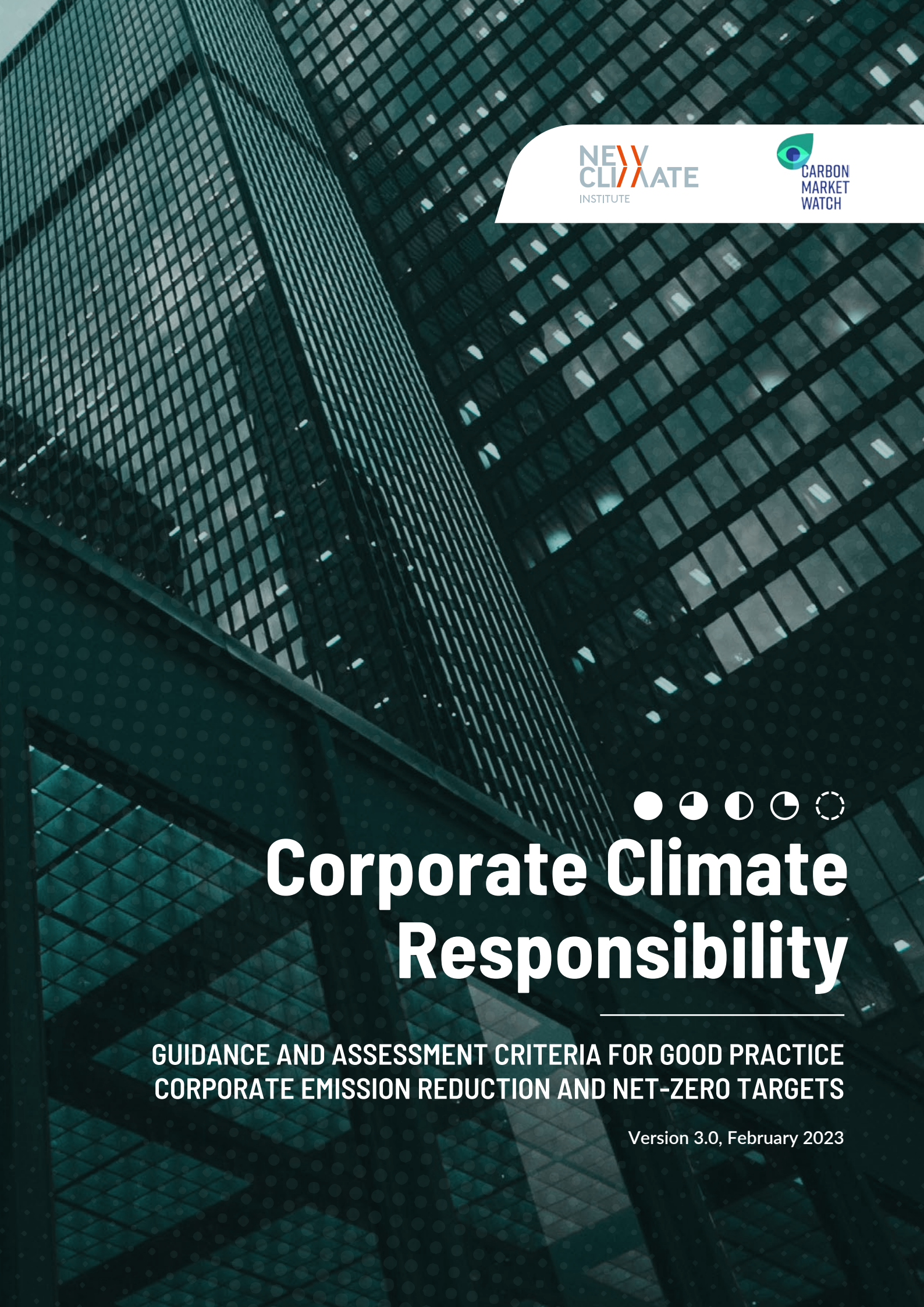

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CARBON MARKET WATCH

Corporate Climate Responsibility

GUIDANCE AND ASSESSMENT CRITERIA FOR GOOD PRACTICE CORPORATE EMISSION REDUCTION AND NET-ZERO TARGETS

Version 3.0, February 2023

Project number 221013

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About this guidance and assessment criteria

The need for scrutiny on corporate climate action

Many companies are putting themselves at the forefront of climate action. The rate of corporate climate pledge setting is accelerating exponentially: by January 2023, nearly 9,000 companies had joined the UNFCCC's Race to Zero campaign (UNFCCC, 2023), up from just over 3,000 one year earlier (Day *et al.*, 2022).

Civil society's increasing concern with the urgency of the climate crisis is resulting in more pressure from consumers, shareholders and regulators for companies to decarbonise. In parallel, companies realise that the direction of travel is set for the decarbonisation of the global economy, and it is increasingly attractive for them to assume a leading role in that new paradigm. Many companies are scrambling for new approaches and narratives to demonstrate their climate leadership, recognising that historical approaches face limitations in today's context.

The rapid acceleration of corporate climate pledge setting, combined with the fragmentation of approaches and the general lack of regulation or oversight, means that it is more difficult than ever to distinguish between real climate leadership and unsubstantiated greenwashing.

The goalpost of what constitutes good practice climate action for companies has shifted in the era of the Paris Agreement and the increasingly clear scientific evidence that underpins its urgency. With the objectives of the Paris Agreement, greenhouse gas emissions need to be reduced at speed, in all countries and in all sectors. The 1.5°C limit requires a reduction in global greenhouse gases and CO_2 emissions by 43% and 48% respectively from 2019 levels by 2030, to reach a state of net-zero global CO_2 emissions by around 2050, net-zero emissions of all greenhouse gases by around 2070, and net-negative emissions thereafter (IPCC, 2022). Company actions that were considered viable in the era of the Kyoto Protocol only ten years ago are no longer sufficient.

