Oxford Principles for Net Zero Aligned Carbon Offsetting (revised 2024)

UNIVERSITY OF OXFORD

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Acknowledgements

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A note from the authors on the 2024 revision

Since the initial publication of the Principles in 2020, there has been growing interest in aligning organisational and offsetting strategies with net zero. Despite this, evidence continues to cast doubt on the integrity of many carbon credits used for offsetting, and most offsetting that occurs today is still not net zero aligned. In the past few years, analyses of the most common types of carbon credit projects have found evidence of over-crediting that undermines climate change mitigation efforts. Furthermore, the supply of credible removals is still far from sufficiently scaled. In recognition of these challenges, organisations and standard bodies have opted to move away from the term 'offsetting' to avoid misleading claims. The revised Principles underscore the core components of the original Principles, calling for a major course-correction in carbon markets and offsetting practices, while also clarifying aspects of the Principles for net zero alignment in areas where authors felt further detail would be beneficial to users. The most significant updates include:

1. **Reinforcing the urgency of reducing emissions**. Following the UAE Consensus at COP28 on "transitioning away from fossil fuels in energy systems," organisations with net zero commitments need to prioritise early investment in renewable energy and improved energy efficiency within their own value chains, while at the same time recognising that, as the world transitions, it will become ever more important to demonstrate that carbon credits used for offsetting are genuinely additional to reductions and removals that would have occurred anyway.
2. **Re-emphasising the need to close the carbon removal gap**. Across the vast majority of credit issuances and retirements, removal projects continue to make up only a tiny fraction of purchases and retirements of credits on the voluntary carbon market.[1] There is not enough high-quality carbon removal and storage available today to meet present or future demand, especially those removal approaches with the lowest risk of reversal, which will need to be scaled 30-fold by 2030 and one-thousand-fold by 2050 under IPCC scenarios aligned with the Paris Agreement.[2]
3. **Highlighting further recent evidence showing that nature-based solutions are critical for addressing the drivers and impacts of climate change**. It is necessary to protect and restore ecosystems to achieve net zero globally and to support adaptation to climate change impacts, irrespective of whether such projects generate credits that are retired as offsets.[3]
4. **Clarifying the durability risks and co-benefits of different types of removal and storage**. The previous version of the Principles made a sharp distinction between removal and storage types, separating them into short- or long-term storage. By recognising that durability and risk of reversal are on a continuum and that storage within types can also vary under different conditions and governance arrangements, the revised Principles discuss the various risks to storage across different types of projects in more detail. They also emphasise the co-benefits of different removal and storage options (See revised Figure 1).

5. **Defining terms to reflect new international guidance on net zero and nature commitments and claims**. Since the initial publication of the Principles, guidance has emerged and converged significantly across international net zero initiatives and standards on definitions of net zero and related terms and targets. Such guidance emphasises that organisations must focus on urgently reducing emissions within their value chain (Scopes 1, 2, and 3) and fund high-quality, durable removals to balance any residual emissions. Recent international guidance has also emphasised the need for companies to set additional targets for the restoration of ecosystems and their biodiversity. The updated Principles reflect this guidance and include a glossary of terms and targets. This revision also intentionally distinguishes between 'offsets', 'credits' and 'projects': although these terms are often used interchangeably. A carbon credit is a unit of CO_2 emission removed or reduced. Credits are generated by projects, and may be used ('retired') to offset emissions but may also be used for other purposes. Projects can also serve other purposes than generating credits or being used as offsets. Hence, all credits and offsets require projects, but not all projects generate credits or offsets.
6. **Recognising the value of mitigation efforts outside of organisational net zero targets**. In response to heightened standards of integrity for climate claims, many actors and initiatives continue to purchase credits and support mitigation projects without using them to make net zero claims or to 'compensate' for ongoing emissions. While the Principles discuss net zero aligned offsetting, we acknowledge there are many other reasons to buy credits and support mitigation projects other than to offset emissions, e.g., to pay for reductions in wider society or to restore ecosystems. Revised Figure 4 illustrates how organisations with capacity can and should support projects beyond their own value chain mitigation efforts, especially understanding others' limited capacity to meet net zero by the global target date.

This document should be interpreted and used in line with its purpose and scope to maintain and promote the highest possible climate ambition. This document does not address legal and other obligations relating to climate action.

Executive summary

As part of their net zero climate strategies, many companies, organisations, cities, regions, and financial institutions are relying on carbon credits (abbreviated to "credits" throughout) to offset their residual emissions. A robust literature and set of voluntary standards continue to identify measures for reducing some of the well-known risks associated with the current use of credits to make climate claims. The Oxford Principles for Net Zero Aligned Carbon Offsetting (the "Oxford Offsetting Principles") add to this literature by outlining how offsetting needs to be approached to help achieve a net zero society. The four principles are:

1. Cut emissions, ensure the environmental integrity of credits used to achieve net zero, and regularly revise your offsetting strategy as best practice evolves

Following best practices developed over the last decade to deal with carbon credits and projects, adherents to the Principles should:

1A Prioritise reducing your direct and indirect emissions – Minimise the need for offsetting. Reducing emissions has multiple co-benefits and there are limits to the availability of high-quality credits.

1B Ensure the integrity of carbon credits – Credits must be measured, reported, verified, and correctly accounted for. Credit-generating investments must yield results that are demonstrably additional to what would otherwise have occurred, have a low risk of reversal, and avoid negative impacts on people and the environment.

1C Maintain transparency – Disclose current emissions, accounting and verification practices, targets and transition plans to reach net zero, and the type of credits you employ, as well as your selection process and the verification processes associated with the credits.

2. Transition to carbon removal offsetting for any residual emissions by the global net zero target date

Most credits in the voluntary market today are associated with **emission reductions** or **avoided emissions**. These can play a key role in the short and medium term to protect the carbon stored in vulnerable ecosystems and accelerate the transition to a low-carbon society, but the scope for further emission reductions will decrease as we approach the net zero target date. Organisations must shift towards **carbon removals**, which remove carbon from the atmosphere to counterbalance residual emissions and achieve net zero. Those targeting net zero with the use of credits will need to increase the proportion that comes from carbon removal, rather than from emission reductions, aiming to reach 100% carbon removal credits by the global net zero date (2050 at the latest). Other mechanisms besides the use of credits will also be needed to avoid and reduce emissions, both before and after the net zero target date.

