Purpose
INVESTMENTS

CARBON CREDITS

What are they, how do they work and the verification standards

1.0 INTRODUCTION

The climate crisis has been deemed a "code red for humanity"[i] as scientists warn of increasingly extreme heatwaves, droughts and flooding, and breaking the 1.5°C temperature limit set out by the Paris Agreement in just over a decade. The main driver of climate change is humans or more specifically, the greenhouse gas (GHG) emissions that we generate. GHG plays an important role in keeping the planet warm enough to inhabit. But the amount of these gases in our atmosphere have skyrocketed in recent decades disrupting the earth's fragile ecosystems and the processes that are essential for keeping us alive.

By 2020, the concentration of CO2 in the atmosphere had risen to 48% above its pre-industrial level (before 1750)[ii] and natural causes, such as changes in solar radiation or volcanic activity are estimated to have contributed less than ~0.1°C to this.[iii]

To help fight climate change, individuals and companies are investing in environmentally friendly projects to cancel or neutralize their carbon footprint. This process is called **carbon offsetting**. Carbon offsetting compensates for **unavoidable** emissions (the ones we can't currently reduce due to a lack of technology, alternatives, or prohibitive costs).

[i] McGrath, M. (2021). Climate change: IPCC report is 'code red for humanity'. Retrieved from https://www.bbc.com/news/science-environment-58130705
[ii] Causes of climate change. Retrieved from https://ec.europa.eu/clima/climate-change/causes-climate-change_en
[iii] Ibid.

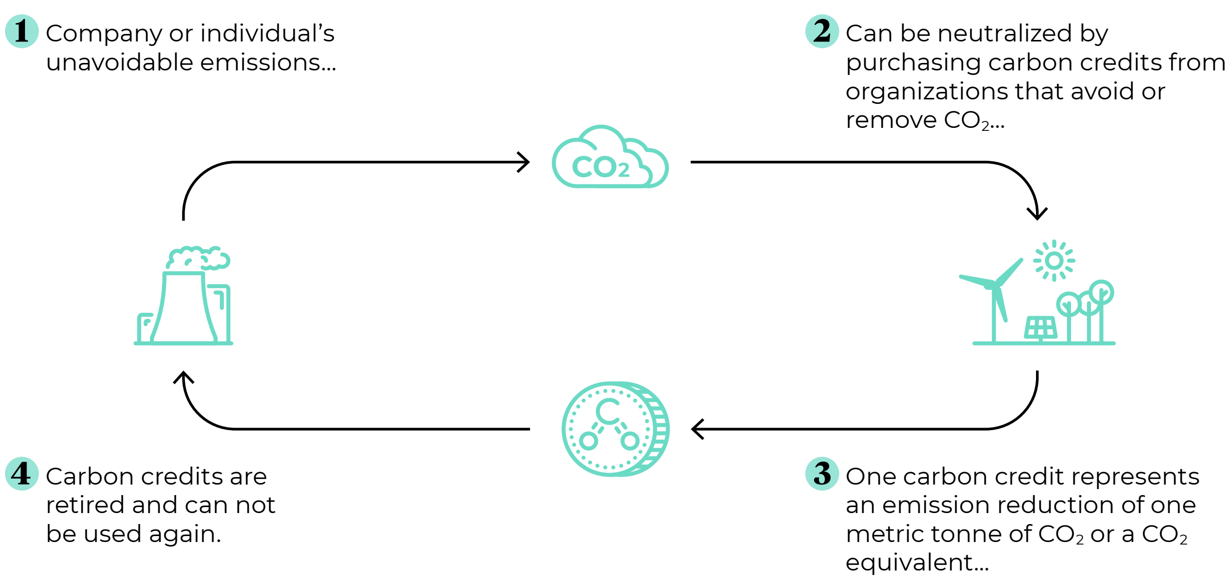
2.0 WHAT ARE CARBON CREDITS?

Carbon offsetting is a process that allows individuals and companies to invest in environmental projects around the world to cancel out or neutralize their carbon footprint.

Carbon offsetting compensates for **unavoidable emissions** (the ones we can't currently reduce due to a lack of technology, alternatives, or prohibitive costs).