For example, it is no longer sufficient for companies to only address their own direct emissions; rather, companies now need to address upstream and downstream emissions as well. It is no longer good practice for a company to compensate for emissions by reducing or removing emissions elsewhere; rather, emission reductions and removals 'elsewhere' need to be enhanced *in parallel* to the company's emission reductions, to reach global net zero.

A new mindset and evaluation standard for companies is emerging. While in the Kyoto era only some countries were required to act, companies now need to ask themselves: "Would we reach global net-zero emissions if all would do what we are doing?"

The difficulty of distinguishing real climate leadership from greenwashing is a key challenge that, where addressed, has the potential to unlock more substantial global climate change mitigation. Corporate climate action is key to closing the emissions gap to a 1.5°C-aligned emissions pathway. In a short space of time, and in the absence of sufficient top-down regulation, consumers' and shareholders' expectations have become a major driver for enhanced corporate climate action. Companies appear to be responding. To facilitate this important bottom-up pressure mechanism, it is essential that the credibility of companies' strategies is transparent and can be understood by their target audiences.

The Corporate Climate Responsibility Monitor

Building on the first version of the guidance and assessment criteria for the *2022 Corporate Climate Responsibility Monitor*, this third version of the guidance and assessment criteria was updated for the *2023 Corporate Climate Responsibility Monitor*. The *Corporate Climate Responsibility Monitor* evaluates the transparency and integrity of companies' climate pledges. The objectives of the *Corporate Climate Responsibility Monitor* are:

- **Identify and highlight good practice approaches** that can be replicated by other companies, recognising that companies are experimenting to work out what is constructive and credible practice.
- **Reveal the transparency and integrity of major companies' climate leadership claims** and provide a structured methodology for others to replicate such an evaluation. **Transparency** refers to the extent to which a company publicly discloses the information necessary to fully understand the integrity of that company's approaches towards the various elements of corporate climate responsibility. **Integrity**, in this context, is a measure of the quality, credibility and comprehensiveness of those approaches.
- **Scrutinise the credibility of companies' plans for offsetting their emissions** through carbon dioxide removals or emission reduction credits, recognising that voluntary carbon markets are highly fragmented and there remains a lot of uncertainty on credible good practice.

The guidance and assessment criteria focuses on four main areas of corporate climate action: tracking and disclosure of emissions (section 1), setting emission reduction targets (section 2), reducing own emissions (section 3) and taking responsibility for unabated emissions through climate contributions or offsetting (section 4).

The development of the assessment criteria is guided by the principles for good practice corporate climate responsibility set out in this document. We have drawn these guiding principles from a combination of scientific literature review, previous work of the authors, and the identification of existing good practices from company case studies. The guiding principles identified in this document relate to issues where the state of scientific knowledge and debate is rapidly evolving. The contents of this document represent the views of the authors, based on our interpretation of existing research and current developments. Our assessments of specific companies are based upon these perspectives and interpretations, which may not be universally held views.

→ See the evaluation of 24 major international companies in the *Corporate Climate Responsibility Monitor* (February 2023)

Good practice overview

Corporates looking to take a position of climate leadership can learn from each other to replicate good practice approaches that are transparent, constructive and robust. The *Corporate Climate Responsibility Monitor 2023* assesses 24 major global companies to draw out good practice in four key areas:

1. Tracking and disclosure of emissions (section 1)

To develop a comprehensive and robust climate strategy, it is key that companies understand and are transparent about their GHG emission footprints and their trajectories. Section 1 presents good practice principles and trends for tracking and disclosure of emissions.

2. Setting specific and substantiated targets (section 2)

Companies' headline climate change pledges encompass a broad range of target setting approaches. Regardless of the type of target and the terminology used, the commitments should send a clear signal for immediate action to decarbonise the value chain, and should avoid misleading consumers, shareholders, observers and regulators. Section 2 presents good practice principles and trends for setting specific and substantiated targets, considering the coverage of emission sources, the explicit specification of an emission reduction target as part of the headline pledge, and the substantiation of long-term visions through interim targets.

3. Reducing emissions (section 3)

Encompassing measures for deep emission reductions are the backbone of ambitious corporate climate targets. Section 3 presents good practice principles and trends for reducing emissions, including a special focus on good practice for sourcing renewable electricity.

4. Climate contributions and offsetting (section 4)

Corporate climate leadership includes not only ambitious target setting, but also taking responsibility for unabated emissions. Section 4 explores good practice and trends related to two distinct approaches for assuming responsibility for unabated emissions: climate contributions and offsetting claims.

The specific assessments include a rating of the **transparency** and **integrity** of companies' approaches:

- **Transparency** refers to the extent to which a company publicly discloses the information necessary to fully understand the integrity of that company's approaches towards the various elements of corporate climate responsibility.
- **Integrity**, in this context, is a measure of the quality, credibility and comprehensiveness of those approaches.

Table 1 provides an overview of good practice corporate climate responsibility and the rating methodology for transparency and integrity in each of these four areas.