3. Shift to removals with durable storage (low risk of reversal) to compensate any residual emissions by the net zero target date

All carbon dioxide (CO_2) removals need to be stored. Different storage methods vary in their susceptibility to releasing GHGs back into the atmosphere (hereafter 'risk of reversal'). To maintain a net zero balance, storage with low risk of reversal and high durability over the long term (centuries to millennia) is needed, such as storing CO_2 in well-selected geological reservoirs or mineralising carbon into a stable form. Some nature-based approaches that restore and protect the carbon stored in well-managed resilient ecosystems could also store carbon for centuries to millennia, provided future generations continue to maintain them and they are not destabilised by future climate change. However, the current deployment level of durable carbon removal and storage approaches is well below what is needed. It is critical that investment in these methods begins early and ramps up rapidly to ensure they are available at the scale needed to meet the demand required to achieve global net zero. Continuing to invest in high-integrity projects with a *moderate* risk of reversal (such as certain nature-based removals that may be susceptible to climate change) will also play a valuable role in the short to medium term whilst complementary approaches with a lower risk of reversal are developed and deployed. These may also have many other benefits beyond carbon removal and storage.

4. Support the development of innovative and integrated approaches to achieving net zero

The market for high-quality removals, whether used to generate credits or for wider offsetting approaches, is immature and in need of early adopters to support its growth. Users of these Principles can develop the market to support net zero by:

- 4A Using long-term agreements that are bankable and investable to provide certainty to project developers so they can raise capital efficiently;
- 4B De-risking project finance;
- 4C Forming sector-specific alliances to work collaboratively with industry peers to develop the market for projects aligned with net zero;
- 4D Supporting the protection and restoration of a wide range of ecosystems in their own right. Not only will this contribute to reducing emissions and removing CO_2, but it will also further secure the multiple ways society is supported by nature, including adaptation to the impacts of climate change. While high-integrity ecosystem restoration projects usually store carbon, such efforts should also be supported for their social and environmental benefits, not solely for the purpose of compensating for ongoing emissions;
- 4E Adopting and publicising the Principles and incorporating them into regulation and standard-setting for net zero; and
- 4F Investing in additional beyond value chain mitigation.

The Oxford Principles for Net Zero Aligned Carbon Offsetting (Revised 2024)

To meet the Paris Agreement's objective[4] of "holding the increase in the global average temperature to well below 2 °C above preindustrial levels and pursuing efforts to limit the temperature increase to 1.5 °C above pre-industrial levels" we must achieve net zero carbon dioxide (CO_2) emissions by mid-century along with rapid reductions in other greenhouse gas (GHG) emissions.[5] This means substantially reducing emissions ("sources") and balancing any residual emissions with removals ("sinks") on an ongoing basis.

Many countries and non-state actors, such as cities, regions, companies, organisations, and financial institutions, have pledged to achieve net zero emissions. 88% of global emissions, 92% of global GDP, and over 50% of the largest publicly listed companies in the world are now covered by some form of net zero target.[6] While some actors can feasibly reduce all of their emissions to reach "absolute zero", others will have residual emissions.[7] For example, some emissions from agriculture, some industrial emissions, and aviation emissions that may be difficult to fully eliminate in some sectors and regions by 2050.

Many actors invest in carbon credits or projects carried out by another actor, to counterbalance their residual emissions as part of their climate strategy.[i,8] However, most actors do not employ sufficient criteria to guide how and for what purposes such credits or projects will be used.[9]

A number of critically important questions emerge for those designing a net zero aligned offsetting strategy. What types of carbon credit projects should be invested in and when? How can actors investing in these projects – and stakeholders holding them accountable – avoid greenwashing? How can users catalyse the cost-effective supply of the right kind of carbon credit projects to achieve net zero globally?

The **Oxford Principles for Net Zero Aligned Carbon Offsetting** are designed to clarify these questions, particularly for non-state actors who want to design and deliver rigorous voluntary net zero commitments and develop high-quality carbon markets.

i A stocktake of net zero commitments in 2022 reveals that approximately 40% of Forbes 2000 companies with net zero targets intended to use credits to reach this target, a figure rising to 60% for companies with targets for 2030 or earlier. Only a few national, regional and local governments explicitly outline their intention to use credits from outside of their jurisdiction for offsetting purposes to meet their net zero targets or reserve the right to do so: 17 out of 128 countries; 15 out of 115 states and regions; 39 out of 235 cities. A significant portion of national, regional, and local governments do not yet communicate whether and to what extent they will rely on carbon removal within their own jurisdiction to meet their net zero targets.

We urge actors with anticipated residual emissions to integrate these Principles into their plans. We encourage regulators and standard setters to deploy them (e.g., in the design of climate-related disclosures) to steer the market away from low-quality credits and projects and align decarbonisation plans with net zero.

The Principles are intended to be used by a variety of stakeholders:

- Corporations and organisations designing and delivering credible plans for achieving net zero;
- Financial institutions for the same purpose, as well as to assess the plans of investors and borrowers. This can inform risk and impact analysis, as well as engagement and stewardship activities;
- Civil society, to gauge which organisations are aligning with the Paris Agreement, thereby revealing leaders and laggards;
- Initiatives and networks that promote net zero target setting and disclosure by non-state actors, who can align their requirements with the Oxford Principles for Net Zero Aligned Carbon Offsetting;
- Regulatory and standard-setting bodies to create mandatory rules or other policy interventions that drive the economy toward net zero, including enabling investments that can support the realisation of the Principles on a global basis;
- Researchers and academic institutions to address their own emissions, or to guide research to fill time-sensitive knowledge gaps in understanding how net zero can be achieved.

Defining terms and targets

Ahead of developing a net zero aligned offsetting strategy, it is critical that users be clear and transparent about the targets they are setting. In this section, we define relevant targets and key terms.

Beyond value chain mitigation

Mitigation action or investments that fall outside an organisation's value chain, meaning beyond their scope 1, 2 and 3 emissions.[10] An actor may wish to set a target for its beyond value chain mitigation efforts that complements its organisational net zero strategy.

