Navigating the voluntary carbon market.

Whitepaper 2022

CEEZER

The voluntary carbon market:

A long history of high hopes.

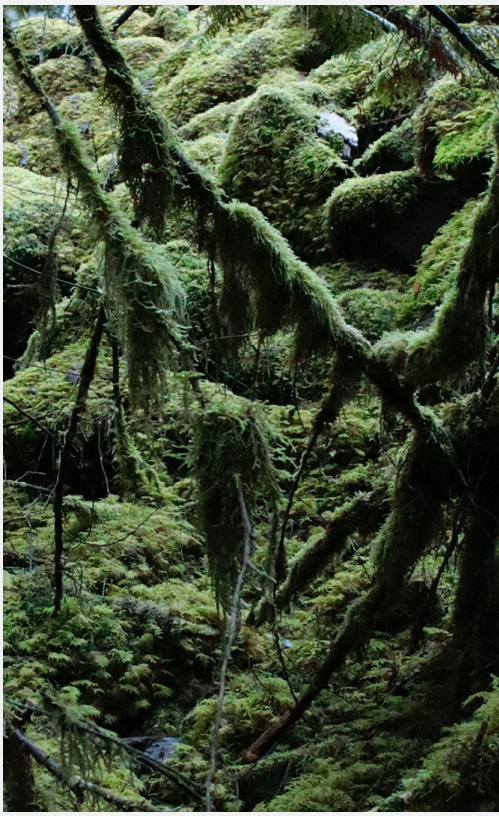
With the Kyoto Protocol in 1996, the first legally binding emission constraints were established[1]. The Clean Development Mechanism (CDM) was one of its major components, allowing emission reduction projects in developing countries to be financed by Western nations that could account for the reductions in their own $CO_{2.}$ budget under certain constraints.

Since the early 2000s, several standards emerged to certify the eligible projects according to CDM methodologies. Some of these certification bodies, like VERRA and Gold Standard, use revised versions of these methodologies in combination with newer and more rigorous assessment tools to certify carbon credits from climate protection projects. While the original CDM credits were adopted by early-mover corporates, today the independently certified and therefore “voluntary” credits with a more rigorous approach to social co-benefits are the predominant tool for corporates to engage in the carbon markets in addition to local compliance efforts and targets.

Over the last years, carbon markets and carbon offsetting increasingly gained regulatory and governmental attention. The Paris Agreement from 2016 for example aims to limit global warming to 1.5 degrees[2].

While the resulting emissions targets are translated into “allowances” for countries and thereby compliance credits, it is now clear that following these targets alone will no longer suffice. Limiting global warming sufficiently cannot be achieved by pure carbon emission reductions as they have taken too long to materialize. The Intergovernmental Panel on Climate Change (IPCC) report from 2022 emphazises that large carbon removal projects (i.e., projects that reduce CO_2e levels in the atmosphere) cannot be bypassed[3].

The voluntary carbon market is thus critical in facilitating the reach of these targets by allowing for private players to complement adherence to compliance goals with priced negative emissions. This way, voluntary carbon action can help in addition to the decarbonization driven by regulatory markets like the European compliance market ("European Trading Scheme" or ETS).



While the compliance markets have their complexity in regulatory setup and execution, they are conceptually simple in the unit of trade: Every compliance certificate equals the "allowed" emission of 1t of CO_2e. On the contrary, the voluntary market trades the avoidance or removal of 1t of CO_2e, achievable by various methods and technologies with varying degrees of effectiveness and risk.

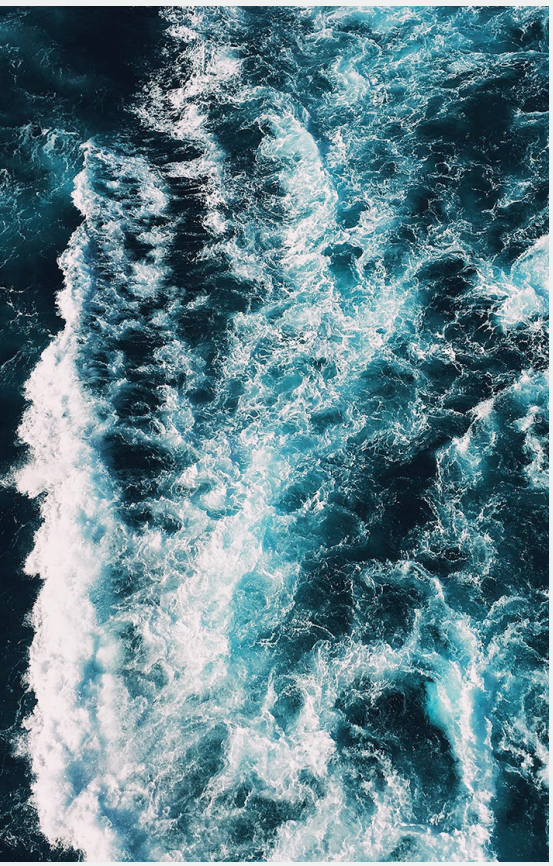
These significant differences in technology, as well as implementation quality and scrutiny, have led to a lack of market trust. Stakeholders continue to question the magnitude of the market's realized reduction and removal impact[4]. As a result, critics argue that the voluntary market is an easy way to avoid real reductions. While providing the right tools to supplement compliance action, buyers must navigate the voluntary market with care to ensure that impact does not fall short.

This whitepaper aims to provide a data-driven direction for navigating the voluntary carbon market as it stands today. It offers insights into the types of carbon credits issued, how they are classified and who is certifying them. Furthermore, it provides transparency on the global spread of projects and helps understand differences in credit quality and prices.

Project categories are ever evolving – with removal technologies creating new project types.

When thinking of carbon credits, a common association is projects who are planting trees in the Amazon rainforest. However, there is a much higher variety of project types that can be classified into the two broad domains of removal and avoidance projects. The CEEZER platform covers more than 5,000 projects from 2,000 developers that are certified at Gold Standard, Plan Vivo, Puro or VERRA. Some of the projects are currently undergoing certification or are still pre-certified due to a lack of coverage by an established standard.

Overall, 91% of the projects are avoidance related and 9% are classified as carbon removal. Avoidance projects are concerned with the avoidance of carbon emissions through the project activity, such as the provision of more energy-efficient cookstoves in developing countries. Removal projects aim to actively remove carbon from the atmosphere through either nature-based solutions like planting trees or technological advancements for carbon capture.



Multiple taxonomies exist to facilitate understanding the ever growing credit type landscape. Following a logic suggested by the Oxford Principles, carbon credits can be classified regarding their permanence next to the removal vs. avoidance classification[5]. Currently, 86% of projects are in the category covering avoidance projects with no permanence (Category 1) and 8% are in a category including projects with removal and medium to high permanence characteristics (Categories 4 and 5).

