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CARBON MARKET WATCH

Companies’ role in scaling up DURABLE CARBON DIOXIDE REMOVALS

An assessment of the status quo and recommendations to voluntary initiatives

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Summary

Limiting global warming to 1.5°C – or even well below 2°C – requires deep reductions in greenhouse gas emissions across all sectors, alongside the use of carbon dioxide removal (CDR). CDR refers to methods that remove CO_2 from the atmosphere and store it for a period of time. These methods are largely categorised as durable and non-durable, based on how long the removed carbon remains stored. Only durable CDR, where carbon is stored securely on a millennial timescale, can truly neutralise emissions from the long carbon cycle, such as fossil fuel emissions, thawing permafrost and degrading peatlands.

Despite the urgent need to scale up durable CDR to reach global net zero, non-durable CDR continues to be widely used – often by companies to claim the neutralisation of ongoing emissions instead of pursuing deep emission reductions. In our analysis of 35 companies' use of CDR in their climate strategies, we found that non-durable CDR is a focus for many of them. Several tech companies launched the Symbiosis coalition, an advanced market commitment for nature-based, non-durable removals like reforestation and agroforestry. Similarly, Inditex invests in ecosystem restoration and reforestation, although it is unclear whether this is intended to neutralise its own emissions. TotalEnergies and Shell are among the largest buyers of forest-based removals, while Air France-KLM finances various nature projects with the aim of neutralising ongoing CO_2 emissions. Although investments in ecosystem restoration and forest protection are important for biodiversity and climate resilience, they are not a credible substitute for actual emission reductions. Due to their low durability, non-durable CDR cannot meaningfully offset fossil fuel emissions.

In the meantime, both the capacity and demand for durable CDR remain far below what is needed. In 2023, less than 1.3 million tonnes of CO_2 were removed through durable CDR methods. To achieve net zero, this would need to increase by a factor of 1,000 by 2050. Yet current demand for durable removals is low, with only a handful of companies accounting for virtually all durable CDR purchases. Microsoft alone is responsible for over two-thirds of all durable CDR ever contracted. Other tech companies also rank among the top 10 buyers. This limited uptake reflects the lack of clear business incentives for most companies to invest in durable CDR unless it can be used for their net-zero claims or marketing purposes.

Durable CDR is not without challenges. Even when carefully managed, it may lead to significant environmental and social risks. Durable CDR technologies compete for scarce resources like land, water and clean energy. Given the limited sustainable potential and scarcity of durable CDR, it should be treated as a public good and should be reserved for neutralising residual emissions in hard-to-abate sectors. Governments are best placed to advance the development and scale-up of durable CDR, through measures such as procurement obligations, removal trading schemes or taxation. However, such policies remain largely absent in most jurisdictions.

Based on our analysis of companies' use of CDR across sectors, we identified three main reasons why they currently invest in durable CDR technologies:

1. To meet their net zero targets, even when deeper reductions are feasible without relying on CDR. In many cases, corporate net-zero targets are not aligned with sectoral decarbonisation benchmarks. For instance, tech companies have the potential to reduce their emissions to near zero, but their net-zero targets often lack deep emission reduction commitments. Instead, they appear to rely on accounting methods and CDR to meet their net-zero goals. However, using the limited global supply of durable CDR as a substitute for feasible emission reductions is not credible and undermines efforts to reach global net-zero emissions.

2. To produce synthetic aviation fuels in the aviation sector. Direct air capture (DAC) – when not paired with permanent storage – is a key input for producing synthetic fuels. Although DAC for fuel production does not qualify as durable CDR, airlines frequently cite both neutralising residual emissions and enabling synthetic fuel production as reasons for investing in DAC.

3. To align with emerging business opportunities. For some companies, investing in durable CDR represents a clear business case. For example, electric utilities such as Ørsted and E.ON are piloting bioenergy with carbon capture and storage (BECCS), which aligns well with their existing infrastructure and supply chains. Fossil fuel producers like Equinor, TotalEnergies and Shell co-own the Northern Lights project and hold CO_2 storage licences, positioning themselves as future providers of CO_2 transport and storage services. ExxonMobil is also developing its own large-scale CO_2 transport and storage network in the United States.

However, even where companies invest in durable CDR, transparency around their purchases remains limited. Companies and project developers they work with generally fail to disclose crucial details, such as the source of biomass feedstock, water and renewable energy use or how social and environmental risks are mitigated. There is also a lack of independent assessments of procurement deals. These gaps should be addressed urgently, or the expansion of corporate support for durable CDR risks harming local ecosystems and communities.

In the absence of ambitious climate regulation requiring companies to support the scale-up of durable CDR, voluntary initiatives can play a critical role. Voluntary initiatives, such as the Science-Based Targets initiative (SBTi) and the International Organization for Standardization (ISO), can help shape corporate action. They should set clear guidance and requirements to direct corporate support for durable CDR, which could serve as a blueprint for future legislation.

Therefore, we make the following seven recommendations for voluntary initiatives:

1. Ask companies to set separate targets for GHG emission reductions, and support for durable CDR. These targets should not be merged into a net-zero target at the company level.
2. Ask companies to set monetary targets for durable CDR in the short and medium term to help finance its scale-up.
3. Provide a clear definition of what durable CDR is and establish social and environmental guardrails.

While we argue that emission reductions and removals should remain separate and not be merged into a net-zero target at the company level, we recognise that this is currently common practice. If voluntary standards continue to ask companies to set such combined targets, then:

4. Durable CDR should only be used to neutralise residual emissions that cannot be reduced with current or anticipated technologies in the coming decades.
5. Long-term and interim durable CDR targets should cover all emission scopes.
6. Durable CDR for fossil emissions should ensure that carbon is stored on a millennial timescale.
7. Non-durable CDR is an unsuitable approach to neutralise biogenic methane emissions and CO_2 emissions from land use, due to current inaccuracies in measurement, reporting and verification (MRV), land constraints and potential conflicts with other ecosystem objectives.

Abbreviations

AR	Afforestation and reforestation
AR6	Sixth Assessment Report
BECCS	Bioenergy with carbon capture and storage
BVCM	Beyond value chain mitigation
CCS	Carbon capture and storage
CCUS	Carbon capture utilisation and storage
CDR	Carbon dioxide removal
CH_4	Methane
CNZS	Corporate Net Zero Standard
CO_2	Carbon dioxide
DAC	Direct air capture
DACCS	Direct air carbon capture and storage
DACCU	Direct air carbon capture and use
DK	Danish krone
EOR	Enhanced oil recovery
F-gases	Fluorinated gases
GHG	Greenhouse gas
Gt	Gigatonne
GWP	Global warming potential
HLEG	High-Level Expert Group on the Net-Zero Emissions Commitments of Non-State Entities
IAM	Integrated assessment model
IPCC	Intergovernmental Panel on Climate Change
ISO	International Organization for Standardization
MRV	Monitoring, reporting and verification
Mt	Megatonne
N_2O	Nitrous oxide
NDC	Nationally Determined Contribution
PtL	Power-to-liquid
SBTi	Science-Based Targets initiative
TRL	Technology readiness level
USD	United States dollar
VCM	Voluntary carbon market

1 Introduction

Deep greenhouse gas (GHG) emission reductions, combined with carbon dioxide removals (CDR), are imperative to limiting global warming to 1.5°C or even well below 2°C (IPCC, 2022a). The 1.5°C temperature limit requires that carbon dioxide (CO_2) emissions reach net zero by 2050 and become net negative thereafter. CDR represents the 'net' in 'net zero' – referring to activities that capture CO_2 from the atmosphere and store it in land, ocean or geological sinks. There are significant differences between various CDR methods when it comes to sustainable potential and storage time, among other factors. Emissions that come from the long carbon cycle (e.g. fossil fuel emissions, thawing permafrost, degrading peatlands) can only be neutralised with CDR that is sequestered on a millennial timescale (Brunner *et al.*, 2024). In this report, we refer to this as 'durable CDR'.

Durable CDR capacity must be scaled up substantially in the next few decades, but a lack of sufficient demand hinders this. Durable CDR technologies are not yet proven and operational at scale: in 2023 just 1.35 Mt CO_2 was removed with durable technologies (Pongratz *et al.*, 2024). While there is a lot of uncertainty about how much durable CDR would be necessary to limit global warming to 1.5°C or well below 2°C, durable CDR deployment will need to scale up substantially towards the middle of this century. However, scaling up CDR has been hindered by a lack of demand from the private sector and public institutions alike. That is partly because CDR deployment can bring benefits for society as a whole by limiting global warming, but it offers no benefits to individual purchasers of CDR – other than being able to count removals towards net-zero targets or for marketing purposes.

Although voluntary standard-setters translated the global goal of 'net zero CO_2' to the corporate level, they do not yet provide guidance on the role of companies in contributing to the scale-up of durable CDR. Most of the world's largest companies have set net-zero targets for their own operations and value chains (Net Zero Tracker, 2025), with many of them following guidance from the Science Based Targets initiative's (SBTi) Corporate Net Zero Standard (CNZS). However, the CNZS currently does not require companies to finance CDR in the short term, although the SBTi is considering introducing removal targets for scope 1 emissions (SBTi, 2025b). Other guidance documents for corporate net-zero targets, including the International Organization for Standardization's (ISO) Net Zero Guidelines and recommendations by a High-Level Expert Group on the Net-Zero Emissions Commitments of Non-State Entities (HLEG), also do not provide any requirements for companies to finance CDR. This lack of guidance on how companies can contribute to the scale-up of CDR in the near term is a gap that voluntary standards should address. Without clear requirements, most companies would have no incentive to finance removals in the near term, making it highly unlikely that they will be able to achieve net zero in the coming decades. Ultimately, this reduces the likelihood of avoiding the worst impacts of global warming.

Voluntary standard-setters do not yet provide sufficient criteria on which types of CDR can be used to balance out residual emissions. The current versions of the SBTi's CNZS and the ISO Net Zero Guidelines state that companies should reduce their GHG emissions by at least 90% and 95%, respectively, and that residual emissions should be neutralised with 'permanent' CDR (ISO, 2022; SBTi, 2024). The guidance documents do not provide a definition of 'permanence' or criteria for the CDR used to neutralise residual emissions. The ISO guidelines explicitly allow for CDR from afforestation and reforestation to be used for counterbalancing emissions, even though scientists warn that these types of CDR do not neutralise the climate impacts of ongoing fossil fuel emissions (Allen *et al.*, 2024; Brunner *et al.*, 2024). In addition, there has been limited discussion on whether corporate support for CDR should be tied to expected residual emissions rather than, for example, historical emissions or ability to pay.

How does this report relate to the Corporate Climate Responsibility Monitor?

This report is to our best knowledge the first to focus exclusively on durable CDR and its role in corporate climate responsibility. It examines corporate responsibility for scaling up durable removals and provides recommendations to voluntary standard-setters, such as the SBTi (Sections 2-5). Section 6 presents an overview of how 35 companies across seven sectors are incorporating durable CDR into their strategies and assesses the transparency and integrity of these companies' CDR approaches. The methodology for these assessments can be found in the Annex.

The findings of this report have directly informed revisions to our methodology for evaluating responsibility for ongoing emissions and scaling up durable removals in the 2025 *Corporate Climate Responsibility Monitor* – an annual publication that assesses the transparency and integrity of corporate climate strategies (NewClimate Institute, 2025b).

2 Carbon dioxide removals

2.1 What is CDR?

Carbon dioxide removal refers to human activities that capture CO_2 from the atmosphere and store it durably in geological, land, or ocean reservoirs, or in products (IPCC, 2022a). CDR must result in net removals: the CO_2 taken from the atmosphere must be greater than the GHG emissions emitted into the atmosphere as part of the CDR activity (Tanzer and Ramírez, 2019).

CDR is the result of ongoing human interventions and is different from natural processes that remove CO_2 from the atmosphere, such as photosynthesis, and from passive uptake of CO_2 that occurs as a consequence of past emissions (Allen *et al.*, 2024). CDR is also different from carbon capture and sequestration (CCS), where CO_2 is captured at the point of emission and stored before it can enter the atmosphere. When the captured and stored CO_2 is of fossil or geological origin, CCS is a way to reduce emissions, not to remove them (Carbon Gap, 2022).

The durability, maturity, costs, removal potential, and limitations of the different CDR technologies vary widely *(see Table 1)*. In this report, we categorise different CDR methods based on how long they sequester carbon:

- **Durable CDR methods** store carbon for at least 1,000 years. This includes bioenergy with carbon capture and storage (BECCS) and direct air capture and storage (DACCS); Biochar may also fall in this category, but there is scientific uncertainty about whether biochar sequesters carbon for centuries or millennia (Geden *et al.*, 2024; Sanei *et al.*, 2024, 2025).
- **Non-durable CDR** methods store CO_2 for less than 100 years. This includes afforestation and reforestation (AR), which account for most current CDR (around 2 $GtCO_2$ per year) (Pongratz *et al.*, 2024).

This categorisation is relevant because ongoing CO_2 emissions from fossil origin can only be neutralised with removals stored on a millennial timescale (Allen *et al.*, 2024; Brunner *et al.*, 2024). This is the case because the CO_2 from fossil fuels would be stored underground forever if those fossil fuels were not burned. Once it enters the atmosphere, CO_2 remains there for thousands of years. Atmospheric CO_2 concentrations can be brought down by removing and subsequently storing CO_2, but given carbon dioxide's long lifespan, storage of less than 1,000 years is insufficient for neutralising CO_2 emissions and will lead to additional global warming (Brunner *et al.*, 2024).

Durable CDR technologies are not yet operational at scale. The technology readiness levels (TRLs) of the various durable CDR methods range from 1-2 for ocean-based CDR to 6 for DACCS. A TLR of 6 means that the technology is demonstrated in a relevant environment but not yet proven at a wider scale (De Rose *et al.*, 2017). Accordingly, the sustainable potential of various durable CDR technologies may not actually materialise.

Large-scale application of durable CDR methods will have a range of negative consequences *(see Table 1)*. Despite the necessity of durable CDR for reaching net zero, the various technologies for durable CDR carry sustainability risks that can significantly impact the environment and people, especially when deployed on a large scale (Deprez *et al.*, 2024; Hansson *et al.*, 2024). For example, BECCS and biochar put high pressure on land resources, as cultivating crops takes up a lot of space (Chiquier *et al.*, 2025). This may lead to loss of biodiversity, competition with food production and stress on water resources. Other CDR methods, such as DACCS, need a large amount of renewable energy and would directly compete with other activities that need renewables to decarbonise. This stresses the need for prioritising deep emission reductions and funding a diverse suite of methods (WKR, 2024).

Although non-durable CDR methods are highly vulnerable to the reversal of carbon storage, they are critical in achieving wider ecosystem objectives. Methods such as afforestation, reforestation and peatland restoration can bring a range of benefits for biodiversity and soil quality, among others. Their low durability should not be a reason to stop funding these methods, but their function cannot be to counterbalance emissions from fossil fuels.

Table 1: Overview of CDR approaches

Approach		Durability[1]	TLR[2]	Costs (USD/tCO_2)[3]	Environmentally constrained removal potential ($GtCO_2$/yr)[4]	Risks and constraints[5]	Environmental co-benefits[5]
CDR stored in **geological formations** has high durability and a relatively high removal potential but also faces several social and environmental limitations.	**BECCS**	>10 millennia	5-6	100-200	0.5-5	Land availability; food security; monoculture affecting biodiversity and soil health; high water requirements	Energy production
	DACCS		6	100-300	0.5-5	High (clean) energy and water consumption; pollution from by-products	Potential source of synthetic carbon (although in this case, DACCS would not count as removal)
CDR measures with **mineral storage** have high durability but are still in their early stages of development.	**Enhanced weathering**	Centuries to millennia	3-4	50-200	2-4	Water and air pollution from mining; loss of habitats	Improved soil carbon, acidity, and water retention; reduced erosion
	Ocean alkalinisation		1-2	82-181	Uncertain	Environmental consequences are uncertain. They could be positive or negative.	
CDR stored in **vegetation, soils and sediments** can bring numerous co-benefits for local ecosystems and communities but has low durability, which makes it unsuitable for neutralising ongoing emissions.	**Biochar**		6-7	30-120	0.5-2	Plant resilience; ecosystem albedo; land degradation; habitat loss	Improved soil quality and fertility; benefits to water; reduction of non-CO_2 emissions; increased crop yield; drought resilience
	Afforestation and reforestation (AR)	Decades to centuries	8-9	5-50	0.5–3.6	Land availability; food security	Enhanced biodiversity; soil carbon and nutrient cycling
	Agroforestry and improved forest managament		9	N/A	0.1-5.76	Possible unsustainable forest management with negative impacts on biodiversity	Enhanced biodiversity
	Soil carbon sequestration		8-9	0-100	2-5	Soil saturation; land scarcity	Enhanced biodiversity; improved soil quality and fertility; benefits to water
	Peatland and wetland restoration		8-9	10-100**	0.9-5.1[6]	Competes with food production; can turn into a CO_2 or CH_4 source	Enhanced biodiversity; soil carbon and nutrient cycling

[1] Based on Geden et al. (2024) .
[2] TRL is the technological readiness level, which ranges from 1 (in research stage) to 9 (proven and operational). Data from Edenhofer et al. (2024).
[3] Based on Fuss et al (2018) and Cobo et al (2023).
[4] Based on Fuss et al (2018) and Cobo et al (2023).
[5] Based on Lenton (2014), Smith, P. et al. (2016, 2019), Griscom et al. (2017), Nemet et al. (2018), The Royal Society and Royal Academy of Engineering (2018), de Coninck et al. (2018), Hepburn et al. (2019), NewClimate Institute (2020), Bey et al. (2022), IPCC (2022b), Cobo et al (2023), Edenhofer et al. (2024), Geden et al. (2024), Smith, S.M. et al (2024). We excluded economic benefits, including job creation, as these could apply to all CDR methods.
[6] Estimates are based on the total potential as we did not identify data on the environmentally constrained potential.