Carbon removal

Anthropogenic activities that remove CO_2 from the atmosphere and durably store it in geological, terrestrial, or ocean reservoirs, or in products. It includes existing and potential anthropogenic enhancement of biological or geochemical CO_2 sinks and direct air carbon dioxide capture and storage (DACCS), but excludes passive CO_2 uptake not directly brought on by ongoing human efforts.[11] As a result, carbon uptake that would have occurred anyway in the absence of any active ongoing human intervention (for example, enhanced vegetation growth by CO_2 fertilisation due to past global emissions) is not categorised as carbon removal for the purposes of reaching net zero.[12]

Carbon neutral

While carbon neutrality and net zero are terms that should be functionally equivalent concepts, practitioners, standards, and regulators alike (particularly referring to claims of non-state actors) have come to interpret and apply 'carbon neutral' as a less rigorous, interim claim in which an organisation purchases credits (reductions or removals) to compensate for the total amount of remaining emissions, often ahead of the net zero target.[13] This understanding of carbon neutrality demonstrates a departure from the definition of net zero, which is achieved through deep emissions reductions, with any residual GHG emissions attributable to that actor being fully compensated by removals with low risk of reversal.

Credits

Tradeable certificates that represent the mitigation (reduction or removal) of a specified amount of greenhouse gas emissions.[14] Credits are often used to offset emissions but can be acquired and retired without use as an offset as a form of extra beyond value chain mitigation.

Nature targets: for biodiversity and ecosystem restoration

Alongside credible net zero commitments, it is critical for organisations to align corporate objectives and targets with the goals and targets of the Kunming-Montreal Global Biodiversity Framework to halt and reverse biodiversity loss by 2030 and substantially increase the area of natural habitats and the abundance of wild species by 2050.[15] Organisations are increasingly setting targets to reduce negative impacts and increase positive impacts on nature and people by protecting and restoring ecosystems, including land, freshwater, and oceans, and managing farmland, forestry, and fisheries more sustainably, as well as responding to nature-related risks and opportunities.[ii] Meeting these targets is important for biodiversity and hence resilience as well as being vital for climate mitigation and adaptation.

Net zero carbon

See Net zero GHGs, but with reference to emissions of carbon dioxide only.

Net zero greenhouse gas emissions

When anthropogenic emissions of greenhouse gases to the atmosphere are balanced by anthropogenic removals over a specified period.[16] Consensus has emerged among international guidance that to claim net zero, actors must reduce emissions as far as possible following science-based pathways, with any residual GHG emissions attributable to that actor being fully compensated by removals with low risk of reversal, exclusively claimed by that actor, either within their own value chain or through the purchase of high-integrity credits.[iii,17]

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ii Over 200 organisations are testing the beta versions of the Taskforce on Nature-related Financial Disclosure's (TNDF) framework. Over 2,600 organisations have set targets for nature that both reduce their negative impacts and increase positive outcomes for nature and people dependent upon it. SBTN offers technical guidance for setting targets for freshwater and land-based ecosystems.

iii Since the publication of the last version of these principles, international guidance has emerged to support organisations in developing credible net zero strategies including: the International Standards Organisation's Net Zero Guidelines, the UN Secretary General's Integrity Matters Report, and the Science Based Targets Initiative's Net Zero Standard. The definition here has been adapted from the Race to Zero Lexicon and aligns with criteria across these initiatives.

Net-negative / climate-positive

When an actor's greenhouse gas removals, internal and external, exceed its emissions over a declared time period.[18] Such targets are often made by organisations in recognition that net zero is a global target requiring actors who can to go further, faster.

Offset

Emissions reduction or removal resulting from an action outside an organisation's boundaries used to counterbalance the organisation's residual emissions.

Project

In the context of these principles, a project is a climate mitigation activity.

Residual emissions

Greenhouse gas emissions that remain after taking all possible actions to implement emissions reductions given current resources and technology.[19]

Understanding types of projects available in today's carbon markets

To improve the credibility of net zero strategies, it is critical to distinguish between the types of projects in today's carbon markets (see Figure 1 below for a visual taxonomy).

Emission reductions

There are three broad categories of options for reducing emissions:

I. **Avoid or reduce emissions from the geosphere**. Emissions can be avoided by deploying renewable energy to replace fossil fuel use, or by improving efficiency.

II. **Avoid or reduce emissions from the biosphere** by protecting ecosystems and their soils and vegetation from damage or degradation.

III. **Reduce emissions from the geosphere by capturing and storing fossil carbon** from industrial point sources or fossil-fuelled power stations.

The scope for further emission reductions will decrease as emissions decline towards the net zero target date.

Carbon removal and storage types

Most carbon removal in Paris-aligned pathways involves sequestering carbon from the atmosphere and storing it in biological or geological reservoirs.

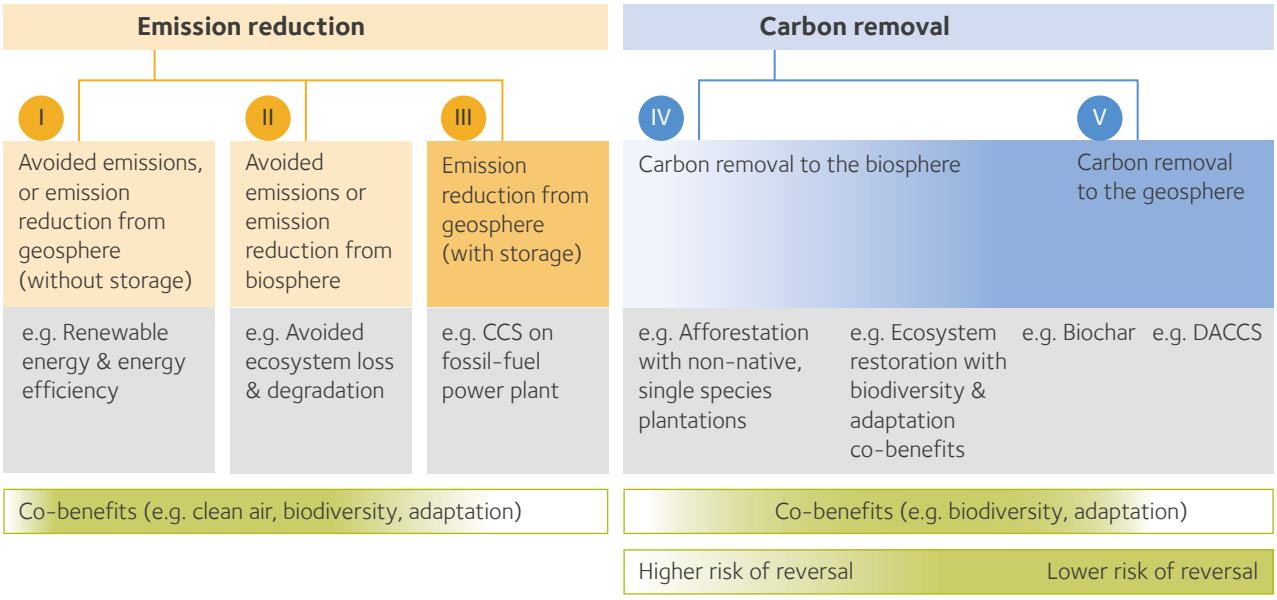
IV. **Carbon removal to the biosphere** involves enhancing the carbon stored in the biosphere, such as by restoring healthy ecosystems (e.g., woodlands, grasslands, wetlands, and marine habitats) or enhancing soil carbon on agricultural land.