Percentage of projects per Oxford Category

Oxford Category 1	**85.5%**
Oxford Category 2	**5.9 %**
Oxford Category 3	**0.2 %**
Oxford Category 4	**7.7 %**
Oxford Category 5	**0.7 %**

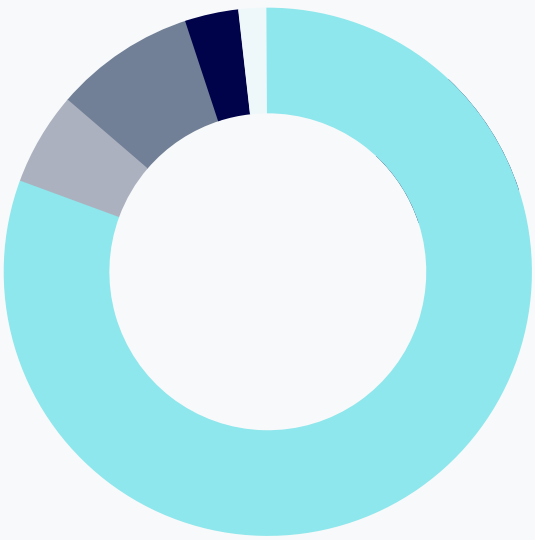
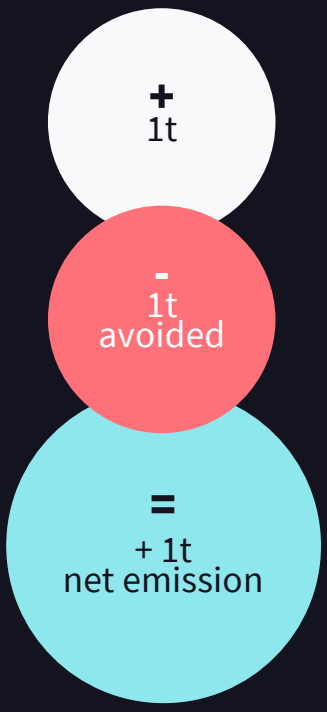
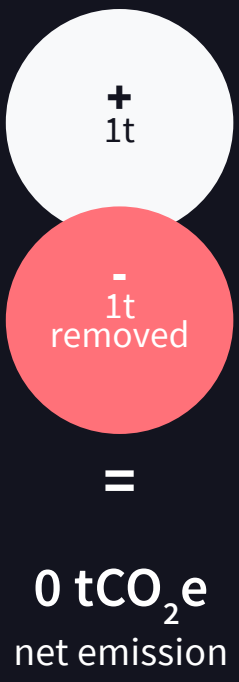


Figure 1: Percentages indicate part of total projects that are in the respective Oxford categories 1 to 5.

Carbon Avoidance vs Carbon Removal





Avoidance

Carbon avoidance credits are generated from activities that prevent additional CO_2e release into the atmosphere. They can be either nature-based or technology-based. Nature-based limits for example the loss of natural habitats such as forests and peatlands that store and sequester carbon. Technology-based solutions reduce emissions from current sources in regions where there is no financial incentive or regulatory requirement to decarbonize. An example for carbon avoidance/reduction credits are projects where biogas plants are installed to switch from cooking on open fireplaces to cooking with biogas. 1t CO_2e is equal to two months of cooking on biogas instead of open fireplaces for one household.

Removal

Carbon removal credits are generated from activities that remove CO_2e from the atmosphere. With carbon removal projects, historical and residual future emissions can be removed. Carbon removal projects can either be nature-based, where nature is used to sequester more carbon in the biosphere, or technology-based removal, where CO_2e is removed from the atmosphere and stored with the help of modern technology. For example, typical carbon removal credits are generated by an afforestation project, where a forest in an area with no previous tree cover is established. 1t CO_2e is equal to a typical hardwood tree when it reaches the age of 40.

Oxford Categories [4]

Multiple taxonomies aim at classifying carbon credits along relevant dimensions. One taxonomy is called the Oxford Categories, which is based on a report by researchers from Oxford's Smith School of Enterprise and the Environment. It was published in September 2020. Five categories are suggested based on whether and how the carbon is stored.

AVOIDANCE

1

Oxford Category I covers avoided emissions or emission reduction projects without storage. Projects are either forward-looking with a counterfactual baseline such as renewable energy or cleaner cookstoves or provide clear retrospective emissions data such as N_2O abatement or methane abatement projects.

2

Oxford Category II refers to emission reduction projects with short-lived storage, ranging from years to decades. Therefore, those projects are less permanent and have a higher risk of reversal. Avoided damage to ecosystems and changes to agricultural practices that retain already-stored carbon are examples of this category.

3

Oxford Category III combines reduction with long-lived storage, from centuries to millennia. Hence, these projects are therefore more permanent with a lower risk of reversal. Carbon Capture and Storage in industrial facilities and fossil-fuel power plants fall under this category.

REMOVAL

4

Oxford Category IV projects are based on carbon removal and have short-lived storage. They are less permanent with a higher risk of reversal. Projects include afforestation and reforestation projects, soil carbon enhancement, and ecosystem restoration.

5

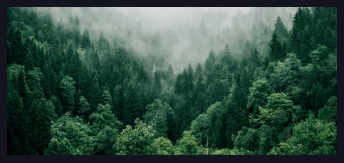
Oxford Category V is also based on carbon removal but with long-lived storage and therefore more permanent with a lower risk of reversal. Projects include Direct Air Capture and Carbon Storage (DACCS), Bioenergy with Carbon Capture and Storage, mineralization, and enhanced weathering.

To allow for comparison across standards and certifiers, CEEZER harmonized the market to 16 project types based on common underlying methodologies and technologies. With a share of 49%, most projects fall into the Renewable Energy category, 27% into Energy Efficiency and 6% into Afforestation and Reforestation, i.e. actually planting trees.

The different project types significantly differ in their average available credit amount. While Avoided Deforestation is accounting for only 4% of the projects they provide 37% of available credits. Meanwhile, 27% of projects are about Energy Efficiency but they only account for 6% of available credits.

When it comes to age, the oldest project types are Fugitives and Afforestation with an average age of 12 years. This is in line with earlier available credits. With Biochar and Biomass, the youngest ones were emerging over the last two years. This is an example of how removal technologies are introducing new project types in line with the growing demand for proactive carbon removal.

CEEZER defined 16 different project types for carbon credits

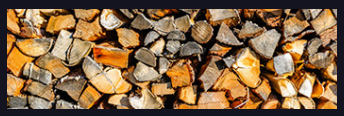


1. Afforestation and Reforestation

Restoration of tree cover on land that currently has no, or minimal, tree cover.

2. Avoided Deforestation

Protection of native forest in areas that would otherwise be cleared for crops or grassland; helps reduce amount of GHG emissions as carbon remains stored in the trees.



3. Biomass

Growing biomass for long-term storage, production of wooden building elements.

4. CCS

Carbon capture and storage; capturing CO_2e before it enters the atmosphere; e.g. DACCS (Direct Air Carbon Capture and Storage) and BECCS (Bio-Energy with Carbon Capture and Storage).

5. Energy Efficiency

Reduction of energy consumption through technical efficiencies, e.g. introducing more energy efficient lighting, cooking heating and cooling systems.

6. Enhanced Weathering

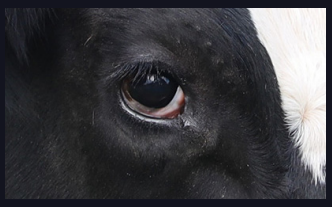
CO_2e removal by spreading large quantities of selected and finely ground rock material onto extensive land areas, beaches or sea surfaces, which accelerates the natural weathering processes of silicate and carbonate rocks.