2.2 Why do we need CDR?

There are four reasons why we need CDR:

1. **To neutralise residual CO_2 emissions at the point of net zero and net negative thereafter**
2. **To avoid carbon budget overshoot**
3. **To reverse temperature overshoot**
4. **To neutralise the climate impact of non- CO_2 emissions**

2.2.1 Neutralising residual CO_2 emissions at the point of net zero and net negative thereafter

Limiting global warming to 1.5°C above pre-industrial levels requires deep emission reductions combined with durable CDR. The Intergovernmental Panel on Climate Change's (IPCC) Sixth Assessment Report (AR6) scenarios show that global CO_2 emissions must reach net zero around 2050, after which they must decrease to net negative, while other GHG emissions should reach net zero around 2070 (IPCC, 2022a). Net zero implies that by 2050, some residual CO_2 emissions will remain after all feasible reduction measures have been implemented. As CO_2 has an atmospheric lifetime of millennia, residual CO_2 emissions need to be neutralised with removals that are stored for millennia (Allen *et al.*, 2024; Brunner *et al.*, 2024). Storage of less than 1,000 years is insufficient for neutralising fossil CO_2 emissions and will lead to additional global warming (Brunner *et al.*, 2024). This means that CDR methods that sequester carbon for several decades, such as reforestation and afforestation, or several centuries, such as biochar, cannot be used to offset ongoing emissions from fossil fuels.

Non-durable CDR methods are not suitable for neutralising ongoing and residual anthropogenic biogenic CO_2 emissions, for example from bioenergy production and deforestation. It can take several to hundreds of years to balance out the release of CO_2 from cutting down trees and other plants, depending on the type of trees used (Holsmark, 2012; Mitchell *et al.*, 2012; Ter-Mikaelian *et al.*, 2015; Searchinger *et al.*, 2018). Unless the rotation length of biomass is very short, for example for perennial grass, anthropogenic CO_2 emissions cannot be neutralised with non-durable CDR (Liu *et al.*, 2017). In addition, using a GHG-equivalent metric to measure and account for non-durable land-based carbon sequestration can create conflicts with other indicators of ecosystem health. Compensating for deforestation in one location through reforestation in another location may indicate a net-zero impact in terms of GHG-equivalent metrics, but it completely neglects the importance of local-scale biodiversity around the globe for ecosystem health that economies and communities rely on. Similarly, maximising CDR potential in forestry projects may come at the expense of other ecosystem services if it results in monoculture and a loss in biodiversity (Sabatini *et al.*, 2019; Wang *et al.*, 2025).

2.2.2 Avoiding carbon budget overshoot

All types of CDR can help reduce net CO_2 emissions and avoid budget overshoot by compensating for continued CO_2 emissions in the short term (Lamb *et al.*, 2023). The global carbon budget is the net amount of anthropogenic CO_2 that can be emitted while keeping the global temperature increase below a certain limit (Lamboll *et al.*, 2023). The remaining carbon budget, which is associated with a 50% likelihood of limiting global warming to 1.5°C, is projected to be exhausted by 2030 (Lamboll *et al.*, 2023). The higher emissions are in the short term, the faster the global carbon budget will be depleted. Efforts to stay within the carbon budget should therefore prioritise rapid emission reductions. However, CDR can reduce net emissions and support efforts to stay within the carbon budget.

2.2.3 Reversing temperature overshoot

Durable CDR could potentially reverse temperature increases as a result of budget overshoot, but there is no guarantee that temperatures would actually decrease again (Schleussner *et al.*, 2024). Overshoot is likely to trigger climate tipping points, which are critical thresholds in the Earth's system. If passed, climate tipping points can cause sudden, severe and even irreversible damage to ecosystems and societies (Dietz *et al.*, 2021; Bauer *et al.*, 2023; Schleussner *et al.*, 2024; WKR, 2024).

2.2.4 Neutralising the climate impact of non- CO_2 emissions

GHG emissions are split into two categories: CO_2 emissions (comprising only carbon dioxide emissions) and non- CO_2 emissions (comprising a range of other gases, including methane, nitrous oxide and F-gases).

Long-lived non- CO_2 GHGs should rapidly decline, and their climate impact can be neutralised with durable CDR. Nitrous oxide (N_2O) and fluorinated gases (F-gases) are long-lived GHGs with a strong warming potential. Both N_2O and F-gas emissions have rapidly increased in the past years and if this continues, it is extremely unlikely that global warming can be limited to 1.5°C (IPCC, 2022a; UNEP and FAO, 2024). This underlines the need for rapid N_2O and F-gas emission reductions in the near term. These GHGs should be significantly reduced in the coming decades, but modelled pathways show that some residual N_2O and F-gas emissions will remain at the point of net-zero GHGs, around 2070 (IPCC, 2022a). These residual emissions should be counterbalanced by net-negative CO_2 emissions, which requires additional CDR. Since N_2O and F-gases occur in the atmosphere at much lower concentrations than CO_2, it would be relatively expensive to develop removal technologies for them specifically (WKR, 2024).

Methane emissions should also rapidly decrease to limit global warming. Methane remains in the atmosphere for about 12 years but has a much stronger warming effect than CO_2 (IPCC, 2021). After methane breaks down in the atmosphere, it is converted into CO_2 and water. In the case of biogenic methane (e.g. from enteric fermentation), this CO_2 was already part of the atmospheric carbon cycle, whereas fossil and geological methane add CO_2 from other carbon pools to the atmosphere. Fossil and geological methane therefore have a temporary and a permanent impact on the climate (WKR, 2025). Given its potent climate forcing effect in the short term, increasing methane emissions can hinder efforts to limit global warming to 1.5°C. Therefore, it should be a top priority for countries and companies alike to reduce methane emissions. In modelled pathways that show a >50% likelihood of limiting global warming to 1.5°C with no or only limited overshoot, global methane emissions decrease by 34% between 2019 and 2030 (IPCC, 2022a).

Methane emissions from fossil fuels or degraded peat land should be neutralised with durable CDR. As explained above, methane breaks down into CO_2 and water at the end of its lifetime in the atmosphere. Methane emissions from fossil fuels, degraded peat lands and thawing permafrost should be neutralised with durable CDR, as they originate from the slow carbon cycle and add additional CO_2 to the atmospheric carbon cycle (WKR, 2025).

Non-durable CDR is an unsuitable approach to neutralise biogenic methane emissions. Some argue that the non-durability of land-based CDR may be acceptable for counterbalancing shorter-lived residual GHGs, like biogenic methane (Brunner *et al.*, 2024). This is also referred to as the 'like-for-like' approach for CDR. However, despite the need and ability of companies to play a role in the protection and restoration of ecosystems, we see serious limitations with regards to quantifying non-durable land-based carbon sequestration in a GHG-equivalent metric at the corporate level, and pursuing measures to maximise that metric:

- **Non-durable CDR is highly prone to MRV inaccuracies,** creating significant uncertainty around the amount of carbon removed and stored permanently, despite major efforts and technological advances aimed to improve this. Estimates of the carbon uptake potential of AR and soil carbon sequestration are subject to large uncertainties and vary between regions and years (Krause *et al.*, 2018; Dooley *et al.*, 2022; IPCC, 2022a; Almaraz *et al.*, 2023; Wang *et al.*, 2023). Scientists have pointed out that higher estimates of soil carbon sequestration potential are likely substantial overestimates (Poeplau *et al.*, 2017; Moinet *et al.*, 2023). Regular measurement of soil carbon stocks at various depths in the soil would be essential if this CDR method were to be used to neutralise biogenic methane emissions, but this would result in high costs. This makes it unfeasible to accurately determine the volume of carbon removals.

- **It is unclear whether there would be sufficient land available to neutralise residual shorter-lived GHGs with non-durable CDR.** Even if the aforementioned challenges could be overcome, using non-durable CDR to neutralise residual methane emissions would only be scientifically defensible if the more appropriate GWP20 metric were applied. This is because GWP100 – the standard metric – significantly understates the short-term climate impact of methane (WKR, 2024). While there may be good reasons for using GWP100 for policy and modelling contexts, this metric is not suitable for calculating how many tonnes of CO_2 a company should remove to neutralise its methane emissions in the short term. It would allow companies to claim 'net-zero emissions' when in fact their business activities continue to contribute to global warming in the near term. In a 'like-for-like' framework, where short-lived greenhouse gases are neutralised by temporary removals, GWP20 better reflects the actual warming effect that companies are claiming to counterbalance. However, the GWP of methane using GWP20 is nearly three times higher than the value under GWP100 (IPCC, 2021), approximately tripling the volume of carbon removals that would be required, raising questions about land availability, ecological trade-offs and feasibility.

- **Moreover, there is a risk – which we see materialising in practice *(see section 6.8)* – that companies will use non-durable removals to avoid or delay the systemic transitions needed to reduce methane emissions at source.** What is framed as a tool for addressing 'residual' emissions could ultimately weaken incentives for real mitigation – especially in agriculture, where deep methane reductions remain challenging but essential.

2.3 How much CDR do we need?

Climate models do not sufficiently consider real-world limitations to scaling up CDR, resulting in unrealistic projections of how much CDR can be used to limit global warming to 1.5°C. The amount of CDR necessary to limit global warming to 1.5°C depends on the pace at which CO_2 and other GHG emissions are reduced and the amount of residual CO_2 emissions by mid-century. However, there are environmental and social constraints to how much CDR can be deployed in reality *(see Table 1)*. Integrated assessment models (IAMs) projecting scenarios with no overshoot show that residual CO_2 emissions could range from 1.8 to 12 Gt at the point of global net zero, whereas scenarios for 1.5°C with overshoot project residual CO_2 emissions of 6.2 to 18 Gt (Lamb, 2024)**. Climate models project lower levels of CDR deployment in scenarios with rapid and deep emission reductions, compared to less ambitious mitigation scenarios** (Gidden *et al.*, 2024)**. However, many of these climate models favour future CDR deployment over near-term emission reductions which undermines the mitigation hierarchy that should be at the centre of CDR policy** (Grubert and Talati, 2024)**. In addition, the underlying assumptions regarding low CDR costs, high abatement costs, lack of mitigation measures and real-world limitations to scaling up CDR may be incorrect, meaning that the sustainable potential for CDR may be lower than these projections** (Köberle, 2019; Prütz *et al.*, 2023).

- **Low costs of CDR and high abatement costs:** Most IAMs primarily formulate least-cost pathways, so the amount of CDR is determined primarily by its cost compared to emissions reductions. As a result, IAMs tend to favour CDR later in the century over expensive mitigation measures in the near future (Prütz *et al.*, 2023). However, IAMs often assume unrealistically low costs for CDR (Chiquier *et al.*, 2025).

- **Lack of mitigation measures:** Further, many of the IAMs assume a continued increase in energy demand, limited improvements in end-use efficiency and no disruptive innovations that could significantly reduce emissions (Köberle, 2019). These assumptions may be overly pessimistic about the emission reductions that are technologically feasible.

- **Real-world limitations to scaling up CDR:** Climate models do not sufficiently consider the implications of durable CDR deployment on planetary boundaries (Cobo *et al.*, 2022). BECCS and DACCS are the two most important durable CDR methods in climate models. However, large-scale BECCS and other bio-based carbon dioxide removals may push the Earth system closer to planetary boundaries for freshwater use and biogeochemical flows (Heck *et al.*, 2018; Cobo *et al.*, 2022). DACCS has fewer negative implications but requires large amounts of clean energy, which is currently not available and is also sought after by other sectors.

In addition to uncertainty about residual emissions and the pace at which emissions will be reduced, there is uncertainty about how much CDR is necessary to neutralise the climate impact of emissions. The global carbon cycle is complex and many aspects of it remain poorly understood. Carbon cycle processes influence how much carbon flows between atmospheric, terrestrial, ocean and geological reservoirs (Keller *et al.*, 2018). The carbon cycle responds differently to emissions and removals of CO_2 (Zickfeld *et al.*, 2021). Modelling studies suggest that emitting a certain amount of CO_2 into the atmosphere has a greater impact on atmospheric CO_2 concentrations than permanently removing that same amount. This suggests that emitting and then removing 1 tCO_2 may not have the same outcome for net atmospheric emissions and temperature as avoiding the emission in the first place.

3 Current landscape of durable CDR

3.1 Status of investment and deployment

Removals through biochar and durable CDR are increasing but still account for just a tiny fraction of all carbon dioxide removals. Non-durable CDR accounts for 99.9% of the approximately 2.2 $GtCO_2$ per year that is removed from the atmosphere and stored in land, ocean and geological sinks (Pongratz *et al.*, 2024). In 2023, durable CDR technologies removed and stored 1.35 tCO_2, which is a doubling compared to 2021. Biochar and BECCS jointly account for virtually all of this.

Most funding for CDR startups comes from private sources, including venture capital, private equity and companies (Nemet *et al.*, 2024). DACCS and biochar were the two CDR technologies that received most funding in recent years, followed by forestry-based CDR. More than two thirds of funding for CDR came in the form of grants and seed investments between 2020 and 2023, suggesting that CDR projects are not yet commercially viable.

Most corporate funding for durable and non-durable CDR is channelled through the voluntary carbon market (VCM), which can be a vehicle for scaling up these removals but also has several limitations. The VCM has a strong focus on emission reduction or avoidance projects: CDR credits account for less than 10% of all credits sold on the VCM in 2023 (Fuss *et al.*, 2024). Most of these CDR credits come from non-durable removals, but the market for durable CDR is growing rapidly. Between 2022 and 2023, the volume of durable CDR credits sold increased sevenfold. However, in the absence of stricter requirements on carbon credit quality and use, it is unlikely that the VCM will become a key driver of durable CDR scale-up. This is mostly because durable CDR credits are significantly more expensive than credits for non-durable CDR or emission reductions (Fuss *et al.*, 2024; Johnstone *et al.*, 2025). Most companies that purchase carbon credits are looking for cheap options, and only those with a high willingness to pay source expensive credits from relatively new technologies. A downside of the VCM is that the negative impacts of CDR are not priced in. Individual buyers may use the credits to claim a net-zero footprint, but society experiences the negative impacts, such as water scarcity and biodiversity decline. For this reason, it is also necessary that governments and voluntary standard-setters set requirements related to credit quality and use.

Although corporate funding for durable CDR is increasing, there is significant uncertainty about future funding flows. Durable CDR purchases, in tonnes of CO_2, increased from almost 600 $ktCO_2$ in 2022 to 8 $MtCO_2$ in 2024 (*CDR.fyi*, 2025b). This includes removals that are not yet delivered. Microsoft accounted for more than 70% of all-time contracted durable CDR by the end of 2024, while companies like Airbus, Amazon, Equinor and Google were also among the top corporate buyers (*CDR.fyi*, 2024). However, there is limited influx of new buyers in the market: although the volume of contracted durable CDR is increasing, most of this is driven by a few corporates that kickstarted the market a couple of years ago (Höglund and Farsan, 2025).

Regulatory efforts to scale up durable CDR are under development, but not yet widespread. Governments play various role in CDR development: They act as funders, buyers, and regulators (Gosalvez, 2024). While there are promising efforts underway in various countries, government funding and regulation for CDR are not yet driving the development of CDR projects at scale. Section 4 provides some examples of how governments in North America and Europe fulfil these roles.

3.2 Risk of double counting and misuse

Corporate support for durable CDR comes with the risk of double counting removals. Double counting occurs if two or more entities, for instance a company and a national government, both count or claim the same removal towards their climate targets. This is problematic because it may disincentivise additional reduction efforts and lead to higher atmospheric CO_2 concentrations compared to the scenario where just one entity counts the removal.

For a company to make an offsetting or neutralisation claim, it is imperative that the claimed removal results in a real, additional and permanent reduction in atmospheric CO_2 concentrations and is neither double counted nor double claimed. In situations where reductions or removals of GHGs cannot be attributed uniquely to one actor, coordination between these actors is necessary to ensure double counting and/or double claiming are effectively avoided. Such a situation arises when corporate buyers are involved, because activities take place within a country's national borders. The default is that countries count the change in GHG emissions in their inventories and claim progress towards their emission reduction targets. This progress might lead to national governments making fewer efforts on other decarbonisation measures. In such a case, corporate support for durable CDR does not lead to lower atmospheric CO_2 concentrations and any neutralisation claim is not credible. Instead, the corporate buyer is merely providing financial support to the country to achieve its target.

Some argue that double counting by national governments and companies does not matter, because corporate GHG accounting is separate from national GHG accounting: like emission reductions, removals can be claimed by both national governments and companies. This argument, however, does not address the core of the issue. The problem is not that removals are accounted for in two separate bookkeeping systems, but rather that a corporate buyer uses removals to claim its GHG emissions are neutralised. For such a claim to be credible, the purchased removals must lead to lower atmospheric CO_2 concentrations compared to what would have happened anyway (Brander *et al.*, 2022). This is not guaranteed if the removals count towards a country's climate target.

While most removal verification standards have rules in place to avoid double counting between corporate buyers, they do not address double counting between national governments and companies. Gold Standard requires a corresponding adjustment to all removals, regardless of whether these are registered as an Article 6 activity (Gold Standard, 2022). Other verification standards, such as Puro and Isometric, allow project developers to sell removal credits that are also used towards national climate targets of the country where the removal project takes place, with just a few exceptions[1] (Isometric, 2025; Puro, 2025). Notably, the EU's Carbon Removal Certification Framework also does not include clear requirements that prohibit double counting of removals by corporate buyers and national governments (EU, 2024; Stoefs, 2024). In the absence of clear rules aimed at avoiding double counting of removals towards national and corporate climate targets, there is a material risk that corporate support for durable CDR does not result in lower atmospheric CO_2 emissions, undermining the credibility of corporate net-zero claims.

1 *Puro requires a corresponding adjustment only for removals that are registered as an Article 6 activity. Isometric has requirements in place to mitigate the risk of double claiming removals by airline operators under the Carbon Offsetting Scheme for International Aviation and governments towards their Nationally Determined Contributions. Both standards also have guidelines in place to avoid that the same removal credit is used, claimed, or counted by more than one corporate buyer.*

4 Governments’ role in scaling up durable CDR

4.1 CDR is a public good

The sustainable potential of durable CDR is limited, which means it is a scarce resource that cannot serve as a fix-all remedy for ongoing emissions. IAMs currently steer the political discourse about the scale and types of CDR that will be needed, but they do not take into account real-world limitations to CDR deployment that restrict its sustainable potential *(see section 2.3)*. For instance, BECCS is limited by the availability of land and biomass, and DACCS is limited by the availability of clean energy *(see Table 1)*.