Table 1: Overview of best practice corporate climate responsibility and rating methodology

1 TRACKING AND DISCLOSING EMISSIONS	COMPANIES EXHIBITING BEST PRACTICE...
Comprehensiveness of disclosure	✓ Disclose full details on their GHG emissions on an annual basis, with a breakdown of the data to specific emission sources (including scope 1, 2, 3 and non-GHG climate forcers) and the presentation of historical data for each emission source.
2 SETTING SPECIFIC AND SUBSTANTIATED TARGETS	**COMPANIES EXHIBITING BEST PRACTICE...**
Short- & medium-term targets towards 2030	✓ Set short- and medium-term emission reduction targets *towards* 2030 within five-year intervals that reflect a commitment to immediate action and accountability. Targets should be independent from offsetting and aligned with 1.5°C-compatible trajectories in the sector, across all emission scopes.
Long-term targets beyond 2030	✓ Set specific long-term emission reduction targets *beyond 2030* that are independent from offsetting and aligned with 1.5°C-compatible trajectories in the sector, across all emission scopes, as a *vision* for deep decarbonisation.
3 REDUCING EMISSIONS	**COMPANIES EXHIBITING BEST PRACTICE...**
Emission reduction measures	✓ Implement encompassing and deep decarbonisation measures and disclose details of those measures to support replication. ✓ Refrain from using bioenergy where alternatives to combustion exist, and ensure that any bioenergy they use does not have negative sustainability implications.
Renewable energy procurement	✓ Procure the highest quality renewable electricity available and disclose the details of that procurement.
4 CLIMATE CONTRIBUTIONS AND OFFSETTING	**COMPANIES EXHIBITING BEST PRACTICE...**
Responsibility for unabated emissions	✓ Pursue high transparency and integrity on climate contributions and any neutralisation claims made today (see criteria below).
Climate contributions	✓ Provide an ambitious volume of financial support to climate change mitigation activities beyond the value chain, without claiming to neutralise the company's own emissions.
Offsetting claims today Offsetting plans for the future	✓ Clearly disclose offsetting claims and plans; avoid misleading pledges and claims; avoid risk of distraction by also committing to measures for deep emission reductions; commit to procure only high-quality credits from ambitious projects with a permanent climate impact; and commit to preventing any form of double-counting of climate impacts.

Note: Best practices were derived from the principles elaborated in the following subsections, and from a compilation of the practices identified from existing company pledges in 2021. High-hanging fruits refer to the most ambitious projects that tackle the least accessible areas of mitigation potential. For more information see section 4.2.1

1 Tracking and disclosure of emissions

To develop a comprehensive and robust climate strategy, it is key that companies understand and are transparent about their GHG emission footprints and their trajectories over time. A complete and transparent overview of a company's emissions footprint is crucial to understand a company's scope of influence, to grasp the relevance of its climate-related targets, and to determine whether emission reduction measures are appropriate and comprehensive.

This section assesses the comprehensiveness of companies' GHG emissions tracking and disclosure for specific emission scopes and for subsidiary companies. This report does not assess the rigorousness and accuracy of companies' calculations when quantifying emissions from each emissions scope. Quantified GHG emissions throughout this document are self-reported by the companies and not verified by the authors. Rather, we assess how comprehensive the companies' own disclosure is in terms of the coverage of emission sources.

1.1 Comprehensive disclosure of emissions

1.1.1 Guiding principles

Companies should annually disclose detailed information on their GHG emissions, covering the full spectrum of climate impacts associated with the activities of the company. Meaningful planning for complete decarbonisation depends on a thorough and granular understanding of a company's emission sources. Complete and transparent disclosure covers all direct emissions (scope 1), indirect energy-use emissions (scope 2), and other upstream and downstream indirect emissions (scope 3). Scope 1, 2 and 3 emissions should be measured and reported separately and be broken down into GHG, activity or emissions source, while providing historical data (ISO, 2022, p. 30). Where relevant, companies should also include non-GHG climate forcers in their disclosure. Companies should publish information on the methodologies and assumptions involved in the calculation of emissions, to facilitate comprehension and verification. This is particularly important for emission sources where there remains significant uncertainty and inconsistency in accounting approaches, such as emissions from land-use change and forestry.

Companies should report on all upstream and downstream indirect emissions, including even minor scope 3 emission sources. The ISO's Net Zero Guidelines require companies to provide separate data for the different scope 3 categories (ISO, 2022, p. 30), such as emissions from procured products and services, investments, waste, upstream and downstream transport and distribution, and emissions from product use. The GHG Protocol's Scope 3 Standard identifies 15 distinct reporting categories for scope 3 emission sources and requires companies to quantify and report scope 3 emissions from each (WRI and WBCSD, 2013). It is important for transparency that companies disclose data or at least explanatory information for all 15 of these normal scope 3 emission categories (see Table 2), even those deemed minor or irrelevant. Differences in interpretations regarding what constitutes a "minor" or "irrelevant" emissions source could lead to significant inconsistencies between companies' reporting. Some observers may perceive the omission of minor emission sources to be a significant gap in disclosure unless these omissions are explained.