V. **Carbon removal to the geosphere** involves extracting CO_2 from the atmosphere and storing it in the geosphere, such as through direct air capture with geological storage (DACCS) or converting atmospheric carbon into rock through remineralisation.

The biosphere is already absorbing significant amounts of carbon in the absence of any active human intervention partly due to CO_2 fertilisation and other indirect effects of past emissions. This "passive" carbon uptake cannot be used to compensate for ongoing emissions if the goal of net zero emissions is to be robust enough to halt global warming, despite being allowable as a negative emission under UNFCCC accounting rules if it takes place on "managed land."[20] Genuine carbon removal must be additional, and therefore must exclude any uptake not directly caused by ongoing human activities.

This broad overview is intended to help users think through their approaches to offsetting, though many projects will involve both biological and geological capture and storage processes.[21]

Figure 1: Project taxonomy. This simplified taxonomy shows five different project classifications which distinguish between emission reductions and carbon removals, distinguishing between where carbon is removed from the atmosphere, how it is stored (in the biosphere or geosphere) and the risks and benefits associated with these different approaches. The shading of colours from light to dark pertain to the durability of storage (also shown in Figure 4). The risk of reversal of storage types and co-benefits are illustrated as gradient bars below the project types. Principle 2 addresses the distinction between emission reductions and carbon removals, stating that a net zero balance requires offsetting with exclusively removals by the net zero target date. Principle 3 addresses the need to invest in and scale up storage options with a low risk of reversal to reach and maintain net zero.



Principle 1:

Cut emissions, ensure the environmental integrity of credits used to achieve net zero, and regularly revise your offsetting strategy as best practice evolves

A growing set of literature, guidance, standards, and regulations is contributing to international consensus on what constitutes credible efforts towards achieving net zero.[iv] Best practice, as it pertains to offsetting or compensating emissions generally guides users to:

1A Prioritise reducing emissions and scale removals within value chain to minimise the need for offsetting

Emissions reductions are the core component of any credible net zero strategy. Voluntary initiatives and standards on net zero commonly advocate using the mitigation hierarchy. This emphasises the need for actors to reduce emissions from within their own value chain as much as possible, and to invest in mitigation outside their value chains to contribute towards societal net zero.[22]

It is important to directly reduce emissions as much as possible because there are limits to the global capacity for removals.[23] Every year of delay before initiating emission reductions decreases the remaining time available to reach net zero emissions in line with Paris Agreement temperature targets. Front-loading emission reductions maintains the option to further tighten remaining carbon budgets, for example, in case of unexpected climate feedbacks.[24] In addition, cutting emissions brings many co-benefits including improved air and water quality, and reduced environmental damage from fossil fuel extraction.

Cutting emissions can take many forms and is often sector specific. As recognised by the first global stocktake under the Paris Agreement in the UAE Consensus at COP28, there is a need to transition away from fossil fuels in energy systems in order to reach net zero, including through significant action this decade.[25] Actors must also work to reduce energy and material consumption across their value chains by working with suppliers and developing low-emissions procurement strategies, taking responsibility for their products' lifecycle emissions, and working with customers to reduce those emissions.[26]

The volume of residual emissions will be specific to the organisation, based on available technologies, equity and inclusivity. Criteria should be revisited frequently, since emissions that were previously considered hard to reduce may become easier to reduce due to new technologies. Indeed, international guidance recommends that actors set out net zero strategies in line with the IEA's modelled pathways that limit warming to 1.5 °C.[v,27] Geography-specific sectoral emissions reduction pathways are also important areas of ongoing research and analysis to support organisations in understanding likely residual emissions in context.[28] Fortunately, the maturity of low-carbon technology means that direct decarbonisation is dramatically easier today than in the past, reducing the need to counterbalance significant volumes of emissions, except in certain harder-to-abate sectors and applications.

iv For example, the Science-Based Targets Initiative's Corporate Net-Zero Standard, the International Organisation for Standardisation's Net Zero Guidelines and the United Nations High Level Expert Group on the Net Zero Emissions Commitments of Non State Entities.

v Ibid.

1B Ensure social and environmental integrity. Credits and projects must be additional, monitored, verifiable, correctly accounted for, and have low risk of reversal or negative unintended consequences to ecosystems and communities

Independent evaluators from academia and civil society have found systematic and wide-reaching deficiencies in carbon markets.[29,30] There remains a lack of publicly available information on the quality of carbon credits, but authoritative estimates suggest that many of them – particularly those that focus on emissions avoidance – have had poor methodologies and faulty assumptions.[31,32] Many standards applied today in the voluntary carbon market do not guarantee environmental integrity, making high-quality projects rare but essential to address residual emissions.