CDR should only be used to neutralise residual emissions in sectors that cannot decarbonise with existing technologies, or novel technologies that become available in the coming decades (NewClimate Institute, 2024). Deep and rapid emission reductions should be the top priority of governments and companies alike. Sectors that are easier to decarbonise should do so as quickly as possible to avoid placing additional demand on the limited CDR potential and hindering efforts to limit global warming to 1.5°C (Shindell and Rogelj, 2025).

CDR should be treated as a public good, and society should exercise collective ownership over CDR deployment, allocation and the acceptance of potential trade-offs. CDR can be considered a common pool resource: its impact transcends borders and benefits the world as a whole by reducing atmospheric CO_2 concentrations; groups cannot be easily excluded from its use and impact; and it has finite availability (IPBES, 2025). While CDR itself will be deployed by national governments and private actors, its purpose and impacts position it as a public good. Given its scarcity and potential negative trade-offs, societies should decide on acceptable levels of CDR deployment and residual emissions across sectors, informed by scientific insights (WKR, 2024). This will help ensure that polluters have an incentive to reduce their emissions, rather than rely on future CDR that may never materialise or have negative sustainability impacts. Currently, some corporate actors are scrambling to purchase scarce CDR potential with the intention of claiming it towards their net-zero targets, even though their businesses are not necessarily among the most difficult to decarbonise (Shindell and Rogelj, 2025). For instance, as of June 2025, tech companies and oil majors are among the main contractors for both durable CDR and removals stored in forest ecosystems with the aim of reaching their net-zero targets (*CDR.fyi*, 2025c; Nbs. *CDR.fyi*, 2025), even though these companies should rapidly decarbonise under 1.5°C-aligned mitigation pathways *(see also section 6)*. Governments have a crucial role to play in shaping the development and deployment of CDR now to ensure it develops according to the values and needs of society, rather than driven by market interests (Grubert and Talati, 2024).

Big polluters carry a large responsibility for scaling up durable CDR, as removals are necessary to compensate for their past and ongoing emissions. However, ability to pay may also inform decisions on which companies could financially contribute to durable CDR. The polluters-pay principle is well established in international law. It provides that those who cause environmental harm should bear the costs of it. Durable CDR is needed because of historical and ongoing GHG emissions: It would be fair for those who contributed most to climate change to bear the largest share of the costs for durable CDR. These are mostly fossil fuel producers (InfluenceMap, 2025), but importers and large consumers of fossil fuels also carry a large responsibility for climate change. Governments can require those big polluters to carry a large share of the burden for durable CDR. However, it could be possible to complement a polluter-pays-approach with an ability-to-pay approach to ensure that sufficient finance flows to durable CDR. In this case, companies that carry limited responsibility for climate change but are able to act and contribute could also be required to contribute to CDR.

4.2 Regulation and policy to enable scale-up

National, and in some cases regional, governments are best placed to drive decision-making processes about CDR. Given the limited sustainable potential of CDR, oversight of CDR development is necessary to ensure that short-term demand helps generate supply while at the same time it is not being used to offset continued unabated emissions, which would reduce capacity for removing CO_2 from the atmosphere in the long term (Grubert and Talati, 2024). Leaving the development of CDR entirely up to the market introduces significant risks, particularly since the market prioritises profit and often fails to account for negative externalities, sustainability limitations and societal needs. Governments can implement policies that balance environmental, economic and social priorities to ensure that CDR deployment aligns with the public interest and global climate goals.

Governments hold the primary responsibility for enabling and guiding the scale-up of CDR through oversight, policy, regulation and public finance, but are not yet fulfilling this role sufficiently. While companies and voluntary standard-setters will play an important role, governments are uniquely positioned to take responsibility for scaling up durable CDR, given their authority and mandate to develop and enforce regulation, ensure accountability and balance societal needs in the long term. To ensure that CDR is deployed responsibly and supports global net-zero goals, governments can take action in three key ways: establishing robust regulation to guide deployment; financing and scaling up CDR (including supporting research and development as well as deployment); and monitoring storage in the long term. The following sections present some examples of how governments can do this. While policymakers in various jurisdictions have started to enable and guide the scale-up of CDR, regulation and policies are not yet sufficiently developed.

4.2.1 Establish robust regulation

In addition to financing research, development and removals deployment, governments play a critical regulatory role and should establish a robust policy infrastructure to guide CDR development and ensure that CDR supports, rather than undermines, climate goals.

As a first step, governments should set separate targets for emission reductions, durable CDR and non-durable CDR (European Scientific Advisory Board on Climate Change, 2025). Setting three separate targets highlights the importance of reductions, permanent removals and non-permanent removals in achieving climate targets and wider environmental objectives while helping generate dedicated support for all three. At the same time, it avoids emission reductions, durable CDR and non-durable CDR being used interchangeably and ensures that countries or companies do not hide a lack of progress towards emission reduction targets behind their support for CDR.

Governments should determine national and sectoral limits for residual emissions that are aligned with sectoral decarbonisation pathways for reaching net zero and keeping warming to 1.5°C, along with the corresponding amount of CDR necessary to neutralise those emissions. To prevent overreliance on CDR, governments should set limits on the total amount of CDR that can be used for the purpose of balancing residual emissions to reach net zero (WKR, 2024). These limits should be aligned with sectoral decarbonisation benchmarks. Additionally, setting limits on the types and amount of CDR that can be used by each sector helps account for differences in emissions reduction potential, while ensuring that decarbonisation remains the priority (WKR, 2024).

Because CDR involves risks, governments must lead decision-making about potential implications and trade-offs of CDR projects in consultation with those who may be impacted. From a technical perspective, decision-makers have oversight of land use planning and must carefully balance competing land-use needs, energy consumption requirements, resources needed to develop and construct infrastructure and trade-offs from large-scale CDR deployment (Bergman and Rinberg, 2021; WWF EU, 2025). It is also the responsibility of governments to implement environmental and social safeguards, which are essential to address concerns around equity, justice, and long-term impacts of removals, both within national borders and abroad, if governments are paying for removals that occur elsewhere.

Governments must play a central role in designing strong, science-based certification methodologies for CDR, along with appropriate monitoring frameworks, to ensure that removals are safe, reliable and truly additional. From the start, it is crucial that governments develop and adopt robust standards for quantifying, assessing and monitoring CDR activities. Voluntary initiatives and other key stakeholders can play a role in supporting these methodologies. If governments are to incorporate removals into existing emissions trading markets, they must ensure that removal credits are certified using strong, science-based methodologies to maintain integrity and avoid risks associated with leaving standards development entirely to non-governmental actors (De Simone and Stoefs, 2023; Schenuit *et al.*, 2023; Fallasch and Böttcher, 2024; WKR, 2024; WWF EU, 2025).

In their role as regulators, governments should enact policies to build up an adequate CDR supply. In addition to the points mentioned above, this includes policies on transport and storage permitting, providing funding for the development of durable CDR and scaling up demand for CDR, which would provide more long-term certainty to CDR project developers. This could include public procurement strategies or taxes *(see section 4.2.2)*, but also requirements for non-state actors to set durable CDR targets. For instance, the Swiss Climate and Innovation Act provides that the federal and subnational governments must ensure that CDR technologies are sufficiently available by 2050 for Switzerland to meet its net-zero target, either within the country's own borders or abroad (Article 3.5) (Switzerland, 2022). The Act further requires all companies to reach net-zero scope 1 and 2 emissions by 2050 and allows them to prepare transition plans, which could help drive corporate demand for CDR (Article 5).

4.2.2 Finance and scale up CDR

Governments, in their role as buyers, funders and regulators, are responsible for creating financial incentives to accelerate the research, development and deployment of durable CDR, and they can do this in a variety of ways (Gosalvez, 2024). Developing and implementing durable CDR will require additional public investment due to high costs, the current level of technological development, the scale needed and long timelines. Setting up these funds and finance flows now will help ensure that CDR is available at scale when needed and that future generations do not bear the full costs.

Governments should contribute to scaling up financing for removals and storage, for instance by implementing taxes, developing public procurement strategies and procurement obligations or using market mechanisms (i.e. carbon markets or trading schemes) (Hickey *et al.*, 2023; WKR, 2024). In terms of generating finance, regulators could establish dedicated funds for CDR and require companies to contribute through taxation, procurement obligations or direct investments in a range of technologies (WKR, 2024). Governments could also use revenues from emission trading scheme (ETS) allowances to support the scale-up of CDR, although in jurisdictions with established ETSs, revenues may already be earmarked for emission reduction measures. In the EU, for example, a large share of EU ETS revenues is used for climate and energy purposes (EEA, 2024). In this situation, there may be a need for additional funding rather than redirecting revenues from abatement activities to CDR. Another potential source for funding is existing fossil fuel subsidies, which could be redirected to fund climate action, or the implementation of an (additional) carbon tax on carbon-intensive companies.

Several governments have created dedicated funds for CDR. The United States has been the frontrunner in providing CDR funding, but there are large uncertainties about the continuation of federal support for durable removals (Silverman-Roati *et al.*, 2025). The US government rapidly scaled up funding for CDR projects through the Inflation Reduction Act and the Bipartisan Infrastructure Law, which brought tax incentives and deployment grants (Gosalvez, 2024; Schulte *et al.*, 2024). For instance, the Bipartisan Infrastructure Law provides USD 3.5 billion for the Regional Direct Air Capture Hubs programme (Nemet *et al.*, 2024; Silverman-Roati *et al.*, 2025). Other governments that fund CDR demonstration programmes include Australia, Canada, the European Union, Japan, Norway and the United Kingdom (Nemet *et al.*, 2024).

Governments can also provide subsidies, buy CDR directly or develop financial agreements that encourage investment by reducing risk (Gosalvez, 2024; Meyer-Ohlendorf *et al.*, 2025). As an example, the Danish government's fund for negative emissions via CCS awarded contracts to three projects that aim to capture and store CO_2 from biomass in 2024 (Danish Energy Agency, 2024). The Danish government provides USD 25 million (DK 166 million) per year between 2026 and 2032, but only after the project developers have shown that they actually captured and stored CO_2. Other purchase programmes exist in Canada and the United States (Gosalvez, 2024).

4.2.3 Monitor storage

Selecting suitable storage sites and carrying out ongoing monitoring and maintenance of these sites is crucial for ensuring that CO_2 remains captured, guaranteeing the integrity of CDR in the long term (WWF EU, 2025). The responsibility for maintaining storage sites is additional to the responsibility for storing CO_2 in the first place. Storage sites need to be maintained and controlled to ensure that carbon remains captured and that parties are liable in case potential risks, such as leakage, occur (Ghaleigh and Macinante, 2023). As the actors undertaking CO_2 storage, both governments and companies should shoulder this responsibility. Companies that profit from CDR activities (i.e. those selling storage and operating sites, and those purchasing CDR). Companies that are among the biggest polluters should bear the costs for maintenance and control and take corrective measures in case of carbon leakage. Governments can provide long-term oversight of CDR.

Though companies should be responsible for CO_2 storage and maintenance as actors undertaking CDR, assigning long-term responsibility for CO_2 storage and maintenance solely to companies is risky. Businesses may merge, split or dissolve entirely over decades and centuries, making it unrealistic to expect them to guarantee responsibility over such long timescales. National governments are generally more stable and are therefore better suited to assume primary responsibility for long-term CO_2 storage. While placing this responsibility only in the hands of government would reduce corporate accountability, leaving it solely to companies could jeopardise the integrity of long-term CO_2 storage.

Though governments have a large role to play in developing, deploying and regulating CDR *(see section 4.2)*, they are not currently taking on this responsibility. It is essential to start financing and scaling up CDR now, and other actors – namely voluntary initiatives and standard-setters – can fill the gap by guiding companies to act and preparing them for future policy, until governments take on this responsibility.

5 The role of voluntary initiatives in driving demand for durable CDR

5.1 Voluntary initiatives in the corporate climate accountability landscape

In the ideal scenario, regulators require companies to reduce their emissions and to contribute to the scale-up of durable CDR and climate action beyond their value chain. As discussed in section 4, governments are best placed to regulate and scale up CDR, which is a public good, and ensure that different societal and environmental interests are taken into consideration. Governments should also set science-aligned emission reduction targets at the national and sectoral levels and require companies to reduce their emissions. In the absence of ambitious climate policies, however, voluntary initiatives can incentivise corporate climate action to bridge the gap and prepare companies for future policy.

Voluntary initiatives such as the SBTi and the ISO provide guidance for corporate climate targets. The SBTi is one of the most influential initiatives for corporate climate action, with almost 8,000 companies having their 2030 or net-zero targets validated as of August 2025 (SBTi, 2025c). The SBTi is in the process of revising its Corporate Net Zero Standard (CNZS) and expects that the updated version will be ready for roll-out in early 2026. This CNZS v2.0 will likely include requirements on removal targets in the near and longer term *(see Box 1)*. The ISO is preparing an international standard on net zero, which will build on the existing ISO Net Zero Guidelines (ISO, 2024). The development of these new standards provides a unique opportunity to incentivise corporate demand for durable CDR.

Although voluntary guidelines can provide meaningful building blocks for future legislation, they are not a substitute for it.

Voluntary initiatives are not able to adequately address ethical questions around scale-up of durable CDR. As explained in section 2, technologies for durable CDR are not yet proven at scale and have various social and environmental constraints. There should be public support for scaling up durable CDR. Fostering this support implies that there need to be discussions on what negative consequences of CDR are acceptable to society, where removals can be stored and what sectors should get priority access to available CDR. Voluntary initiatives are not able to facilitate this discussion and ensure public support. In addition, requiring companies to contribute to the scale-up of durable CDR may have unintended consequences, such as increasing prices for basic needs, which may lead to financial problems for low-income households. Whereas governments can ensure that low-income households are not disproportionately affected by this, voluntary initiatives cannot take such measures.

Voluntary guidelines are prone to being watered down due to conflicts between the various aims of a voluntary initiative and corporate involvement in the development of standards. Voluntary initiatives often perform several functions simultaneously: mobilising corporate climate action, setting standards and validating targets (NewClimate Institute, 2023). There are tensions between these various functions. For instance, if the aim is to have many companies follow a specific standard, initiatives might compromise on the scientific principles underlying their guidelines. Another issue is that companies often have a formal role in the development of climate standards, which creates a conflict of interest for those companies and risks watering down climate standards to the benefit of corporate interests. Further, voluntary initiatives lack enforcement mechanisms. For these various reasons, we consider that governments should implement policies that require companies to support the scale-up of durable CDR in the longer term.

Voluntary initiatives should not duplicate government policies and regulations. Where companies are under strict regulatory control, there is less need for voluntary corporate climate action. If, for instance, companies were under the legal obligation to procure durable CDR, voluntary initiatives should not necessarily require companies to spend additional money on removals. As national climate policies evolve, voluntary initiatives should regularly revise their guidelines to ensure that companies are not under a double burden to pay for CDR.

5.2 Recommendations for CDR requirements in voluntary standards

Based on the insights from sections 2-4 we make seven recommendations to voluntary standards.-setters. Some of these recommendations refer to the SBTi's draft CNZS 2.0 (SBTi, 2025b). We have outlined our understanding of this draft in Box 1 below.

5.2.1 Recommendations for corporate GHG reduction and durable CDR targets

⚠ 1. Require companies to set separate targets for emission reductions and support for durable CDR. These targets should not be merged into a net-zero target at the company level.

Standard-setters should require companies to commit to deep emission reductions that are aligned with 1.5°C-compatible sectoral trajectories and contribute to durable CDR, without aggregating this into a net-zero target. It would be more transparent for companies to commit to deep emission reduction targets aligned with 1.5°C-compatible trajectories. Having separate targets for emission reductions and durable removals reinforces the mitigation hierarchy and recognises that reductions and durable CDR are different commodities that cannot be used interchangeably (NewClimate Institute, 2024). Separate policies and monitoring, reporting and verification (MRV) systems are needed for each, and corporate support for CDR may be framed using different metrics than companies' emissions.

The urgency of the climate crisis means that emission reductions should be companies' priority. Deep and fast emission reductions aligned with sectoral and regional decarbonisation benchmarks should be at the core of corporate climate strategies. Removals are not an equivalent alternative to emission reductions due to issues related to non-durability, scarcity and environmental and social risks of removals.

Responsibility for scaling up CDR should be based on companies' ongoing and historical emissions rather than solely on expected residual emissions. We consider it fair that those who contributed the most to global warming to carry the largest responsibility for durable CDR *(see also* section 4.1*)*. Both historical and ongoing emissions should determine the extent to which an individual company is responsible for durable CDR. If voluntary standards tie corporate responsibility for durable CDR to expected residual emissions only, as currently proposed by the SBTi (SBTi, 2025b), some companies will not be put under any burden to take responsibility for their historical emissions. For example, electric utilities can reach real zero emissions and should therefore not rely on CDR to get to 'net zero'. However, the power sector has historically contributed to climate change through the use of fossil fuels and therefore carries a responsibility to scale up durable CDR.

However, we recognise that tying responsibility for durable CDR to historical and ongoing emissions is likely not realistic for voluntary standards. Such a requirement would put a relatively large burden and incur high costs on sectors that are most difficult to decarbonise, such as heavy industry. Companies in these sectors do not necessarily have the profit margins to invest in durable CDR (Höglund, 2023). We consider it unlikely that companies would participate in a voluntary standard if they considered the financial implications too high.

In the absence of government regulation of durable CDR, which could hold big polluters accountable for paying for durable CDR, we recommend that voluntary standards ask companies to set mandatory targets for durable CDR, which are independent from emission reduction targets. There is a need to scale up durable CDR to limit global warming to 1.5°C, but there is currently limited traction among large companies for supporting durable CDR projects *(see* section 6*)*. We propose that voluntary standards make CDR targets mandatory to ensure more financial flows towards CDR research and development. As it is not realistic to implement the polluter-pays principle to determine support for durable CDR at the voluntary level, we propose that these targets be based on companies' ability to pay, even though companies with the highest profit margins are not necessarily responsible for a large share of historical and ongoing emissions. We see this as an interim solution – when governments start to regulate durable CDR, they can decide how they want to distribute responsibility among polluters. Governments could complement a polluter-pays approach with an ability-to-pay approach to ensure that sufficient finance flows to durable CDR. In this case, companies that carry limited responsibility for climate change but are able to act and contribute could also be required to contribute to CDR.

