JORO

Carbon Removal Report 2021

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on behalf of Joro Experiences.

www.klimate.co

Klimate ApS, 2021, Copenhagen

A word from Klimate

To reach Net Zero, every company needs to Measure, Reduce and Remove their emissions. For Joro Experiences, we have have removed 265 tons of CO_2 from the atmosphere to compensate for their emissions in 2021.

In alignment with the Science-Based Targets[1] initiative and their Net-Zero Standard and the Oxford Principles for Future-aligned Offsetting[2], we compensate our clients' carbon footprint using four principles:

1. Ensure that all offsets are of the highest quality possible.

2. Exclusively procure offsets through carbon removal, meaning that CO_2 is removed from the atmosphere.

3. Source carbon removal methods that are as permanent as possible within the current financial and technological restraints.

4. Leverage the investment in high-potential removal technologies to send a market signal and thereby further develop these technologies.

From the perspective of Klimate, we believe that Joro Experiences is pursuing these principles effectively using the portfolio described in this report.

Katja Grothe-Eberhardt

Co-founder and CEO

Mads Emil Dalsgaard

Co-founder and CCO

Simon Bager, PhD

Co-founder and CIO

[1] https://sciencebasedtargets.org/net-zero

[2] https://www.smithschool.ox.ac.uk/publications/reports/Oxford-Offsetting-Principles-2020.pdf

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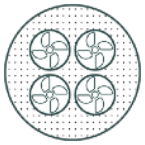
Term	Definition
CO_2/CO_2e	CO_2 refers specifically to Carbon Dioxide, the greenhouse gas (GHG) which is the primary cause of climate change. However, CO_2 is not the only GHG causing climate change. CO_2e refers to CO_2-equivalents, which considers the impact of additional GHGs, such as methane and nitrous oxide, expressed in quantities of CO_2.
GHG / GHGs	GHG is an abbreviation for Greenhouse gas(es). It is used to refer to all those gases that are released into the atmosphere and contribute to global warming.
Carbon Offset/ Compensation	An offset or compensation is an action taken by a company to level their emissions by paying for carbon negative activities. In general, offsets aim to remove or avoid the same amount of emissions as have been caused.
Avoidance vs Removal	Avoidance offsets reduce emissions by preventing their release into the atmosphere. Removal offsets reduce the level of CO_2 by directly removing carbon from the atmosphere.
Net emissions	“Net” refers to the difference between the amount of CO_2e that has been emitted and the amount of CO_2e that has been compensated.
Net Zero	Net Zero is used to describe situations where emissions over a given period - for example, a year - are balanced by compensating through removal of the same amount of CO_2e that has been emitted.
Net negative / positive	Net negative and net positive are marketing terms used by companies to describe situations where companies compensate or offset a greater amount of CO_2e than the emissions of a product or company. The two terms are non-scientific and are used interchangeably. We generally suggest not to use these.
Carbon neutrality	Carbon neutrality refers to situations where CO_2e-emissions by an entity (e.g. a product or a company) are balanced by equally large carbon removals. Carbon neutrality is often assessed over the life cycle of a product including indirect (i.e. scope 3) emissions, but can also describe emissions and removals over a specific period, such as a year.

Joro Experiences removal 2021



Direct Air Capture

Direct Air Capture uses large fan-like machines to pull CO_2 directly out of the atmosphere. Captured CO_2 can either be stored permanently in rock formations underneath the earth's surface.

1.049 Tons contracted

Bio-Oil

By heating up biomass to extremely high temperatures without oxygen, carbon is locked up in bio-oil. This carbon-rich material can then either be stored away permanently underground or be refined and used as a green energy source.

2.650 Tons contracted

Biochar

Heating waste biomass to high temperatures without oxygen turns it into carbon-rich biochar. Applied to soils, biochar is great for storing carbon for a decades, while simultaneously increasing agricultural productivity.

10.6 Tons contracted

Soil Sequestration

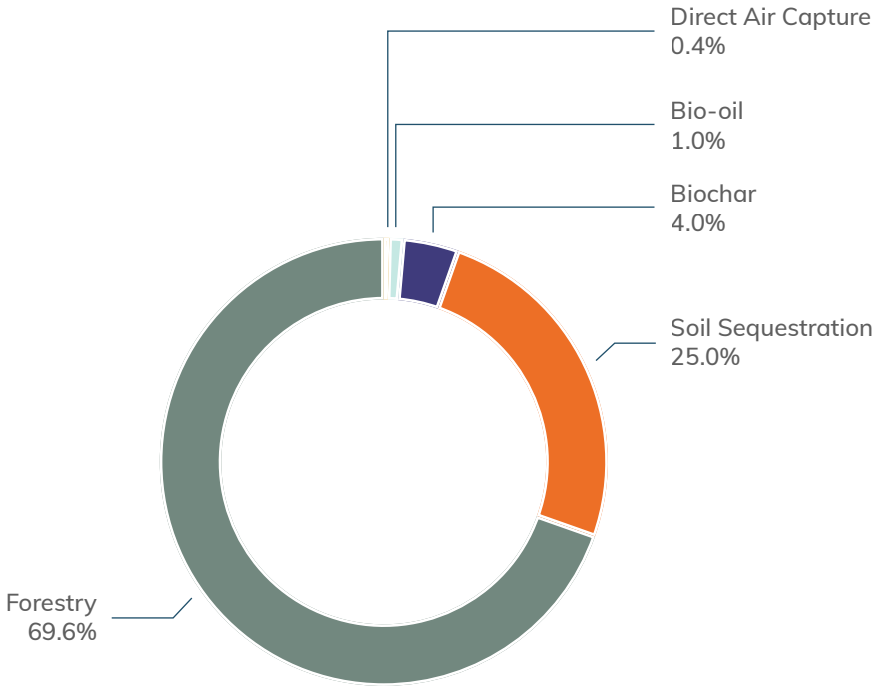
Soils are great at capturing carbon, but the overuse of soils over the past decades has reduced their ability to do so. Diverse techniques can optimize and help regain the carbon-capturing properties of soils.

66.3 Tons contracted

Forestation

Trees are the earth's natural carbon removal machines. Trees sequester CO_2 using photosynthesis and store it in every part of the tree. A single tree can capture up to a ton of CO_2 in its lifetime.

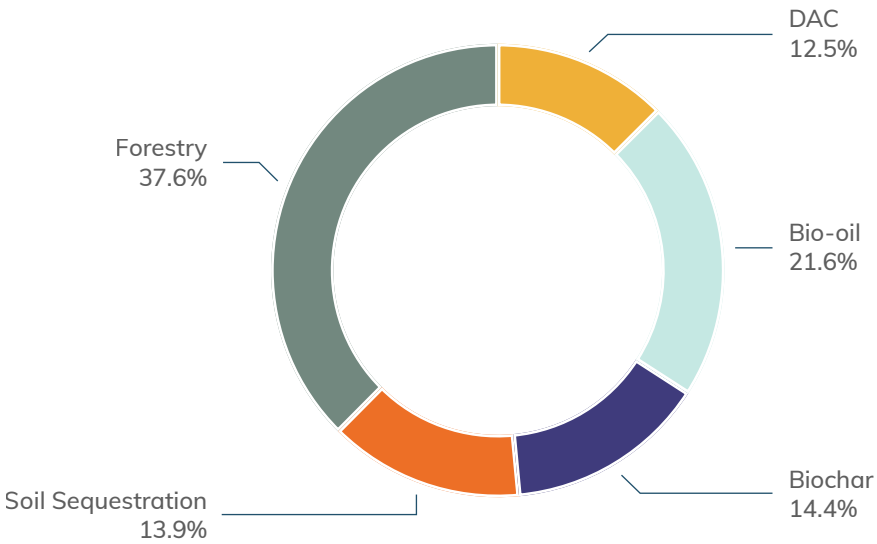
184.5 Tons contracted



Total contracted

265

Tons CO_2



Total invested

8.480

EUR

Online portfolio & traceability

We believe that transparency is the key to ensure trust in our carbon neutral efforts. To ensure this, we work with Klimate to develop carbon removal portfolios. Klimate's system includes an online record of all our portfolios, which includes information about the specific projects and suppliers.

Follow the links below to explore all the details of each portfolio. The portfolio certificate includes access to the underlying carbon removal orders made by Klimate.

Portfolio Certificate - P963519

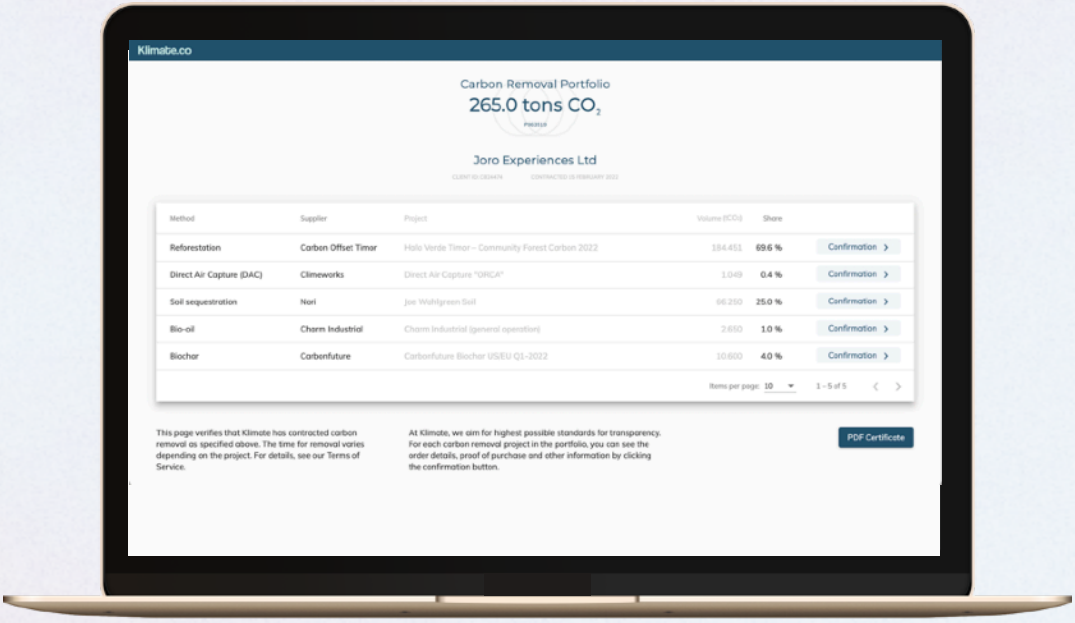
265 tons

Contracted on 15 FEBRUARY 2022
https://app.klimate.co/portfolios/P963519

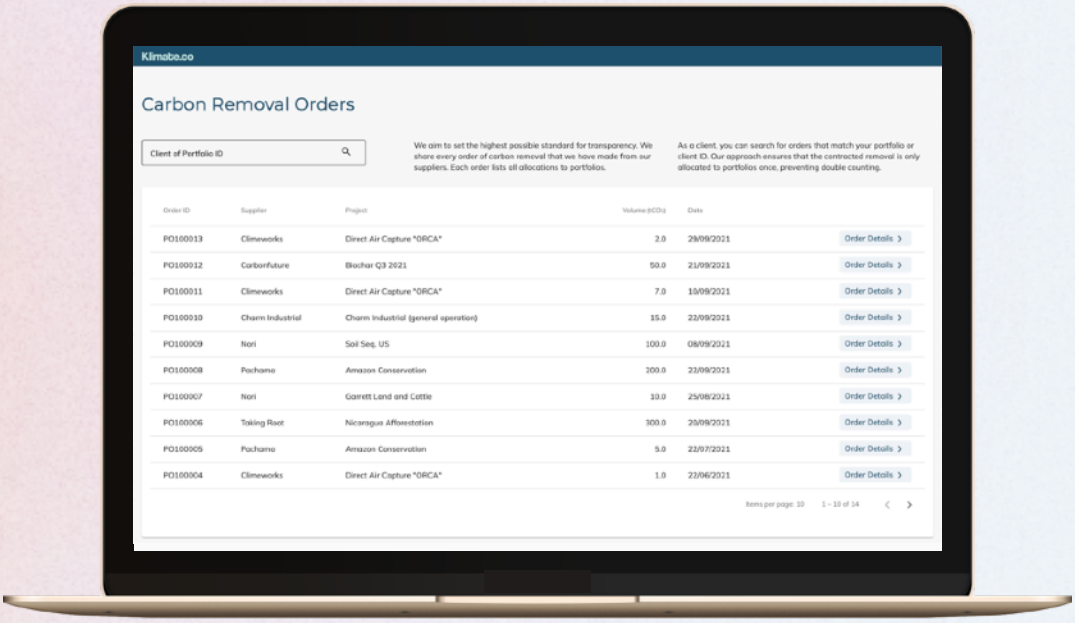
Public Record

Klimate provides a public record of all their carbon removal orders. Using our Client ID below, anyone can look up all the carbon removal orders included in our portfolios. Klimate's system of allocation and verification ensures that double counting is not possible.