Verifying projects with robust methodologies is critical to ensuring that the emission reduction or carbon removal actually takes place and that no double-counting, including double-claiming of the emission reduction or removal benefit, occurs. This includes consulting the appropriate registries to ensure credits are retired when used to counterbalance residual emissions. Care must also be taken to ensure proper conversion of climate impacts of non-CO_2 climate pollutants into CO_2 equivalencies, to take into account their actual warming impact, particularly for short-lived greenhouse gases such as methane.[33]

Any projects invested in for offsetting purposes must represent an additional emission reduction or carbon removal, meaning that the project would not have taken place but for the investment activity, relative to a credible counterfactual baseline.[34,35] Currently, many projects fail to meet additionality tests. Some projects are already mandatory under regulatory regimes, such as 'avoided deforestation' projects in regions that have already put in place commitments and policies to end deforestation. Carbon removal may also be economically non-additional if it already generates by-products for industrial use.[36] Furthermore, some actors are exploring the potential to stack or bundle different types of credits from one project, a process which must be carefully managed to ensure additionality.[37]

Projects used to counterbalance residual emissions can have differing co-benefits or adverse impacts. Good design and adherence to standards are crucial to maximising benefits and reducing trade-offs. Nature-based projects, such as ecosystem protection and restoration, should aim to meet the criteria for nature-based solutions, by following the four Nature-based Solutions Guidelines[38] and the more detailed IUCN Global Standard for Nature-based Solutions.[39]

Some approaches can have negative consequences for biodiversity, hydrological or nutrient cycles, food security, livelihoods, or land rights, undermining societal goals, including equity and climate justice, while also threatening the socio-ecological resilience of landscapes and hence the longevity of carbon storage. To avoid this, schemes must be co-designed and implemented with the full engagement of Indigenous peoples and local communities, ensuring free, prior, and informed consent.[40] Offsetting strategies to achieve net zero must avoid these unintended negative consequences for people and the environment.

Certain novel tools, including carbon credit rating systems and integrity assessments, can assist with quality assessments. Beyond this, organisations can and should also signal their support for public regulation of the voluntary carbon market, which is currently largely unregulated.

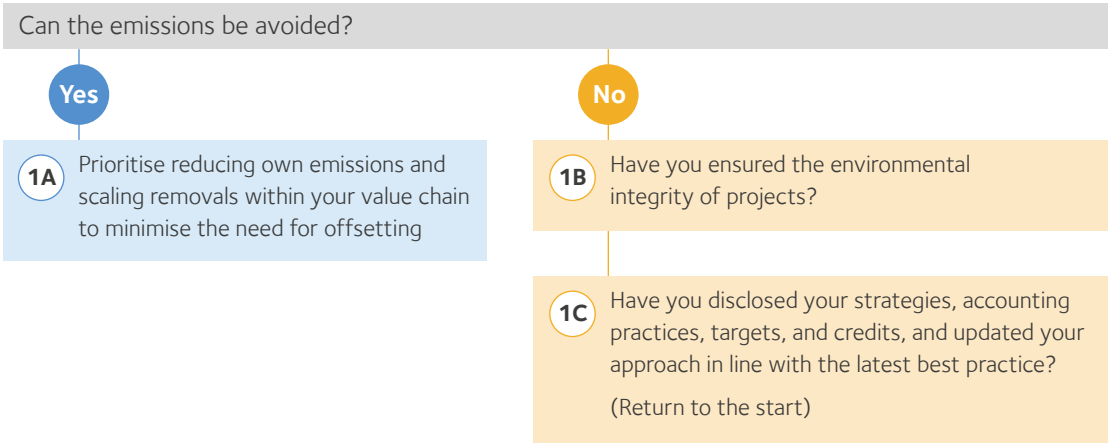
1C Regularly revise and disclose strategies, accounting practices, targets, and credits or other investments to reach net zero

Disclosure includes all emissions within an organisation's value chain, often categorised according to the GHG Protocol framework for reporting emissions:[41]

- **Scope 1** includes direct emissions from owned or operated sources, e.g., company vehicles.
- **Scope 2** includes indirect emissions from the generation of purchased energy, e.g., purchased electricity.
- **Scope 3** includes all other indirect emissions that occur in the value chain, including both upstream and downstream emissions, including emissions associated with the use of products or services sold or used by an organisation and embodied emissions in procured materials.

Organisations must disclose the accounting practices they use to measure emissions and convert the climate impacts of short-lived greenhouse gases (e.g. methane) into CO_2-equivalent terms. Following current best practices in measurement, reporting, and target-setting is a crucial precondition to offsetting residual emissions via credits.[vi,42,43]

Figure 2: A decision tree for Principle 1. Figure 2 offers a decision tree for users considering offsetting. Note, these approaches are not necessarily mutually exclusive or sequential. Organisations can continue to seek and prioritise new ways to reduce emissions, while at the same time supporting highest integrity, net zero aligned offsetting projects, updating strategies as solutions evolve.



vi Disclosure of climate related or broader sustainability risk is now mandatory or scheduled to become so under national legal frameworks in states accounting for nearly half of global GDP and GHGs (n 41 at p8).

Principle 2:

Transition to carbon removal offsetting for any residual emissions by the global net zero target date

The only way to achieve and maintain net zero is to either not emit in the first place, or to compensate any residual emissions with durable removals (See Principle 3 for durability considerations).

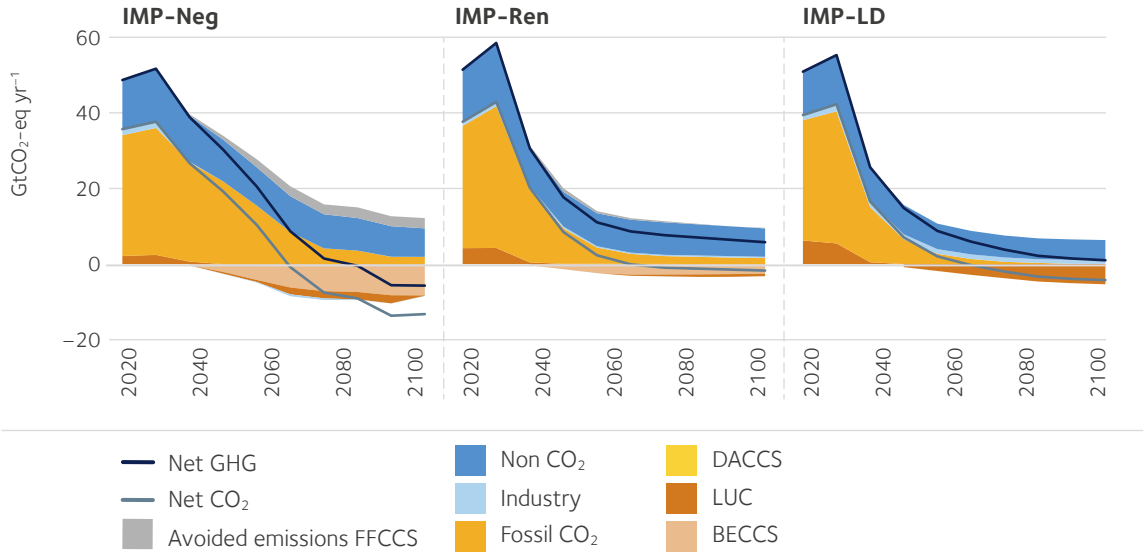
Most carbon credits available today relate to projects that avoid or reduce emissions.[vii,44] These can be an efficient way to accelerate the transition to a lower carbon society in the short to medium term but are insufficient as a global strategy to achieve net zero in the long run. If organisations around the world kept emitting at the net zero target date while paying another organisation or actor to only reduce their emissions, global emissions would never reach net zero. If there are any remaining residual emissions at the net zero target date, these will have to be balanced by removals. An actor's minimum removal target will be implicitly defined by the level of residual emissions it predicts at its end-state of net zero. Such carbon removal targets should be made explicit and re-examined at regular intervals to reflect actual progress in reducing emissions.