7. Fugitives

Detection and repair of leaks or other irregular releases of gases from e.g. industrial plants and pipelines.

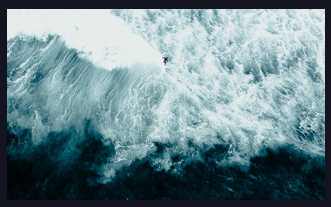
8. Energy Distribution

Distribution of energy to electrify communities through e.g. grid extension or construction of new mini-grids.



9. Methane

Farm-based projects to tackle emissions from animal waste (e.g. cow or pig manure) through separation equipment or anaerobic digestion.

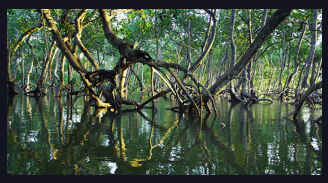


10. Ocean

Carbon removal through sequestration in oceans through carbon sequestration by e.g. artificial ocean upwelling, seaweed growing and restoration of coastal wetland.

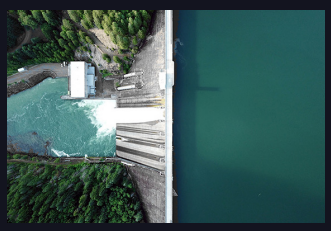
11. Other Land Use

Preservation and increase of storage capacity of forests while using the natural resource of wood (forest remains supplier of wood but in a sustainable and climate friendly way).



12. Blue Carbon

Blue Carbon consolidates activities that approach carbon-capturing by leveraging the natural storage capacity of Mangroves that are cultivated in water.



13. Renewable Energy

Helps to build e.g. solar, wind, hydro sites; increasing amount of renewable energy on grid, creating jobs, decreasing reliance on fossil fuels, increasing sectors global growth.

14. Transport

Project activity related to transportation, e.g. fuel switch from gasoline to ethanol, energy efficiency, carpooling, electric vehicle charging systems.

15. Waste

Project activity related to alternative waste treatment processes such as composting process in aerobic conditions.

16. Biochar

Transition of plant and wood residuals into plant based coal that can be added for example to soil as a natural fertilizer.

Percentage of projects per project type

Renewable Energy	49.4 %
Energy Efficiency	27.3 %
Afforestation and Reforestation	5.5 %
Methane	4.0 %
Avoided Deforestation	3.8 %
Fugitives	3.7 %
Other Land Use	2.6 %

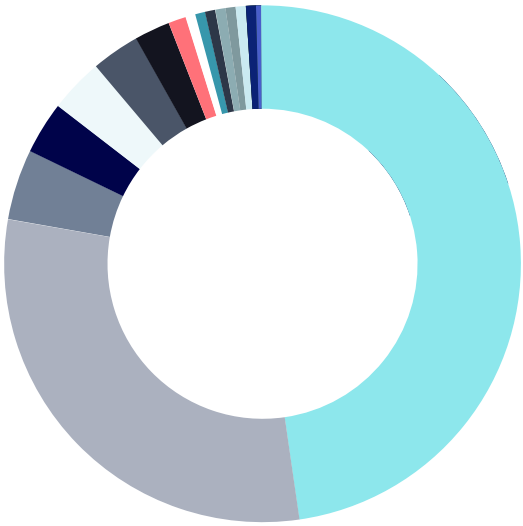
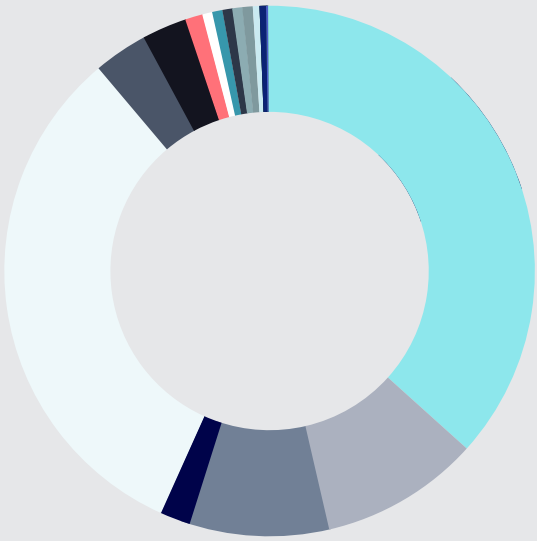


Figure 2: Percentages indicate the proportion of projects per project type independent of the actual project size.

Percentage of non-retired credits per project type



Renewable Energy	43.2 %
Energy Efficiency	5.9 %
Afforestation and Reforestation	5.0 %
Methane	0.8 %
Avoided Deforestation	37.1 %
Fugitives	3.6 %
Other Land Use	3.7 %

Figure 3: Percentages indicate the proportion of cumulated non-retired credit volumes per project type. When retirement information was unavailable, available volumes were set to zero. Retirement status is no indication of transaction availability.

Comparison of percentage of total projects and percentage of total credits per project type