URL	Client ID
https://app.klimate.co/orders	P824474

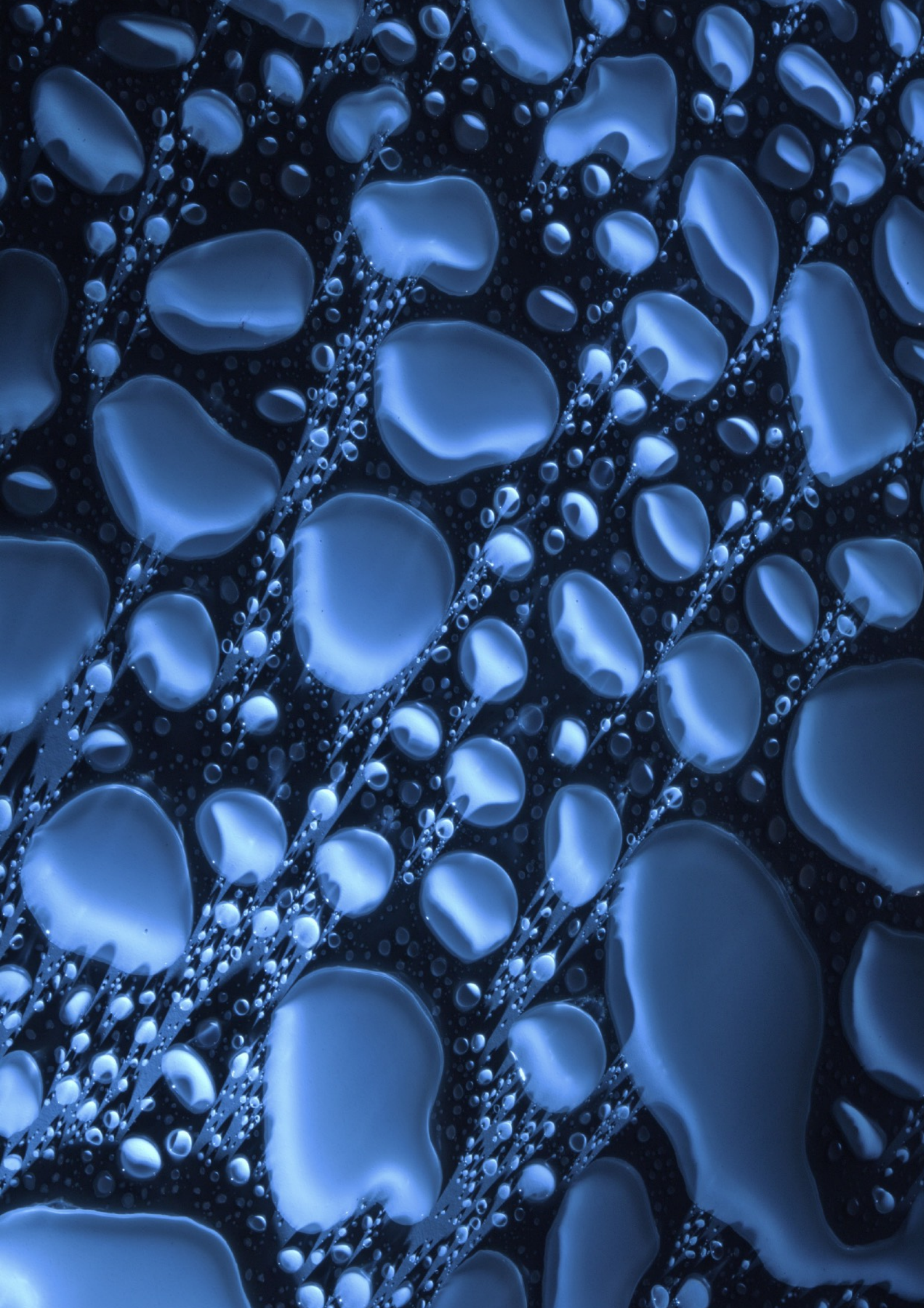


Online certificate



Public ledger - All orders

Portfolio **Details**



Intro

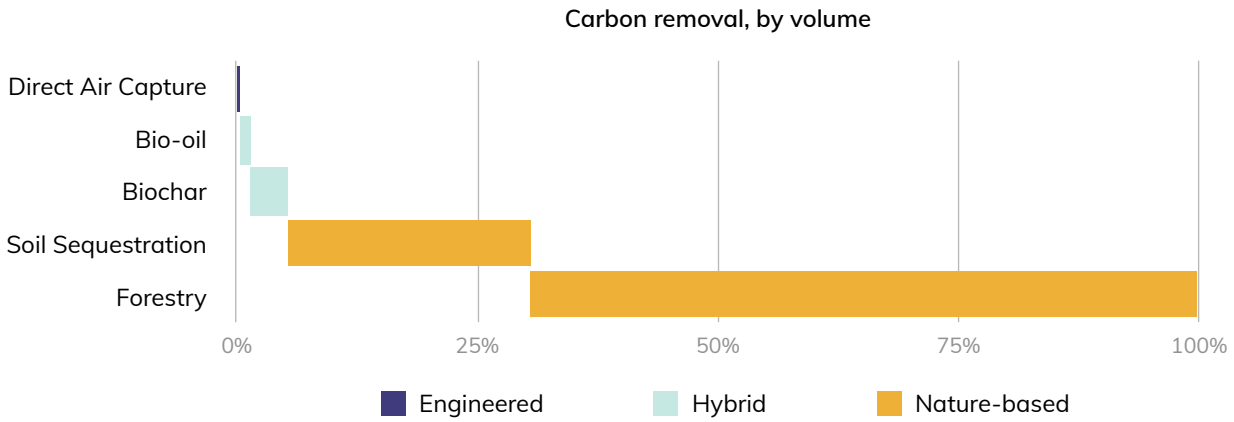
This report describes our effort to become Net Zero. Getting to Net Zero takes effort across the entire company and we have set a clear plan to become Net Zero.

First, we measured our emissions to benchmark our efforts against competitors and define areas for further improvement. Second, we work to reduce our emissions. As a responsible company, we reduce where possible and have set a clear path toward further reductions. However, it is not possible to reduce to zero, which is where we need to go to stay within the goals of the Paris Agreement.

As a third step, we remove our unavoidable emissions. Removing CO_2 is not an excuse to maintain current levels of emissions, but an effort to bring our company as close to zero as possible.

There are several methods to remove CO_2 from the atmosphere. We work with Klimate to source and analyse carbon removal projects from all over the world to find the best solutions. With Klimate's help, we combine different suppliers and projects in portfolios. Combining different technologies, suppliers, and projects mitigates the risks of "placing all eggs in one basket." Instead, we diversify the investment and reduce the risk, while simultaneously supporting a diverse set of technologies and projects.

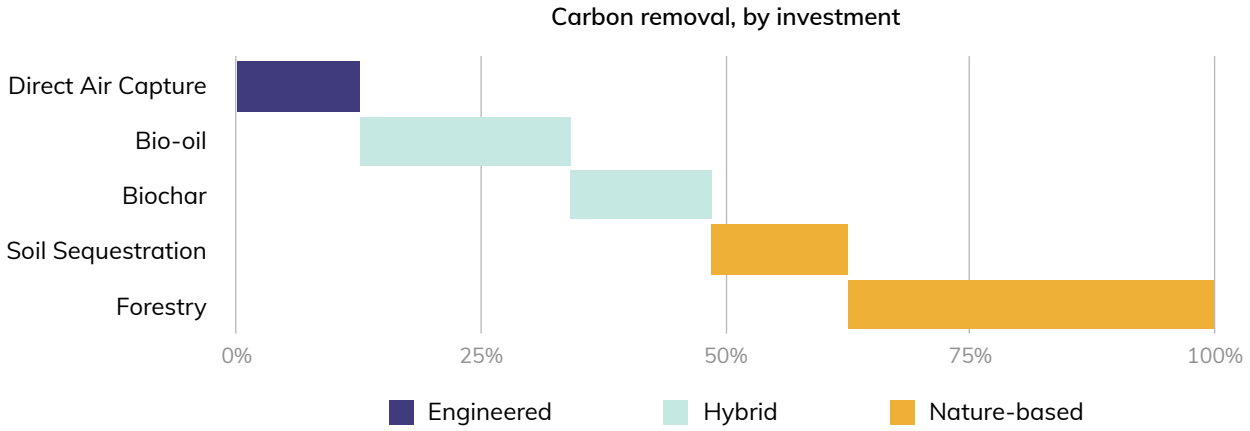
We remove 265 tonnes of carbon using five different methods of carbon removal. Most of the carbon removal comes from nature-based solutions (94.6%), while hybrid methods deliver 5%. The remaining 0.40% comes from engineered solutions.



Nature-based solutions generally offer more co-benefits, while hybrid and engineered solutions are faster and more permanent, leading to higher climate impact.

Even though a majority of the carbon by volume is removed using Nature-based solutions, a majority of the funds that we allocate are invested in permanent removal methods. Over time, we expect the cost of hybrid and engineered solutions to decrease, and as a result, we can maintain a similar split in our investments, while the volume shifts towards more long-term removal of CO_2.

Not all carbon removal options cost the same. And by putting our money where our mouth is, we send a market signal and support emerging technologies. Below, you can see which technologies our carbon removal portfolio supports. 12.5% of our investment is placed in engineered solutions and another 36% is placed in hybrid solutions. In total, almost half of our investment goes towards scaling permanent solutions.



In the following, we present each method of carbon removal in more detail, and provide information about each specific project that we use.