Carbon removal will play an essential role in achieving net zero emissions to halt global warming and may be required to further reduce temperatures after net zero is achieved. The magnitude of removal required depends on the mitigation scenario, as per Figure 3. Yet on our current emissions trajectory, we are not on track to achieve the levels of removal deployment needed for net zero.[45]

Users investing in projects to counterbalance residual emissions should progressively increase the portion of their investments into carbon removal projects, starting now, ultimately aiming to reach 100% removals by the global net zero date (2050 at the latest) to ensure alignment with the Paris Agreement. However, the characteristics of the different carbon removal options must be carefully considered. For example, bioenergy carbon capture and storage and biochar require biomass feedstock which can have high land and water requirements, with potential negative impacts on food security, biodiversity, and resilience.[46] High-quality nature-based solutions can have major benefits for biodiversity and ecosystem services, in particular for climate change resilience.[47,48]

vii Based on the latest release of the Berkeley Carbon Trading Project's Voluntary Offsets Database (December 2023) only 3.3% of carbon credits retired since records began can be classified as 'pure removals' across the four major registries (Verra, American Carbon Registry, the Gold Standard and Climate Action Reserve). All of these credits represented removals via afforestation, reforestation and revegetation and biochar projects. 82.9% of credits retired came from emissions reduction or avoidance projects, including renewable energy generation, clean cookstove distribution and REDD+. The remaining 13.8% of retirements were mixed reduction and removal credits from projects including improved forest management, wetland restoration, sustainable agriculture, compost addition to rangeland, and sustainable grassland management projects.

Figure 3: Illustrative IPCC Pathways. Adapted from Figure 3.7 from IPCC WG3, showing different scenarios for meeting net zero in which emphasis is placed on negative emissions (IMP-Neg), renewables (IMP-Ren), or lowering demand (IMP-LD). These demonstrate that the global demand for offsetting capacity is much smaller in scenarios that maximise demand reduction and renewables. This is important because the global capacity for effective and affordable net zero-aligned removal and storage capacity is limited and uncertain, which raises concerns about well-resourced emitters taking up the available supply.[49]



Supply of all types of high-quality carbon removal is still very limited. Strengthening demand signals can spur investments in carbon removal supply. Paying for carbon removal in excess of an organisation's emissions can also allow ambitious actors to achieve a net negative emissions balance (this is also sometimes called climate positive).[50]

That said, an immediate shift to a 100% carbon removal offsetting portfolio may not be necessary or currently feasible for some. While it is critical to close the gap in required carbon removal and storage capacity, carbon removal projects need time to scale. Although projects used to counterbalance residual emissions to claim net zero eventually need to come exclusively from carbon removal, emission reduction projects will have an important role to play over at least the next decade on the path to net zero and should be invested in as a form of beyond value chain mitigation. Eliminating ongoing emissions will still be essential at and after the global net zero target date.[51] Contributions may still be made through the carbon market to reduce emissions beyond compensating for an organisation's carbon footprint. Such contributions will complement emissions reductions through regulation, government investment, and new finance mechanisms.

Principle 3:

Shift to removals with durable storage (low risk of reversal) to compensate residual emissions by the net zero target date

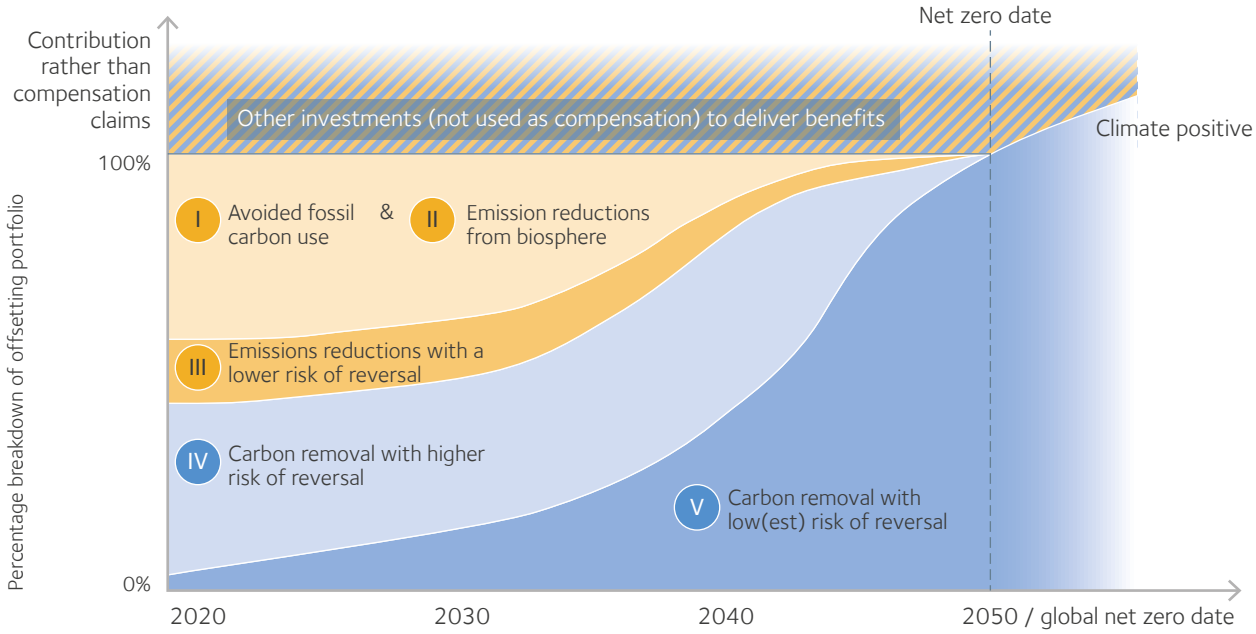
Any credits used to counterbalance residual emissions increasingly need to come from activities that store carbon effectively permanently, with a low risk of re-release into the atmosphere. Whereas Principle 2 concerns the distinction between emissions reduction and carbon removal, Principle 3 addresses the importance of storing carbon permanently with a low risk of reversal. The risk of carbon being inadvertently released back into the atmosphere must be acknowledged and accounted for in a strategy to achieve net zero. Different types of carbon storage (biological and geological) have differing characteristics depending on how they are deployed and managed.