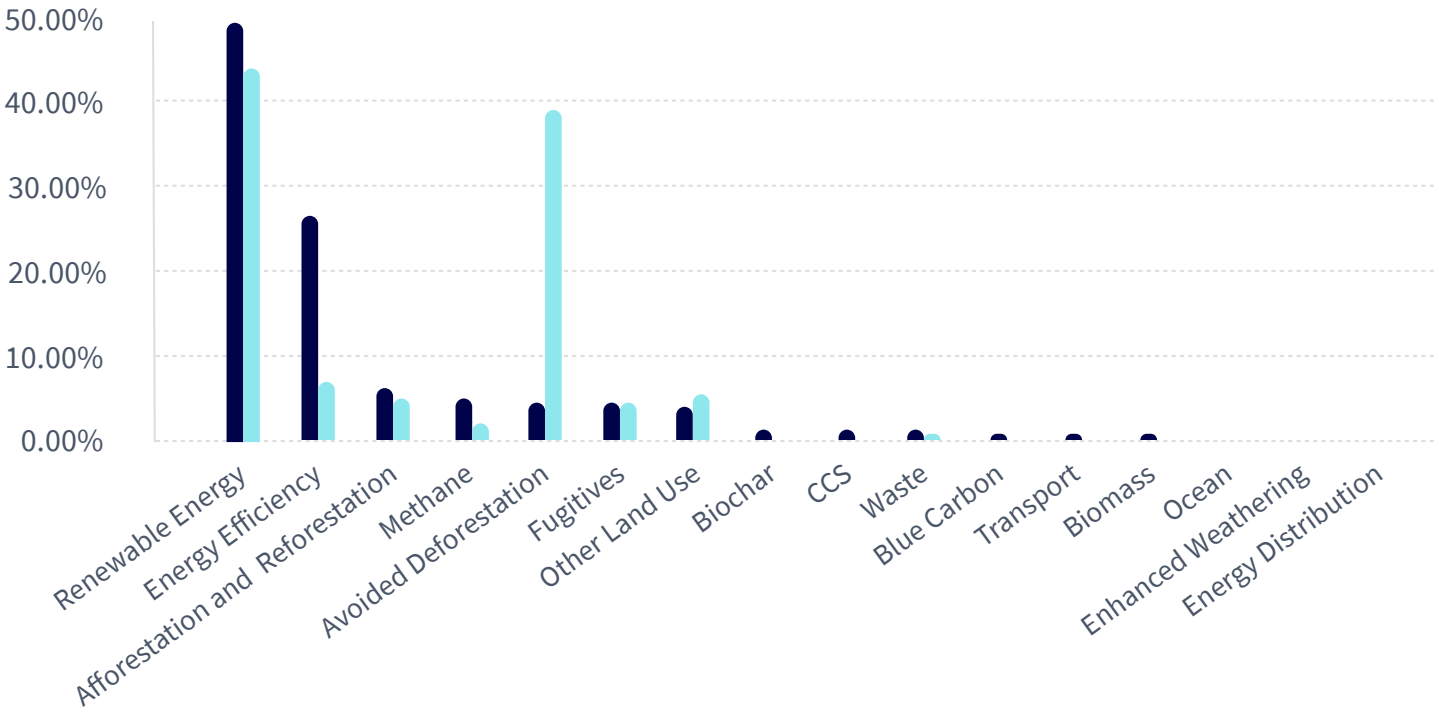


Figure 4: Percentages of total projects and available credit volumes per CEEZER project types are compared allowing for indications of differing project sizes.

Incumbent registries continue to dominate the market – first shifts of removal technologies going mainstream.

In the voluntary sector, incumbent registries such as VERRA and Gold Standard were the first to address issues such as double counting and double certification. These two players are still the market's most powerful today. However, as projects become more diverse, new technologies emerge that necessitate novel ways to certification. Certifiers must now reconcile the necessity to certify older project categories with the rising pressure to produce standards covering newer technologies and their adequate monitoring within new methodology.

This has led to the rise of smaller, more specialized registries like Puro.earth, solely focussing on removal, as well as a larger number of projects that are not yet certified by any of the larger standards (pre-certified projects).

Number of projects per registry

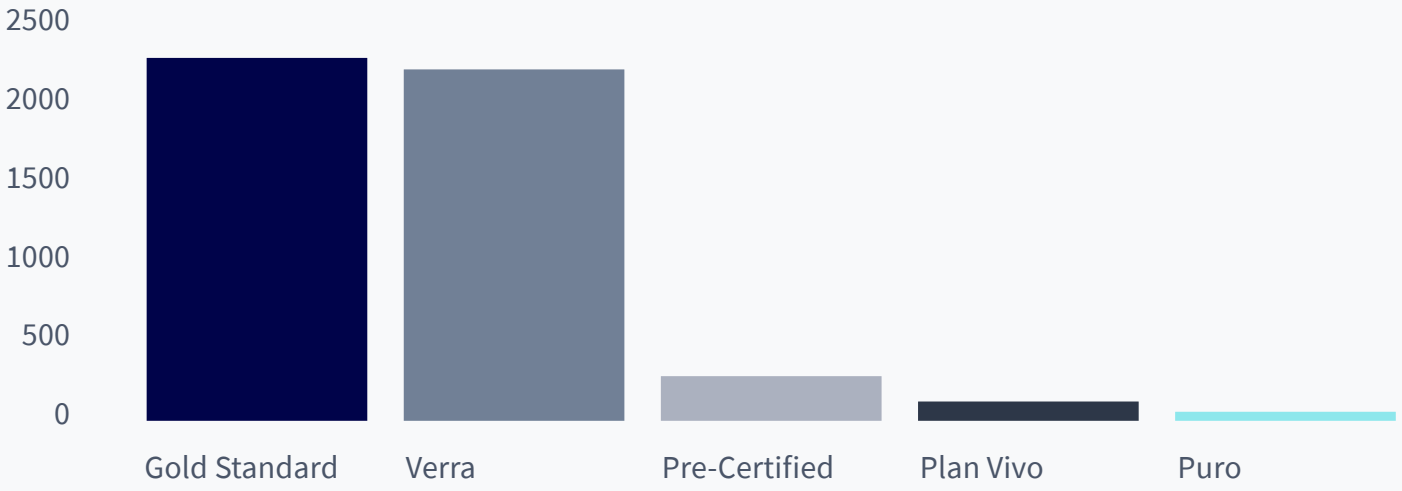


Figure 5: Number of registered projects per registry covered by CEEZER, indicating continued dominance of Gold Standard and VERRA as the biggest registries.

Across Verra, Gold Standard, Plan Vivo, and Puro, certifiers use a total of 251 assessment methods or combinations of methods, leveraging different criteria and measurement tools for the carbon credit certification of the projects. These cover different activity types and levels of complexity to fit the individual projects and can differ significantly by project scale. For the Energy Efficiency type, for example, 52 different method mixes exist to serve each project's circumstances.

In terms of overall maturity, the recent splurge in demand has certainly led to an increase in project development. While the majority of projects (61%) are already active, meaning that carbon credits have already been made available, a larger share of 37% are pipeline projects that are on their way to complete certification and subsequent issuing of credits. To ensure the quality of projects, the registries fo not only assess the amount of carbon credits but also look at criteria such as Additionality and Permanence, which are also prominent criteria in the scientific community.

Additionality and Permanence

Additionality

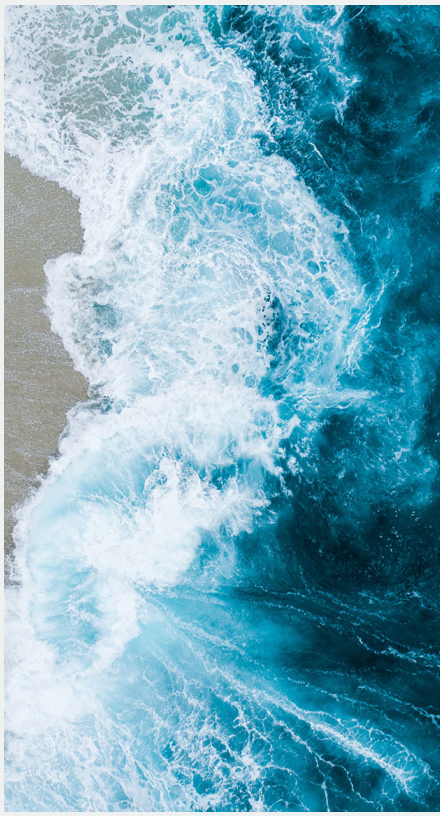
Additionality separates environmental projects from offsetting projects. While both can have a positive effect on climate, only projects that are additional can be used to generate credits in the VCM. Additionality must be examined on two levels: financial and policy-level additionality. Financial additionality means that the project would not have happened without carbon credit revenue.

Policy-level additionality means that the project goes beyond its host country's climate objectives. If a project only enacts what policies already require, the project may be great for the climate, but is not suitable for the VCM. As an example, if a national policy already protects certain types of trees, a project protecting them is not additional on the policy level.