⚠ 2. Ask companies to set monetary targets for durable CDR in the short and medium term.

It is current practice for companies to express their support for CDR in tonnes of CO_2 removed, but this may hinder investments in research and development in the near term. Companies supporting durable CDR usually report this in terms of tonnes of CO_2 removed. The SBTi's draft CNZS v2.0 also follows a tonne-for-tonne approach, under which companies would be required to purchase as many tonnes of CDR as their expected residual emissions (SBTi, 2025b). However, this tonne-for-tonne approach provides companies with an incentive to invest in the CDR options with the lowest price per tonne removed, rather than supporting the development and scale-up of a range of technologies. When and if durable CDR technologies become more widely available in the future, a tonne-for-tonne approach may become more appropriate, although issues around externalities and assigning responsibility for CDR to specific companies will remain.

By expressing support for CDR in tonnes of CO_2, there is a risk that companies do not consider the co-benefits or negative implications of certain CDR technologies in their purchase decisions. CDR may have negative social and environmental impacts. The costs of these impacts are usually borne by ecosystems, local communities or society – but not by the company that purchases removal credits. If companies are to measure their support for CDR in monetary terms (i.e. USD spent), it becomes more attractive to consider both positive or and negative implications of different CDR technologies in their purchase decisions.

⚠ 3. Provide a clear definition of what durable removals are, as well as social and environmental guardrails.

There is not one clear definition of what durable removals are. The (IPCC, 2022a) defines CDR as human activities that capture CO_2 from the atmosphere and store it durably in geological, land or ocean reservoirs, or in products. It does not define 'durably'. Others argue that it is important to consider any GHG emissions as part of the CDR process and only account for the net removals (Tanzer and Ramírez, 2019). It is important that voluntary standard-setters, informed by science, provide a clear definition of what durable CDR means to prevent companies from having to make their own interpretations.

Durable CDR technologies have a range of social and environmental limitations *(see Table 1)*. It should not be the case that corporate support for durable CDR results in other environmental or social issues. Although voluntary standard-setters are not in a position to assess every single CDR project that companies may support, they can set a number of social and environmental guardrails to minimise the likelihood that corporate support for durable CDR has negative impacts on local ecosystems and societies. In addition, voluntary standards should require companies to transparently report on the durable CDR project they support. As our analysis in section 6 shows, it is currently impossible to assess the environmental and social integrity of virtually all durable CDR project that companies financially support.

5.2.2 Additional recommendations for CDR requirements in the context of corporate net-zero targets

While we argue that emission reductions and removals should not be merged into a net-zero target at the company level, we recognise that this is currently common practice. If voluntary standards require companies to set net-zero targets, we recommend the following with regard to CDR requirements:

⚠ 4. Durable CDR should only be used to neutralise residual emissions that cannot be reduced with current technologies or those expected in the coming decades.

The sustainable potential of durable CDR is limited *(see Table 1)* and there are uncertainties about carbon cycle responses to ongoing emissions and removals *(see section 2.2.3)*. It is therefore important that companies prioritise deep emission reductions and use durable CDR only for residual emissions. Both the emission reduction targets and levels of residual emissions should be informed by sectoral and, where appropriate, regional decarbonisation benchmarks. Voluntary standard-setters should regularly review their guidelines to ensure that they reflect the newest scientific insights: some of the emissions currently expected to remain around mid-century could be reduced using novel technologies that do not yet exist.

⚠ 5. Long-term and interim durable CDR targets should cover all emission scopes.

Corporate net-zero targets should cover all emissions within a company's value chain (NewClimate Institute, 2025a). A company cannot claim to reach net zero if it has residual scope 3 emissions which it does not neutralise with durable CDR. Companies are responsible to make sure that enough CDR is deployed to cover their full value chain emissions. They can purchase CDR themselves but other companies along the value chain can also do so. If a supplier is handling their own CDR then this reduces the burden of the company to ensure the residual emissions of the supply chain are covered. Over the longer term, guidelines on how to account for durable removals in the value chain should be developed. It is critical that such guidelines are watertight and do not allow for contentious insetting approaches.

To scale the market and ensure that sufficient durable CDR will be available around mid-century, it is important that voluntary standard-setters ask companies to set interim removal targets for the full value chain. The SBTi's draft CNZS v2.0 proposes that companies set interim removal targets for their scope 1 emissions only, on the basis that scope 2 emissions will be eliminated at the point of net zero and there are large uncertainties in projecting long-term scope 3 emissions (SBTi, 2025b). However, scope 1 accounts for a small share of most companies' GHG footprint – in many cases less than 5% (NewClimate Institute, 2024). Limiting interim removal targets to scope 1 emissions will not provide enough of an incentive to scale the removals market, risking that there is a lack of available durable CDR at the point of net zero. Virtually all of the corporate funding for durable CDR to date would not have taken place if these companies had only planned to neutralise their scope 1 emissions, as most of this funding comes from the tech sector (*CDR.fyi*, 2025c; Höglund, 2025).

⚠ 6. Durable CDR for fossil emissions should ensure carbon is stored on a millennial timescale.

Carbon that is removed from the atmosphere and subsequently stored for less than 1,000 years does not truly neutralise ongoing emissions from the long carbon cycle (Brunner *et al.*, 2024). Neutralisation claims based on non-durable CDR, such as afforestation, are not credible. If voluntary standard-setters allow companies to set net-zero targets, they must also require those companies to use durable CDR to neutralise residual emissions from the long carbon cycle by the net-zero target year. This includes all fossil CO_2 and methane emissions, as well as methane from thawing permafrost and degraded peatlands.

7. Non-durable CDR should not be used to neutralise biogenic methane emissions or CO_2 emissions resulting from bioenergy and deforestation.

Non-durable CDR is an unsuitable approach to neutralise biogenic methane emissions. the need and ability of companies to play a role in the protection and restoration of ecosystems, we see serious limitations with regards to quantifying non-durable land-based carbon sequestration in a GHG-equivalent metric at the corporate level, and pursuing measures to maximise that metric: *(see sections 2.2.1 and 2.2.4)*:

- **Non-durable CDR is highly prone to MRV inaccuracies**, creating significant uncertainty around the amount of carbon removed and stored permanently, despite major efforts and technological advances aimed to improve this.
- **It is unclear whether there would be sufficient land available to neutralise residual shorter-lived GHGs with non-durable CDR.**
- **Using a GHG-equivalent metric to measure and account for non-durable land-based carbon sequestration can create conflicts with other indicators of ecosystem health.** Compensating for deforestation in one location through reforestation in another location may indicate a net-zero impact in terms of GHG-equivalent metrics, but it completely neglects other ecosystem and social indicators.
- **Moreover, there is a risk – which we see materialising in practice *(see section 6.8)* – that companies will use non-durable removals to avoid or delay the systemic transitions needed to reduce methane emissions at source.** What is framed as a tool for addressing 'residual' emissions could ultimately weaken incentives for real mitigation – especially in agriculture, where deep methane reductions remain challenging but essential.

Box 1: The SBTi's proposal for interim removal targets in the Corporate Net Zero Standard v2.0

This section is taken from our Input for the update of the SBTi Corporate Net Zero Standard (NewClimate Institute, 2025c).

The SBTi published a draft version of their CNZS v2.0 in March 2025 and invited stakeholders to provide feedback (SBTi, 2025b). The draft version included three options for removal targets, durability requirements and indicators for removals.

REMOVAL TARGETS

CNZS v1.2 required companies to neutralise residual emissions in the net-zero target year with permanent removals, without defining 'permanent'. It does not require or recognise interim removal targets. The CNZS v2.0 draft proposes three options to address residual scope 1 emissions during the transition to net-zero and from the net-zero year onwards:

1. A requirement to set removal targets for the net-zero target year and for the interim periods;
2. Optional recognition for companies that set removal targets, including interim milestones; and
3. An option to address expected residual emissions entirely through emissions reductions, entirely through removals, or through a combination of both.

The draft CNZS v2.0 explains that these three options are **limited to addressing scope 1 emissions**, because there will be no residual scope 2 emissions from energy generation in scenarios that limit global warming to 1.5°C. Additionally, there are large uncertainties in projecting long-term residual scope 3 emissions. However, the CNZS v2.0 still requires Category A companies to ensure that any residual scope 3 emissions in the net-zero target year are neutralised either by the value chain partner in direct control of these emissions, or by providing support to enable this neutralisation in the net-zero target year and thereafter.

Our understanding of the third option is that companies may address expected residual scope 1 emissions through deeper emission reductions within their own scope 1 operations. We understand that SBTi does not intend for the third option to allow companies to claim emission reductions outside their value chain toward their removal target; however, the current text could be interpreted in that way.

DURABILITY REQUIREMENTS

The draft CNZS 2.0 outlines two options for removal durability requirements:

1. **Like-for-like**, where a company's expected residual emissions are broken down by GHG type and neutralised with a CDR method that stores CO_2 for the same amount of time in which the specific GHG is persistent in the atmosphere; and
2. **Gradual shift** from less to more durable removals over time.

The first option requires that companies break down their expected residual emissions by individual GHG type and address each with specific removal methods through a like-for-like approach. Under this approach, residual methane (CH_4) emissions can be neutralised with temporary CO_2 removal (minimum 12 years), whereas residual CO_2 emissions must be neutralised with durable CDR (minimum 1000 years).The Target-Setting Methods Documentation that accompanies the draft CNZS provides an overview of the minimum durability threshold for the storage of CO_2 for four different CO_2, CH_4, N_2O and SF_6 (SBTi, 2025a).

The second option allows companies to gradually shift from less to more durable removals between 2030 and 2050, in line with the deployment of durable CDR methods projected by climate scenarios. This option implies that companies would be allowed to neutralise their residual emissions with some non-durable CDR.

INDICATOR FOR REMOVALS

The draft CNZS v2.0 describes the indicator for removals (CNZS.17) as 'the quantity of removals (direct, indirect and BVCM removals) purchased relative to the residual emissions of the company':

- Direct removals: Amount of carbon dioxide removed by sinks and pools that are directly owned or controlled by the company;
- Indirect removals: Amount of CO_2 removed by sinks and pools owned or controlled by another entity within the company's value chain; and
- BVCM removals: Amount of CO_2 removed by sinks and pools that are owned or controlled by an entity outside of the company's value chain.

6 Status quo of corporate support for CDR by sector

6.1 Main findings

We assessed the durable CDR strategies of 35 companies across seven sectors to understand why and to what extent companies are already supporting durable CDR, as well as potential risks of their support.

1. Across the board, there is some traction for scaling up durable CDR, but overall support remains low. Companies channelling significant finance into durable CDR usually do not implement deep reduction measures, suggesting that support for CDR may replace deep decarbonisation.
2. The environmental and social integrity of CDR projects remains a blind spot.
3. The risk of double counting of removals by national governments and corporate buyers may hinder additional emission reduction efforts and lead to misleading net-zero claims.

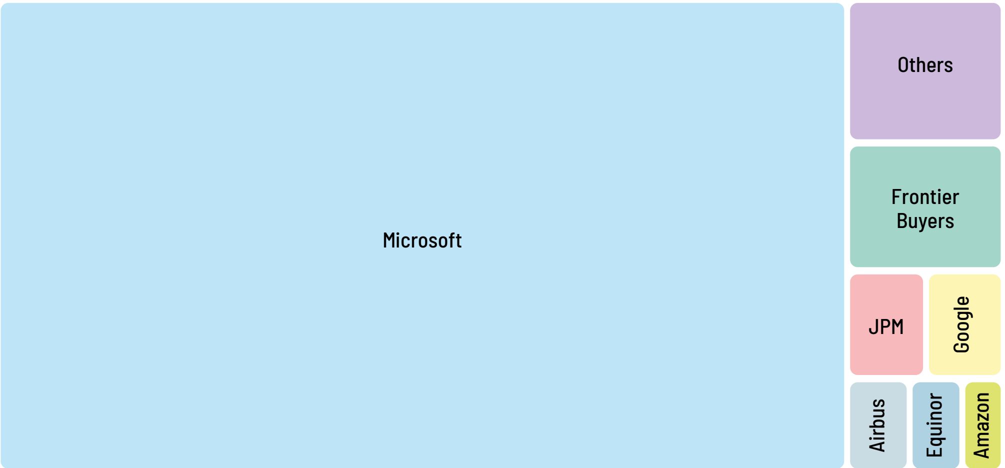
6.1.1 Growing but limited traction for durable CDR in most sectors

Most companies supporting durable CDR do so to reach their net-zero commitments, but those commitments are in many cases not underpinned by 1.5°C-aligned emission reduction targets. Given the limited sustainable potential of durable CDR and uncertainties about carbon cycle responses to ongoing emissions and removals, companies must prioritise deep emission reductions and use durable CDR only for residual emissions. However, we find that companies supporting durable CDR usually do not commit to deep emission reductions. Using durable CDR to neutralise emissions that can be reduced is not credible and undermines global efforts to limit global warming to 1.5°C

Durable CDR appears to be particularly prominent in the tech sector, with four of the five assessed tech companies purchasing durable CDR. In 2024, Microsoft alone is responsible for 84% of all durable CDR purchased globally, while Google accounts for 2% *(see Figure 1)* (*CDR.fyi*, 2025c). The main reason why tech companies invest in durable CDR appears to be achieving their net-zero targets between 2030 and 2040. However, these net-zero targets are not underpinned by deep emission reduction targets, and tech companies' emissions have soared in the past five years (NewClimate Institute, 2025b). Support for durable CDR may distract from deep emission reductions in the tech sector.

Durable CDR is also becoming a focus in the aviation industry. Four of the five airlines assessed in this report are investing in CDR or direct air capture (DAC) technologies. As in the tech sector, achieving net-zero targets seems to be an important driver of airlines' investments in durable CDR. In addition, some airlines are investing in DAC to build out the production infrastructure for power-to-liquid (PtL) fuels, which are necessary to reduce emissions from aircraft (CAT, 2024). PtL fuels are produced with electricity, water and CO_2, which can be sourced through DAC.

Figure 1: Overview of the 20 largest purchasers of durable CDR (by volume)*



The category 'others' includes 13 companies. Underlying data for this figure comes from CDR.fyi (cut-off date 18 July 2025).

We see some traction for scaling up durable CDR among electric utilities, for which durable CDR appears to be a business case. Ørsted, for instance, is retrofitting two bioenergy plants with CCS facilities. However, overall investments in durable CDR remain low among the electric utilities assessed in this report.

There is very limited support for durable CDR in the fashion, automobile and agrifood sectors. H&M Group has signed a deal with Climeworks for 10,000 tonnes of durable CDR in 2022 (H&M Group, 2023b). In the absence of guidance from the SBTi on what 'permanent' removals are, the Swedish fashion company focuses solely on CDR methodologies with a durability of at least 1,000 years (H&M Group, 2025). The other four fashion companies assessed do not appear to support durable CDR projects, despite their commitments to reach net zero by neutralising residual emissions with permanent CDR.

Stellantis has provided finance to a biochar start-up (NetZero, 2023b). We could not identify whether Stellantis plans to use the removals generated by this start-up to reach its own climate targets or whether the removals will be sold to others on the VCM (Stellantis, 2025). Stellantis is also planning to contract other removal project developers to test additional CDR methods (Stellantis, 2025, p. 47). The other four automobile companies assessed present no plans for supporting durable CDR.

Fossil fuel producers tend to blend CDR with carbon capture and storage (CCS), which is an emission reduction measure rather than a removal. All of the fossil fuel producers are investing in CO_2 storage sites – usually old gas and oil fields (Sinopec, 2023; ExxonMobil, 2024a; Shell, 2024; Equinor, 2025a; TotalEnergies, 2025a). Equinor, for instance, holds several CO_2 storage sites licences in Denmark and Norway (Equinor, 2025a, 2025c), TotalEnergies is investing in storage in multiple locations (TotalEnergies, 2025a), and ExxonMobil is developing large-scale transportation and storage infrastructure for CCS (ExxonMobil, 2024a, 2025). Equinor also appears as one of the top purchasers of durable CDR, through its deal for credits from BECCS with Ørsted (Equinor, 2024; *CDR.fyi*, 2025c). Based on limited information in Equinor's sustainability report, we understand that the Norwegian oil company plans to act as an intermediary for removal credits (Equinor, 2025a, p. 12).

We find that major agrifood companies tend to develop plans that rely on land-based, non-durable CDR, such as soil carbon sequestration, without plans to support the deployment of durable CDR. We could not identify any concrete plans for Nestlé, Mars, JBS and PepsiCo to invest in durable CDR. Danone is a partial exception, committing to invest in durable CDR to claim the neutralisation of residual emissions by buying carbon removal credits and through its own removal projects, without specifying further (Danone, 2025).

6.1.2 Environmental and social integrity of CDR projects remains a blind spot

Since durable CDR methods have social and environmental trade-offs, it is key for companies to transparently report on the potential negative side effects of projects they support and how they minimise them. As shown in Table 1, all types of durable CDR have risks and constraints. To avoid climate action leading to other environmental and social issues, companies must report on the potential trade-offs of their CDR projects and how they are minimised.

However, none of the 35 companies assessed in this report provides sufficient information to assess the environmental and social integrity of the CDR projects they support. For example, companies relying on biomass-based CDR, such as biochar and BECCS, fail to provide information on the biomass feedstocks used. In most cases, it is unclear where biomass is cultivated, what type of biomass is used for BECCS or biochar, let alone whether and how the biomass cultivation impacts local ecosystems and communities. In the absence of this information, it is impossible for independent observers to assess the potential environmental and climate impacts of durable CDR projects *(see also Box 2)*.

6.1.3 Risk of double counting of removals

As outlined in section 3.2, there is a risk that companies and national governments double count the same removals towards climate targets, which can lower overall climate ambition. In our analysis, we found two clear examples of corporate buyers and governments double-counting removals. Given that most carbon removal verification bodies allow double counting, we consider it likely that this issue is more widespread than these two examples suggest.