Biological storage methods, such as ecosystem restoration and soil carbon enhancement, if properly managed, have the potential for durable carbon storage, while providing multiple benefits to biodiversity and society.[52] However, factors such as changing land-use demands, political priorities or economic pressures (e.g., increasing the risk of deforestation) and climate change itself (e.g., increasing the risks of fire, disease, floods, droughts, heat stress) all increase the risk that this stored carbon will be re-emitted from the biosphere in the short to medium term. These risks can be reduced if projects are well governed, adaptively managed, and designed to be resilient to climate shocks and societal pressures in the project location.[53] Climate resilience may be further enhanced by improving ecosystem health, biodiversity, and connectivity, and by reducing pressures such as pollution, habitat loss, over-exploitation, and invasive species.[54] The IUCN Global Standard for Nature-based Solutions covers many of these issues in a set of principles for delivering high-integrity projects with a low risk of reversal.[55] To reduce the risk of reversal of nature-based storage, these principles must be followed and projects with a high risk of reversal (e.g., due to bio-physical (including climatic) or political risks) should be avoided or approached with an appropriate risk reduction strategy, e.g. assurance to replace the storage in these projects should carbon be re-released. However, some biological options for carbon storage, such as monoculture plantations of non-native species, have much higher vulnerability, or may even be designed with eventual reversal in mind (as the carbon will be lost when timber is felled and used for short-lived products such as paper), and should be avoided. In addition, there are limits to the use of ecosystem-based carbon removal due to competition for land on a finite planet.

Geological storage methods, including storing CO_2 in geological reservoirs or mineralising carbon into stable forms, may offer a low risk of reversal with storage duration on millennial timescales. While some leakage from storage in reservoirs could still occur, for example, due to earth movements causing fractures in the rocks, or unexpected gas movement between rock formations,[56] certain approaches to geological storage pose a very low risk in this regard.[57,58,59] However, as with any other project involving carbon storage, monitoring and verification are required alongside a strategy to compensate for any reversals. For this reason, removal projects with geological storage constitute project types that can store carbon *on long-time scales with low risk of reversal*, but these may remain challenging to invest in due to the novel technologies involved, limited supply, and, for the time being, high costs. [60,61]

It is critical that significant investment in carbon removal with a low risk of reversal begins now to reach the thousand-fold increase needed by 2050.[62] A diverse portfolio of carbon removal and storage technologies should be supported to maximise the chances of scaling removals whilst minimising the risks to biodiversity and food production from over-reliance on any one given approach at scale.[63] To help close the gap between demand for removals and storage and current supply, a net zero aligned offsetting strategy must progressively increase both the portion of **carbon removal (Principle 2)** and the portion of projects that store carbon with a **low risk of reversal (Principle 3)**.

Figure 4: Example of a Net Zero Aligned Offsetting Portfolio. An illustrative (not to scale) breakdown showing the proportion of different project types that could be used to address residual emissions between 2020 and 2050. This is not what the current market reflects but what an outcomes-based portfolio on the path to net zero could look like. It is not intended to be read precisely or prescriptively but shows a plausible net zero aligned offsetting pathway compatible with Principles 2 & 3. The figure demonstrates the move from projects based on emissions reductions (yellow) toward carbon removal (blue), and the shift from types with no storage or higher risk of reversal (lighter shades) to types with storage and lower risk of reversal (darker shades). The 100% line in Figure 4 indicates the total offsetting credit portfolio for the emissions attributable to the organisation's value chain, including Scope 1, 2 and 3 emissions.[64] The striped area above the line is used to indicate that investments across all credit types may be valuable as a contribution to wider mitigation efforts beyond an organisation's value chain mitigation or net zero target, up to and beyond the net zero target date. Such contributions (not used for offsetting) may be particularly valuable to organisations that set climate-positive targets, especially from the perspective of beyond value chain or climate positive targets. Such targets and contributions are made for pragmatic and equity considerations in mind, acknowledging that some organisations will need to go further than net zero given equity considerations and the limited capacity of others to meet the target by the global net zero target date. An organisation may also have a nature or biodiversity target towards which investment in nature-based credits is appropriate, separate from efforts to counterbalance or compensate residual emissions.