Permanence

Permanence indicates how long the climate impact of a project or activity is expected to last. High permanence implies that emission reductions or removals cannot be reversed, which means that they cannot be reintroduced into the atmosphere for centuries to millennia. Projects with low permanence have a higher risk of reversal, which means reintroduction of emissions into the atmosphere occurs within years to decades.

Project activity is as global as climate change but historic roots remain.

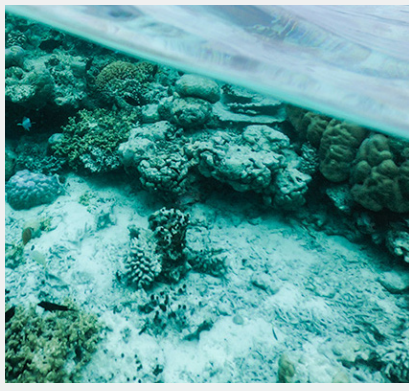


Carbon emissions are global and so are the projects' effects on climate. Nevertheless, the Global North and South play different roles in the voluntary carbon market, with the North contributing the most emissions due to industrialized development.

Therefore, the buying side of the voluntary carbon market is also concentrated in that area. At the same time, over 90% of projects generating and selling carbon credits are in the Global South. Of the around 4500 projects in the Global South 1087 are in India only.

With regard to project types and sizes, significant differences are observable globally. On average, the biggest projects with the highest credit amount per project can be found in South America, primarily driven by large Avoided Deforestation projects in the Amazon rainforest.

In Africa, Energy Efficiency is the primary project type. Activities include distribution of cookstoves for the local community. On average, these projects are rather small and often run either by small projects who cross-finance their development work through the voluntary carbon credit market or by bigger developers who have several activities.

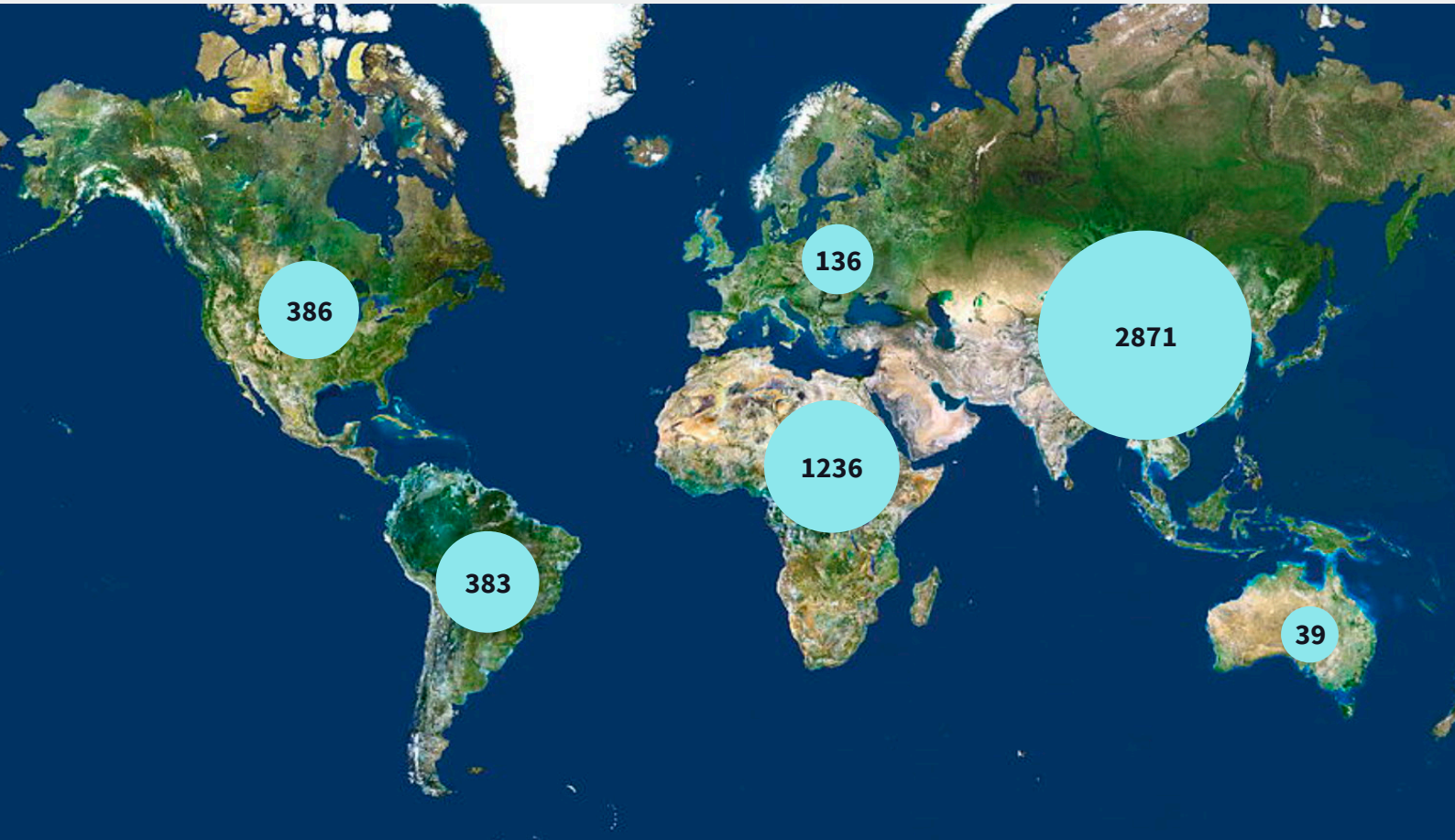


In Asia, one can observe a strong focus on Renewable Energy projects like increased use of wind or biomass based power generation, which is accounting for 38% of the total global supply.

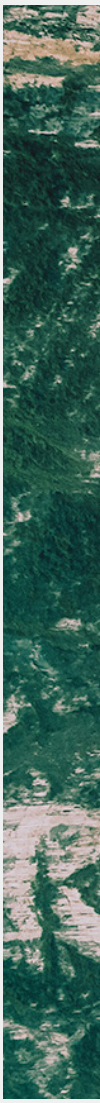
While for all these cases the region is highly suitable for a certain project type due to local circumstances, nature, and society, emerging technological solutions like Direct Air capture are still in the process of finding the fit between location and project type. For example, Direct Air Capture requires a lot of energy which qualifies only a few global locations with sufficient carbon-neutral energy sources like thermal energy (Iceland is one example, as widely known). While nature-based removal follows the patterns for traditional nature-based projects, technological removal seems to be emerging more clearly in North America and Europe.