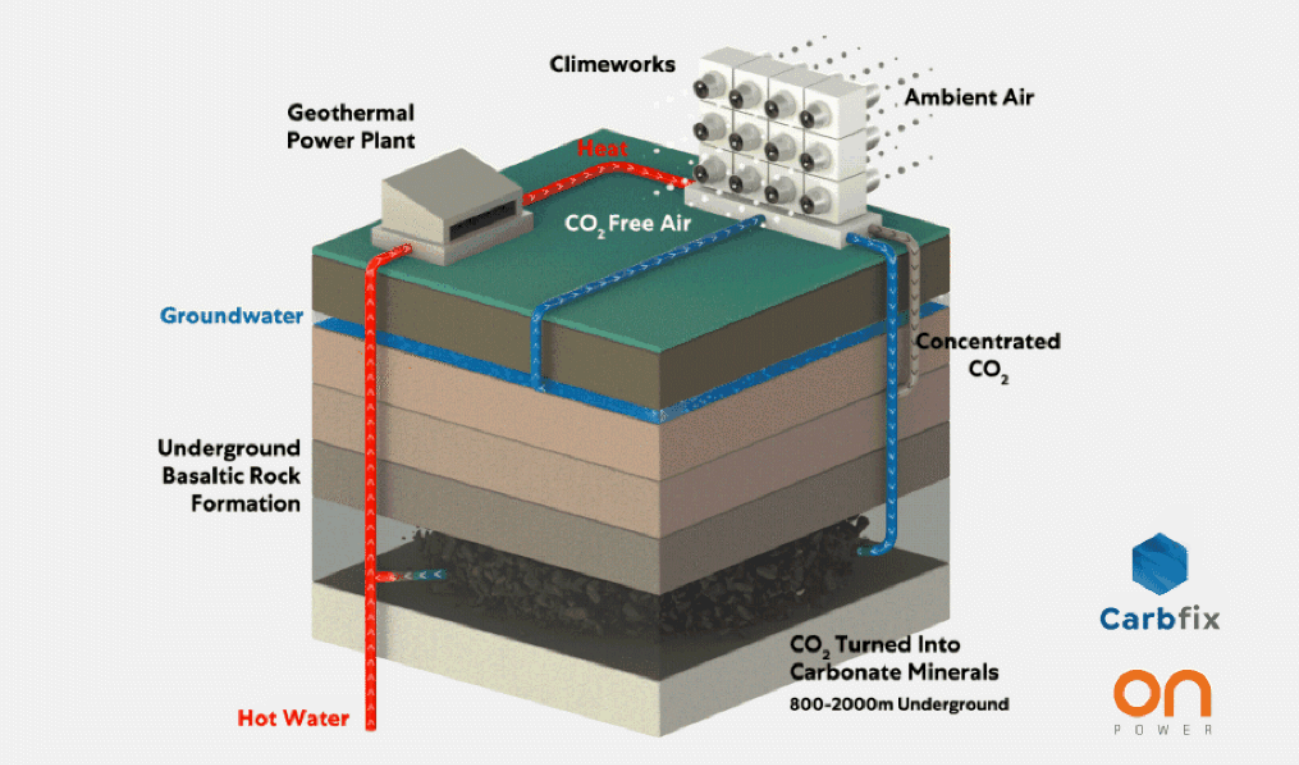
Direct Air Capture

Direct Air Capture uses large fan-like machines to pull CO_2 directly out of the atmosphere. Captured CO_2 is stored permanently in rock formations underneath the earth's surface.

Direct Air Capture is a form of carbon removal used to describe different technologies that permanently remove CO_2 from the air. After capturing CO_2, there are many options to store it, such as underground mineralization.

Put simply, CO_2 is directly pulled out of the air using big machines, resembling fans. Captured carbon can then either be reused in other products or safely stored deep below the earth's surface in rock formations. This permanently locks away the carbon.

This carbon removal method is attractive for several reasons: removed carbon is precisely measurable, permanent, and uses only a fraction of the land and water that is required for other methods.



Source: climeworks.com

ORCA by Climeworks & Carbfix

Climeworks use direct air capture technology, powered solely by renewable energy, to remove CO_2 from the air and store it permanently underground in natural sinks, such as geological formations.

Direct Air Capture

climeworks.com

Volume	0.4%
Investment	12.5%

The amount removed using this supplier, and amount of our total investment in removals used with this supplier

Benefits	Drawbacks
Very permanent	Very high cost
Very traceable	No additional benefits

Climeworks is the frontrunner among direct air capture technology companies. They operate several Direct Air Capture (DAC) facilities, and we procure from the most recent facility Orca, which captures around 4,000 tonnes of CO_2 per year. This is the world's biggest direct air capture facility to date.

Climeworks' technology and their collaboration with Carbfix enables anyone to permanently remove carbon and store it deep underground. Investing in DAC helps Climeworks to work on additional facilities to scale up the amount of carbon directly captured from the air.

Curious to know more about this exciting pioneer on the carbon removal market? Click here to find your way to their website.

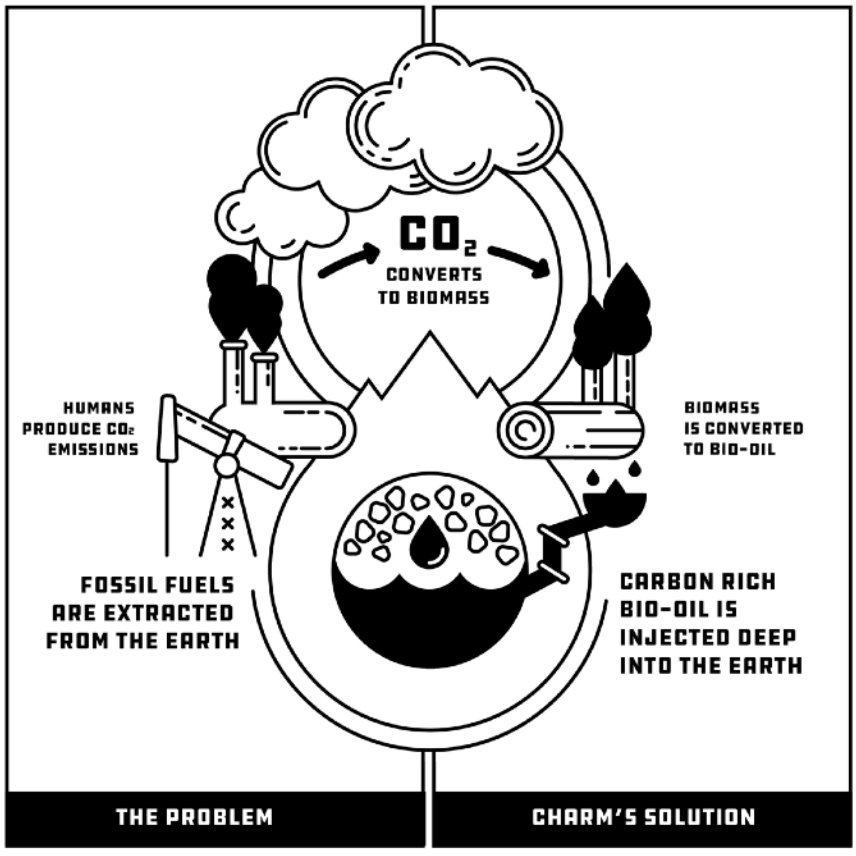
Bio-Oil

By heating biomass to extremely high temperatures without oxygen, carbon is locked up in bio-oil. This carbon-rich material can then either be stored away permanently underground or be refined and used as a green energy source.

Bio-oil is a thick, black substance resembling crude oil with a very high carbon content. But there's one major difference between bio-oil and conventional crude-oil: Due to its low energy content and tendency to harden over time, the oil is ill-suited for direct combustion or refining.

Exactly these properties make bio-oil the perfect candidate for putting it back into the same formations where crude-oil was held for millions of years - in underground rock formations. Fast pyrolysis, essentially a combustion without air, converts the biomass into bio-oil. This oil is injected into old oil wells to permanently store the oil (and thus its carbon content) deep underground.

This means that bio-oil essentially reverses the current flow of oil by converting biomass into inaccessible bio-oil and storing it underground. It's an innovative and exciting technology, which has great potential.



Source: CharmIndustrial

XXX by Charm Industrial

Charm converts waste biomass, such as sawdust, into bio-oil using a process called fast pyrolysis. Then they inject the bio-oil, a liquid oil-like substance, into underground rock formations for long term storage.

Bio-oil charmindustrial.com

Volume	1%
Investment	21.6%

The amount removed using this supplier, and amount of our total investment in removals used with this supplier

Benefits

Very permanent
Very traceable

Drawbacks

High cost
No additional benefits
Dependent on

Charm Industrial, a Silicon Valley startup, converts waste biomass into bio-oil using the process of pyrolysis. Biomass already captures hundreds of gigatonnes of carbon each year. Charm collects waste biomass and put it through a process called fast pyrolysis, which converts it into bio-oil.

Charm has pioneered the use of waste biomass to bio-oil conversion using fast pyrolysis and aim to remove millions of tonnes of CO_2. They inject it in depleted oil wells across the US, where the bio-oil sinks and solidifies in place for permanent storage. To read more about the company and their technology, visit their website.

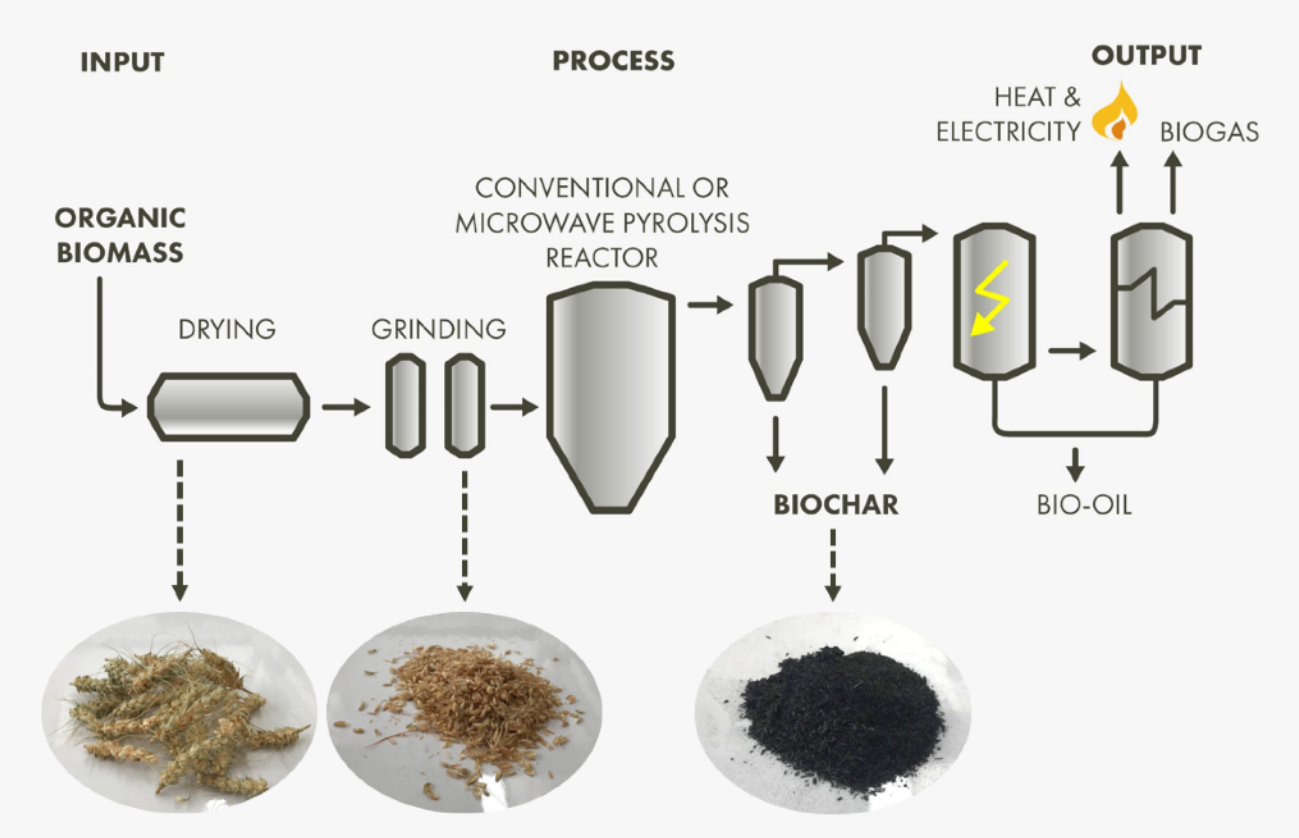
Biochar

Heating waste biomass to high temperatures without oxygen turns it into carbon-rich biochar. Applied to soils, biochar is great for storing carbon for a decades, while simultaneously increasing agricultural productivity.