Table 2: Categories of scope 3 emission sources

	UPSTREAM SCOPE 3 EMISSION CATEGORIES	
1	Purchased goods and services	Extraction, production, and transportation of goods and services purchased or acquired by the reporting company in the reporting year, not otherwise included in Categories 2 - 8.
2	Capital goods	Extraction, production, and transportation of capital goods purchased or acquired by the reporting company in the reporting year.
3	Fuel- and energy-related activities (not included in scope 1 or scope 2)	Extraction, production, and transportation of fuels and energy purchased or acquired by the reporting company in the reporting year, not already accounted for in scope 1 or scope 2.
4	Upstream transportation and distribution	Transportation and distribution of products purchased by the company between a company's tier 1 suppliers and its own operations (in vehicles and facilities not owned or controlled by the reporting company); and transportation and distribution services purchased by the company including inbound logistics, outbound logistics (e.g., of sold products), and transportation and distribution between a company's own facilities (in vehicles and facilities not owned or controlled by the reporting company).
5	Waste generated in operations	Disposal and treatment of waste generated in the company's operations (in facilities not owned or controlled by the reporting company)
6	Business travel	Transportation of employees for business-related activities (in vehicles not owned or operated by the reporting company)
7	Employee commuting	Transportation of employees between their homes and their worksites (in vehicles not owned or operated by the reporting company)
8	Upstream leased assets	Operation of assets leased by company (lessee) and not included in scope 1 and scope 2 – reported by lessee
	DOWNSTREAM SCOPE 3 EMISSION CATEGORIES	
9	Downstream transport and distribution	Transportation and distribution of products sold by the company between the company's operations and the end consumer (if not paid for by the reporting company), including retail and storage (in vehicles and facilities not owned or controlled by the reporting company)
10	Processing of sold products	Processing of intermediate products sold by downstream companies (e.g., manufacturers)
11	Use of sold products	End use of goods and services sold by the company
12	End-of-life treatment of sold products	Waste disposal and treatment of products sold by the company (in the reporting year) at the end of their life
13	Downstream leased assets	Operation of assets owned by the company (lessor) and leased to other entities, not included in scope 1 and scope 2 – reported by lessor
14	Franchises	Operation of franchises, not included in scope 1 and scope 2 – reported by franchisor
15	Investments	Operation of investments (including equity and debt investments and project finance), not included in scope 1 or scope 2

Source: GHG Protocol Corporate Value Chain Standard (GHG Protocol, 2011)

Reporting on scope 3 emissions outside of these normal categories is in some cases crucial for transparency, while in other cases it may not be constructive. Comprehensive coverage of emissions disclosure does not necessarily mean reporting any emissions that are outside of the company's normal reporting scope if a tenuous link to the company can be found. *Indirect use-phase emissions* as well as *direct use-phase emissions* from products that are not sold to an end-user are described by the GHG Protocol Scope 3 Standard as optional reporting components. The vagueness of this specific guidance represents a significant limitation, since the way in which companies report on these emissions and include them in their targets can significantly strengthen or undermine their targets, depending on the specific sector and the context:

- **Direct use-phase emissions for products that are not sold to an end-user** form a highly significant part of the climate impact associated with the business model of many companies in the energy supply sector, for example. Fossil fuel commodity traders and companies providing distribution infrastructure provide a key service to the fossil fuel supply chain. For many of these companies, the combustion of those fossil fuels constitutes the most significant issue for the companies' climate impact, and the unabated continuation of those business models may be fundamentally misaligned with the objectives of the Paris Agreement. However, those companies may not be required by the GHG Protocol guidance to report on the downstream emissions associated with their fuel sales unless their sales are directly to end-users, leading to the situation that those companies' climate impact is misunderstood. For these companies, focusing on emission reduction measures that fall only in their currently mandatory emissions reporting scope can lead to the situation that investments are made to "green" the fossil fuel production and supply chain industries, creating further financial lock-in to the continuation of that industry, whilst the most important measure for the Paris alignment of the sector would rather be to work towards the phaseout of the use of fossil fuels.

  The guidance for direct use-phase emissions for sales that are not sold to an end-user can also create an accounting loophole for electricity retailers. Electricity retailers that purchase lower-cost wholesale electricity containing a mixture of renewable and non-renewable sources could claim to have no downstream emissions, if they claim to have passed the renewable portion of that electricity onto customers while reselling the remainder of the electricity to other sales partners. This could create limited incentives for electricity retailers to pursue high quality renewable electricity procurement constructs. The significance of this issue may increase with the trend that major electricity utilities are transitioning their business models from electricity generation to electricity retailing to shift their emissions footprint from scope 1 to the less strictly regulated scope 3.

- In contrast to direct use-phase emissions from products, such as the energy consumption of vehicles and appliances, **indirect use-phase emissions** refer to the emissions that occur indirectly from the use of a product. For example, soap and detergents are often used with heated water when washing clothes; indirect use-phase emissions in this case generate from water heating. While there are circumstances where it could be constructive to report on these emissions and include them in targets, special care should be taken in determining when it is appropriate to do so: if these emissions constitute a major portion of a product's footprint and the company has no control or influence on potential emission reductions, then reporting on these emissions can also lead to distraction from the company's mandatory emissions scope, or targets can be disingenuous.

Companies should report scope 2 emissions using both the location-based and market-based method, taking the highest of the two values for their calculation of their total emissions footprint. According to the GHG Protocol companies should report on scope 2 emissions using both the location-based and market-based accounting methods (WRI and WBCSD, 2015, p. 59):

- The **location-based method** reflects the average emissions intensity of electricity grids from which consumption occurs.
- The **market-based method** reflects emissions from electricity that companies have purposefully chosen to buy. It derives emission factors from contractual renewable electricity procurement instruments.

Both accounting approaches have the potential to mispresent the emission footprint of electricity consumption in different circumstances. Companies have a variety of options for sourcing renewable electricity (see section 3.3). While for some options an emissions reduction claim may be legitimate, for others the impact is unclear. As the impact of renewable electricity projects varies and is often unclear, market-based reporting for renewable energy constructs may give the false impression that a company has no or few scope 2 emissions and could divert prioritisation away from energy efficiency improvements.

On the other hand, some companies' market-based emission estimates may be higher than their location-based estimates, due to contractual arrangements for the direct procurement of fossil-fuel-generated electricity. In this case, companies could report location-based emissions based on the local grid emissions factor, while profiting from cheaper electricity procurement constructs from a more emissions-intensive source.