Global distribution of project activities

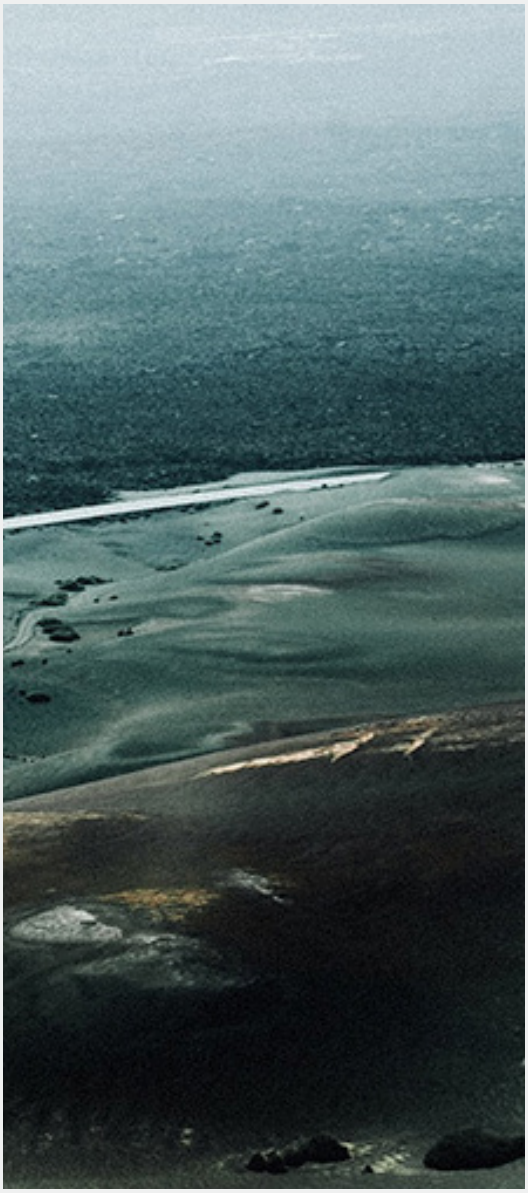
Figure 6: Distribution of projects across global regions summarized by continent, indicating a focus most activity in Asia and the Global South in general.



Consequently, while the attractiveness of supporting projects in one's own geographical vicinity is understandable, the wish is hardly fulfillable for buyers looking for balanced portfolios. Many Western nations have covered a large share of activities within their individual national targets - rendering them practically invalid for voluntary market certification. Hence, impact is best optimized by embracing a global approach, where project type and local circumstances have the highest synergies - independently from the buyer's location.



Only half of projects have additional sustainable development benefits certified.



Considering the variety of project types and their often deep impact on local communities, it is apparent that many of the projects are not only reducing or removing carbon but also change livelihoods beyond the project activity. Ideally, these changes are positive and come with societal or ecosystem co-benefits often mapped to the UN Sustainable Development Goals (SDGs). Especially for nature-based solutions, verified co-benefits can be crucial in determining a credit's quality as project activities can have paradox effects on local communities if not carefully managed. Hence, co-benefit certifications are a key value-add provided by the certifiers to potential buyers in determining project quality.

A total of 2519 projects, so almost 50%, have a co-benefit certification or SDG impact issued from their respective registry. Gold Standard certifies SDG contributions for all projects. VERRA issues Co-benefit certifications only for projects applying for them, which is true for only around 6% of their certified projects. For some project developers, co-benefits are the key driver for their project activity and carbon credits are a measure for cross financing.

Most co-benefit certifications are aligned with the 17 Sustainable Development Goals (SDGs) of the United Nations. In line with the overall aim of carbon credits, SDG 13 - "Take urgent action to combat climate change and its impacts", is certified for almost every project that has an

SDG certification. This climate impact dimension is followed by SDG 3 - “Ensure healthy lives and promote well-being for all at all ages” and SDG 7 - “Ensure access to affordable, reliable, sustainable and modern energy for all”, primarily driven by Energy Efficiency projects. Compared to that, SDG 16 - “Peace, Justice and strong institutions” is only certified 5 times.

Especially when acquiring carbon credits through resellers or brokers, these unique aspects of project activities are often less visible. The SD Vista Certification, for example, a high standard for assessing the sustainable development benefits of project-based activities, has only been issued to 3 projects currently marked as active.