Biochar is charcoal produced by slow pyrolysis of biomass, which means combusting biomass under oxygen-limited conditions. Feedstock biomass can include forestry and agricultural waste products, municipal greenwaste, biosolids, animal manures, and other biomass waste products.

By converting biomass to biochar, the carbon locked in the biomass becomes inaccessible for decades or centuries. Biochar is stored on agricultural soils, where it acts as a soil amendment, or in other natural applications, for example forestry. Due to its high stability, the biochar remains in the soil for centuries.

We use biochar because it is an efficient and permanent method for locking away carbon. Plants are incredibly effective at drawing down CO_2 from the atmosphere, and by converting plant biomass to biochar, the carbon stays out of the atmosphere for significantly longer than when stored in plant material, which easily decomposes. Biochar also has several environmental benefits when applied to agricultural soils.



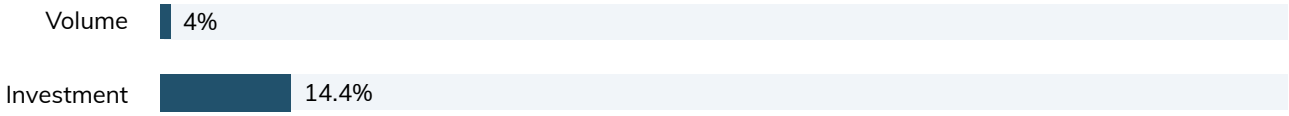
Source: https://spacebakery.be/basics-biochar

Biochar Q2 by CarbonFuture

Carbonfuture generates biochar from waste biomass using a process called pyrolysis. They then apply the biochar back to the soil for long-term storage. Their system ensures documented and verified removals for more than 100 years.

Biochar

carbonfuture.earth



The amount removed using this supplier, and amount of our total investment in removals used with this supplier

Benefits	Drawbacks
Fairly permanent	Limited supply
Increases agricultural yields	Underdeveloped
Helps retain water and adsorb excess nutrients	Risk of soil contamination

By putting biomass carbon back into the earth in the form of biochar, Carbonfuture is reversing the stream of carbon emissions. They are biochar pioneers who work with several biochar producers to apply biochar to agricultural soils around the world. Carbonfuture has created the first fully documented and verified biochar based carbon removal system with blockchain-enabled traceability.

Purchasing a Carbonfuture Carbon Sink credit finances the removal of one tonne of CO_2 over a period of 100 years. Carbonfuture accounts for the decay and loss of carbon over time by removing more than one tonne of carbon today.

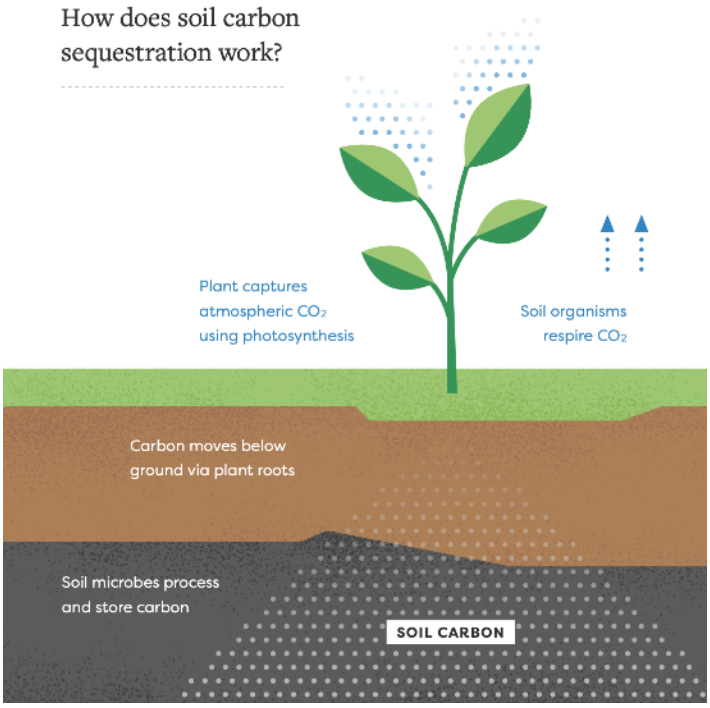
Soil Sequestration

Soils are great at capturing carbon, but the overuse of soils over the past decades has reduced their ability to do so. Diverse techniques can optimize and help regain the carbon-capturing properties of soils.

Soil carbon sequestration is a process in which CO_2 is removed from the atmosphere and stored in the carbon pool in the soil. Soil carbon storage is an important function of terrestrial ecosystems. Globally, soil contains more carbon than plants and the atmosphere combined.

Plants capture atmospheric CO_2 using photosynthesis. Via plant roots, the carbon moves below ground, where soil microbes process and store it in the soil carbon pool. Improved management practices, primarily in cropland and grazing lands, can increase the amount of carbon stored as soil organic matter, while also increasing soil fertility.

Soil sequestration is among the most scalable nature-based solutions for carbon removal. The global soil carbon pool has the potential to store several billion tonnes of CO_2, if properly managed. By investing in suppliers working to sequester carbon in soils, we help build the global potential for soils as a part of the solution to climate change.



Source: https://carbon180.medium.com/behind-the-scenes-of-the-leading-with-soil-report-e5fc663a02a

Joe Wahlgreen by Nori

Nori pays farmers for storing carbon in the soil using regenerative agriculture projects and techniques. They built a blockchain-based accounting system which eliminates risks of double counting and fraud.

Soil Sequestration nori.com

Volume	25%
Investment	13.9%

The amount removed using this supplier, and amount of our total investment in removals used with this supplier

Benefits	Drawbacks
Low cost	Uncertain measurement and quantification
Traceable	Low permanence
Great potential for scaling	

Nori enables transparent, verifiable, and high-quality carbon removal by farmers investing in agricultural practices to sequester carbon in the soil. By using sustainable farming practices, farmers remove carbon from the atmosphere and store it in their soil. An independent third-party, SoilMetrics, quantify and verifies the carbon removal delivered by the farmer.

Nori's software approach helps reduce costs for suppliers and buyers by streamlining the data collection, and by accounting for carbon removal transactions on a blockchain, Nori's approach eliminates double-counting problems.

Forestation

Trees are the earth's natural carbon removal machines. Trees sequester CO_2 using photosynthesis and store it in every part of the tree. A single tree can capture up to a ton of CO_2 in its lifetime.

Forestation includes reforestation and afforestation projects. Reforestation refers to the replanting of previous forest areas that have been lost due to e.g. deforestation, while afforestation refers to the replanting of non-forest areas.

The area is planted with trees - native or other non-invasive species - to increase the speed of forest growth. In agroforestry systems, trees are planted alongside crops such as coffee or banana. The trees store carbon in biomass above and below ground, which they sequester through photosynthesis. The CO_2 stays out of the atmosphere as long as the tree is alive.

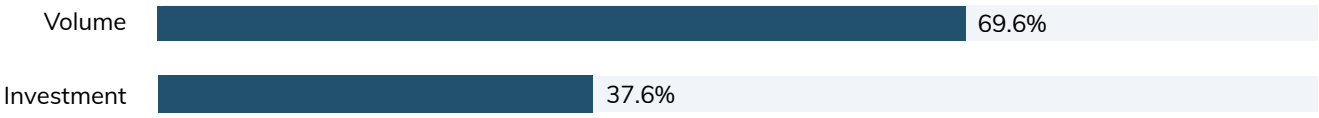
Forestation processes bring several co-benefits in addition to removing carbon from the atmosphere. Forests provide biodiversity and protect water resources, and forests provide income and livelihood to millions of people around the world. And trees are cool: they are the earth's natural carbon removal machines. We need to protect the ones existing and keep adding more.

Source: https://climatescience.org/advanced-reforestation-afforestation-tree-planting/

Halo Verde Timor by Carbon Offset Timor

FCOTI provides over 1000 small-scale farmers with financial incentives to plant trees and boost soil carbon storage in Timor Leste, thus reversing climate change, deforestation, and soil degradation.

Forestation carbonoffsettimor.com



The amount removed using this supplier, and amount of our total investment in removals used with this supplier

Benefits

Restores biodiversity
Creates local jobs and economic opportunities
Low cost

Drawbacks

Low permanence

FCOTI removes carbon from the atmosphere by providing financial incentives for small-scale farmers in the rural central mountains of Timor Leste to plant native trees, end slash and burn practices, and adopt improved land management techniques to increase carbon stocks.

Additionally, they have further reduced local poverty by introducing modern agroforestry systems which optimize the balance between the production of food and carbon storage pools. To date, FCOTI's Halo Verde project has improved the lives of over 1000 farmers, restored over 75 ha of previously barren and agriculturally unproductive lands, and sequestered around 18,000 tonnes of CO2; achievements which result from the planting of over 250,000 trees.

They aim to increase the land under Halo Verde project to over 320 ha by the end of the decade, which would enable a far larger amount of CO2 to be sequestered. As of 2020, they achieved retroactive Plan Vivo certifications for all climate benefits generated by reforestation and soil management activities conducted by their participating farmers since 2011.

Portfolio **Benchmark**

How much are we investing, and why?