A carbon credit, also called a carbon offset, is a certified transferrable instrument that represents an emissions reduction of one metric tonne of CO_2 or an equivalent amount of other GHGs. There are two different types of carbon credits: voluntary credits and compliance credits. The first type allows the buyer to claim the action of avoiding or removing one tonne of CO_2, through the actions of the supplier of the credit. The second type can be accumulated, traded, and sold through regulated systems. Both types of carbon credits are used to facilitate a net climate benefit or carbon neutrality from one entity to another.

For example, an individual can offset a flight that emits 1.2 tonnes of CO_2 by purchasing a carbon credit that promises to reduce 1.2 tonnes of CO_2 via a reforestation project in Alaska. While this scenario would only require the flyer to purchase a few offsets, carbon offsets can range in size from a couple tonnes that individuals can purchase to kilotonnes that large organizations buy to meet assigned targets. Since climate change is a global problem, so is the approach to carbon offsetting: where a tonne of carbon dioxide is emitted or reduced is irrelevant for the atmosphere in scientific terms.[iv] Going back to the flight example, taking a flight from Toronto to Montreal can be offset through a project in Asia because carbon offsetting is measured on a global not continental or regional basis. This is not to say that all carbon offsetting projects are created equal, but this is something we will get to later when we talk about co-benefits.



[iv] Intergovernmental Panel on Climate Change. (2021). Climate Change 2021 The Physical Science Basis. Cambridge University Press. Retrieved from https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_Full_Report.pdf

Types of Carbon Offsetting Projects

OFFSET PROJECT TYPE		EXAMPLE PROJECT
Avoidance Offsets Carbon offsets are considered "avoided emissions" when the offsets you bought pay for a project that avoids or reduces the amount of CO_2 being produced elsewhere.	• Renewable energy (Wind, Solar, Hydroelectric) • Cookstoves • Landfill gas reduction • Carbon capture and storage (CCS) • Energy efficiency	The Soma III Wind Farm Project is a large-scale wind project in Turkey. The project involves the installation of 50 wind turbines that will generate approximately 280 GWh per year. The electricity generated will be delivered to the national grid and will reduce approximately 167,000 tCO_2eq/year.
Carbon Removal and Sequestration These offsets remove and sequester CO_2 from the atmosphere using either biological or technological methods. Negative emissions are far more effective at neutralizing a company's emissions because the net outcome of the offset is zero.	• Direct air capture (DAC) • Biochar • Biomass • Mineralization • Bio-oil • Enhanced weathering • Avoided forest conversion • Improved forest management • Soil & oceans See Appendix for more detailed descriptions of the above project types.	Doe Mountain Improved Forest Management Project is located on over 8,500 acres of forestland in the Blue Ridge Mountains of eastern Tennessee. By committing to maintain forest CO_2 stocks above the regional common practice, the project will provide significant climate benefits through carbon sequestration.

Why are carbon credits important?

Humankind must slash GHG emissions by 50% by 2030 and reduce them to net zero by 2050 to meet the Paris Agreement's 1.5°C target. Carbon credits can help meet this target by financing technologies and practices that deliver the most significant and cost-effective drawdowns in a timely manner.

It's important to note that carbon credits were not created to assuage the guilt that comes with engaging in emissions intensive activities. This is because carbon credits are only effective when they are used to offset **unavoidable emissions**. For example, it wouldn't be effective to buy a carbon credit to offset your drive to work every day if you could have taken the subway instead. In the pecking order of climate action, the first and most effective option is to always abate emissions, if that cannot be done then carbon offsets offer a good solution.

Other instances where offsets are effective is when organizations want to start mitigating emissions immediately. For example, if a lumber plant wants to reduce its emissions it may invest in new zero-emissions technology. However, this technology is usually expensive, and may require years for all the financing and infrastructure to fall into place. To take more immediate action, the plant could use a carbon offset scheme to reduce their carbon footprint while they wait to undergo the larger transformation.

