critical that what we establish as Puro.earth now in the 2020s remains relevant in 2050s and 2100s. At Puro.earth, our mission is to mobilize carbon removals and expand their scale and type so that humanity has sufficient removal capacity for emission balancing and beyond. To achieve this, we mobilize carbon removal activities with credits that serve two purposes:

1. Enabling revenue for carbon removal activities to make them long-lasting businesses

2. Commoditizing each metric ton removed using the standard quantification and verification rules

Building trust and integrity will be fundamental in establishing a highly functioning market and public acceptance for carbon removals on the scale needed to reverse climate change.

Antti Vihavainen, co-founder and CEO of Puro.earth, stresses our role;

"We started as a pioneer and the first learner in the "least disputable" carbon removal methodologies. We strive to do the right thing, as guided by the scientists and our Advisory Board while working collaboratively with the wider ecosystem including governments, other standard setters, carbon removal suppliers and buyers."

To achieve our mission, we recognize that Puro.earth and carbon removal suppliers cannot operate alone – we need all of humanity to work with us. With all hands-on deck using carbon removals and reducing emissions while transitioning from current emitting habits to carbon-negative and carbon-neutral habits, we can find the balance and return to normal CO_2 levels.

When there is a will, there is a way.

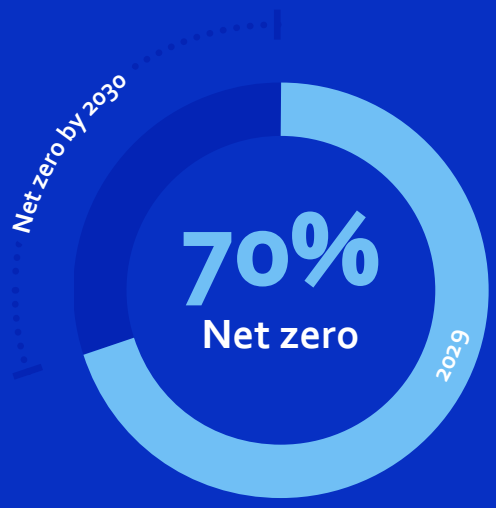
07

Buyer case study: Zurich Insurance Group

One corporation that is leading by example is Zurich Insurance Group (Zurich). Zurich is a leading global insurance company, with a presence in over 200 countries and territories. As part of its commitment to sustainability and combating climate change, Zurich has set targets to achieve net zero emissions across its operations and value chain. Furthermore, it ambitiously brought its original target to achieve net zero in its operations by 2050 forward by 20 years, to 2030.

Zurich is one of the companies purchasing CORCs from operational projects, early-stage development projects, and pilot methodologies alike. We spoke to **Anja-Lea Fischer**, who leads operational sustainability for the group to find out more.

Our goal is to reduce operational emissions by 70% by 2029



What responsibility do corporations like Zurich have in combatting climate change?

Corporations have many different touch-points to influence sustainability opportunities, from the products and services they offer, the investments they make, how they run their own operations, and down to the individual employees. When you can activate these opportunities across unified goals such as achieving net zero, it can become a powerful movement. At a minimum, we drive awareness. But what we really want is to inspire others by leading by example. We set bold targets and we are accountable to these targets through our transparent reporting. I hope that our stories influence others across our value chain to take action.

Why was it important to bring your operational net zero goal ahead by 20 years?

2050 seemed too far-off as we wanted to establish more urgency for action now. Our goal is to reduce operational emissions by 70% by 2029, therefore we felt it would be a logical next step to aim for net zero by 2030. By doing so, we have established the internal buy-in to help push the carbon removal space forward with pre-purchase agreements. Due to our size, we are not expecting to be driving the market, but rather we are helping to demystify the process, and hopefully motivate others to take their first steps toward net zero sooner.

Why focus on carbon removal now?

"We need to be proactive in addressing the climate crisis. While reducing emissions has to be our top priority, it won't be enough. We need to combine reduction and removal."

And carbon removal technologies are still in their infancy, so we need to start investing and developing them now so that we can scale high-quality solutions to the needed volumes and cost point.

Why did you purchase CORCs?