To create a clear incentive both to maximise energy efficiency improvements and to procure renewable electricity, it would be most constructive for companies to report both market- and location-based estimates for scope 2 emissions and to use the larger of the two values towards the company's aggregated emissions footprint. This is aligned with the ISO's Net Zero Guidelines, which require companies to calculate scope 2 emissions using both accounting methods but use the highest of the two estimates to drive energy efficiency improvements; the same estimate should be used for emission reduction targets and tracking progress (ISO, 2022, p. 18).

Companies' disclosure should include contextual information to understand key emission drivers and trends. Complete and transparent disclosure includes historical data, a breakdown of emission sources, activity data and emission intensities. Ambitious companies go beyond the publication of aggregated emissions; they provide a high level of detail to allow for thorough understanding of the specific individual emission sources. Transparency on specific emission sources and activity data is a tool for increasing ambition in its own right; it contributes to a constructive, collaborative dialogue that is required to overcome challenges and share lessons learnt for accelerated decarbonisation.

Companies' disclosure should include the emissions associated with subsidiary companies. Companies may depend on emission-intensive assets and infrastructure that are held by other subsidiary companies. Transparent and complete reporting also includes these emissions, which should be integrated into the company's scope 1, 2 and 3 emissions. The exclusion of these emissions from GHG inventories can lead to inaccurate interpretations regarding specific brands' or products' GHG emissions footprint. If companies report transparently on the emissions of all subsidiaries, this can incentivise those companies to make a real shift away from emission-intensive activities and assets, rather than continuing those emission-intensive activities through subsidiaries.

1.1.2 Assessment criteria

In line with the guiding principles above, we base our evaluation of companies' reporting and disclosure of GHG emissions on the assessment criteria in Table 3.

Table 3: Assessment criteria for tracking and disclosure of emissions

TRACKING AND DISCLOSURE OF EMISSIONS		
Assessed for the following emission scopes individually: • Scope 1 • Scope 2 • Scope 3 upstream • Scope 3 downstream	●	The disclosure of emissions from the emissions scope is complete and presented in a way that facilitates a thorough understanding. It includes: ✓ An annual disclosure ✓ A breakdown of the data to specific emission sources ✓ The presentation of historical data for the same emission sources. ✓ Explanations on why omitted emission sources are not tracked ✓ Disclosure of non-GHG climate forcers, if relevant ✓ For scope 2, disclosure of both market- and location-based emission estimates, while using the highest estimate for emission aggregates
	◐	The disclosure of emissions in the scope is complete, but the level of detail does not facilitate a thorough understanding of emission sources.
	○	The emissions scope is not tracked and disclosed, or only to a limited extent.
Assessed for subsidiary coverage	●	The company includes all emissions from subsidiaries in its emissions disclosure.
	◐	The company includes most emissions from subsidiaries in its emissions disclosure.
	○	The company does not include emissions from subsidiaries in its disclosure. *<OR>* The company omits emissions from major subsidiaries from its emissions disclosure.

2 Setting emission reduction targets

Companies' climate change pledges encompass a broad range of target setting approaches:

- Some companies opt for specific GHG emission reduction targets as their headline climate change pledges, but most major companies are moving towards "net-zero" pledges (or similar terminology). These net-zero pledges envisage emission reductions combined with offsetting some emissions.
- Some companies' headline pledges are long-term visions for 2040 or 2050, while others focus on shorter-term commitments for 2025 or 2030.
- Headline pledges are often supported by short- and medium-term targets towards 2030, but companies do not always explain how these targets align with their longer-term visions in terms of emission coverage and emission reduction commitments.
- Some targets cover a company's full scope of emissions throughout the value chain, while others focus only on specific emission sources.
- Some companies do not commit to absolute GHG-related targets, but rather focus on emission intensity targets (emissions per unit of output), or targets associated with decarbonisation indicators, such as renewable energy targets.
- Some companies select from only one of these target setting approaches, while others combine several, or all of them.

The high diversity of target setting approaches could stem from differences in companies' specific circumstances, different understandings of mitigation options, and understanding of the materiality of scope 3 emissions. Further, there are differences of opinion and mixed messages regarding the type of targets that represent the highest standard of climate change mitigation ambition.

Regardless of the type of target set and the terminology used, it is most crucial that the targets send a clear signal for immediate action to reduce emissions along the entire value chain paired with a longer-term vision for deep decarbonisation. For this reason, corporates should set both short- and medium-term climate targets towards 2030 *and* long-term climate targets beyond 2030.

The pathway to net zero is crucial: a 1.5°C limit requires immediate action to achieve a reduction in global CO_2 emissions of about 48% from 2019 levels by 2030 (IPCC, 2022). Further delay puts the Paris Agreement objectives beyond reach. Credible **short- and medium-term targets towards 2030** must ensure that corporate emissions decrease in line with what limiting global temperature increase to 1.5°C requires by 2030. Well-defined short- and medium-term targets set within five-year intervals can ensure such immediate action and provide accountability.

Long-term targets beyond 2030 must set out a vision towards full decarbonisation. Such targets must provide a clear indication of what the company aims to achieve in the long-term, to inform today's management and investment decisions. Limiting global temperature increase to 1.5°C requires the rapid decarbonisation of all sectors, to reach a state of net-zero global CO_2 emissions by around 2050, net-zero GHG emissions by around 2070, and net-negative emissions thereafter (IPCC, 2022).

Targets should also not mislead consumers, shareholders and observers, whose demands represent a vital pressure mechanism for raising ambition. Nor should they mislead regulators into avoiding or limiting the implementation of policies to incentivise ambitious climate action.