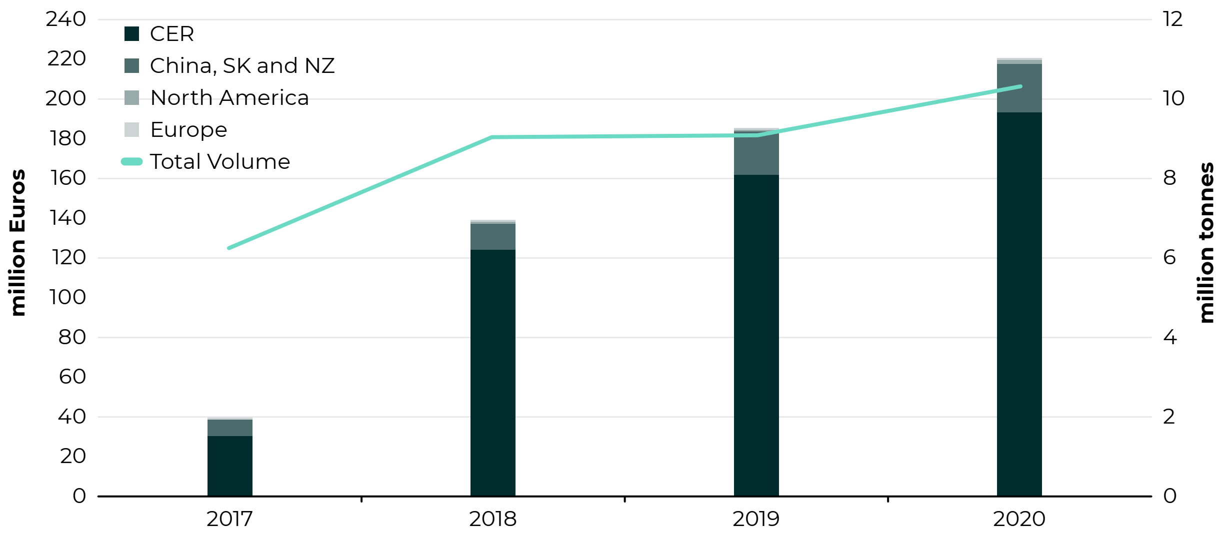
3.0 CARBON CREDIT MARKETS

As mentioned earlier, there are two types of carbon credits: voluntary and compliance. As such there are also two different markets.

According to Ecosystem Marketplace, the volume of the voluntary carbon market in 2019 was 104 Mt CO_2e with a market value of $282.3 million, and an average price of $2.7 / ton CO_2e.[v] Estimates of the size of the global carbon compliance offset market ranges between $40 billion and $120 billion.

In compliance markets, companies and governments buy carbon credits through a cap-and-trade system in order to comply with mandatory and legally binding caps on the amount of CO_2 they are allowed to emit per year. Failure to comply with these caps results in fines or legal penalty. Countries all over the world have compliance markets, but the largest one is The European Emissions Trading System which represents nearly 90% of the global value of carbon credits and accounts for most of the highest ever global traded volume of 10.3 Gt. Over 8 billion emission allowances traded hands in the European carbon market in 2020, nearly 20% more than in 2019.[vi]

World Carbon Markets (2017-2020) total value by segment, total volume[vi]