Carbon removal is an invisible commodity. It's a little bit abstract for many people, so having the CORC backing most of our agreements makes our actions more tangible. And the rigour behind the Puro Standard gives our approach credibility. Of course we always do our own due diligence, but its invaluable to have the expertise from Puro.earth to help us navigate the market. We know Puro is very critical of the types of projects they certify, they are conservative in the calculation methodologies applied, and their auditing and monitoring process all contribute to the development of credible carbon removal claims.

What carbon removal methods have you supported so far?

We have signed pre-purchasing agreements with more mature technologies such as biochar. The feedstock for one project is biomass from forests, the use of which helps minimize fire risks, creating a great co-benefit. We're also supporting a biochar project in Puerto Rico. Our pre-purchasing agreement has helped get this company off the ground. Their feedstock is bamboo which is a nuisance plant that blocks up rivers and roads, especially during storms. So, the biochar project is creating an incentive to remove that biowaste and turn it into a valuable product that is then going to local coffee farmers to help improve soil quality.

We're also supporting an earlier stage terrestrial storage of biomass burial project in Australia. They have purchased barren land and will plant fast-growing native trees which they are coppicing, so not chopping them down completely but trimming to allow for re-growth. Then they bury and seal this biomass to stop the decaying process, thereby stopping the release of CO_2. I am very happy to say they have been developing rather quickly since our initial engagement with them.

What advice do you have to other companies considering supporting carbon removal?

It is not that hard, just get started. Especially for those companies already active in the offsetting space. While I encourage companies to maintain their support of critical projects such as avoided deforestation, transitioning into carbon removals is a logical evolution. And don't let cost scare you. While it will cost more than traditional offsetting, early action will likely help mitigate future costs by establishing relationships, securing supply, and helping diversify the market. Sometimes a relatively small income contribution to a start-up company can make a critical impact to their development. Make sure your internal stakeholders are aware of the benefits of getting off the sidelines. 2030 is right around the corner, and 2050 is not that far off. We need to create change now if we want to have a chance to stop the worst impacts of climate change.

This is not a wait and see game.

08

Definitions

Anthropogenic greenhouse gas emissions
The release of greenhouse gases into the atmosphere as a result of human activities.

Beyond value chain mitigation
Efforts and actions taken by a company or organization to address environmental and social issues or emissions that extend beyond the direct impact of its value chain.

Carbon cycle
The natural process in which carbon is exchanged between the atmosphere, oceans, land, and living organisms. It consists of two interconnected cycles: the long-term carbon cycle and the short-term carbon cycle.

The long-term carbon cycle operates over geological timescales, involving slow carbon exchange between the Earth's surface and interior through processes like weathering, volcanic activity, and the burial of organic matter.

The short-term carbon cycle operates over shorter timescales, ranging from years to decades, and involves the exchange of carbon between the atmosphere, oceans, and land.

Carbon Crediting Platform
A platform that provides project verification, credit issuance, and retirement, following the rules set by the standard to help suppliers monetize their net-negative emissions and buyers to acquire carbon credits.

Carbon removal sometimes referred to as removal or carbon dioxide removal (CDR)
The process of physically drawing down carbon dioxide from the atmosphere and durably storing it.

Durability
Refers to the time the carbon is locked away and not returned to the atmosphere as CO_2.

Durable carbon credits
Puro.earth considers durable carbon credits to come from methods that provide long-term storage of carbon, with carbon storage durations of 100 years and over.

High-quality carbon removal
The use of technologies or approaches that only account for 'removed' carbon dioxide from the atmosphere and durably store it in a long-term and secure way.

Methodologies
A comprehensive and often technical set of requirements for a specific carbon removal method to follow to ensure safe operation, robust quantification and quality compliance.

Net-negative emissions
When anthropogenic greenhouse gas removals exceed anthropogenic greenhouse gas emissions for a defined region or entity over a year (IPCC AR6 WGIII).

Net zero
Achieving an annual balance between the amount of greenhouse gases (GHG) emitted and the amount captured and stored from the atmosphere.

Supplier
An organization or entity that actively works to remove more carbon dioxide from the atmosphere than it emits through its products and/or processes.

Voluntary Carbon Market (VCM)
Voluntarily purchases of carbon credits to compensate for own greenhouse gas (GHG) emissions. The VCM operates alongside the regulated compliance carbon market, which is driven by mandatory emissions reduction targets set by governments.

Thank you.

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Start your carbon
removal journey today

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