This section assesses whether both short- and medium-term targets towards 2030 (section 2.1) and long-term targets beyond 2030 (section 2.2) are specific and substantiated. Each sub-section outlines the consideration on the coverage of emission sources and emission reductions in line with the Paris Agreement's 1.5°C temperature limit.

2.1 Short- and medium-term targets towards 2030

2.1.1 Guiding principles

2.1.1.1 Coverage of emission sources

Short- and medium-term targets should be explicit in their coverage of the complete spectrum of emission sources and greenhouse gases, to maximise impact and avoid misleading communication. The most comprehensive short- and medium-term targets cover a company's full GHG emission footprint, including upstream and downstream scope 3 emissions, and non-GHG climate forcers where relevant (see section 1). When setting multiple short- and medium-term targets, for example targeting specific emission scopes, the company ought to transparently explain what share of its emissions across the value chain these targets cover towards 2030. Companies setting headline climate pledges set towards 2030 (e.g., net-zero by 2030) should explicitly set out these pledges' coverage to avoid misinterpretation and to ensure accountability. Targets with partial scope coverage have the potential to mislead: disclaimers get lost or may not be well understood by the audiences of climate pledge communications. The United Nations' High-Level Expert Group (HLEG) recommendations and ISO Net Zero Guidelines,[1] both released at COP27 in November 2022, both mandate the coverage of all emission scopes for short- and medium-term targets (ISO, 2022, p. 11; UN HLEG, 2022, p. 17).

Coverage of all mandatory scope 3 emission categories is highly relevant, despite uncertainties and indirect influence. Scope 3 emissions can entail a degree of uncertainty, particularly for complex emission sources related to land-use, such as upstream food processing, and downstream emissions associated with consumer behaviour and product use. The decarbonisation of these emissions may also depend partially on actions taken by others. Despite these uncertainties, the inclusion of all mandatory[2] scope 3 emission sources from the GHG Protocol's Scope 3 Standard in companies' targets is crucial (WRI and WBCSD, 2013). This provides a clear incentive for all actors with a potential influence on the decarbonisation of emission sources to take measures to do so. For manufacturers of cars, electric appliances, or electronic devices, scope 3 emissions often account for the major share of those companies' emissions. And the companies are the actors with the greatest influence to decarbonise those emission sources, by manufacturing products with alternative or more efficient technologies. Even in the cases where companies have a lower degree of influence in the reduction of scope 3 emissions, this does not justify their exclusion from targets; the full inclusion of scope 3 emissions in targets can incentivise companies to cooperate with suppliers and consumers to mutually support each other to reduce emissions, including to seek out new solutions where needed. Targets that omit scope 3 emissions carry a significant potential to mislead, since scope 3 emissions account for a large portion of most companies' climate impact.

2.1.1.2 Emission reductions along value chain

Short and medium-term targets must be ambitious enough to align with 1.5°C-compatible emission pathways. To stand a reasonable chance of limiting global warming to 1.5°C, global GHG and CO_2 emissions must decrease by around 43% and 48% respectively between 2019 and 2030 (IPCC, 2022). Both the HLEG recommendations and ISO Net Zero Guidelines emphasise the need for company to align their short- and medium-term targets according to these most recent IPCC findings (ISO, 2022, pp. 19–20; UN HLEG, 2022, p. 17). Where available in the literature, benchmarks for specific decarbonisation indicators provide key 1.5°C-compatible milestones for specific sectors and regions at the global, country, and corporate level. Table 4 presents benchmarks identified in existing literature for all key sectors used for the integrity assessment of corporate targets.

Net-zero targets set as headline climate pledges towards 2030 (e.g., 'net-zero emissions by 2030') can become highly misleading if not explicitly including deep emission reduction commitments that are independent of offsetting and carbon dioxide removals. Corporate climate pledges only contribute to the Paris Agreement objectives in a meaningful way if they put emission reductions across the entire value chain in the spotlight. Such pledges are also more constructive if they avoid ambiguous terminology that can distract from this focus, for example by remaining unspecific on emissions reductions to be achieved without relying on offsets or carbon dioxide removal. For example, both the Net Zero Standard of the Science-Based Targets initiative (SBTi) and the ISO Net Zero Guidelines require companies from any sector with net-zero targets—except the forestry, land-use, and agriculture sectors—to explicitly commit to emission reductions of at least 90% below 2019 levels across all emission scopes (SBTi, 2021c; ISO, 2022, pp. 16–17). Companies should only set net-zero targets by 2030 or earlier if they indeed can commit to such deep emission reductions at such an early point in time.

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1 *While the wording of the ISO Net Zero Guidelines – that all 'relevant' emission scopes should be covered – may be interpreted inconsistently, we understand that this excludes only emission categories that are irrelevant by definition of there being zero GHG emissions from those categories; all emission sources from which companies have any GHG emissions are clearly 'relevant'.*

2 *The inclusion of* non-mandatory *scope 3 emissions is not always constructive. See section 1.1.*

Credible short- and medium-term targets requiring immediate action and accountability are vital for credible corporate commitments to fight climate change and should be the focus of corporate target setting. Long-term visions *can* provide a useful signal for deep decarbonisation in the future, but only when accompanied with adequately ambitious interim targets within a timeframe that requires immediate action. Pathways to decarbonisation that are characterised by initially slow or delayed action will lead to a larger volume of cumulative emissions (Rogelj *et al.*, 2018). Delayed action thus requires even deeper emission reductions and larger amounts of highly uncertain carbon dioxide removal at a later date, and can put the objective to limit global warming to 1.5°C beyond reach. Within a corporate environment, we consider that a maximum 5-year timeframe for interim targets is good practice, since it is particularly challenging to establish a credible accountability mechanism for targets set over the medium or longer-term. The HLEG recommendations and ISO Net Zero Guidelines both emphasise the need for short- and medium-term targets set within five-year intervals (ISO, 2022, pp. 19–20; UN HLEG, 2022, p. 17).