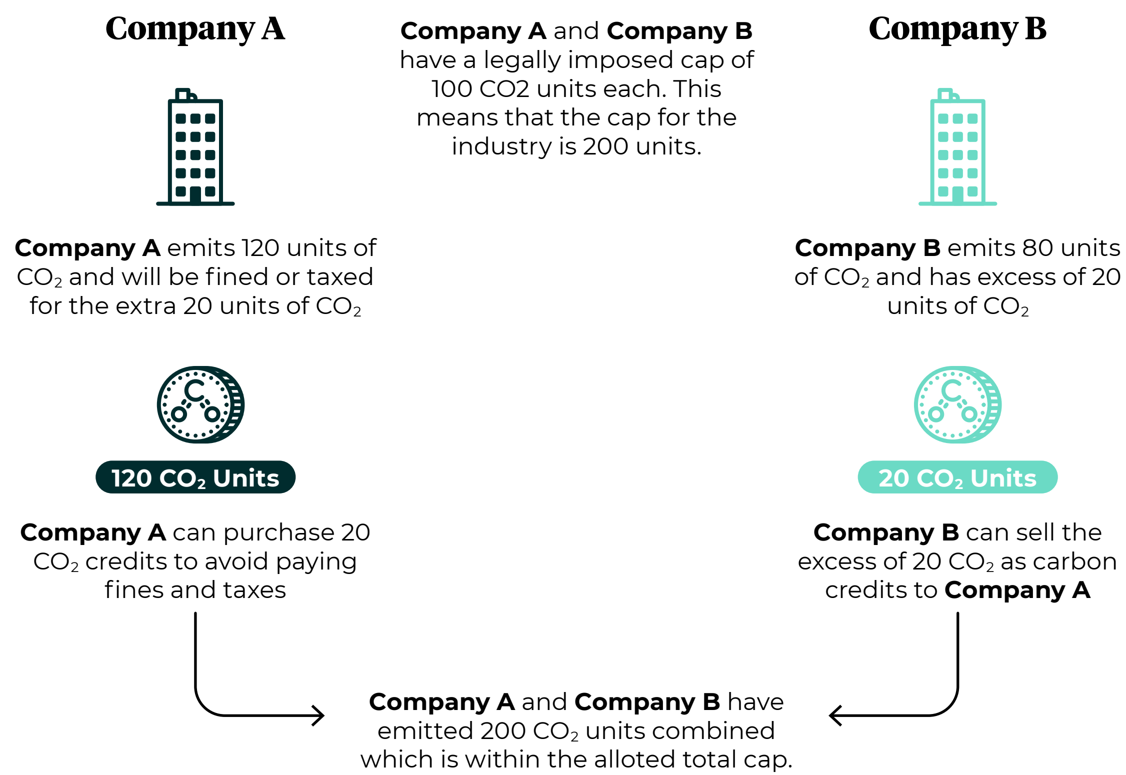
[v]Carbon Market Year in Review 2020. (2021). Retrieved from https://www.refinitiv.com/content/dam/marketing/en_us/documents/reports/carbon-market-year-in-review-2020.pdf.
[vi]"Carbon Market Year in Review 2020". Refinitiv.Com, 2021, https://www.refinitiv.com/content/dam/marketing/en_us/documents/reports/carbon-market-year-in-review-2020.pdf.

3.0 CARBON CREDIT MARKETS

The cap-and-trade system

In compliance markets cap-and-trade programs are used to control the distribution and management of carbon credits. In cap-and-trade systems countries and corporations are allotted a certain level of acceptable emissions —the "cap" in "cap-and-trade." These caps were initially introduced by the Kyoto Protocol which assigned signatory countries a base national emissions amount and in turn, these countries set quotas on the emissions of local organizations. (The Kyoto Protocol expired in 2020, so now compliance markets are part of the Paris Agreement). Countries manage their caps through national registries, which are validated and monitored for compliance by the United Nations Framework Convention on Climate Change. If a business controls their carbon output so that it falls below their cap, they can sell the difference between the actual and capped carbon levels to other companies that have exceeded their quotas (companies profit from selling these credits).

Companies that are unable to reduce their carbon production must buy carbon credits from the market —this is the "trade" in "cap-and-trade." Each year the caps are adjusted, ideally downwards, bringing the total level of pollution down as well.



3.0 CARBON CREDIT MARKETS

Voluntary Markets

The voluntary carbon offset market is different from the compliance market because as the name suggests it's completely voluntary and up to the company or individual to engage in purchasing offsets. There also is no cap-and-trade mechanism. Instead, voluntary credits can be sold and purchased through carbon credit brokers, retailers, or exchange trade platforms. It's important to note that the voluntary market is comprised of both verified and unverified credits.

A wide range of participants are involved in the voluntary carbon offset market, including providers of different types of offset projects, brokers, retailers, standards boards, and consumers who purchase offsets.

- Brokers – introduce buyers and sellers in the marketplace for a commission. Brokers usually do not take ownership of the underlying carbon credit.
- Retailers – sell credits connected to activities run internally or activities run by external project providers.