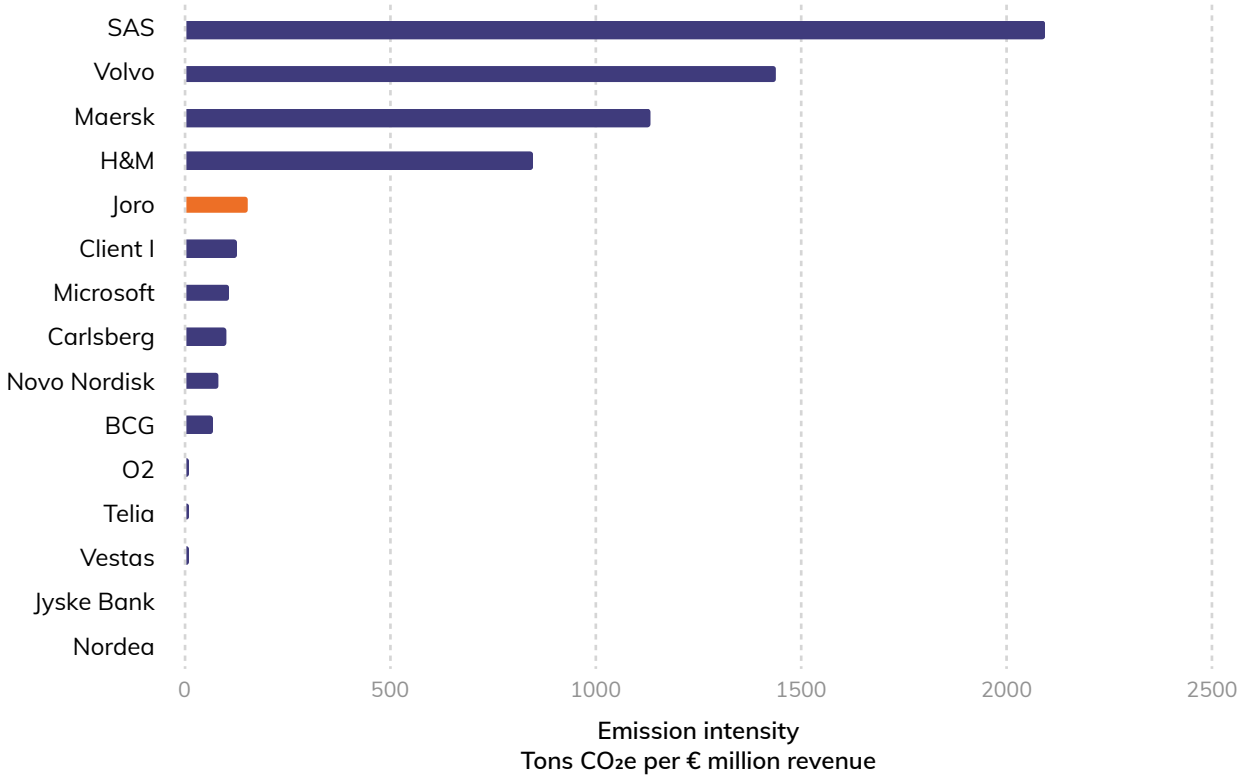
Not every company can, or should, invest the same in carbon removal. However, aligned with the Oxford Offsetting Principles, we wanted to invest an amount that was significant and would send a market signal to help push forward novel carbon removal technologies.

In this section, we share our insight as to why we chose to invest the amount that we do, and how this compares to other companies.

Emission intensity

To set an ambitious level of our investments, we first started by seeing how our *emission intensity* compared to companies in other sectors.

The **emissions intensity** - how much a company emits relative to revenue - varies greatly between sectors. In some sectors, such as airlines, emissions are large relative to revenue, whereas in others, such as financial services, emissions are low compared to revenue. As these sectors operate in different fields, they face different challenges and requirements, and cannot be directly compared.

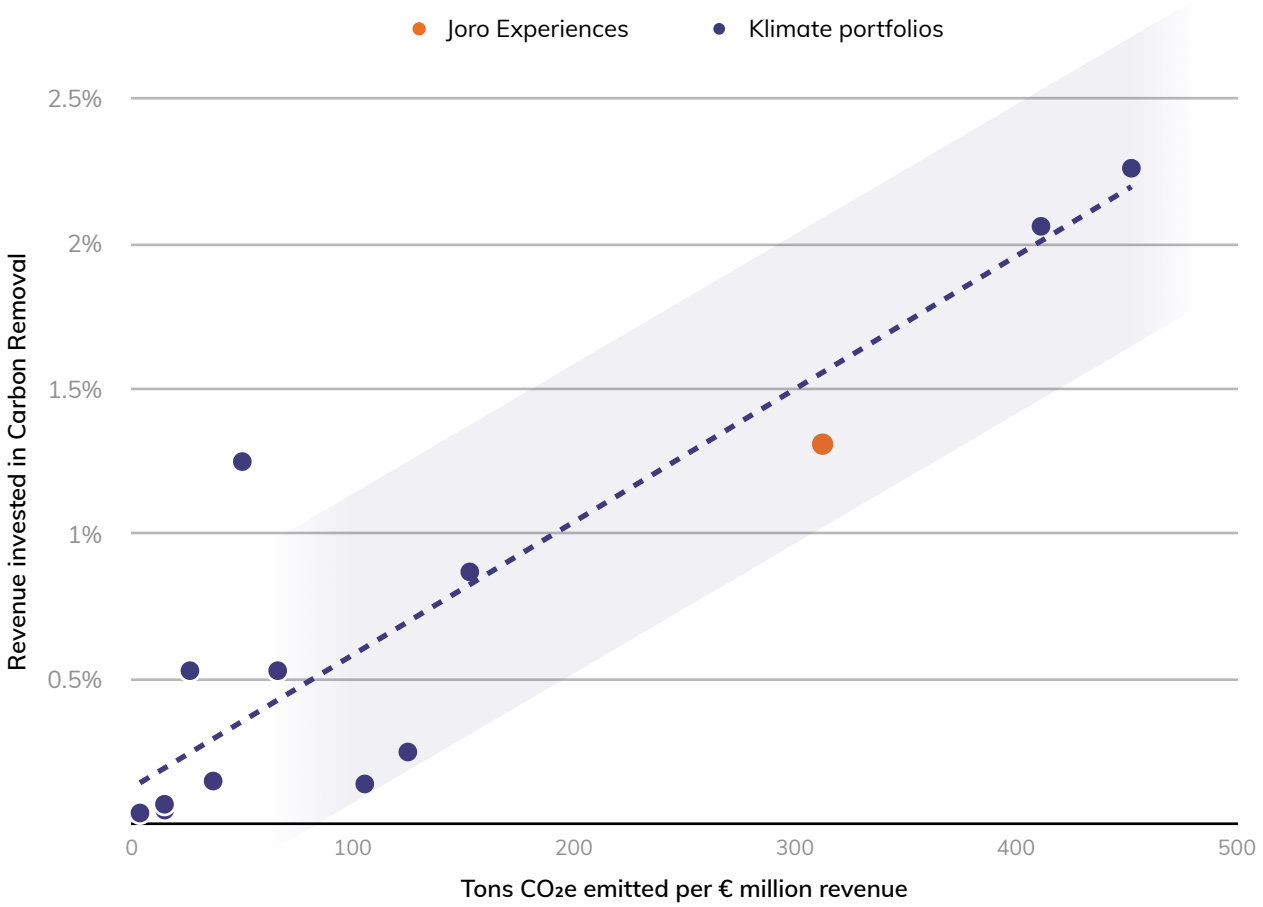


It's clear that our emission intensity is relatively low compared to industries like aviation. However, we still have several times higher emissions than companies in banking.

This gave us an indication that we should be able to create a genuine carbon removal portfolio.

Our investment, benchmarked

Next, we needed to bring this data into the context of how much to invest in total. Using data provided by Klimate, we were able to see our emissions intensity compared to other Klimate companies.



With our emission intensity, we were able to benchmark ourselves to what companies with a similar footprint would spend. It's important to factor in that Klimate's clients are generally very ambitious, and represent sectors that can afford a high investment in carbon removal.

Using this, we landed at an investment equal to 0.50% of our revenue, and 33 euro per ton of CO_2 that we emit. This is in line with other clients and allows us to create a strategy for how we will develop our portfolio as our emission intensity decreases with our carbon reduction efforts. Importantly, we were able to create a portfolio of removal solutions that send a strong signal to the market that we are not only planting trees.

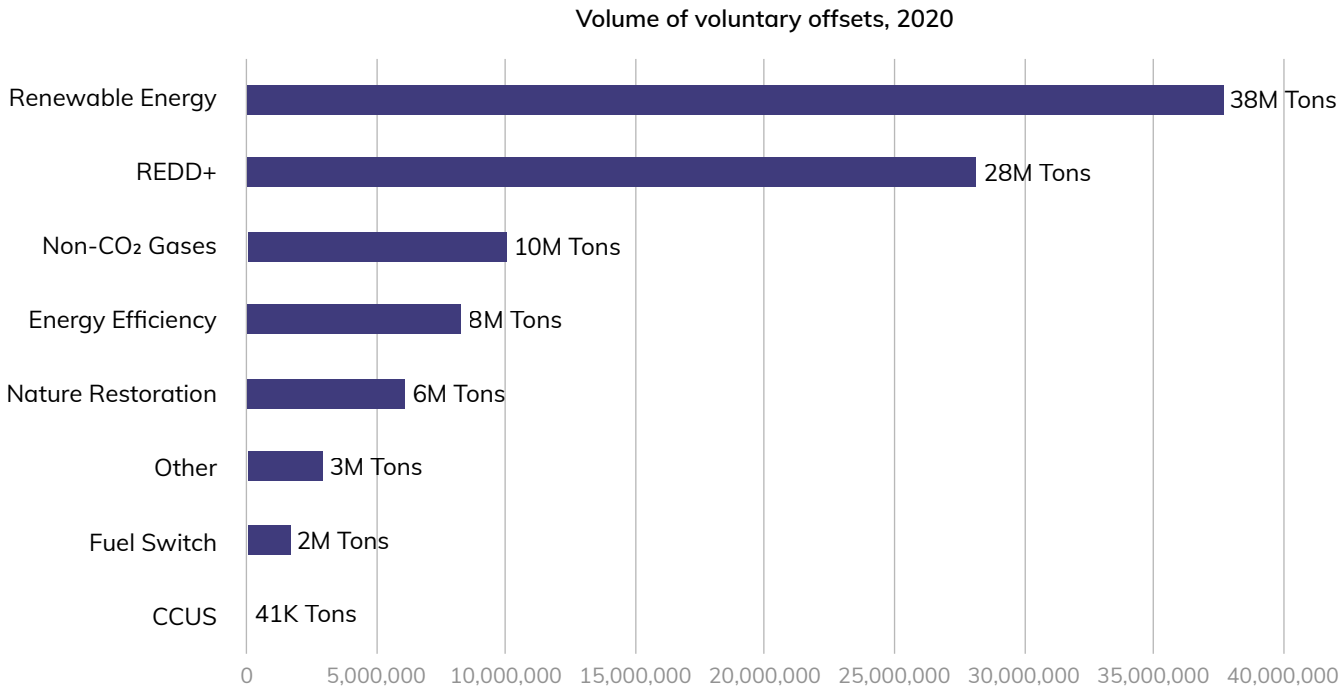
What is everyone else doing?

With this report, we aim for complete transparency in how we compensate for our unavoidable emissions. To put this in context, we want to share what we are doing in context of what other companies are doing. However, it can be hard to find data about what companies are doing.

We use three approaches to benchmark ourselves. First, we look at the big picture, seeing where the market for voluntary offsetting is currently. Next, we took a look at another platform providing data on carbon offsets. Finally, we compared ourselves to Microsoft, which is generally seen as a pioneer in carbon removal.

Public data records

According to data from Trove Intelligence[3], a total of 95M tons of CO_2 was offset in voluntary markets in 2020. From that, it is only possible to split based in a number of categories, none of which give a clear picture of what companies are actually doing.