Short- and medium-term target should use the same base years and provide transparent explanation on why these base years have been chosen. Emission baselines should appropriately represent a company's GHG emissions profile while not being affected by special circumstances that might distort a company's (ISO, 2022, pp. 15; 18). For example, companies have experienced exceptionally high emissions in certain historical years that do not reflect their normal GHG emission profile that are not suitable as target baselines. Companies should transparently explain and justify if they decide to choose different base years across different targets.

Table 4: Sector-specific decarbonisation benchmarks available in existing literature as of February 2022. Sectors listed in alphabetical order.

Automotive manufacturers	**Phase out of internal combustion engines (ICEs)** Several studies identify 1.5°C-aligned decarbonisation milestones for the phase out of internal combustion engines (ICEs) replaced by electric and low-emission vehicles at the global and regional level (CAT, 2020; IEA, 2021; UNFCCC, 2021; Boehm *et al.*, 2022; Teske *et al.*, 2022; WBA, 2022). **Intensity of vehicles' use-phase emissions** The Science Based Targets Initiative (SBTi) and the Transition Pathways Initiative (TPI) define 2°C-aligned benchmarks to evaluate corporate intensity targets on the vehicles' use-phase emissions (downstream scope 3 category 11) emissions (SBTi, 2018b, 2018a; Dietz *et al.*, 2020, p. 8). The SBTi has indefinitely paused the use of its methodology for automakers as the method does not reflect a 1.5°C-compatible definition from SBTi's point of view (SBTi, 2022g).
Aviation	**Use of sustainable aviation fuels (SAFs)** Several studies identify 1.5°C-aligned decarbonisation milestones for the use of sustainable aviation fuels (SAFs) in international aviation (IEA, 2021, p. 138; UNFCCC, 2021, p. 12; Boehm *et al.*, 2022, p. 74). **Intensity of jet fuel emissions** The TPI and SBTi base their benchmarks on an intensity-based metric exclusively focusing on the use of jet fuel emissions (scope 1) (Dietz, Byrne, Sheer, *et al.*, 2021, p. 14; SBTi, 2021d, 2021b). While the TPI uses the IEA's *Net Zero by 2050* report to derive 1.5°C-compatible benchmarks towards 2050 (Dietz, Byrne, Sheer, *et al.*, 2021; IEA, 2021), the SBTi uses the IEA's *Energy Technology Perspec ves* (ETP) report to derive a 'well-below 2°C'-aligned benchmark (IEA, 2020; SBTi, 2021d). All benchmarks exclusively focus on jet fuel emissions and do not consider any non-GHG climate forcers from flying, which account for about two thirds of aviation's climate impact (Lee *et al.*, 2021). **Absolute emission reductions of global aviation sector** Several studies identify 1.5°-aligned absolute emission reductions for the global aviation sector (IEA, 2021, p. 199; CAT, 2022a; Teske, 2022, p. 216). The International Council on Clean Transportation (ICCT) further provides absolute reductions in line with a 1.75°C temperature limit (Graver *et al.*, 2022, p. i).
Cement industry	**Intensity of operational emissions in cement production (scope 1 and 2)** Several studies identify 1.5°C-aligned decarbonisation milestones for the emissions intensity for cement production covering scope 1 and 2 (CAT, 2020; Boehm *et al.*, 2022; SBTi, 2022a, 2022d). The Transition Pathways Initiative (TPI) defines 1.5°C-aligned benchmarks for scope 1 emissions only (Dietz, Hastreiter and Jahn, 2021, p. 9). **Absolute emission reductions of global cement sector** A few studies identify 1.5°-aligned absolute emission reductions for the global cement sector (SBTi, 2021c, p. 27, 2022c; Teske, 2022, p. 323).
Chemical industry	We could identify very few and non-conclusive sector-specific decarbonisation milestones for the chemical industry and its various sub-sectors in existing literature (IEA, 2021, pp. 20; 129; UNFCCC, 2021, p. 12; Teske, 2022, p. 322). For this reason, the assessment of chemical companies currently requires a case-specific approach (e.g., considering particularities of a given sub-sector a company operates in or the overall relevance of scope 3 emissions). Future research needs to put further emphasis on determining sector-specific decarbonisation milestones for the chemical industry in line with the Paris Agreement across the sector's entire value chain.