Carbon offset credit lifecycle and buyer purchase options at each stage

Carbon offset credit lifecycle progression

Methodology development	• Engage in new methodology development (contributing funding, expertise, project management, etc in exchange for offset credits)
Project development, validation, registration	• Direct investment in an offset project • Contract for offset credit delivery with an offset project developer and in some case a standards board.
Project implementation and offset credit issuance	• Purchasing in a one-off transaction directly with project developer
Offset credit transfer	• Purchase from an offset credit broker (who has previously purchased credits from a project developer or exchange) • Purchase via an exchange
Offset credit retirement	• Purchase offset credits from a retailer (who retires credits on your behalf)

- Project providers – organizations that manage offsetting projects. Projects can range from large-scale, innovative projects like developing new carbon storage technology, to smaller community-based ones like clean cookstoves.
- Standards boards – independent organizations that provide standards, guidance, and requirements for project developers to follow in order to generate carbon offsets. Examples include American Carbon Registry, Verra, Gold Standard, and Climate Action Reserve.

4.0 CARBON OFFSET STANDARDS

In compliance markets, the UN's Clean Development Mechanism (CDM) is involved in setting standards and verifying projects and carbon credits are verified and certified by authorized third parties called Designated Operational Entities (DOE). In voluntary markets, there are a handful of independent organizations, such as the American Carbon Registry, Verra, Gold Standard, and Climate Action Reserve, that serve this purpose.

What exactly do DOE's and standards board's look at when evaluating the legitimacy of carbon credits and offset projects?

1. Additionality – The emissions reduction achieved by the offsetting project must be "above business as usual," meaning the reduction would not have happened unless the credit was bought, and the project was implemented. It usually requires rigorous analysis and investigation to ensure the project is additional.

2. Permanence - To limit climate change, greenhouse gas emissions must be kept out of the atmosphere pretty much forever – e.g., the effects of offset projects that develop new ways of storing carbon will likely last longer than the effects of tree planting projects.

3. Double Counting - Once someone purchases an offset it is retired and the underlying emissions reduction shouldn't be sold again or be available for someone else to take credit for. This principle is especially important for international offsets.

4. Leakage – Not all individuals and organizations respect or abide by mandatory environmental initiatives. For example, if a country implements a cap-and-trade scheme, it's possible that the sources of emissions — factories, power plants, farms — may relocate to a place without a cap. As with additionality, controlling leakage demands rigorous accounting and good governance, which in the international arena, requires cooperation between countries[vii].

Co-Benefits

While the primary goal of carbon offsets is to reduce global carbon emissions, many offset projects also have additional benefits like improving community employment opportunities, air or water quality, food security, habitat conservation, energy access, and access to health and education services. These additional improvements are termed co-benefits and should be considered when evaluating and comparing carbon offset projects. The introduction briefly mentioned co-benefits and explained that while it doesn't matter where a carbon offset project takes place (carbon is measured on a global level) some offset projects can be more valuable than others. Co-benefits is the reason why. For example, a cookstove project in Kenya that reduces the amount of emissions, AND provides job opportunities, AND food security are preferrable to a carbon offset program in developed nations that don't face the same challenges.

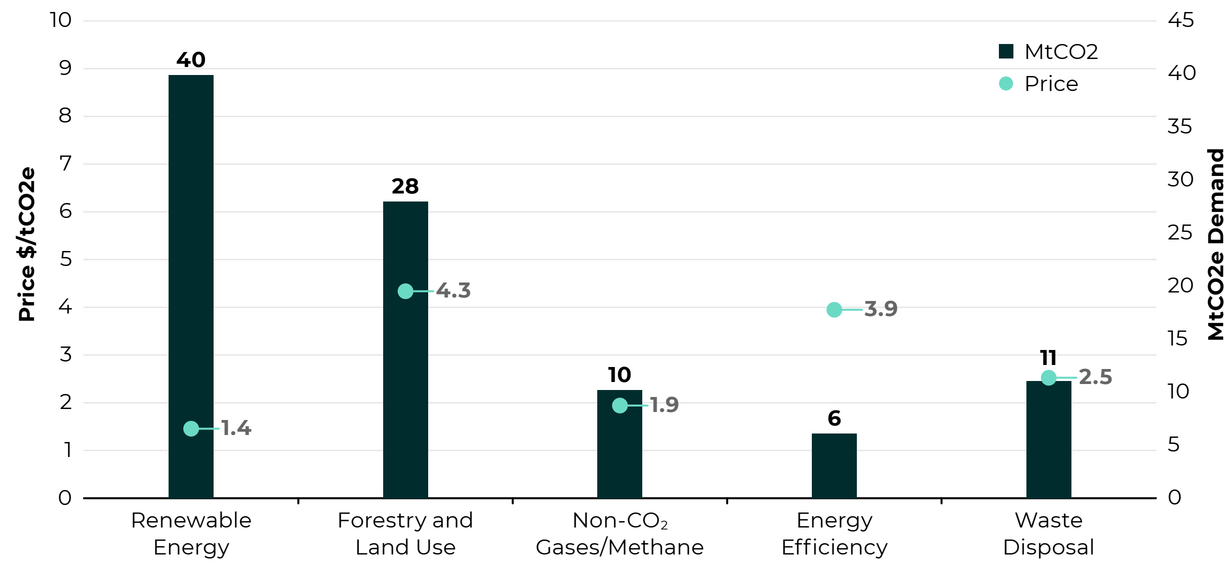
[vii] Ibid.