- Microsoft signed a deal with the Danish energy utility Ørsted to procure removal credits from bioenergy with CCS (BECCS) plants (Ørsted, 2024). The tech company will use these credits towards its pledge to be carbon negative by 2030. Equinor and Ørsted also signed a deal, although it is unclear what Equinor plans to do with the procured BECCS removals. Equinor's latest sustainability report suggests that the company plans to resell the credits to other buyers (Equinor, 2025a, p. 12). The removals bought by Microsoft and Equinor will also count towards Denmark's national climate targets for 2025 and 2030 (Ørsted, 2025).
- Microsoft signed a BECCS deal with Stockholm Exergi, a local energy company from Sweden (Stockholm Exergi, 2024). The tech company will purchase 3.33 million tonnes of removals from 2028 to 2038 and use these towards its target of becoming carbon negative by 2030. Stockholm Exergi's generated removals will also count towards Sweden's national climate targets (Stockholm Exergi, 2024).

Microsoft's support for durable CDR is aimed at achieving its carbon negative target. The durable removals will be used to claim the neutralisation of ongoing emissions. However, such a claim is only credible if a company's support for removals leads to lower atmospheric CO_2 concentrations than what would have happened anyway (Brander *et al.*, 2022). Given that both Denmark and Sweden have economy-wide nationally determined contributions (NDCs), Microsoft's deals with Ørsted and Stockholm Exergi do not lead to lower CO_2 levels compared to what would have happened anyway, because Denmark and Sweden must achieve their NDCs – whether through removals by BECCS plants or other mitigation measures.

The best solution to this issue is for companies not to make any ownership claim over the durable CDR they support. Separate targets for emission reductions and support for CDR, which should not merged into a net-zero target, are more transparent and avoid companies making misleading claims about net-zero emissions.

6.2 Tech

	Focus of support for durable CDR – Transparency	Focus of support for durable CDR – Integrity	Claim over durable CDR – Transparency	Claim over durable CDR – Integrity	Environmental & social integrity of CDR – Transparency	Environmental & social integrity of CDR – Integrity	Overall climate strategy beyond CDR* – Transparency	Overall climate strategy beyond CDR* – Integrity
AMAZON	Moderate	Moderate	Moderate	Very poor	Very poor	?	Poor	Poor
	Supports some DACs projects, but non-durable CDR the key focus for offsetting purposes.		Will use potentially significant amounts durable and non-durable CDR to claim net zero.		Some details on CDR projects, but insufficient to assess the environmental and social integrity.		Net-zero target relies relies heavily on carbon credits. No emission reduction targets identified.	
APPLE	N/A	Very poor	N/A	N/A	N/A	N/A	Moderate	Moderate
	No support for durable CDR identified. Transparent about reasons to focus on non-durable CDR.		No plans identified for durable CDR.		No plans identified for durable CDR.		Some transition alignment targets but potentially heavy reliance on market-based accounting.	
GOOGLE	Reasonable	High	Moderate	Very poor	Very poor	?	Moderate	Moderate
	Channels USD200 million into durable CDR for neutralisation of residual emissions.		Will use potentially significant amounts of durable and non-durable CDR to claim net zero.		No information identified.		Some transition alignment targets but potentially heavy reliance on market-based accounting.	
META	Moderate	Moderate	Moderate	Very poor	Very poor	?	Poor	Poor
	Supports some durable CDR, but non-durable CDR key in neutralisation strategy.		Will use potentially significant amounts of durable and non-durable CDR to claim net zero.		No information identified.		Endefined reliance on offsetting to reach net zero. Unambitious emission targets.	
MICROSOFT	Reasonable	High	Moderate	Very poor	Very poor	?	Moderate	Moderate
	By far the largest purchaser of durable CDR and biochar.		Will use potentially significant amounts of durable and non-durable CDR to claim net zero.		Some details on CDR projects, but insufficient to assess the environmental and social integrity.		Some transition alignment targets but potentially heavy reliance on market-based accounting.	

Transparency & integrity: 5-point rating scale: High · Reasonable · Moderate · Poor · Very poor

Transparency refers to the disclosure of information. **Integrity** refers to the quality and credibility of the approach.

? Integrity assessment not possible due to lack of available benchmarks for the transition.

*The rating was extracted from the **Corporate Climate Responsibility Monitors (CCRM)** of the NewClimate Institute.*

Role for tech companies in scaling up durable CDR

As tech companies can fully decarbonise without relying on CDR, there is no justification for significant use of removals in reaching net zero. We consider it best practice for companies to support durable CDR completely independently of their emission reduction targets, and without making any claim on the ownership of the removals for neutralisation *(see section 5.2.1)*. Even if voluntary initiatives were to require corporates to use durable CDR to neutralise their residual emissions, there is no case for tech companies: the tech sector's emissions footprint mostly derives from electricity generation, which should reach real-zero emissions through emission reductions under 1.5°C-compatible pathways – by 2035 in OECD countries, by 2040 in China and by 2045 in other countries (IEA, 2023; Dietz *et al.*, 2024). As such, tech companies should not have a significant volume of residual emissions to be neutralised.

However, tech companies demonstrate a relatively high ability to support the scale-up of durable CDR. Big tech companies are among the most lucrative companies in the world (Forbes, 2025) and have relatively high profits per tCO_2e emitted (Höglund, 2023). The examples in this section below show how tech companies are already employing their capabilities in this area. This underlines the need for voluntary initiatives to separate corporate emission reductions from companies' role in contributing to the scale-up of durable CDR based on ability-to-pay.

Status of tech companies' involvement in durable CDR

Microsoft, by a wide margin over Google, is the main corporate buyer of durable CDR. Microsoft alone is responsible for about 70% of all durable CDR ever contracted (*CDR.fyi*, 2024). As of July 2025, Microsoft had purchased 26 million tonnes of durable removals, followed by Frontier and Google, which purchased 1.4 million tonnes and 560,000 tonnes, respectively (*CDR.fyi*, 2025c). Frontier is an advance market commitment (AMC), which was founded by Google, Meta, Stripe, Shopify and McKinsey Sustainability, with the aim of buying USD 1 billion of durable CDR until 2030 (Frontier, 2025).

Ninety per cent of the durable CDR that Microsoft purchased comes from BECCS (*CDR.fyi*, 2025a). Google pursues a more diversified portfolio: enhanced weathering accounts for about 40% of the durable CDR contracted on its own name, followed by biochar (35%) and DACCS (19%). While Amazon and Meta have purchased durable CDR, their support remains limited. Amazon signed an agreement with 1PointFive, which is a subsidiary of Occidental Petroleum, to buy 250,000 tonnes of removals through DACCS in 2023. By July 2025, Meta had purchased close to 3,000 tonnes of removals through biomass geological sequestration and signed contracts for removals from DAC projects through Frontier (Meta, 2023; *CDR.fyi*, 2025a). Apple is the only one of the five tech companies not financing durable CDR, as the company focuses entirely on non-durable removals to claim the neutralisation of its ongoing emissions by 2030 (Apple, 2025).

Tech companies provide very limited information on their CDR purchases, hindering an understanding of the social and environmental integrity of the CDR projects that they support. While the tech companies highlight some durable CDR purchases in their public communications, they do not provide a comprehensive overview of CDR purchase agreements. In the absence of public disclosures, we relied on the independent database *CDR.fyi* for our analysis. Further, the tech companies fail to provide sufficient details on aspects such as the location of CDR projects and storage sites, the origin of biomass feedstocks and whether the energy used to power CDR plants is truly renewable, among others. This hinders a comprehensive assessment of the social and environmental integrity of the CDR projects that tech companies financially support, including net removals and impacts on local ecosystems and communities *(see Box 2 for questions around the environmental integrity of two CDR projects from which Microsoft purchases removals)*. As a result, it is currently not possible for consumers, investors, regulators and independent observers to fully understand the impact of companies' support for, and claims over, CDR. If this issue is not resolved, there is a material risk that companies' support for durable CDR could, in some instances, have severe adverse effects on ecosystems and local communities.

Although tech companies are driving the market for durable CDR, they are also heavily investing in non-durable CDR with the aim of neutralising fossil fuel emissions. Apple focuses exclusively on non-durable CDR for its 2030 carbon neutrality goal (Apple, 2025). Google, Microsoft and Meta, together with Salesforce, launched the Symbiosis Coalition (Symbiosis Coalition, 2024), an advance market commitment to purchase carbon credits from 'nature-based carbon removals', such as reforestation and agroforestry. As of July 2025, Microsoft is the top buyer of non-durable forest-based removals, with 29 Mt contracted, which is roughly equivalent to its durable removals contracted (Nbs.*CDR.fyi*, 2025). Amazon invests in several agroforestry projects and plans to use removals towards its 2040 net-zero pledge (Amazon, 2024).

Although investments in projects that protect and restore ecosystems are necessary and critical in achieving wider ecosystem objectives, they should not be used to claim the neutralisation of tech companies' ongoing GHG emissions, which overwhelmingly stem from fossil-powered energy systems. As fossil CO_2 emissions remain in the atmosphere for thousands of years, they can only be neutralised with durable CDR *(see section 2)*.

The tech sector's plans to use CDR towards its net-zero commitments raise serious questions about its commitments to really decarbonise its sector, where removals are not an equivalent substitute for deep emission reductions. All five tech companies consider both non-durable and durable CDR a key instrument for achieving their net-zero targets. Amazon and Meta aim for net zero by 2031 and 2040, respectively, but present no emission reduction targets alongside these commitments (Amazon, 2024; Meta, 2024), leaving the door wide open for unlimited use of CDR to achieve net zero. Apple, Google and Microsoft commit to market-based emission reductions of 50-75% alongside their net-zero targets (Google, 2024; Apple, 2025; Microsoft, 2025). Due to their reliance on market-based accounting and a stark increase in emissions from data centres in recent years, it is unclear what these reduction targets mean in practice (NewClimate Institute, 2025b). Even if they translated into real emission reductions of 50-75%, it is not credible for these tech companies to use removals for their remaining emissions and claim to have reached net zero instead of prioritising deeper emission reductions.

Removals are not an equivalent alternative to emission reductions (Zickfeld *et al.*, 2021). Even if issues with permanence are addressed through high liability guarantees and continued MRV, there remains scientific uncertainty about how much CDR is necessary to neutralise the climate impact of emissions and how large-scale removals impact the global carbon cycle *(see* *section 2.3**)*. The allocation of the scarce global CDR potential should be reserved for truly residual emissions (Deprez *et al.*, 2024). Most (if not all) of tech companies' emissions can be feasibly decarbonised. By failing to prioritise the deepest possible emission reductions and relying on CDR instead of reaching their net-zero targets, the five tech companies place an unjustifiably high demand on the scarce global CDR potential.

Box 2: Spotlight on the environmental integrity of Microsoft's CDR portfolio

Our assessment of the agreement between Microsoft and Exomad Green is based on unpublished work from Zsolt Lengyel.

Microsoft's heavy reliance on BECCS and biochar may impact local ecosystems negatively. Microsoft sets out quality principles for CDR, including on social harms and benefits, environmental harms and benefits, additionality and baselines, MRV, durability and leakage (Microsoft and Carbon Direct, 2025). However, we were unable to assess whether and to what extent Microsoft abides by these quality principles.

BECCS accounts for 90% of the durable CDR that Microsoft has purchased, followed by biochar at 5% (*CDR.fyi*, 2025a). While BECCS can provide negative emissions, its potential is constrained by land scarcity, the limited number of geologic storage sites and environmental concerns (Hanssen *et al.*, 2020, 2022). BECCS' abatement potential depends highly on the location of biomass cultivation, the type of biomass and the transport distance of the biomass. Microsoft, or its BECCS suppliers, does not provide sufficient detail to assess the sustainability of their BECCS deals. Its largest deal (6.75 Mt over 15 years) is with AtmosClear, which plans to build a BECCS plant in Louisiana (AtmosClear, 2025). AtmosClear provides no information on feedstocks for this plant, other than a reference to 'sustainable materials like sugarcane bagasse and trimmings from prudent forest management practices' (AtmosClear, 2025). Microsoft also signed a deal with Ørsted worth 2.7 Mt of removals from BECCS plants in Denmark, powered by Danish straw and woodchips from the Baltics (Ørsted, 2024). Civil society organisations have criticised the use of wood residues from the Baltics in Danish power plants, as this contributes to deforestation in Latvia and Estonia (NOAH, 2025).

Likewise, the environmental integrity of biochar projects from which Microsoft purchases removals remains unclear. In May 2025, Microsoft and supplier Exomad Green announced the largest biochar deal to date: Exomad will deliver 1.2 Mt of removals to Microsoft over the next ten years (Exomad Green, 2025b). Exomad states that it produces biochar from hardwood residues sourced from sawmills in Bolivia (Exomad Green, 2025a) but we were unable to identify further information on the forest origin of these residues. Bolivia has one of the highest deforestation rate in the world, mostly due to agriculture expansion (Global Canopy, 2023; GFW, 2025).If the residues used for biochar production stem from unsustainably managed forests or illegal logging, biochar may not lead to net emission removals, for it displaces carbon sequestration in forests. It could also contribute to biodiversity loss and ecosystem destruction. Microsoft would need to provide more information on its biochar agreements for observers to understand how environmental and social risks are managed and to prove that these activities meet its own quality principles for CDR

6.3 Airlines

	FOCUS OF SUPPORT FOR DURABLE CDR		CLAIM OVER DURABLE CDR		ENVIRONMENTAL & SOCIAL INTEGRITY OF CDR		OVERALL CLIMATE STRATEGY BEYOND CDR*	
	TRANSPARENCY	INTEGRITY	TRANSPARENCY	INTEGRITY	TRANSPARENCY	INTEGRITY	TRANSPARENCY	INTEGRITY
AIR FRANCE-KLM	Very poor No support for durable CDR identified.	Very poor	N/A No support or plans for durable CDR identified.	N/A	N/A No support for durable CDR identified.	N/A	*Not assessed*	*Not assessed*
ALL NIPPON AIRWAYS	Reasonable Invests in DAC for SAFs and permanent storage.	High	Moderate ANA plans to neutralise 10% residual emissions by 2050, which is aligned with sectoral benchmarks.	Reasonable	Very poor Some details on CDR projects, but no details on energy intensity, technology or procurement used.	?	*Not assessed*	*Not assessed*
AMERICAN AIRLINES	Moderate Invests in carbon casting and aims to neutralise residual emissions with CDR.	High	Moderate Unclear quantity of residual emissions.	Very poor	Very poor Some details on CDR projects, but insufficient to assess the environmental and social integrity.	?	*Not assessed*	*Not assessed*
LUFTHANSA	Reasonable Signed purchase agreements for DACCS and biochar.	Moderate	Moderate Details on CDR claim are provided, but quantity of residual emissions unclear.	?	Very poor Some details on CDR projects, but insufficient to assess the environmental and social integrity.	?	*Not assessed*	*Not assessed*
UNITED AIRLINES	Moderate Invests in DAC for SAFs or permanent storage.	High	Moderate Unclear whether DAC will be used for neutralising residual emissions or only for producing SAF.	?	Very poor Some details on CDR projects, but no details on energy intensity, technology or procurement used.	?	*Not assessed*	*Not assessed*

Transparency & integrity: 5-point rating scale: High, Reasonable, Moderate, Poor, Very poor
Transparency refers to the disclosure of information. **Integrity** refers to the quality and credibility of the approach.
? Integrity assessment not possible due to lack of available benchmarks for the transition.

The rating was extracted from the **Corporate Climate Responsibility Monitors (CCRM) of the NewClimate Institute.*

Role for airlines in scaling up durable CDR

Airlines will likely have significant residual emissions remaining by 2050, which would need to be neutralised with durable CDR to bring sectoral emissions to net zero. We consider it best practice for companies to support durable CDR completely independently of their emission reduction targets, and without making any claim on the ownership of the removals for neutralisation *(see section 5.2.1)*. In the case that voluntary initiatives decide that corporates should use durable CDR to neutralise their residual emissions, airlines would be required to build a significant portfolio of durable CDR by 2050. The vast majority of their emissions stem from burning kerosene, which also has significant non-GHG climate impacts (Lee *et al.*, 2021). CO_2 emissions from airlines should decrease by 90-100% by 2050, compared to 2019 levels (CAT, 2024).

Airlines need captured CO_2 to produce synthetic aviation fuels, which is another reason for them to contribute to DACCS infrastructure. Synthetic power-to-liquid (PtL) fuels hold considerable abatement potential for the aviation sector (CAT, 2024). They are produced with electricity, water and CO_2. Some airlines are already investing in DAC projects with the aim of being able to produce PtL fuels at scale in the coming decades.

Status of airlines' involvement in durable CDR

There is growing traction for durable CDR in the aviation sector. Four of the five airlines assessed in this report are investing in CDR or DAC technologies. While not assessed in this report, Airbus is the fifth largest purchaser of durable CDR through its offtake agreements with 1PointFive for removals from a DACCS plant, as of July 2025 (Airbus, 2022; *CDR.fyi*, 2025a). The aerospace corporation will resell these removal credits to airlines through its Airbus Carbon Capture Offer service. Boeing and British Airways are also among the top 25 largest purchasers of durable CDR (*CDR.fyi*, 2025c).

Airlines invest in durable CDR to offset ongoing emissions or to neutralise residual emissions at the point of net zero, although many lack concrete plans. All Nippon Airways (ANA) plans to neutralise 1% of its aircraft operation emissions by 2030 and 10% by 2050 with CDR, including DACCS (ANA, 2025b). In 2023, ANA also signed a procurement contract with 1PointFive for 30,000 tonnes of CO_2 removals from a DAC plant in Texas, which are to be delivered over three years beginning in 2025 (ANA, 2023). American Airlines purchased 10,000 tonnes of removals from carbon casting from the start-up Graphyte, to be delivered in early 2025. However, we did not identify any updates on whether this happened (American Airlines, 2024, 2025). Carbon casting is a CDR technique by which biomass (e.g. timber residues) is dried and converted into carbon blocks. These blocks are then encapsulated in film and stored underground. American Airlines does not explicitly say that it will use those 10,000 tonnes to neutralise its residual emissions, but instead frames the purchase as supporting the scale-up of the removal market. Lufthansa signed an offtake agreement with Airbus for a total of 40,000 tonnes of CDR from DACCS, to be delivered over four years (Lufthansa, 2023). It is unclear if these removals will be used to neutralise Lufthansa's residual emissions or if they will be offered to customers to offset flight emissions. Lufthansa and Air France-KLM are members of the Aviation Climate Task Force, an innovation network that funds advanced pre-commercial research and development projects to accelerate decarbonisation in the sector. Air France-KLM states that the task force also helps develop direct air capture technology (AirFrance-KLM, 2024, p. 242).