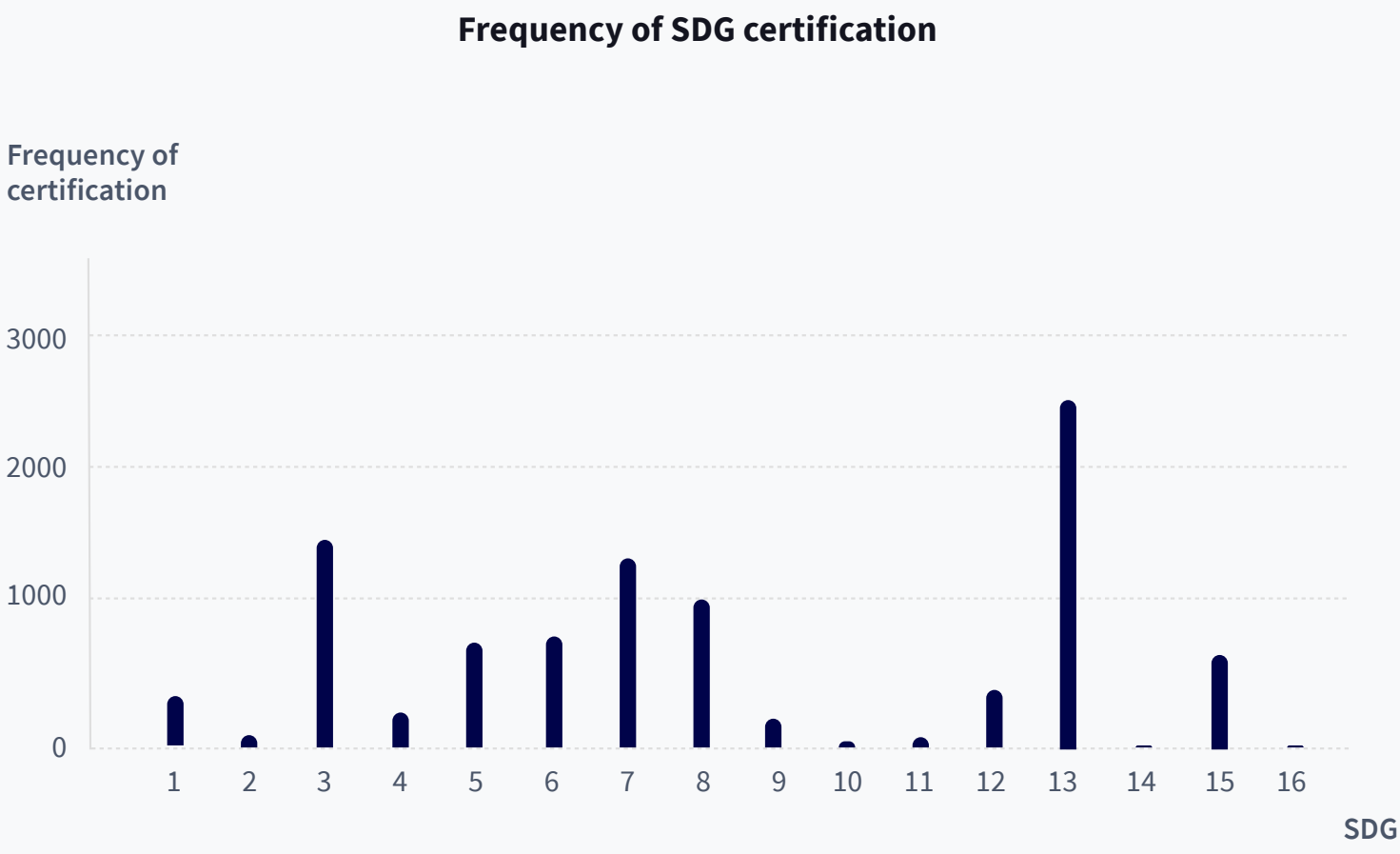


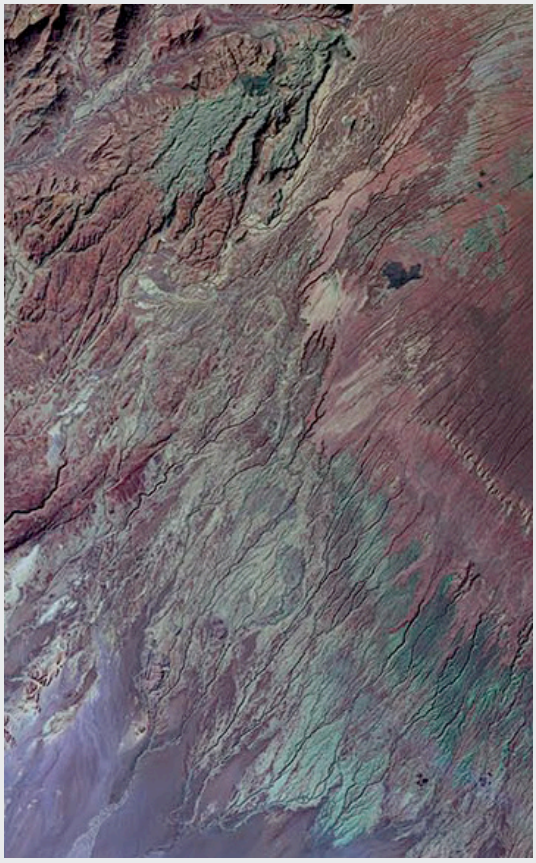
Figure 7: Cumulated amount of certification per SDGs 1 to 16. One project can have none, one or several SDG certifications issued by the registries.

Credit prices differ hugely by product type.

Keeping differences in project types, locations, and certified co-benefits in mind, it becomes salient that one carbon credit is not necessarily like another in terms of quality and long-term impact. Consequently, prices are neither.

Overall, there is a tendency that removal credits are more expensive than avoidance credits and prices tend to increase with increasing use of more permanent technologies. The volume weighted average price for avoidance credits is 12$/t, and 21$/t for removal, conversely. The prices also differ between project categories, driven by the popularity and cost of the respective methods. The cheapest project type is Transport with an average price of 6.81$/t, followed by Waste with 7.36$/t. The most expensive project category is Carbon Capture and Storage (CCS) with a price range between 200$/t and 600$/t.

Unfortunately, prices do not structurally consider the long-term perspective on how permanent and valuable the credit is in the future. The permanence of the project activity largely differs between project types. Various research and different registry procedures[6] suggest that while for example Afforestation and Reforestation can have permanence of 30 to 50 years[7], Carbon Capture and Storage or Enhanced Weathering can store carbon for more than 1000 years[3].



Considering this time dimension, a refactoring of prices towards a 100-year timeframe eases comparability. From a 100-year time perspective, prices for Afforestation and Reforestation range from 53$/t to 71$/t, while prices for Carbon Capturing Solutions are in the range of 20$/t to 60$/t. Considering this perspective, the initially more expensive removal credit might not only be the more permanent one but also the one with better value for money.

Price distributions Avoidance vs. Removal Credits

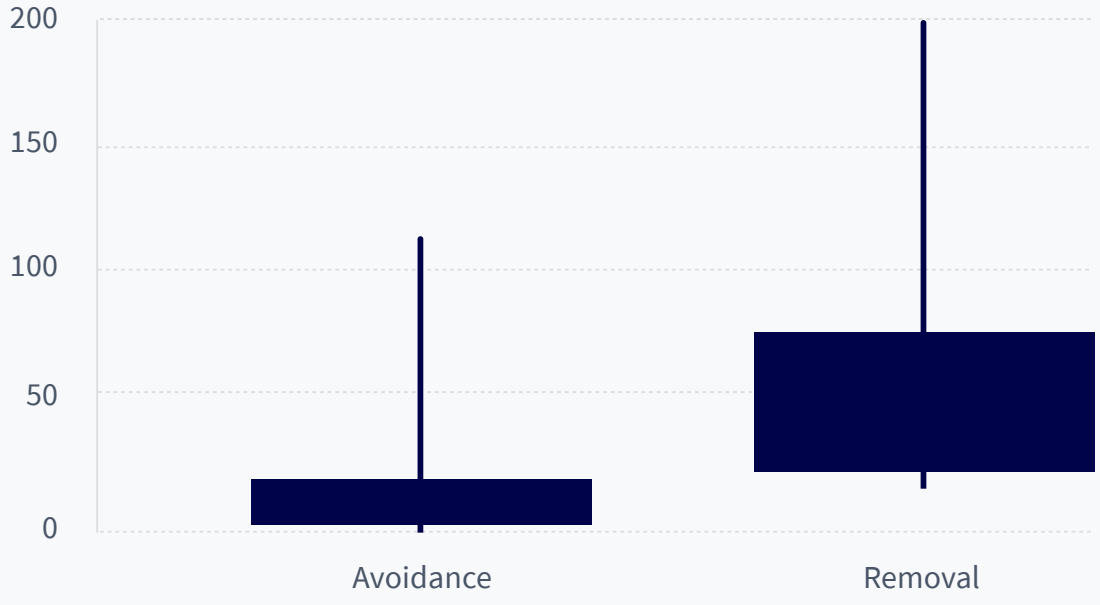


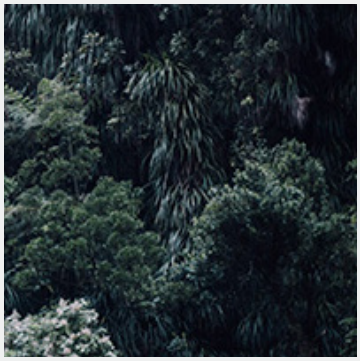
Figure 8: Visualization of price distributions between the categories avoidance and removal credits. Line indicates the spread from minimum to maximum price. Box indicates the price range where the central 50% of prices are. Upper limit for removal shortened to 200 due to single outlier with a price of 600 $/t. Prices are not corrected for 100-year perspective.