5.0 THE PRICE OF VOLUNTARY CARBON CREDITS

The price of voluntary carbon credits varies widely from <$1 per tonne to >$500 per tonne. Factors that influence the price include the type of offset project, the development standards, the project location, the co-benefits, and the vintage year (the year in which the carbon emissions reduction project generates carbon offset credits).

Supply and demand also play a role in the price of credits. If unchecked, energy use and emissions levels will keep rising over time. Consequently, the number of companies wanting to buy credits will increase, and the rules of supply and demand will push up the market price, encouraging more groups to undertake environmentally friendly activities that create carbon credits to sell.[viii]

Voluntary carbon credit prices and demand in 2019 by project type (average of wholesale and retail prices)[ix]



[viii]"Carbon Credit - Wikipedia". En.Wikipedia.Org, 2021, https://en.wikipedia.org/wiki/Carbon_credit.
[ix]"Future Demand, Supply And Prices For Voluntary Carbon Credits – Keeping The Balance". Trove-Research.Com, 2021, https://trove-research.com/wp-content/uploads/2021/06/Trove-Research-Carbon-Credit-Demand-Supply-and-Prices-1-June-2021.pdf.

6.0 LOOKING FORWARD

With climate change at the top of governmental and corporate agendas, carbon offsetting schemes are becoming more than just a trending topic among environmental activists and investors. Not only are offsets a responsible way of reducing the impact of individual's, businesses', government's, and nation's unavoidable carbon emissions, but we need negative emissions and carbon offsetting in order to limit warming to 1.5°C.

To summarize, carbon offsetting is a set of activities you can engage in, individually or as a business, to compensate for the carbon emissions you release into the environment. They usually work by funding the equivalent amount of carbon dioxide removal. While the direct impact of these activities often isn't felt within your local area, these projects strive to balance out the global effects of GHG emissions.

While the purpose of this report is to provide a brief overview of what carbon offsetting is and how it can help deal with emissions, it is also a call to action. The future of our planet and humanity is in your hands and although you are likely not the CEO of an oil rig or actively cutting down forests you can become educated on the issue of emissions and use your investments to make the essential transition to lower emissions happen.