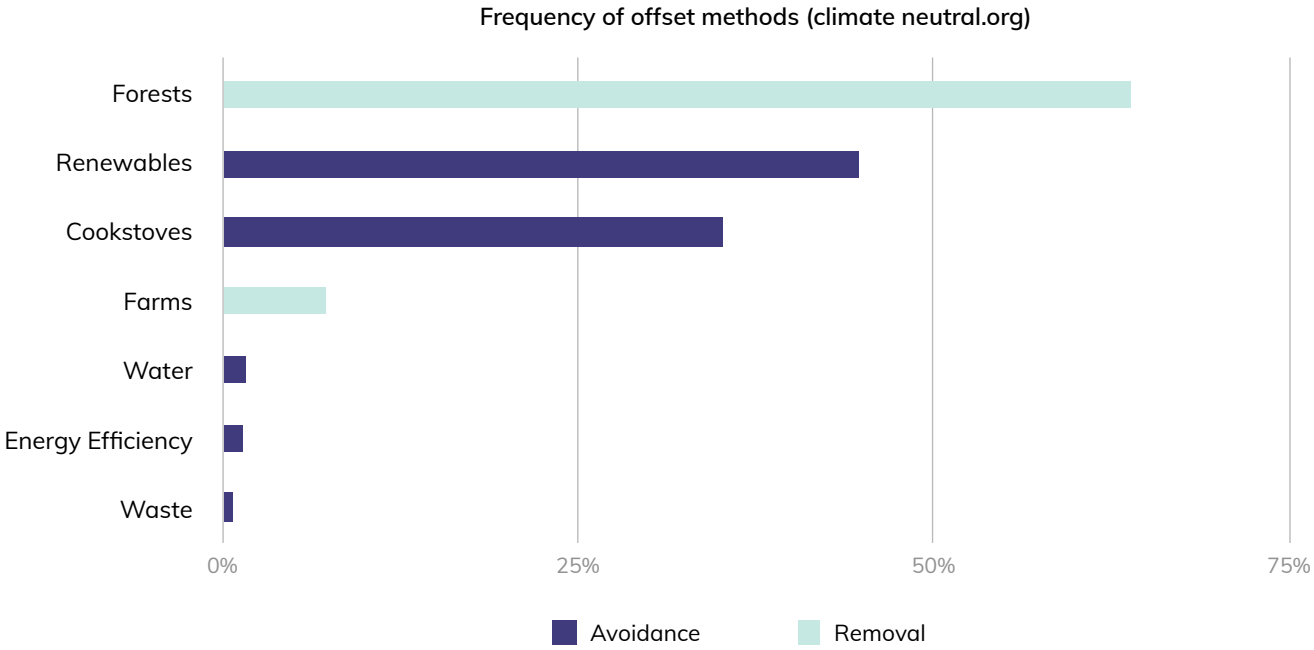


It is, however, clear, that the vast majority of offsets come from methods that are not removing CO_2 from the atmosphere like credits from renewable energy (40%). Only 41k Tons (0.04%) comes from Carbon Capture, but it is not clear how much of this includes storage CCS as opposed to CCU, where the captured CO_2 is used and as a result re-emitted.

[3] Trove Intelligence, retrieved 13.10.2021: https://trove-intelligence.com/modules/carbon-projects/

Other platforms

Similarly, from ClimateNeutral.org[4], we can glean that companies are relying heavily on offsets that avoid emissions elsewhere, instead of removing CO_2 from the atmosphere. A lot of companies are planting trees, but methods like Cookstoves and credits from renewable energy are still frequently used.



Forests are the type of offset that is most commonly used, and this is in fact removing CO_2 from the atmosphere. In the data from Climate Neutral, we could see that less than half of companies were relying only on planting trees. This is a good start. However, the removal is short-lived.

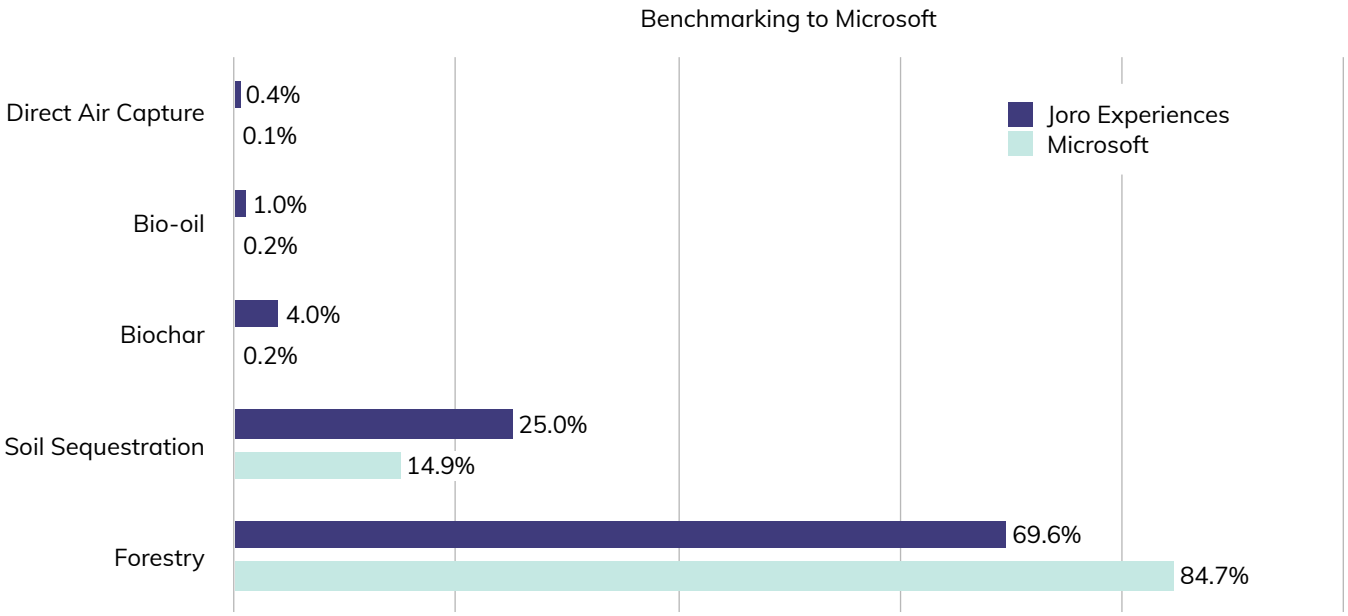
4 Climate Neutral, retrieved 15.09.2021: https://www.climateneutral.org/certified-brands

A market leader

One of the only companies that are committed to carbon removal at a large scale is Microsoft.

Even though Microsoft is just one company, they have been generally recognised as a first-mover in carbon removal portfolios, and it makes sense for us to set the ambition to be at least as ambitious as they are.

Below, you can see how our carbon removal portfolio compared to that of Microsoft.



Comparing our portfolios side-by-side, we can see that we are sourcing a higher share of our removal from permanent methods such as Biochar, Bio-oil and Direct Air Capture.

13x

Share of long-term removal in Joro portfolio relative to Microsoft

Portfolio **Impact**

Climate Impact

We evaluate the *permanence* and *rapidity* of carbon removal projects to determine the impact they have on climate change.

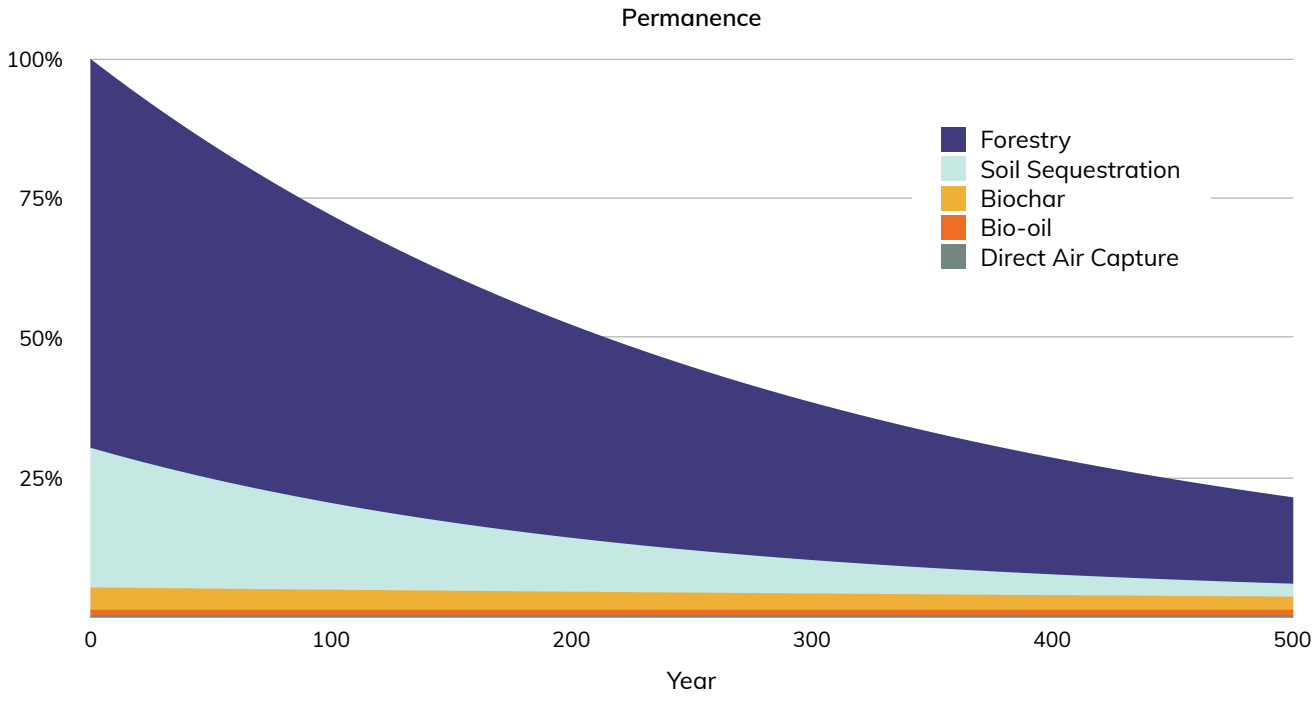
Permanence

Impact

Carbon removal projects reduce climate change by removing atmospheric CO_2, storing it in various reservoirs, and preventing it from being re-emitted. The more permanent the carbon removal is, the longer it keeps carbon locked away in reservoirs. This is important because the longer carbon stays locked away, the longer it does not contribute to climate change.

> Nature-based solutions sequester carbon in the terrestrial biosphere, but do not permanently remove carbon from the atmosphere, as it is at constant risk of being returned through deforestation or other disturbances, whether intentional or not
>
> (Palmer, 2011)

The permanence of removal varies across technologies and projects, as they each rely on different methods to remove and store CO_2. In general, technical solutions and projects involving geological storage are more permanent than nature-based solutions.



This figure shows how the projects included in our portfolio differ on expected permanence. Nature-based solutions have the shortest permanence, while engineered projects with geological storage have the longest permanence.