Another reason airlines invest in DAC is to enable the production of synthetic aviation fuels. Synthetic PtL fuels, which need CO_2 as a feedstock, have a relatively large emissions reduction potential for the aviation sector (CAT, 2024). Direct air carbon capture and use (DACCU) is economically more attractive than coupling ongoing kerosene use with DACCS, because it also addresses the non-CO_2 climate impacts of aviation (Brazzola *et al.*, 2025). ANA and United Airlines invest in DAC, partially to scale capacity for synthetic aviation fuels with a lower GHG footprint than standard jet fuel (ANA, 2023; United Airlines, 2025). To this end, ANA signed a Memorandum of Understanding with Climeworks in 2022, but we could not identify any further agreements between ANA and the Swiss DAC start-up (ANA, 2025a). United Airlines invested in the DAC company Heirloom and signed an agreement for the right to purchase up to 500,000 tonnes of captured CO_2, which can be used to produce sustainable aviation fuels or permanently stored (United Airlines, 2025). Heirloom claims that its plants are powered by 100% renewable energy that is additional to the existing supply, but we did not identify further details on how this energy is procured and generated (Heirloom, 2025).

Durable CDR and DACCU can help mitigate the aviation industry's climate impact, but they should be coupled with a reduction in demand for aviation. Aviation is hard to decarbonise, with no reduction technologies currently available at sufficient scale to reduce all emissions to near zero. Synthetic PtL fuels are expected to play an important role in decarbonising the aviation sector (Searle *et al.*, 2019; Mission Possible Partnership, 2022) but there are economic and social limitations to how much of these fuels can be produced (CAT, 2024). The production of synthetic PtL fuels could require 9% of global renewable energy by 2050 (Becken *et al.*, 2023), presenting significant opportunity costs for reducing emissions in other economic sectors. Scaling up the production of synthetic PtL fuels would also require more land dedicated to renewable energy installations, which can then no longer be used to grow food crops or store carbon (Becken *et al.*, 2023). Durable CDR can be used to neutralise some of the ongoing fossil fuel emissions in the aviation sector, but it is a scarce resource *(see section 4.1)*. To place themselves on a 1.5°C-aligned trajectory, aviation companies should complement their plans for durable CDR and DACCU for PtL fuel production with measures to reduce overall demand for air travel. However, such measures are currently absent from the climate strategies of all five airlines assessed.

Airlines also invest in non-durable CDR to neutralise their emissions. Air France-KLM plans to use 'high-quality carbon offsets' and the development of natural carbon sinks to neutralise residual emissions at the point of net zero, without disclosing more concrete plans around the type, timing and quantity of these offset credits and natural carbon sinks (AirFrance-KLM, 2024). Air France invests in mangrove forest restoration and protection projects in Martinique, but it is unclear if this is a climate contribution or serves to neutralise its residual emissions (AirFrance, 2025). Quantities are also not specified. Due to the high likelihood of carbon being released from natural carbon sinks within decades, nature-based removals are not suitable for neutralising fossil fuel emissions *(see section 4.1)*. Lufthansa invests in non-durable CDR to offset emissions from jet kerosene, which is not a credible approach. Lufthansa offers its consumers the possibility of offsetting their flight emissions and, to that end, invests in two biochar projects, alongside several projects for ecosystem recovery and forest management (Lufthansa, 2022).

6.4 Electric utilities

	Focus of support for durable CDR		Claim over durable CDR		Environmental & social integrity of CDR		Overall climate strategy beyond CDR*	
	TRANSPARENCY	INTEGRITY	TRANSPARENCY	INTEGRITY	TRANSPARENCY	INTEGRITY	TRANSPARENCY	INTEGRITY
DUKE ENERGY	Very poor	Very poor	N/A	N/A	N/A	N/A	Moderate	Poor
	No support for durable CDR identified.		No support for durable CDR identified.		No support for durable CDR identified.		Net-zero target relies relies heavily on carbon credits. No emission reduction targets identified.	
ENEL	Poor	Poor	Moderate	Moderate	Very poor	?	Reasonable	Reasonable
	No support for durable CDR identified.		Plans to use CDR for residual emissions, which are slightly misaligned with 1.5°C benchmarks.		No information identified.		Some transition alignment targets but potentially heavy reliance on market-based accounting.	
E.ON	Moderate	Moderate	Moderate	?	Very poor	?	*Not assessed*	*Not assessed*
	Will install CCS on a waste-to-power plant. Removals may be sold on the VCM.		Removals from BECCS may be sold on the VCM.		Some details on CDR projects, but no details on biomass provenance.			
IBERDROLA	Very poor	Very poor	N/A	N/A	N/A	N/A	Reasonable	Reasonable
	No support for durable CDR identified.		No support for durable CDR identified.		No support for durable CDR identified.		Endefined reliance on offsetting to reach net zero. Unambitious emission targets.	
ØRSTED	Reasonable	High	Moderate	?	Very poor	?	*Not assessed*	*Not assessed*
	Turning bioenergy power plants into BECCS plants. Carbon credits are sold to other companies.		BECCS credits sold to others do not count towards the net-zero target.		Some details on CDR projects, but no details on biomass provenance.			

Transparency & integrity: 5-point rating scale: High | Reasonable | Moderate | Poor | Very poor

Transparency refers to the disclosure of information. **Integrity** refers to the quality and credibility of the approach.

? Integrity assessment not possible due to lack of available benchmarks for the transition.

The rating was extracted from the **Corporate Climate Responsibility Monitor 2024 (CCRM) of the NewClimate Institute.*

Role for electric utilities in scaling up durable CDR

As electric utilities can fully decarbonise without relying on CDR, there is no justification for significant use of removals in reaching net zero. But these companies still have the potential, responsibility and a business case to support durable CDR. Under a 1.5°C-compatible trajectory, the electricity sector is required to be the first to achieve net zero. This should happen by 2035 in advanced economies, by 2040 in China, and by 2045 in the rest of the world (IEA, 2023, p. 79). By 2050, electric utilities are expected not only to have zero carbon emissions, but also to employ negative emissions technologies to achieve a state of negative carbon intensity (Dietz *et al.*, 2021, p. 7; Boehm *et al.*, 2023, p. 29; IEA, 2023, p. 199). There is therefore no case for electric utilities to use CDR to claim the neutralisation of their emissions. However, we consider it best practice for companies to support durable CDR completely independently of their emission reduction targets, and without making any claim on the ownership of the removals for neutralisation *(see section 5.2.1)*. Electric utilities can play a role in scaling up CDR, particularly environmentally and socially beneficial BECCS. There may also be a business case for these companies to support DACCS projects, which need large amounts of renewable energy.

Status of electric utilities' involvement in durable CDR

Support for durable CDR in the power sector remains limited overall, although two of the five electric utilities assessed for this report – Ørsted and E.ON – are developing BECCS plants. Ørsted received government subsidies to install CCS at two biomass-fuelled power plants in Denmark, turning them into BECCS plants (Ørsted, 2023). The two plants are expected to start capturing CO_2 in 2025, which will be transported and stored in the Norwegian part of the North Sea. As of 2026, the two power plants are projected to capture an estimated 430,000 tonnes of CO_2 annually, which corresponds to 1.5% of Denmark's national emissions. Those removals will also be counted towards the country's 2025 and 2030 climate targets (Nielsen *et al.*, 2024; Ørsted, 2024, 2025). In addition to receiving state subsidies, Ørsted has secured private funding for its BECCS plants. The Danish utility company signed agreements to sell 3.67 million tonnes of CO_2 removals in the form of carbon credits to Microsoft and Equinor (Ørsted, 2024). This made Ørsted the second biggest supplier of durable removals in 2024 (*CDR.fyi*, 2025c). The fact that these removals will count toward both Denmark's and other companies' emissions reduction targets suggests problematic double counting.

Ørsted will not use negative emissions generated in their own value chain towards their climate targets. Ørsted expects to have 1% of residual emissions remaining by 2040, primarily from building materials such as cement (Ørsted, no date). These emissions will be compensated through non-durable removal projects, including mangrove restoration in Gambia.

E.ON signed an agreement in March 2025 with a Danish waste company to install CCS at a waste-to-energy plant (E.ON, 2025). A portion of the CO_2 emitted by this plant is of biogenic origin and capturing it would result in negative emissions, which E.ON may sell on the voluntary carbon market (VCM) E.ON also commissioned pilot projects and feasibility studies for DACCS and BECCS in Germany (E.ON, 2024). We could not identify whether E.ON plans to use negative emissions generated in its own value chain will count towards its net-zero target.

We did not find evidence that Duke Energy, Enel and Iberdrola are supporting durable CDR. None of these companies provides a concrete plan for how they will neutralise residual emissions. Duke Energy commits to net zero by 2050. However, it has neither set a separate emission reduction target nor provided information on whether and how it plans to neutralise residual emissions (NewClimate Institute, 2024; Duke Energy, 2025). Iberdrola commits to net-zero emissions by 2040, underpinned by a reduction target of 90% across the value chain (NewClimate Institute, 2024; Iberdrola, 2025). This is misaligned with sectoral benchmarks and would mean that Iberdrola places an unjustifiably high demand on scarce CDR potential. Iberdrola had previously communicated that it would neutralise residual emissions with forest-based removals, either through the Carbon2Nature venture owned by Iberdrola or by buying removal credits on the VCM (Iberdrola, 2023b). In its latest sustainability report, however, the company merely states that it will neutralise residual emissions 'in accordance with the highest quality standards' without providing more details (Iberdrola, 2023a). Finally, Enel commits to net zero by 2040, which translates to a reduction of 98% below 2019 value chain emissions, and states that it will remove residual emissions of less than 2.5 $MtCO_2e$ annually after reaching carbon neutrality in 2040 (NewClimate Institute, 2024; Enel, 2025). The Italian energy utility states that it will purchase removal credits from nature- or technology-based removals in the VCM to neutralise these emissions. However, nature-based CDR does not truly neutralise residual fossil fuel emissions *(see section 2.2.1)*.

6.5 Fashion

	Focus of support for durable CDR – Transparency	Focus of support for durable CDR – Integrity	Focus of support for durable CDR	Claim over durable CDR – Transparency	Claim over durable CDR – Integrity	Claim over durable CDR	Environmental & social integrity of CDR – Transparency	Environmental & social integrity of CDR – Integrity	Environmental & social integrity of CDR	Overall climate strategy beyond CDR* – Transparency	Overall climate strategy beyond CDR* – Integrity	Overall climate strategy beyond CDR*
ADIDAS	Very poor	Very poor	No support for durable CDR identified.	Moderate	Reasonable	Plans to use CDR to neutralise residual emissions, which are aligned with sectoral benchmarks.	Very poor	?	No information identified.	Moderate	Moderate	Clear emission reduction targets. Has some transition alignment targets.
H&M GROUP	Moderate	High	Several agreements for DACCS and other durable CDR.	Moderate	Reasonable	Plans to use CDR to neutralise residual emissions, which are aligned with sectoral benchmarks.	Very poor	?	No information identified.	Reasonable	Moderate	Aims for net zero by 2040. Has specific emission targets. Some transition alignment targets.
INDITEX	Very poor	Very poor	No support for durable CDR identified.	Moderate	Reasonable	Plans to use CDR to neutralise residual emissions, which are aligned with sectoral benchmarks.	Very poor	?	No information identified.	Reasonable	Moderate	Aims for net zero by 2040. Has specific emission targets. Some transition alignment targets.
LULULEMON	Very poor	Very poor	No support for durable CDR identified.	Moderate	Reasonable	Plans to use CDR to neutralise residual emissions, which are aligned with sectoral benchmarks.	Very poor	?	No information identified.	Moderate	Moderate	Aims for net zero by 2050. No specific emission targets. Some transition alignment targets.
SHEIN	Very poor	Very poor	No support for durable CDR identified.	Moderate	?	Residual emissions not in line with 1.5°C. Unclear whether durable or non-durable CDR will be used.	Very poor	?	No information identified.	Poor	Poor	2030 emission target doubles emissions from 2021 levels. No transition alignment targets.

Transparency & integrity: 5-point rating scale: High, Reasonable, Moderate, Poor, Very poor

Transparency refers to the disclosure of information. **Integrity** refers to the quality and credibility of the approach.

? Integrity assessment not possible due to lack of available benchmarks for the transition.

*The rating was extracted from the **Corporate Climate Responsibility Monitors (CCRM)** of the NewClimate Institute.*

Role for fashion companies in scaling up durable CDR

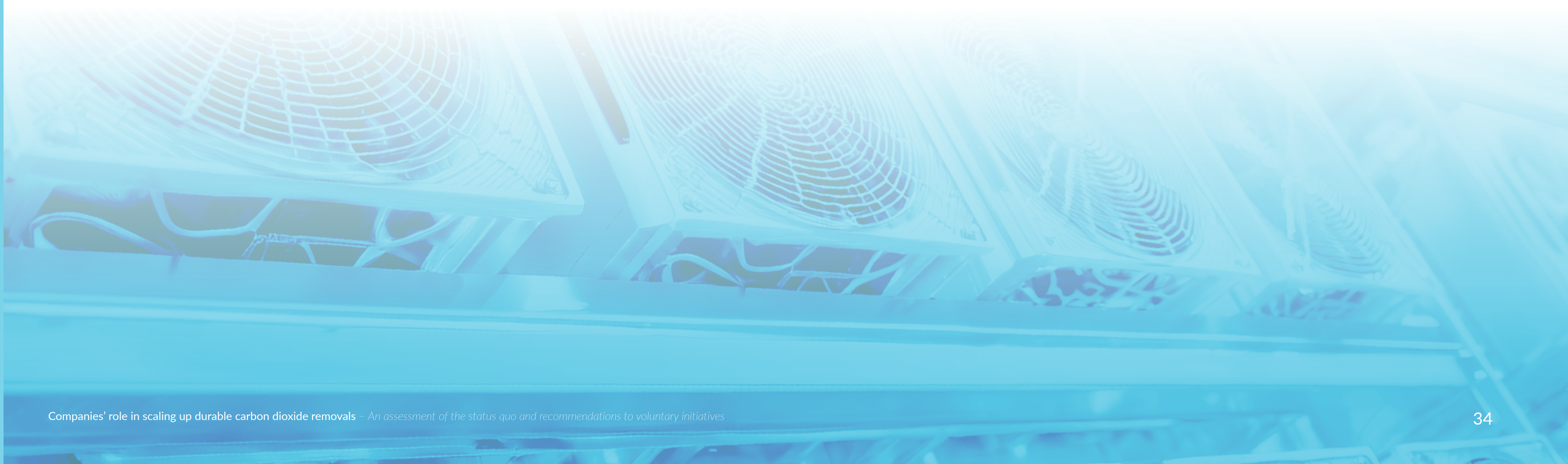
The fashion sector will likely have a small but significant volume of residual emissions left by 2050, which would have to be neutralised with durable CDR to bring sectoral emissions to net zero. We consider it best practice for companies to support durable CDR completely independently of their emission reduction targets, and without making any claim on the ownership of the removals for neutralisation *(see section 5.2.1)*. In the case that voluntary initiatives decide that corporates should use durable CDR to neutralise their residual emissions, fashion companies would be required to build up a significant portfolio of durable CDR by 2050. The fashion sector's emissions footprint derives largely from energy in the supply chain, much of which can be entirely mitigated through electrification and renewable electricity. However, for other emission sources, particularly agricultural emissions related to sourcing materials, technologies and practices to bring emissions to zero are not yet available. Accordingly, 1.5°C-compatible pathways foresee a small but significant volume of residual emissions in 2050, as the sector is expected to be able to reduce its scope 1 and 2 emissions by 100% and scope 3 emissions by 48% by 2050, compared to 2019 levels (Teske, 2022).

Status of fashion companies' involvement in durable CDR

There is limited support for durable CDR in the fashion sector. Of the five fashion companies that we assessed, H&M Group is the only company to channel finance to a durable CDR project. The company states that, in the absence of clear guidance from the SBTi, it focuses on removals that have a durability of over 1,000 years (H&M Group, 2025, p. 60). H&M Group signed a deal with Climeworks for 10,000 tonnes of CO_2 to be removed via DACCS to neutralise its residual emissions. It also joined Frontier, a coalition of companies, which provides one billion US dollars and offtake agreements for permanent carbon removals (H&M Group, 2023a, p. 27, 2025, p. 63). This positions H&M Group among the top 50 CDR purchasers globally, as the only fashion company among them (*CDR.fyi*, 2025c).

Durable CDR plans are still undefined. Inditex states that it plans to invest in technological, durable CDR as well as non-durable removal solutions (Inditex, 2024, p. 8). While adidas and lululemon plan to use permanent carbon removal and storage to neutralise their residual emissions (Adidas, 2024, p. 175; lululemon, 2024, p. 36), we could not identify concrete plans for durable CDR investment. Shein states it will explore 'diversified carbon removal solutions', yet without specifying if, and which, durable removals are meant (Shein, 2025, p. 54).

One of the assessed fashion companies invests in non-durable CDR. Inditex plans to use nature-based solutions to neutralise residual emissions in their its net-zero target year (Inditex, 2025, pp. 144–146). The fashion company currently invests in non-durable CDR, in the form of ecosystem restoration, conservation and reforestation (Inditex, 2025, pp. 104–105, 189–190). It is unclear if these specific efforts are meant to neutralise Inditex's emissions or count as a climate contribution. Given the low durability of these removals, they would not be suitable as a neutralisation approach *(see section 6.8 for further discussion on strategies for agricultural emission sources and non-durable CDR)*.