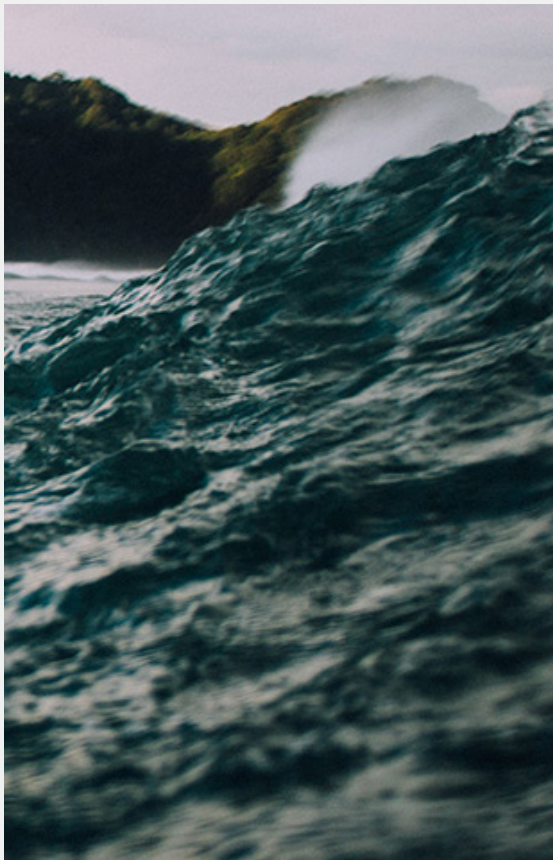
Deep market insights can help take on responsibility for the impact of your company's "negative emissions".

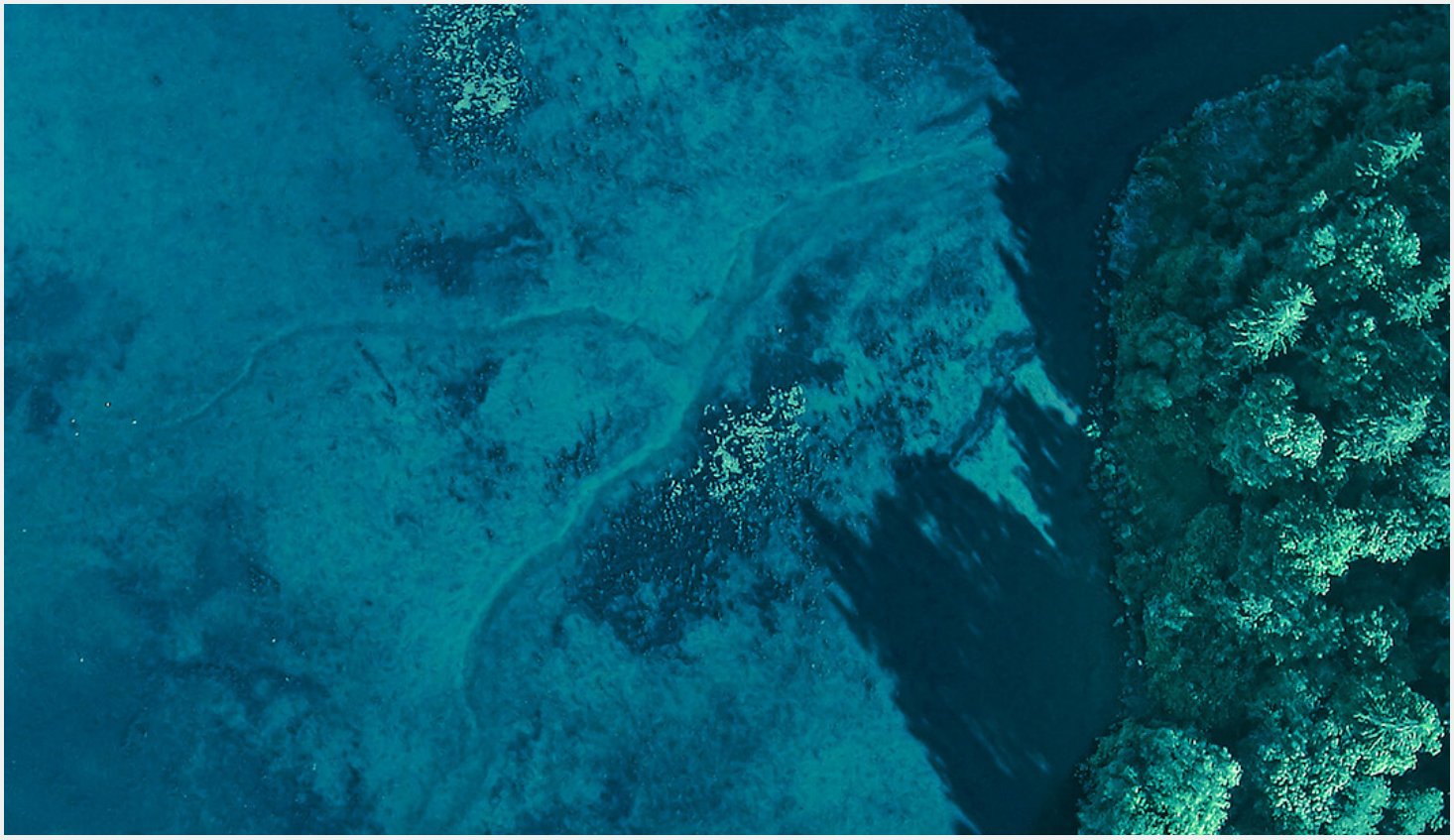
Considering the different market aspects and the diversity of credits, a truly impactful strategy for negative emissions is only possible with accurate, detailed and verified data at hand. Only tools with the right level of depth and direct access to the global supplier landscape can help companies make the right call on their credit portfolio. Leveraging external and proprietary data to facilitate direct interaction with global suppliers, tools like CEEZER can harmonize information and provide actionable insights to navigate through the project landscape.

Making the right negative emissions as easily accessible as stocks or debt in the capital markets can accelerate true climate impact when other measures and internal reductions run slow. On the way, direct transactions with developers ensure investments in credits make a difference on the ground.

If you are interested in learning more about CEEZER and how to take control of your carbon credit portfolio, visit www.ceezer.earth or contact us at info@ceezer.earth.







Sources

1. Protocol, K. (1997). Kyoto protocol. UNFCCC Website. Available Online: Http://Unfccc. Int/Kyoto_protocol/Items/2830.Php (Accessed on 1 January 2011).

2. Agreement, P. (2015). Paris agreement. Report of the Conference of the Parties to the United Nations Framework Convention on Climate Change (21st Session, 2015: Paris). Retrived December, 4, 2017.

3. IPCC. (2022). Climate Change 2022: Impacts, Adaptation, and Vulnerability. Cambridge University Press. https://report.ipcc.ch/ar6wg3/pdf/IPCC_AR6_WGIII_FinalDraft_FullReport.pdf

4. Blum, M. (2020). The legitimation of contested carbon markets after Paris–empirical insights from market stakeholders. J. Environ. Policy Plann. 22, 226–238. doi: 10.1080/1523908X.2019.1697658

5. Allen, M., Axelsson, K., Caldecott, B., Hale, T., Hepburn, C., Mitchell-Larson, E., Malhi, Y., Otto, F., & Seddon, N. (n.d.). The Oxford Principles for Net Zero Aligned Carbon Offsetting 2020. 15.

6. VERRA. (2022). Verified Carbon Standard [VERRA Standard]. https://verra.org/wp-content/uploads/2022/02/VCS-Standard_v4.2.pdf

7. Netter, L., Luedeling, E., & Whitney, C. (2022). Agroforestry and reforestation with the Gold Standard-Decision Analysis of a voluntary carbon offset label. Mitigation and Adaptation Strategies for Global Change, 27(2), 17. https://doi.org/10.1007/s11027-021-09992-z

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