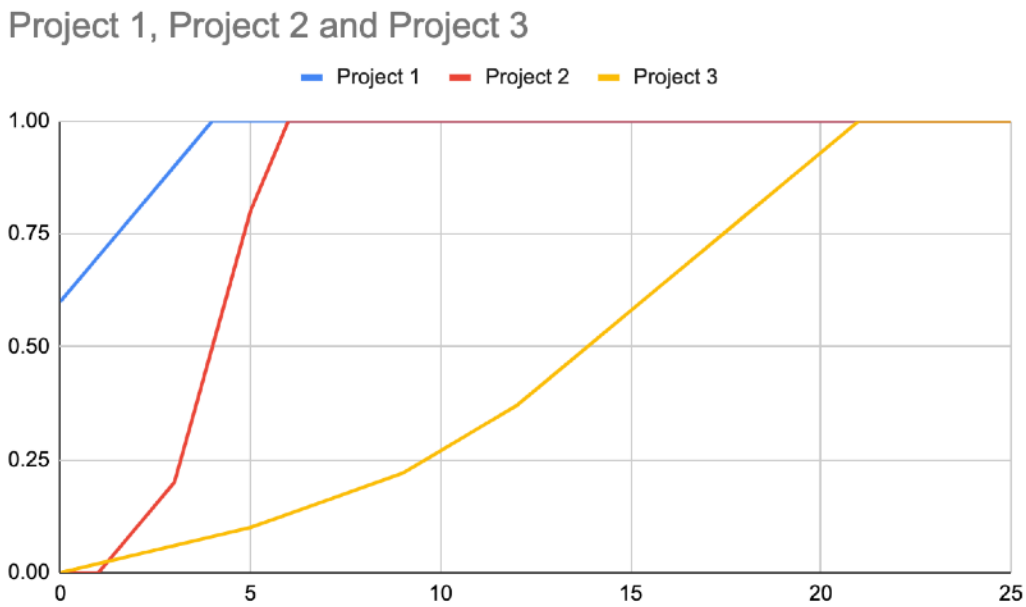
Given our project selection, at least 1,4% of the carbon we removed will remain sequestered for more than 1000 years, while at least 5.4% will remain sequestered for more than 100 years. The remaining carbon will slowly be released back into the atmosphere during the next 30-100 years. These numbers are estimated time horizons and the actual permanence depends on several factors that cannot be directly measured or controlled.

Rapidity

Impact

The time period between emissions occurring and carbon removal projects removing those emissions and sequestering them in various reservoirs affects how much emissions contribute to climate change. The project's rapidity - how fast are emissions removed - affects the climate impact of the project. Faster reduction means less warming from CO_2. This is important because the faster CO_2 is removed from the atmosphere, the less it can contribute to climate change.

The projects in the portfolio differ on how fast and when they remove carbon. The full data is not available for each individual project, but the graph below shows different trajectories. In some projects, most of the carbon has already been removed (Project 1). For example, for most biochar projects, the carbon is already removed when the biochar is sold. For others, demand exceeds supply, meaning that removals are contracted now, but take place in the coming 2-5 years (Project 2). Finally, for many nature-based projects, the carbon is removed over several years as trees grow and sequester carbon in the biomass (Project 3).



Illustrative

We strive towards including projects that have already removed carbon or will do so in the next few years, but also acknowledge that for some of our nature-based projects, the carbon is gradually removed over a couple of decades as the biomass sequesters carbon.

Co-benefits

Beyond carbon removal, we evaluate the social and environmental benefits that carbon removal projects generate.

Social

Impact

Resulting from its activities, carbon removal projects can generate social benefits, such as jobs and welfare. But they can also cause social harms, such as loss of livelihoods or noise pollution. Both aspects must be considered.

Our portfolio contains a mix of nature-based, hybrid and engineered solutions. It's great to combine projects, as they generate different social benefits.

List of projects and examples of the social benefits they generate

Carbonfuture	Carbonfuture provides income to farmers and biomass producers who apply or deliver biochar.
Nori	Nori helps farmers gain extra income by selling carbon credits, which enables them to keep adding carbon to agricultural soils through regenerative practices.
Charm	Charm drives innovation and supports job creation in rural communities.
Climeworks	Climeworks generate high-skilled jobs and drive research on carbon removal forward.
FCOTI	FCOTI provide financial incentives for small-scale farmers in the rural central mountains of Timor Leste and reduce local poverty, greatly improving local livelihoods.

Environmental

Impact

Carbon removal projects can generate environmental benefits, such as biodiversity or clean air. But they can also cause environmental harms, such as waste, pollution, or biodiversity loss. Both aspects must be considered.

Our portfolio contains a mix of nature-based, hybrid and engineered solutions. It's great to combine projects, as they generate different environmental benefits. Below, we have highlighted some of the different environmental benefits that we help contribute to through our investment.

List of projects and examples of the Environmental benefits they generate

Carbonfuture	Carbonfuture helps lock biochar in the soil. This builds up the soil carbon content, helps retain water, and improves yields. Biochar also helps de-acidify soils, which contributes to their decontamination.
Nori	Nori supports regenerative farming practices, which increase soil organic matter and fertility, improves water retention, and enhances nutrient cycling.
Charm	No immediate environmental co-benefits.
Climeworks	No immediate environmental co-benefits.
FCOTI	FCOTI plant native trees and adopt improved land management techniques to increase carbon stocks. This helps restore previously barren and agriculturally unproductive lands, while increasing tree density. This improves biodiversity, reduces flood risks, and improves local micro-climate.

Validation

We analyse the accounting and verification procedures of carbon removal projects to ensure sound and credible projects.

Carbon Accounting

Integrity

Systems to monitor, measure, and report on CO_2 emissions enable carbon removal projects to account for the carbon removed by the project's activities. For each of the projects in our portfolio, we ask project suppliers to report on how they account for the carbon removed by the project. This enables traceability and fosters transparency, building credibility in carbon removal projects.

It is important to ensure that carbon removal projects are as additional as possible. Additionality means that the carbon removal would have not taken place, had it not been for the specific project activity. In other words, if the removal would have occurred regardless of the project, it is not additional. Had some of the carbon been removed even without the project, the carbon removal is only partly additional. Additionality is difficult to measure and verify and will always be somewhat subjective since the counterfactual scenario—in which the project did not take place—cannot be directly observed.

Carbon removal projects create additionality when the project removes carbon that would not otherwise have been removed.

Verification

Integrity

Carbon removal projects must have procedures in place to verify carbon removals. This can be certification standards, such as Gold Standard, or various internal or tailored solutions, such as blockchain. We have assessed each of the suppliers in the portfolio to ensure that they have solid procedures and tools for verification.

Carbonfuture	Carbonfuture relies on independent sink certification with scientifically substantiated and conservative quantifications of removal potentials and consider the full life-cycle of sinks, including production emissions and explicit accounting of the sink duration. They document the sinks end-to-end on a blockchain-based distributed ledger platform.
Nori	Nori relies on independent third parties to quantify and verify carbon removals before listing these on the marketplace. Nori uses a blockchain to account for the ownership of carbon removals to eliminate issues of double-counting.
Charm	Charm conducts LCAs to estimate emissions due to bio-oil production, transporation to well, and injection. Charm registers clients' purchases on a ledger and provides certificates of carbon removal.
Climeworks	An independent life-cycle assessment by RWTH Aachen University showed that Climeworks' direct air capture plants has a net removal efficiency of more than 90%. Climeworks measures exactly how much CO_2 the process removes and sequesters,
FCOTI	FCOTI has developed a unique model to use observed data from tree-planting, soil management activities, and tree-counting activities to determine their net-carbon benefits. They mitigate the risks of leakage and uncertainty by creating risk buffer pools. Further, the project has achieved Plan Vivo certification and registers the generation, sale and retiring of credits on an official registry to avoid misuse and double-counting.

Outlook

We analyse the potential and risks of the carbon removal projects and technologies to future-proof our investments.

Potential

Integrity

Carbon removal projects differ on many fronts, utilising nature-based, hybrid, or engineered solutions. These differences cause projects and technologies to have different potentials for scale and scope, which should be considered.

Our portfolio includes projects that we believe have a high potential for carbon removal. They differ on various aspects, such as maturity and technological innovation. For example, while nature-based solutions are proven ways of removing carbon, we source our nature-based solutions from providers that provide additional guarantee, such as local monitoring and cutting edge technologies, such as drone footage, to monitor and verify carbon uptake.

For our other projects, we support carbon removal projects and suppliers that develop technologies, which have the potential to reduce the cost of removing carbon while scaling the total carbon removal potential significantly. This includes both bio-oil (Charm Industrial) and direct air capture (Climeworks), which are still costly solutions, but where innovation and market development can help reduce the cost of removing carbon.

While being innovative in and off themselves, our projects also rely on technological advancements to manage and account for the carbon removal within each project. For example, two of the projects in our portfolio (Nori and Carbonfuture) use blockchain technology to avoid double-counting issues and improve the security of their platform.

Together with Klimate, who has developed this portfolio for us, we constantly scour the market for new promising technologies, suppliers, and projects, which we can include in our portfolio. Klimate's analysts identify, analyse, and manage these carbon removal projects to help us constantly improve our carbon removal portfolio and stay ahead of the curve

Risks

Integrity

Carbon removal projects carry inherent risks, both natural and man-made. These must be evaluated and mitigated to ensure the lowest possible risk of carbon removal projects not delivering on their promise of removing CO_2.

The risks of carbon removal projects most importantly include the failure to remove and subsequently store carbon. Firstly, projects must ensure that carbon is removed from the atmosphere and secondly that the carbon is stored (for shorter or longer periods) in respective reservoirs, such as biomass (forests), soils (biochar), and geological reservoirs (bio-oil, DAC), among others.

For each of the projects in our portfolio, Klimate assesses the risks inherent in each project; from the risk of not removing carbon to the rapidity with which it is taken up and the permanence of the storage. They also assess the social and environmental co-benefits and the methods used for validating the removal.

Risks can never be eliminated, and it is important to understand that investing in carbon removal projects will always involve a degree of risk. The supplier might fail (business risk) or the project itself might not work or be destroyed. Consider for example the risks of a facility or forest burning. This can never be avoided. But carefully selecting projects and analysing and understanding their risk profile reduces the risk of investing in projects that might fail.

Finally, investing in a portfolio of projects reduces the risk of failure of the overall carbon removal investment. While each individual project involves a risk of failure, the likelihood of all projects in a portfolio failing is drastically reduced by spreading the risk across multiple projects. It is the carbon removal equivalent of not putting all one's eggs in one basket. This is why Klimate helps us invest in a portfolio of different projects spread across different technologies and different suppliers

SDGs

The Sustainable Development Goals (SDGs) or Global Goals are 17 interlinked goals (see next page) designed to be a "blueprint to achieve a better and more sustainable future for all". The UN adopted the SDGs in 2015 with the intention of achieving the goals by 2030. Each goal includes specific targets along with indicators used to measure progress toward each target.

Each of the projects in the portfolio address one or more of the SDGs. On some SDGs, the carbon removal projects make a strong contribution to the given SDG, while for others, the contribution is more indirect. This assessment builds on the indicators within each SDG and the contribution that each project makes to fulfilling these. As each project contributes to different SDGs, the portfolio approach enables us to address more and different SDGs than an individual project, while the overall impact of the portfolio remains to take climate action (SDG13).

List of SDGs addressed by our projects

SDG	Climeworks	Charm	Carbonfuture	Nori	FCOTI
1					Yes
2			Yes	Yes	Yes
4					Partially
6					Partially
8	Partially	Partially	Partially	Yes	Yes
9	Yes	Yes	Partially		
10					Partially
12	Partially	Partially	Partially		
13	Yes	Yes	Yes	Yes	Yes
15			Partially	Partially	Yes
17	Yes	Yes	Partially		

SUSTAINABLE DEVELOPMENT GOALS

The **Sustainable Development Goals** (SDGs), also known as the Global Goals, adopted by the United Nations in 2015 as a universal call to action to end poverty, protect the planet, and ensure that by 2030 all people enjoy peace and prosperity.