6.6 Automobile manufacturers

	Focus of support for durable CDR			Claim over durable CDR			Environmental & social integrity of CDR			Overall climate strategy beyond CDR*		
	Transparency	Integrity		Transparency	Integrity		Transparency	Integrity		Transparency	Integrity	
FORD	Very poor	Very poor	No support for durable CDR identified.	Very poor	?	Plans to use CDR to neutralise residual emissions. Unclear amount of residual emissions.	N/A	N/A	No support for durable CDR identified.	Moderate	Moderate	Aims for net zero by 2050. No specific emission targets. Has some sector targets, details missing.
GM	Very poor	Very poor	No support for durable CDR identified.	Very poor	?	Says it is unsure if it will neutralise residual emissions with permanent removals.	N/A	N/A	No support for durable CDR identified.	Poor	Poor	Aims for net zero by 2040. No specific emissions targets. Unclear sector targets.
STELLANTIS	Moderate	Moderate	Invested in a biochar CDR start-up.	High	?	Unclear whether Stellantis will count biochar it invests in towards its net zero target.	Very poor	?	Some details on CDR projects, but insufficient to assess the environmental and social integrity.	Reasonable	Reasonable	Net-zero target includes a reducction of at least 90%. Some transition alignment targets.
TOYOTA	Very poor	Very poor	No support for durable CDR identified.	N/A	N/A	The company does not mention residual emissions or removals despite having a net zero target.	N/A	N/A	No support for durable CDR identified.	Poor	Poor	Aims for net zero by 2050. No specific emissions targets. Lacks transparency, no sector targets.
VOLKSWAGEN	Very poor	Very poor	No support for durable CDR identified.	Very poor	?	Considers offsetting <10% of residual emissions, but no details.	N/A	N/A	No support for durable CDR identified.	Poor	Poor	Aims for net zero by 2050. No clear emissions targets. Unclear transition alignment targets.

Transparency & integrity: 5-point rating scale: High, Reasonable, Moderate, Poor, Very poor
Transparency refers to the disclosure of information. **Integrity** refers to the quality and credibility of the approach.
? Integrity assessment not possible due to lack of available benchmarks for the transition.

The rating was extracted from the* ***Corporate Climate Responsibility Monitors (CCRM)* *of the NewClimate Institute.*

Role for automobile manufacturers in scaling up durable CDR

As automotive manufacturing companies can reach near-zero emissions, there is only a limited case for these companies to use CDR to get to net zero. We consider it best practice for companies to support durable CDR completely independently of their emission reduction targets, and without making any claim on the ownership of the removals for neutralisation *(see section 5.2.1)*. In the case that voluntary initiatives decide that corporates should use durable CDR to neutralise their residual emissions, there are only a small portion of emission sources for which automobile manufacturing companies could reasonably consider using CDR for such neutralisation purposes: the sector's emissions footprint mostly derives from the use of vehicles downstream, as well as the procurement of steel, aluminium and batteries. Under a 1.5°C-compatible trajectory, there should be no significant volume of residual emissions from downstream use of vehicles, as internal combustion engines (ICEs) should be phased out and replaced mostly with electric vehicles (EVs) by 2050, and well before in many regions (Teske, 2022, p. 333; Boehm *et al.*, 2023, pp. 77–78; CAT, 2023, p. 27; IEA, 2023, p. 80; SBTi, 2024, pp. 16–17; UNEP, 2024, p. 46) while the electricity sector should also reach real zero and even negative emissions by mid-century (IEA, 2023, p. 79). A small amount of residual emissions is foreseeable for procured materials, including steel, where emissions should be reduced by over 90% but will not reach real zero by 2050 (IEA, 2023, p. 95).

Status of automobile manufacturers' involvement in durable CDR

Support for durable CDR is limited in the automobile sector. Stellantis is the only automobile manufacturer analysed that currently invests in durable CDR. Together with two other multinationals, Stellantis made a joint EUR 11 million investment in the biochar start-up NetZero (NetZero, 2023b). NetZero's biochar project is located in Lajinha, Brazil, and uses coffee husks from nearby farms to produce biochar (NetZero, 2023a). Coffee husks are generally treated as waste, and their disposal causes environmental challenges such as burning and landfills (International Coffee Organization, 2024, pp. 24–25). In small quantities, they can also be used as a fertiliser when processed (Situmeang *et al.*, 2023). NetZero's biochar project is expected to deliver first removals at the end of 2025, but it remains unclear whether Stellantis plans to use these towards their own climate targets or whether the removals will be sold to others on the VCM (Stellantis, 2025, p. 47). Stellantis is also planning to contract other removal project developers to test additional CDR methods NetZero currently has three production sites running: a full-scale pilot plant in Cameroon and two commercial-scale factories in Brazil (NetZero, 2023a). Coffee Husks produced from coffee processing are waste that can be used as raw material for making organic fertilizer. Utilizing coffee Husks as organic fertilizer can increase added value and farmers' income while reducing the smell from piles of coffee Husk waste, which can pollute the environment (International Coffee Organization, 2024, pp. 24–25).

The potential role of removals in the automobile manufacturers' net-zero strategies remains unclear. Although all five companies assessed have net-zero targets, none of them present a plan for neutralising residual emissions. Stellantis underpins its carbon net-zero target for 2038 with a pledge to reduce carbon intensity by more than 90% (Stellantis, 2025), but does not specify whether it will use durable or non-durable removals to address residual emissions. Similarly, Volkswagen commits to reduce scope 1 and 2 emissions by 90% by 2040 and partial scope 3 emissions by 30% by 2030, however, it also does not specify plans with residual emissions (Volkswagen, 2025, p. 267). The other three companies do not commit to emission reductions alongside their net-zero targets (Toyota, 2024; Ford, 2025; General Motors, 2025). As a result, it is unclear to what extent these companies will rely on removals or reductions outside of the value chain to reach their net-zero targets. Volkswagen plans to use carbon credits to reach its climate targets, but gives no details on whether these credits will come from emission reduction or removal projects, and what criteria the company will use to source them (Volkswagen, 2025, p. 295). Ford states that it is 'studying options for removing residual CO_2 emissions via nature-based and technical solutions (CDP, 2023, p. 28). In 2021, GM announced it would invest in carbon credits or offsets to neutralise remaining emissions, but has not further clarified this (General Motors, 2021). In its 2024 CDP disclosure, GM stated it is 'unsure' whether it would neutralise residual emissions with permanent removals (CDP, 2024, p. 341). We did not identify any information on Toyota's intention for neutralising residual emissions or investing in removals.

6.7 Fossil fuel producers

	FOCUS OF SUPPORT FOR DURABLE CDR		CLAIM OVER DURABLE CDR		ENVIRONMENTAL & SOCIAL INTEGRITY OF CDR		OVERALL CLIMATE STRATEGY BEYOND CDR*	
	TRANSPARENCY	INTEGRITY	TRANSPARENCY	INTEGRITY	TRANSPARENCY	INTEGRITY	TRANSPARENCY	INTEGRITY
EQUINOR	(Moderate) Purchased BECCS credits. Holds CO2 storage licences, which could be used for CDR or CCS.	(Moderate)	(Very poor) Does not explain how it will use its removal credits.	?	(Very poor) Some details on CDR projects, but insufficient to assess the environmental and social integrity.	?	*Not assessed*	*Not assessed*
EXXONMOBIL	(Poor) Minimal support for durable CDR via DAC pilot project, but focus of company strategy is on CCS.	?	(Very poor) Future of DAC pilot project and plans to sell credits or offset own emissions are unclear.	?	(Very poor) Some details on CDR projects, but insufficient to assess the environmental and social integrity.	?	*Not assessed*	*Not assessed*
SHELL	(Poor) Minimal support for durable CDR via DAC pilot project. Main focus are CCS and non-durable CDR.	?	(Very poor) Future of DAC pilot project and plans to sell credits or offset own emissions are unclear.	?	(Very poor) Some details on CDR projects, but insufficient to assess the environmental and social integrity.	?	*Not assessed*	*Not assessed*
SINOPEC	(Very poor) No support for durable CDR identified. Focus of strategy is on CCS/CCUS.	(Very poor)	N/A No plans identified for durable CDR.	N/A	N/A No support for durable CDR identified.	N/A	*Not assessed*	*Not assessed*
TOTALENERGIES	(Very poor) No support for durable CDR identified. Focus of strategy is on using non-durable CDR.	(Very poor)	N/A No plans identified for durable CDR.	N/A	N/A No support for durable CDR identified.	N/A	*Not assessed*	*Not assessed*

Transparency & integrity: 5-point rating scale: High, Reasonable, Moderate, Poor, Very poor

Transparency refers to the disclosure of information. **Integrity** refers to the quality and credibility of the approach.

? Integrity assessment not possible due to lack of available benchmarks for the transition.

The rating was extracted from the* ***Corporate Climate Responsibility Monitors (CCRM)* *of the NewClimate Institute.*

Role for fossil fuel producers in scaling up durable CDR

As the use of fossil fuels should be phased out by 2050, there is no case for fossil fuel producers to use significant amounts of CDR to get to net zero. However, these companies still have great potential, responsibility and a business case to support durable CDR. Fossil fuels should be nearly phased out by 2050, and no new oil and gas sites should be developed (UNFCCC, 2021, p. 17; IEA, 2022, pp. 20–21, 117, 2023, pp. 117, 199; IISD, 2022, pp. iv–v; Teske, 2022, p. 319; CAT, 2023; IRENA, 2023, pp. 47–49; UNEP, 2024, p. 47), meaning fossil fuel companies need to change their business model. As such, these companies should not have a significant volume of residual emissions to be neutralised, and there is no case for them to be using CDR for such neutralisation purposes. As major historic and ongoing polluters, fossil fuel companies bear an enormous responsibility for climate change and therefore should pay to mitigate the impacts, including supporting the scale-up of durable CDR. Their ownership of potential CO_2 storage sites means they are best placed to invest in research and development and to eventually develop a business case for developing durable CDR. An accountability framework that ties support for durable CDR to residual emissions to claim corporate net zero emissions would either completely remove responsibility from this sector to play a role in scaling up CDR, or it would provide an accounting tool to delay the necessary emission reduction trajectories. Rather, we consider it best practice for companies to support durable CDR completely independently of their emission reduction targets, and without making any claim on the ownership of the removals for neutralisation *(see section 5.2.1)*. Fossil fuel producers should be considered key players in scaling up durable CDR.

Status of fossil fuel producers' involvement in durable CDR

Overall, fossil fuel company strategies focus heavily, if not entirely, on carbon capture and storage (CCS). If removals are considered, they are discussed under the umbrella of CCS or 'low-carbon solutions', and vague language makes it difficult to assess the integrity of these strategies. Often, they are unclear and do not explicitly distinguish between removals and CCS, or conflate the two, though these methods serve very different purposes. CCS is, at best, an emissions reduction measure that can be used alongside emission reduction in sectors that are the most difficult to decarbonise (e.g. heavy industry). However, there is a serious risk that fossil fuel companies may use CCS to justify prolonged production, rather than aligning with the required phase-out of fossil fuels. One company – Sinopec – includes CCS capture targets in its strategy, and in news releases clarifies that it is actually pursuing carbon capture utilisation and storage (CCUS), with the intention of using captured CO_2 for enhanced oil recovery (EOR) – a process where CO_2 is injected into oil fields to extract remaining fuel, thereby increasing production from extraction sites (Reuters, 2022; Sinopec, 2022, 2023, p. 48, n.d.). Though not assessed in this report, Occidental Petroleum is a US-based fossil fuel producer that promotes its strategy for net zero and CDR with misleading messaging; the company intends to use removal technologies to market their oil products as 'net-zero', carry out EOR or develop synthetic fuels, and overall greenwash continuing business as usual (Liekens *et al.*, 2024). The company's CEO announced that DAC 'is going to be the technology that helps to preserve our industry over time' (Temple, 2023). Via a subsidiary, 1PointFive, the company is constructing a large DAC facility and has likely oversold removals credits to other companies, including Amazon, Airbus and All Nippon Airways *(see sections 6.2 and 6.3)*, according to a report from Carbon Market Watch (2024).

Depleted oil and gas fields and existing pipeline infrastructure are, and will continue to be, important for transporting and storing captured CO_2, and most of the companies assessed are actively developing these capabilities. Several companies have large-scale CO_2 storage sites, sometimes jointly operated (e.g. the Northern Lights project in Norway with investments from Equinor, Shell and TotalEnergies (Shell, 2024, p. 39; Equinor, 2025b; TotalEnergies, 2025b). These sites will be used to store CO_2 that is captured using CCS, meaning it is being used to offset ongoing emissions produced by fossil fuel companies or their clients, as well as using CDR methods, meaning already-existing CO_2 is being removed from the atmosphere. ExxonMobil owns and operates the largest pipeline for transporting CO_2 in the US, and it is continuing to build out this infrastructure; most of its use so far has been for CCS, with the company claiming to have 'cumulatively captur[ed] more human-made CO_2 than any other company' (ExxonMobil, 2024a, p. 13).

In terms of durable CDR, two companies – Shell and ExxonMobil – are undertaking DAC pilot projects at their facilities to test specific approaches and contribute to further developing the technology to help bring down costs, which would support widespread scale-up (ExxonMobil, 2024a; Shell, 2024, p. 19) These projects serve as examples of how developing and scaling up removal technologies can be a business case for fossil fuel companies. However, in their descriptions of these projects, it remains unclear both their intended use and what kind of claims the companies may make toward the removed CO_2. Shell explains that DAC can be used for capturing and storing CO_2 or capturing and using CO_2 as a feedstock to produce synthetic fuels, which would fall into the category of utilisation (Shell, 2024, p. 31). ExxonMobil is planning a blue hydrogen plant at the same facility as their DAC project (ExxonMobil, 2024a, pp. 14, 28, 2024b).

Instead of investing in CDR directly, other companies are purchasing credits for durable removals to offset their emissions. This is not a solution for the sector as companies should be changing their business models in line with sectoral benchmarks to phase out fossil fuels by 2050, and in the cases where they support durable CDR, this should be independent of their emission reduction targets. Equinor is the largest purchaser of durable removal credits in the sector, and one of the top purchasers of CDR credits among corporate actors, having secured 330,000 tonnes of BECCS credits from Ørsted to be delivered over a ten-year period starting in 2026 (Equinor, 2024, 2025a; CDR.fyi, 2025c). It is unclear if the company intends to use these credits to reach its net-zero target or plans to sell these credits to other companies (Equinor, 2025a, p. 12). In the case of the former, there is real risk of double counting, where both Equinor and the Danish government claim the removals carried out by Ørsted toward their net-zero targets *(see section 6.2 and 6.4)*. Equinor also does not comment on the potential negative environmental impacts of BECCS.

For other companies – including TotalEnergies and Shell – nature-based solutions, with unclear though likely low durability, form the crux of their CDR strategies. TotalEnergies is the second-biggest buyer of nature-based carbon credits (and the biggest in the sector), with 10 million tonnes contracted (Nbs.*CDR.fyi*, 2025), and it intends to use these credits to offset its Scope 1 and 2 emissions (TotalEnergies, 2025c). In its strategy, the company explains that it plans to invest in nature-based solutions, including regenerative agriculture, wetland protection, and improved forest management, to generate carbon credits that it will begin using in 2030 to offset its emissions (TotalEnergies, 2025a, 2025c). Shell centres contributions to nature-based solutions in its net-zero strategy, both through investing in projects to generate credits or buying credits existing credits (Shell, 2023, 2024, p. 31, no date). While nature-based projects are important and do need funding, only durable CDR is suitable for neutralising residual emissions.

6.8 Agrifood

	FOCUS OF SUPPORT FOR DURABLE CDR		CLAIM OVER DURABLE CDR		ENVIRONMENTAL & SOCIAL INTEGRITY OF CDR		OVERALL CLIMATE STRATEGY BEYOND CDR*	
	TRANSPARENCY	INTEGRITY	TRANSPARENCY	INTEGRITY	TRANSPARENCY	INTEGRITY	TRANSPARENCY	INTEGRITY
DANONE	Very poor	Very poor	Moderate	Reasonable	Very poor	?	Moderate	Moderate
	No support for durable CDR identified.		Will use durable CDR to neutralise residual emissions, which are aligned with sectoral benchmarks.		No information identified.		Emission reduction and some transition alignment targets. Uses non-durable CDR for reduction target.	
JBS	Very poor	Very poor	N/A	N/A	N/A	N/A	Very poor	Very poor
	No support for durable CDR identified.		No plans identified for durable CDR.		No plans identified for durable CDR.		Aims for net zero by 2040, not underpinned by an emission reduction target.	
MARS	Very poor	Very poor	N/A	N/A	N/A	N/A	Moderate	Moderate
	No support for durable CDR identified.		No plans identified for durable CDR.		No plans identified for durable CDR.		Specific emission targets but no long-term transition alignment targets.	
NESTLÉ	Very poor	Very poor	N/A	N/A	N/A	N/A	Poor	Poor
	No support for durable CDR identified. Pursues non-durable CDR to claim target achievement.		No plans identified for durable CDR.		No plans identified for durable CDR.		Emission reduction and some transition alignment targets. Heavily relies on non-durable CDR.	
PEPSICO	Very poor	Very poor	N/A	N/A	N/A	N/A	Poor	Poor
	No support for durable CDR identified.		No plans identified for durable CDR.		No plans identified for durable CDR.		Emission reduction and some transition alignment targets. Heavily relies on non-durable CDR.	

Transparency & integrity: 5-point rating scale: High, Reasonable, Moderate, Poor, Very poor

Transparency refers to the disclosure of information. **Integrity** refers to the quality and credibility of the approach.

? Integrity assessment not possible due to lack of available benchmarks for the transition.

The rating was extracted from the* ***Corporate Climate Responsibility Monitors (CCRM)* *of the NewClimate Institute.*

Role for agrifood companies in scaling up durable CDR

Agriculture will account for a major portion of global residual emissions in 2050 and thereafter. The agriculture sector is projected to retain substantial residual greenhouse gas (GHG) emissions by 2050 – primarily methane (CH_4) and nitrous oxide (N_2O) rather than CO_2. A study of 71 governments' long-term net-zero emission strategies found that the agriculture sector is projected to account for up to 36% of residual global emissions (H. B. Smith *et al.*, 2024).