7.0 APPENDIX

TYPE OF CARBON REMOVAL AND SEQUESTRATION PROJECTS	DESCRIPTION
Biomass	When biological systems sequester carbon, it ends up in a form that will eventually decompose and result in carbon dioxide emissions. It is possible to take biomass and convert it to some more durable form, such as building materials or biochar. The complete system of biomass production and carbon storage removes carbon dioxide from the atmosphere. Biomass projects include bio-oil, biochar, and bio-energy with carbon capture and storage.
Bio-Oil	Bio-oil is produced through fast pyrolysis, where biomass such as wood, corn stover, rice straw, or almond shells is heated without the presence of oxygen. This produces bio-oil and a solid mixture of ash, which is a useful potash fertilizer. Bio-oil can be used as a fertilizer, low-value fuel, or injected underground.
Biochar	Waste biomass is converted to biochar through a process called pyrolysis under low oxygen conditions. Biochar is a porous, carbon-rich material which has several applications, including soil improvement, and remediation and pollution control. In agriculture, biochar improves farming productivity 3 by enhancing soil fertility, improving plant growth, and providing crop nutrition. There are also applications for biochar for animal feed in livestock farming.
Direct Air Capture (DAC)	DAC takes CO_2 out of the air by using large fans. The air that is brought in by the fans is exposed to synthetic sorbents or solvents that bind CO_2. Once the air is exposed to the chemicals, separation to recover the carbon dioxide in pure form occurs. The resulting stream can be combined with mineralization or geological injection to achieve permanent carbon removal.
Mineralization	When alkaline materials react with carbon dioxide, they form solid carbonate minerals that can achieve effective permanent carbon removal. Source materials include naturally occurring silicates like olivine and serpentine, or wastes from mining operations. Specific implementations can include grinding minerals for reaction with carbon dioxide in ambient air, or injecting pure carbon dioxide into alkaline-rich geological formations and concrete.

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TYPE OF CARBON REMOVAL AND SEQUESTRATION PROJECTS	DESCRIPTION
Enhanced Weathering	Above ground mineralization, also known as Enhanced Weathering, is a carbon removal technology by which weathering, or the exposure of carbon dioxide to crushed basalt or olivine, is sped up via industrial processes in order to sequester carbon. Scientists are currently developing methods of enhanced mineralization for carbon sequestration using ground-up basalt and olivine that can be added to soil or even the ocean, where it would absorb carbon dioxide. Once the basalt and olivine have absorbed the CO_2, they will never again release it. Enhanced weathering has the added benefit of making water more alkaline, thus helping counteract ocean acidification. And adding minerals to soils can boost nutrient levels, improving crop yields and helping restore degraded agricultural soils.
Improved Forest Management	Forests are natural carbon sinks, capturing carbon dioxide from the atmosphere through the chemical reactions of photosynthesis and storing it in their biomass, about half of which is carbon. Carbon removal projects with forests can include planting trees or other vegetation to restore existing forests, or preventing deforestation, which enhances the natural carbon sink — but all remain at risk to natural or human disturbance.
Soils	Soil carbon sequestration occurs when changes to land management practices increase the storage of carbon in soils. Practices include the addition of cover crops, changes from conventional tillage to no tillage, and applying soil amendments. In theory, these practices can both increase soil storage and crop health, but they must be maintained over time for effective carbon removal.
Oceans	The world's oceans are vast carbon sinks with a critical role in the carbon cycle. At least two pathways may accelerate uptake and storage of carbon in the ocean. The first is to enhance the productivity of organisms in the ocean, such as phytoplankton. The second is to increase the store of inorganic carbon in the ocean through the extraction, processing, and dissolution of minerals.

7.0 APPENDIX

i “Causes Of Climate Change”. European Commission, https://ec.europa.eu/clima/climate-change/causes-climate-change_en

ii Ibid.

iii Ibid.

iv Irfan, Umair. “Can You Really Negate Your Carbon Emissions? Carbon Offsets, Explained.”. Vox, 2020, https://www.vox.com/2020/2/27/20994118/carbon-offset-climate-change-net-zero-neutral-emissions.

v Donofrio, Stephen et al. “State Of The Voluntary Carbon Markets 2020”. Forest Trends, 2020, https://www.forest-trends.org/publications/state-of-the-voluntary-carbon-markets-2020-2/.

vi “CARBON MARKET YEAR IN REVIEW 2020”. Refinitiv.Com, 2021, https://www.refinitiv.com/content/dam/marketing/en_us/documents/reports/carbon-market-year-in-review-2020.pdf.

vii Ibid.

viii “Carbon Credit - Wikipedia”. En.Wikipedia.Org, 2021, https://en.wikipedia.org/wiki/Carbon_credit.

ix “Future Demand, Supply And Prices For Voluntary Carbon Credits – Keeping The Balance”. Trove-Research.Com, 2021, https://trove-research.com/wp-content/uploads/2021/06/Trove-Research-Carbon-Credit-Demand-Supply-and-Prices-1-June-2021.pdf.

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