Looking **forward**

Conclusion

There are numerous ways to offset CO_2, and when we started this project, we found that it was a jungle out there. There are lots of offsetting projects that cost less than €10 per ton, and have verifications like Gold Standard and Verra. However, being avoidance-based offsets, a lot of these don't actually remove CO_2, while they also lack permanence, and show low or non-existent additionality.

01

There are no perfect solutions for compensating emissions. Our main focus remains to reduce our emissions.

We quickly realised to have a real impact, we also needed to make a real investment, and combine several different methods. Our portfolio is a result of that, and we can be proud of what we have done so far.

There are no perfect solutions to neutralise emissions, and our primary focus will continue to be how we can reduce our emissions as much as possible.

02

We go beyond the expected and strive to inspire others to follow suit.

We analyse each of the projects in our portfolio to understand the climate impact, co-benefits, validity, and outlook.

By analysing our portfolio and benchmarking to what other companies are doing, it's clear that we are going well-ahead of what companies in general are doing.

Our approach is not perfect, but we strive to do the best we can, go beyond the expected, and inspire others to follow suit.

03

This is only the beginning, we will continue to improve our efforts every year

We are committed to continue to remove all of our emissions from the atmosphere, as we gradually decarbonise.

Together with Klimate, we are setting a strategy for how we will improve our carbon removal efforts over time to stay ahead of the curve and in line with science. The more we decarbonise, the better we can remove our emissions using increasingly permanent methods.

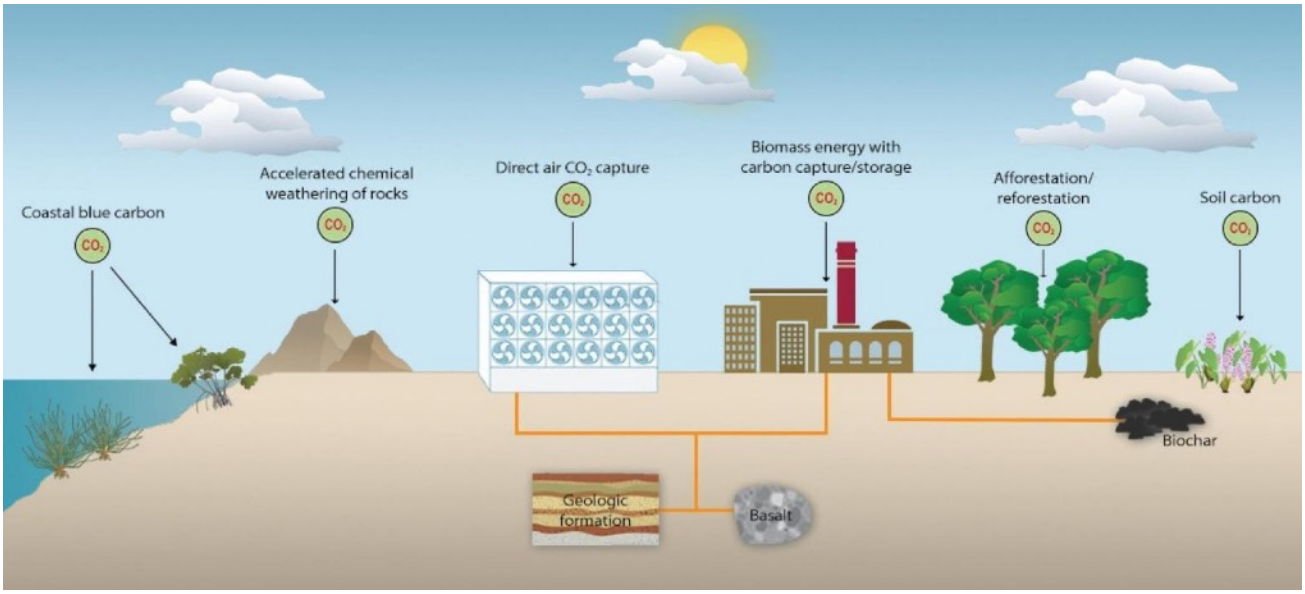
Background & Context

What is carbon removal?

At the most basic level, carbon offset methods can be split into two groups: Methods that avoid greenhouse gas emissions and methods that remove CO_2, which is already in the atmosphere.

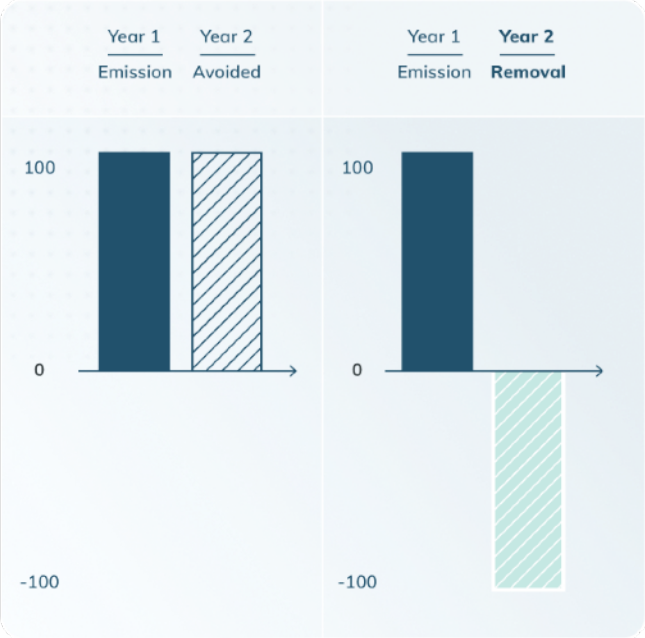
The most common forms of avoidance are renewable energy projects, such as wind and solar, as well as energy-saving activities such as providing clean cookstoves or boilers.

The general idea is that if you buy energy-efficient cookstoves for people in developing countries, they will use these instead of burning wood. This results in a net reduction in the amount of CO_2 being emitted in the future (as less wood is harvested from forests and burned to heat the stove). Similarly, renewable energy offsets assume that the energy generated from renewable sources would otherwise have been generated from sources with higher CO_2 emissions like coal, oil, and gas. The difference is then counted as an offset.



An overview of carbon removal methods. *National Academy of Sciences*

Why do we exclusively remove carbon?



The problem with avoidance is that no GHGs are actually removed from the atmosphere. As shown on the graph to the left, there are no negative emissions taking place, but rather an absence of emissions in a future year. As a result, it is not advisable to use avoidance for any type of compensation, especially if you intend to communicate your efforts to the public.

Furthermore, most renewable energy offsets, particularly wind and solar, struggle with proving *additionality*. This means that it is highly uncertain whether the investment makes a difference - for many of the avoidance projects, most of the emissions would never have occurred anyway. As such, there is limited additional impact as a result of the investment.

The alternative to avoidance is carbon removal. The advantage of carbon removal is that instead of avoiding future emissions, we actively remove GHGs from the atmosphere. This makes it more appropriate to talk about compensation, as there is a greater equivalence between emitting GHGs and removing them.

As shown in the graph, this results in a negative emission, which can be used to make claims around being Net Zero. The relationship is not 1-to-1 and depends on factors such as the permanence, rapidity, additionality, and accounting of the emissions, which we take into account when we evaluate the different carbon removal methods and projects.

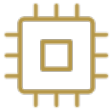
What are the different types of removals?

Carbon removal can happen either through nature-based solutions like planting trees or through engineered solutions that use technology to capture and store CO_2. There are also several solutions that combine nature-based solutions with engineering. For instance, some methods rely on nature to capture CO_2 in biological material, but then use engineering solutions to convert the biomass into products or materials that retain carbon much longer than unmodified biological material.

Nature-based solutions

Nature-based solutions (NBS) are carbon-removal solutions inspired and supported by nature. They rely on natural processes for cost-effective carbon removal, provide environmental, social and economic benefits, and support various ecosystem services.[5]

Nature-based solutions include projects, such as land-based forest restoration and protection, agroforestry, mangrove forests, and marine biomass, such as kelp forests and seaweed.



Engineered solutions

Engineered solutions rely on technology and engineering to capture CO_2, bind, and subsequently store the carbon. The most prominent and promising technologies are Direct Air Capture solutions that directly suck CO_2 from the atmosphere using giant fans and use various processes to store the carbon, usually in underground geological formations.

Hybrid solutions

Hybrid solutions combine nature-based and engineered aspects. They rely on nature for part of the carbon removal process - usually to bind carbon in biomass through photosynthesis - and then use technology to modify and store the biomass. For example, many hybrid solutions use various types of pyrolysis to modify the carbon and subsequently store it in soil or underground reservoirs.

[5] https://ec.europa.eu/info/research-and-innovation/research-area/environment/nature-based-solutions_en

How do we identify and analyse suppliers?

We source carbon removal from various suppliers, who each operate a number of different carbon removal projects. To ensure that we get the best projects, we perform a thorough analysis and technical due diligence on all our suppliers and their projects.

We analyse each supplier's project within four different categories (Climate impact, co-benefits, validation, and outlook), which each include a number of parameters and data indicators. We collect and review data on these aspects in collaboration with our suppliers to assess and score each project, enabling us to compare the different carbon removal projects included in our portfolios.

With this assessment, we strive to ensure that our projects in fact remove carbon emissions (at a given pace and permanence), have proper accounting and verification systems in place (to avoid double-counting, double-selling, etc.), provide co-benefits to the environment and society, and do not carry undue risks.

Climeworks

Why do we use portfolios?

Klimate source projects from a variety of different suppliers. There are two reasons for this:

Firstly, investing in different technologies sends a market signal. Many of the novel technologies, such as Direct Air Capture and Bio-oil, are still too expensive for companies to source individually. By including these in portfolios, the overall cost of the portfolio can be kept at a level that matches our current investment capacity. As the price of different technologies change - technological solutions will decrease, while some nature-based solutions will become more expensive - the composition of the portfolio will change.

The second reason for using a portfolio approach is to mitigate risks. By spreading our investment portfolio across different projects, we can reduce the risk posed by individual projects failing. As the old adage goes, putting all one's eggs in one basket is never a good idea. So we spread our investment across different technologies and invest in different suppliers developing projects using the technologies. We don’t want to pick a winner - we want to support different technologies to help as many suppliers as possible contribute to solving the climate crisis.

A note on our method and approach to create this document.

The assessments of carbon removal suppliers and projects presented in this report builds on data collected by Klimate from its suppliers, as well as on best available estimates of the different technologies sourced from academic and grey literature sources. The assessments and the subsequent analysis of projects and suppliers present an approximation of the impact across various parameters, as evaluated by Klimate given the best available information.

Klimate conducts analyses of the suppliers and projects included in this portfolio. They collect information from the supplier and third-party sources to assess and score each individual supplier and project. The analyses presented here are based on self-reported data by suppliers and are not verified by third parties.

The portfolio benchmarking and analyses presented in this report are not *the definitive* answer to the quality and characteristics of this portfolio. As this is not exact science, it should not be presented or treated as such, but rather as a means for comparing and contrasting different carbon removal projects, suppliers, and technologies across different portfolios using the same parameters, criteria and metrics.

Klimate constantly seeks to improve how we assess and analyse the projects and suppliers included in its respective portfolios. If you have any questions or suggestions for changes, please contact Simon Bager at simon@klimate.co.

Spread the word!
Join the fight against climate change!

This report was created by Klimate on behalf of Joro Experiences.

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