Land-based non-durable CDR is an unsuitable approach to claim the neutralisation of agricultural emissions, fundamentally because it is not accurate or optimal to measure ecosystem protection in terms of tCO_2e, and to pursue measures that maximise that metric. Agriculture companies have a special ability and responsibility to address the protection and restoration of ecosystems. Some have proposed that the non-durability of the CDR may be acceptable for counterbalancing shorter-lived residual GHGs, like methane, and biogenic CO_2 emissions, while calling for more consideration of the limitations of such an approach (Brunner *et al.*, 2024). This is sometimes referred to as the like-for-like approach for CDR. However, despite the need and ability of companies to play a role in the protection and restoration of ecosystems, we see serious limitations to quantifying non-durable land-based carbon sequestration in a GHG-equivalent metric at the corporate level and to pursuing measures to maximise this metric.

- Non-durable CDR remains highly prone to MRV inaccuracies, creating significant uncertainty around the amount of carbon removed and stored permanently, despite major efforts and technological advances aimed to improve this *(see section 2.2.4)*.
- It is unclear whether there would be sufficient land available to neutralise residual shorter-lived GHGs with non-durable CDR. Even if the aforementioned challenges could be overcome, using non-durable CDR to neutralise residual methane emissions would only be scientifically defensible if the more appropriate GWP20 metric were applied.[2] This is because GWP100 – the standard metric – significantly understates the short-term climate impact of methane. In a 'like-for-like' framework, where short-lived greenhouse gases are neutralised by temporary removals, GWP20 better reflects the actual warming effect that companies are claiming to counterbalance. However, the GWP of methane using GWP20 is nearly three times higher than the value under GWP100 (IPCC, 2021), approximately tripling the volume of carbon removals that would be required, raising questions about land availability, ecological trade-offs and feasibility.
- Using a GHG-equivalent metric to measure and account for non-durable land-based carbon sequestration at the corporate level may create conflicts with other indicators of ecosystem health. Compensating for deforestation in one location through reforestation in another location may indicate a net-zero impact in terms of GHG-equivalent metrics, but it completely neglects the importance of local-scale biodiversity around the globe for ecosystem health that economies and communities rely on. Similarly, maximising CDR potential in forestry projects may come at the expense of other ecosystem services if it results in monoculture and a loss in biodiversity (Sabatini *et al.*, 2019; Wang *et al.*, 2025).

Moreover, there is a risk – which we see materialising in practice *(see further details below)* – that companies will use non-durable removals to avoid or delay the systemic transitions needed to reduce methane emissions at source. What is framed as a tool for addressing 'residual' emissions could ultimately weaken incentives for real mitigation – especially in agriculture, where deep methane reductions remain challenging but essential.

Major agrifood companies have the ability and should be accountable to address ecosystem protection and restoration. But due to limitations outlined above, we propose that non-durable land-based CDR should be quantified and financed based on other non-GHG indicators that align more holistically with broader ecological and social objectives, rather than being a means for claiming the neutralisation of agricultural emissions.

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2 *We do not question or recommend deviation from the use of GWP100 for most policy and modelling contexts, but we consider that this metric is not suitable for the specific purpose of calculating how many tonnes of CO_2 a company should remove to neutralise its methane emissions in the short term.*

Status of agrifood companies' involvement in CDR

We find that major agrifood companies are tending towards developing plans that rely on land-based, non-durable CDR, such as soil carbon sequestration, without plans to support the deployment of durable CDR. This strategy raises critical concerns for the transparency and integrity of these companies' climate strategies.

A heavy reliance on land-based CDR currently risks undermining companies' climate action. Major agrifood companies are increasingly planning to count land-based CDR towards their emission reduction targets, rather than to counterbalance residual emissions only. Nestlé plans to achieve a large share of its 2030 targets with land-based CDR (NewClimate Institute, 2025b). Mars has shifted from ruling out land-based CDR in 2023 to now implicitly including it in its targets in 2024 (Mars, 2024, p. 15). Danone's definition of residual emissions also considers land-based CDR as part of emission reduction efforts (Danone, 2025, p. 216). PepsiCo is vague on the role of removals, indicating plans to use them once new GHG accounting guidance is available (Pepsico, 2025).

Treating short-lived soil carbon storage as equivalent to emission reductions poses serious risks. It can create a misleading picture of progress, while companies delay or avoid transformative change. For example, evidence from the 2025 *Corporate Climate Responsibility Monitor* (CCRM) shows that Nestlé, Mars and PepsiCo are not sufficiently engaging in the deeper transitions needed to reduce the climate footprint of the agriculture sector – such as a shift to plant-based protein and a reduction in the use of synthetic fertilisers – although their GHG targets may give a misleadingly optimistic impression on their plans.

Food and agriculture companies do not yet tend to assume responsibility for supporting durable CDR. We could not identify any concrete plans for Nestlé, Mars, JBS and PepsiCo to invest in durable CDR. Danone is a partial exception, committing to invest in durable CDR to claim the neutralisation of residual emissions by buying carbon removal credits and through its own removal projects, without specifying further (Danone, 2025, p. 219).

7 Conclusion

Given the limited sustainable potential of durable CDR, it should be treated as a public good and reserved for neutralising residual emissions in the hardest-to-decarbonise sectors, while other sectors achieve real zero emissions. Despite the necessity of durable CDR for reaching net zero, the various technologies for durable CDR carry sustainability risks that can significantly impact the environment and people, especially when deployed on a large scale (Deprez *et al.*, 2024; Hansson *et al.*, 2024). In addition, there are scientific uncertainties about how the carbon cycle responds to emissions and removals (Zickfeld *et al.*, 2021). For these reasons, deep and rapid emission reductions should be the top priority of governments and companies alike. Sectors that are easier to decarbonise should do so as quickly as possible to avoid placing additional demand on the limited CDR potential and hindering efforts to limit global warming to 1.5°C.

Governments should regulate durable CDR and hold big polluters accountable for scaling it up. Governments are best placed to advance the development and scale-up of durable CDR, for instance through procurement obligations, removal trading schemes or taxation to create public finance for durable CDR. Governments can require big polluters, who are largely responsible for climate change, to carry a large share of the burden for durable CDR. However, they could complement a polluter-pays approach with an ability-to-pay approach to ensure that sufficient finance flows to durable CDR. In this case, companies that bear limited responsibility for climate change but are able to act and contribute could also be required to contribute to CDR.

As there is not yet comprehensive government regulation of durable CDR, voluntary initiatives can develop guidance and requirements for corporate support of durable CDR to facilitate the scale-up of these technologies in the short term and serve as a springboard for future regulation by governments. In the absence of guidelines and requirements from voluntary standards, we consider it unlikely that companies will substantially contribute to the scale-up of durable CDR, as few companies are currently channelling finance to durable CDR projects. As our analysis shows, one company – Microsoft – is driving the market, while traction for durable CDR remains limited among most other companies and across sectors. Indeed, as of May 2025, only 70 out of the nearly 12,000 companies that have submitted targets to the SBTi had procured durable removals (*CDR.fyi*, 2025a).

Through their accountability and governance frameworks, voluntary initiatives should separate the role of companies in supporting the scale-up of durable CDR from their responsibility for emission reductions. This means that voluntary initiatives should ask companies to set separate targets for emission reductions and removals. Deep emission reductions should be at the core of corporate climate strategies and cannot be replaced with removals due to issues around scarcity, permanence and uncertainties about carbon cycle responses to removals. While responsibility for durable CDR should be based on historical and ongoing emissions – which contribute to climate change – it is not realistic for voluntary initiatives to ask the biggest polluters to contribute most to durable CDR, as those companies will likely not voluntarily sign up to a standard if they consider the financial implications too high. As a result, finance for durable CDR will remain very limited. We therefore propose that voluntary initiatives require companies to set mandatory targets for durable CDR, based on companies' ability to pay, even though companies with the highest profit margins are not necessarily responsible for a large share of historical and ongoing emissions. We see this as an interim solution – when governments start to regulate durable CDR, they can require big polluters to take their responsibility for climate change by paying for the scale-up of durable CDR.

Separate targets for emission reductions and durable CDR can help ensure that companies do not hide inaction on decarbonisation behind investments in removals. Our analysis shows that companies with large profit margins are investing most in CDR, with tech companies leading on durable CDR. Their large investments can distract from the fact that these companies often have insufficient GHG reduction targets and are not on track to meet them. Additionally, the tech sector in particular can decarbonise without large amounts of residual emissions that would need to be accounted for through durable CDR. There is a concern that, in the absence of government regulation and recommendations from voluntary standard-setters, companies will rely too heavily on CDR rather than prioritising emission reductions – and in some cases use CDR to greenwash ongoing business-as-usual practices. This risk can be mitigated if voluntary initiatives clearly distinguish targets for emission reductions – and progress towards them – from support for durable CDR.

Encouraging corporate support for durable CDR while avoiding negative environmental and social impacts from large-scale CDR deployment will remain a delicate balancing act. In general, there is a lack of detail and transparency about durable CDR projects, as well as a lack of independent assessments. This gap needs to be addressed to ensure that increased corporate support for durable CDR does not come at the expense of local ecosystems and communities. Without proper oversight and monitoring, large-scale deployment risks intensifying competition for land, water and clean energy resources. Durable CDR also has limited sustainable potential – it is not a substitute for emission reductions, and global capacity for high-integrity removals is limited.

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Annex

Company selection

In this report, we assessed 35 companies across seven sectors: tech, fashion, food and agriculture, automobile manufacturing, fossil fuel companies, electric utilities and airlines. We selected these seven sectors because they differ on aspects such as the amount of expected residual emissions, profit margins (i.e. ability to pay), available technologies to decarbonise and early investments in durable CDR. As a result, our findings can provide insights into corporate efforts for scaling up durable CDR across the economy.

The tech, fashion, agrifood and automobile manufacturers were covered in the 2025 *Corporate Climate Responsibility Monitor* (NewClimate Institute, 2025a), which we developed in parallel with this report on corporate support for durable CDR.

- For the **agrifood sector**, we selected the largest agrifood companies with high relevance for the SBTi FLAG guidance development (e.g. targets validated by the SBTi as 1.5°C-compatible), excluding companies solely focusing on beverages, agricultural raw materials or retailing. These companies include Danone, JBS, Nestlé, Mars, and PepsiCo. This specific sample selection is to test the hypothesis that the SBTi's FLAG guidance can incentivise higher transparency and integrity of agrifood companies' targets.
- For the **tech sector**, we selected the top five global tech companies according to their annual revenue in 2023 (Net Zero Tracker, 2025), excluding companies primarily focused on electronics manufacturing. These companies include Amazon, Apple, Google, Meta and Microsoft.
- For the **fashion sector**, we selected some of the largest global apparel and sportswear companies according to their annual revenue in 2023 (Net Zero Tracker, 2025), excluding luxury brands. These companies include adidas, H&M Group, Inditex, lululemon, and Shein.
- For **automobile manufacturers**, we selected the top five global incumbent manufacturers of light-duty vehicles by revenue, ensuring the inclusion of at least two companies headquartered in the United States. This enabled analysis of the climate strategies of US-headquartered manufacturers, which were not the focus of previous *Corporate Climate Responsibility Monitor* editions that concentrated on European and Asian manufacturers. The selection includes Ford, General Motors, Stellantis, Toyota and Volkswagen.

We excluded majority state-owned companies from the CCRM 2025 because we perceive fundamental differences in their management and decision-making structures related to climate strategies. These differences may significantly reduce the comparability of their plans and the insights we can draw from the sample.

For the other three sectors (fossil fuel producers, electric utilities and airlines), we selected only companies with a net-zero or carbon neutrality target, as we considered those companies to be more likely to have a strategy for removals. Other considerations that influenced our company selection in these three sectors were **annual revenue**, **geographical diversity** (where possible), the **availability of CDR strategies** and the **diversity of incentives** to invest in CDR (e.g. to be able to neutralise residual emissions or to develop synthetic aviation fuels) and the **diversity of CDR solutions**.

- For **fossil fuel producers**, we selected the largest three according to annual revenue in 2023 (Net Zero Tracker, 2025), Sinopec, Exxon Mobil and Total Energies. We added Royal Dutch Shell, as the company was the world's largest buyer of carbon offset credits in 2024 (Bryan, 2025), and Equinor, who is among the top buyers of durable CDR (*CDR.fyi*, 2025a).
- For **electric utilities**, we selected the largest two companies according to their annual revenue in 2023 (Net Zero Tracker, 2025). Enel and E.ON. We added Iberdrola, as this company is investing in nature-based CDR, Ørsted, as they have started selling BECCS credits to corporate buyers, and Duke Energy, to have more geographical representation in the sample.
- For **airlines**, we selected the largest three by revenue in 2023 (Net Zero Tracker, 2025): United Airlines, Lufthansa, and Air France-KLM. We added American Airlines, as they are investing in carbon casting, which is a different approach from most other airlines, and All Nippon Airways, which is among the largest buyers of durable CDR (*CDR.fyi*, 2025a).

Due to the small sample size, the companies analysed are not necessarily representative of a given sector. They do, however, give a good impression of CDR strategies and goals employed by the largest companies within these seven sectors.

The cut-off date for assessing companies' support for durable CDR is 09 July 2025.

Methodology

A. FOCUS OF SUPPORT FOR DURABLE CARBON DIOXIDE REMOVAL

	TRANSPARENCY	INTEGRITY
	The company provides details on the following: 1. Type of durable CDR supported 2. Project developers 3. Location of CDR project 4. Amount of finance 5. Emission removal potential of the supported project 6. Expected timing of removals 7. Whether and how the company will use its support (e.g. for making a neutralisation claim) 8. How the finance is channelled (own investments, offtake agreement, prepurchase agreement, standalone carbon credits)	• The company supports one or more durable CDR projects as the key focus of its CDR strategy (>1’000 years storage). • The company provides support through longer-term offtake or prepurchase agreements or own investments.
	The company provides details on at least **6 of the 8 points above**.	Not applicable.
	The company provides details on at least **4 of the 8 points above**.	• The company focuses on CDR with medium durability (more than 100 but less than 1,000 years of storage). Support for durable CDR projects is limited or not-existent. • The company provides support through longer-term offtake or prepurchase agreements, through own investments, or through the purchase of removal credits already available on the market. <OR> • The company supports one or more durable CDR projects (>1’000 years) but this is not a key focus of its CDR or neutralisation strategy. • The company provides support through offtake, prepurchase agreements or carbon credits.
	The company provides details on ***less* than 4 of the 8 points above**.	Not applicable.
	The company provides no details.	The company neither provides support for durable CDR (>1,000 years storage) nor for CDR with medium durability (more than 100 but less than 1,000 years storage).
?		The information provided does not facilitate an assessment of the company’s support for durable CDR.
N/A	The company does not support durable CDR and explains why.	

5-point rating scale: High | Reasonable | Moderate | Poor | Very poor

B. CLAIM OVER DURABLE CARBON DIOXIDE REMOVAL

	TRANSPARENCY	INTEGRITY
High	The company 1. Outlines why it contributes to CDR (e.g., to be able to neutralise residual emissions in the net-zero target year, to offset a share of its current GHG footprint, to accelerate climate action outside the value chain). <AND> 1. If the company plans to claim ownership over the CDR, it provides details on: 2. The volume of CDR 3. The timing of the removals 4. The year in which the company plans to make a neutralisation claim	The company does not (plan to) make any ownership claim over the durable CDR supported.
Reasonable	Not applicable.	The company plans to claim or claims durable CDR towards its net-zero target. Residual emissions are in line with sectoral decarbonisation benchmarks.
Moderate	The company outlines why it contributes to CDR. <AND> If the company plans to claim ownership over the CDR, it provides details on at least one of the following: • The volume of CDR • The timing of the removals • The year in which the company plans to make a neutralisation claim <OR> unclear whether the company plans to claim ownership.	The company (plans to) claim(s) durable CDR towards its net-zero target. Residual emissions are slightly misaligned with sectoral decarbonisation benchmarks.
Poor	Not applicable.	Not applicable.
Very poor	The company does not meet the criteria listed above.	The company (plans to) claim(s) durable CDR towards its net-zero target. Residual emissions are misaligned with sectoral decarbonisation benchmarks. <OR> The company (plans to) claim(s) durable CDR towards an emission reduction target.
?		The information provided does not facilitate an assessment of the company's claim on for durable CDR. <OR> The company's plans for durable CDR in the future and associated claims are unclear.
N/A	The company does not provide any support for durable CDR.	The company does not provide any support for durable CDR.

5-point rating scale: High | Reasonable | Moderate | Poor | Very poor

C. ENVIRONMENTAL AND SOCIAL INTEGRITY OF CDR SUPPORTED

	TRANSPARENCY	INTEGRITY
High	The company provides details on the following (for all CDR projects): 1. Project developer(s) 2. Location of CDR project(s) 3. Any co-benefits or limitations of the CDR method(s) pursued 4. How any risks or negative side effects of the CDR method(s) are minimised 5. Biomass feedstocks used (if relevant) 6. Energy used to power CDR plans (if relevant)	We could not yet identify a sufficient framework for assessing the integrity of companies' plans to minimise social and environmental impacts associated with durable CDR. Accordingly, companies that publish guardrails to minimise negative impacts and to maximise co-benefits associated with durable CDR projects are evaluated as 'Unclear' for integrity, unless it is clear that those guardrails are inadequate. This indicates a clear gap in knowledge and guidance available on this important issue.
Reasonable	Not applicable.	
Moderate	The company provides information on the project developer(s) and location of CDR projects, and on either the co-benefits or limitations (point #3 above) or how risks and negative side effects are managed (point #4 above).	
Poor	Not applicable.	
Very poor	The company provides no or insufficient details.	The CDR project(s) that the company support have significant negative environmental impacts and the company does not set out adequate measures to minimise these negative impacts.
?		The information provided does not facilitate an assessment of the company's support for durable CDR.
N/A	The company does not provide any support for durable CDR.	The company does not provide any support for durable CDR.

5-point rating scale: High, Reasonable, Moderate, Poor, Very poor

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