Managing risk of reversal and ensuring durability on timescales relevant to net zero

Many of the recent international initiatives aimed at improving integrity in the voluntary carbon market encourage investment in projects that are "permanent or, where there is a risk of reversal, with measures in place to address those risks and compensate reversals."[65] However, given the millennial lifespan of fossil carbon in the atmosphere, schemes or standards that only require monitoring and management of potential reversal on decadal timescales may undermine efforts to achieve and maintain net zero.[66] For this reason, reversals must be monitored and addressed over timescales meaningful for net zero.[67] It could be possible to achieve a state of 'dynamic permanence' where stocks in sinks with lower durability are directly replenished as they expire.[68] So-called 'contracted permanence' may also be possible through financial or legal mechanisms, such as covenants to top up a separate carbon sink.[69] However, such strategies require strong governance and may involve significant costs which may ultimately mean that strategies based on replenishment of short-term stocks become costlier than durable storage options.[70]

Principle 4:

Support the development of innovative and integrated approaches to achieving net zero

Principle 1 reaffirms the need to reduce emissions as a priority, only use high-quality credits, and continually revise one's offsetting strategy as best practices evolve. Principles 2 and 3 introduce a framework for transitioning the mix of projects in an organisation's offsetting portfolio toward a state compatible with net zero. However, while some carbon removal options that meet Principles 2 and 3 exist today, the absolute and proportional levels of carbon removal with a low risk of reversal must rise, and costs must decline, in order to make this transition more feasible. Actors should not wait until just a few years before their net zero target and assume that the solutions they will need to counterbalance their residual emissions will be available. To address this, Principle 4 highlights the various levers actors have at their disposal to stimulate the development of removals, which includes, but also goes beyond, offsetting via carbon credits. It affirms the need for organisations to signal and commit today to buy carbon removals to balance residual emissions and meet their net zero targets, (e.g. through advanced market commitments). While purchase volumes will initially be small, given the high cost associated with rigorous, first-of-a-kind durable carbon removals, offtake agreements and other innovative mechanisms can unlock financing for suppliers and motivate investment and project creation. This can enable the exponential growth required in this critical decade to ensure sufficient durable carbon removal is available in the future to meet net zero commitments.

What explicit actions can be taken in the short to medium term to support the development of projects that may be needed to achieve a net zero in future? Organisations can use their buying power, demand signals, and political and social credibility to drive meaningful change today in the following ways:

4A Using long-term agreements that are bankable and investable to provide certainty to project developers so they can raise capital efficiently

Currently, there are too few projects employing storage with low risks of reversal. There are also too many projects that have a high risk of reversal, short-lived storage and low integrity (see Principle 1) contributing to an ongoing market failure.[71] Adopting the Oxford Principles for Net Zero Aligned Carbon Offsetting and publicising this can help create demand for the durable removal projects needed to meet and sustain net zero. Just as it remains difficult to drive demand for high-quality additional projects in carbon markets (due to the perverse price incentive to support weaker and cheaper projects), it is currently also difficult to attract investment into removal credits or projects with low risk of reversal. Creating demand for high-quality credits with low risk of reversal of carbon storage will help accelerate their deployment to deliver the necessary supply over the long term.

4B De-risking Project Finance

Organisations adopting the Oxford Offsetting Principles have an opportunity to be more proactive than simply by signalling demand. Users of the Principles could individually or collectively enter into long-term purchase agreements, similar to the power purchase agreements (PPAs) which supercharged solar and wind deployment. Such agreements provide certainty to project developers to raise capital efficiently whilst also providing price certainty for purchasers. These could be designed as Contracts-for-Difference which create price floors (known as "put" options) to provide a credible price signal to suppliers to motivate investment while giving buyers flexibility and value for money or be in the form of offtake agreements via advanced market commitments.[72,73]

4C Forming sector-specific alliances

Unique levels of absolute emissions reductions are available in each sector before offsetting is required. Supporters of the Principles should build partnerships and collaborate across their sector(s) and up and down their value chains to leverage shared decarbonisation opportunities and set out sector-specific rules and commitments consistent with the Principles and internationally agreed net zero standards. Alliances and associations should also advocate for industry bodies to take clearer and stronger stances on climate policy and standards to accelerate sectoral decarbonisation and wider sustainability opportunities. As part of this, it is important to acknowledge the differentiated roles and responsibilities of certain sectors, and certain actors within sectors, in supporting the development of the market for credible and durable removals. The Principles are primarily intended to guide buyers, but carbon project developers and intermediaries have an enormously important role to play and can adopt the spirit of the Principles by actively advocating that their customers shift their demand in the manner described in Principles 2 and 3.

4D Supporting the protection and restoration of a wide range of ecosystems in their own right

While investing in credits can be one of the mechanisms for supporting high-quality nature-based solutions, especially in the short to medium term, ecosystem restoration and protection must be rapidly scaled up and valued for a broader suite of social and environmental benefits, including resilience to climate change[74,75] and protection of biodiversity.[76] Well-governed and adaptively managed ecosystems will contribute to carbon storage over the long term, and nature-based solutions will likely be needed to restore carbon released from natural feedbacks under a warming scenario, even as we achieve net zero between residual emissions and removals.[77,78] Rigorous social and environmental protection must be employed, in line with the IUCN Global Standard,[79] a human rights-based approach and free, prior, and informed consent, so that any strategy to achieve net zero through investment in nature-based credits also supports other interlinked ecological and social objectives, whilst at the same time ensuring that the pursuit of these objectives does not undermine climate benefits.

4E Adopting and publicising the Principles and incorporating them into regulation and standard-setting for net zero

A wide range of voluntary and regulatory standards currently offer guidance as to how net zero is defined and could be achieved. Going forward, actors adopting the Principles should work to ensure that such regulations and standards evolve to reflect a science-based approach to achieving net zero, as defined in the Principles. This could include advocating for specific interim and long-term carbon removal targets to build up the volumes needed without deterring emissions reduction or nature targets. It could also include supporting the development of governance institutions and recognised industry standards that would ensure that carbon removals are effective, well-monitored and have clear liability.

4F Investing in additional beyond value chain mitigation

All actors with the means to do so should consider how they can invest in further contributions to climate mitigation. This could include, but is not limited to, supporting additional nature-based reforestation or other investments primed for developing the potential of durable removal technologies.[viii]

Principle 4 outlines some immediate ways in which organisations can work to ensure the necessary development and scaling of the solutions needed to deliver net zero. There are a variety of enabling conditions that can and should be pursued simultaneously, from supporting new marketplaces, standards, and relevant certifications, to conducting research and development to increase the quality and supply of high-integrity removal projects. A net zero aligned offsetting strategy should help create these enabling conditions through the development and deployment of innovative and integrated approaches.

Conclusion

The vast majority of current offsetting approaches are not net zero aligned. To correct this, the Oxford Offsetting Principles offer a science-based framework for achieving and maintaining a net zero balance. While users must still exercise due diligence when building their offsetting strategies, these Principles offer guidance for those dedicated to high integrity climate outcomes.

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