Energy utilities	**Intensity of electricity generation (scope 1 and 2)** Several studies identify 1.5°C-aligned decarbonisation milestones for the emissions intensity of electricity generation globally and for specific geographies (CAT, 2020, pp. 11; 15; 18; SBTi, 2020c, 2021c, pp. 18; 27; Dietz, Gardiner, Jahn, et al., 2021, pp. 7; 9; IEA, 2021, pp. 20; 117; UNFCCC, 2021, p. 12; Boehm et al., 2022, p. 30). **Share of renewables and unabated fossil fuels** Several studies identify 1.5°C-aligned decarbonisation milestones for the share of renewables in electricity generation and the phase-out of and unabated coal, oil and fossil gas power plants (CAT, 2020, pp. 11; 15; 18; IEA, 2021, pp. 20; 117; UNFCCC, 2021, p. 12; Boehm et al., 2022, p. 30).
Electronics	We could not identify sector-specific decarbonisation milestones for the electronics industry in existing literature. For this reason, we compare electronics companies to global economy-wide decarbonisation trajectories to reduce GHG and CO_2 emissions by 43% and 48%, respectively. These emission reductions are necessary to stand a reasonable chance of limiting global warming to 1.5°C (IPCC, 2022). Given that CO_2 is the most relevant GHG in the electronics sector's emission profile and the sector has readily accessible decarbonisation options, we consider that companies should meet at least the global benchmark of a 48% CO_2 reduction by 2030 below 2019 levels.
Fashion retailing	We could identify only few sector-specific decarbonisation milestones for the fashion retailing industry in existing literature. Teske (2022, pp. 322; 327) provides global benchmarks for both the *textile and leather industry* and the *manufactured fibres and synthetic rubber*. Given that emissions in the fashion industry occur in various sectors, including agriculture and energy, we also compare fashion retailing companies to global economy-wide decarbonisation trajectories to reduce GHG and CO_2 emissions by 43% and 48% respectively to stand a reasonable chance of limiting global warming to 1.5°C (IPCC, 2022).
Food and agriculture	We could identify only few sector-specific decarbonisation milestones for the agriculture and food industry in existing literature (Boehm *et al.*, 2021, 2022; SBTi, 2022b; Teske, 2022). We do not consider the 1.5°C-aligned benchmarks presented by SBTi's FLAG guidance for the assessment of companies in the agriculture and food sector. The FLAG guidance's benchmarks include both reductions and in-supply chain removals (SBTi, 2022b, pp. 44–45), the latter sometimes referred to 'insetting' within a company's value chain. SBTi explicitly acknowledges that the definition of insetting and its suitability towards emission reduction targets remains uncertain, but still allows for its use (SBTi, 2021c, p. 30, Box 3). We cannot use SBTi's FLAG guidance benchmarks to assess company's *emissions reduction* commitments as they integrally include emission removals. The TPI also allows companies in the food sector to rely on offsetting for target realisation but we interpret the benchmarks itself not relying on offsetting (Dietz, Harvey, *et al.*, 2022, p. 17). Therefore, we only consider these benchmarks to evaluate targets excluding offsetting. We further compare companies in the agriculture and food industry to global economy-wide decarbonisation trajectory, including reductions of global methane emissions by 34% between 2019 and 2030 as particularly important for the global food and agriculture sector (IPCC, 2022).
Information & communication technology	We could identify few sector-specific decarbonisation milestones for the technology service industry in existing literature, especially for company's scope 3 emissions. Only SBTi provides benchmarks for ICT sector including data centre operators (SBTi, 2020, p. 15). For this reason, we compare technology service companies to global economy-wide decarbonisation trajectories to reduce GHG and CO_2 emissions by 43% and 48%, respectively. These reduction levels are necessary to stand a reasonable chance of limiting global warming to 1.5°C (IPCC, 2022). Given that CO_2 is the most relevant GHG in the sector's emission profile with readily accessible decarbonisation options, we consider that companies should meet at least the global benchmark of a 48% CO_2 reduction below 2019 levels.
Oil & gas	**Development of new oil and gas fields** Several studies identify 1.5°C-aligned milestones to not develop any new oil and gas fields globally from 2021 / 2022 onwards (IEA, 2021, pp. 20–21; 117; IISD, 2022, pp. iv–v; Teske, 2022, p. 319). Several studies further identify 1.5°C-aligned benchmarks for the reduction in global oil and gas production volumes (UNFCCC, 2021, p. 17; IISD, 2022, pp. iv–v). **Emissions intensity of oil and gas companies (scope 1, 2 and 3)** The TPI provides emission intensity benchmarks for oil and gas companies for scope 1, 2, and 3 emissions from the use of sold products (Dietz, Gardiner, Hastreiter, et al., 2021, pp. 9–10). The benchmark comprises all energy products sold externally by oil and gas companies including, for example, electricity generated from renewables (Dietz, Gardiner, Hastreiter, et al., 2021, p. 13). The TPI allows oil and gas companies to rely on offsetting for target realisation but we interpret the benchmarks itself not relying on offsetting (Dietz, Gardiner, Hastreiter, et al., 2021, p. 19). Therefore, we only consider these benchmarks to evaluate targets excluding offsetting. In August 2020, SBTi released a draft guidance for the oil and gas sector for public consultation (SBTi, 2020b). We do not consider this SBTi draft guidance for the company analysis in the CCRM 2023.
Pulp and paper industry	We could identify only very few sector-specific decarbonisation milestones for the pulp and paper sector in the existing literature. Only the TPI provides emission intensity milestones for scope 1 and 2 for paper producers (Dietz, Irwin, Rauis, et al., 2021). As for companies operating in the food and agriculture sector, we do not consider the 1.5°C-aligned benchmarks presented by SBTi's FLAG guidance for the assessment of companies in the pulp and paper sector. The FLAG guidance's benchmarks include both reductions and in-supply chain removals (SBTi, 2022b, pp. 44–45), the latter sometimes referred to 'insetting' within a company's value chain. SBTi explicitly acknowledges that the definition of insetting and its suitability towards emission reduction targets remains uncertain, but still allows for its use (SBTi, 2021c, p. 30, Box 3). We cannot use SBTi's FLAG guidance benchmarks to assess company's emissions reduction commitments as they integrally include emission removals. For these reasons, the assessment of pulp and paper companies currently requires a case-specific approach (e.g., considering the relevance of scope 3 emissions). Future research needs to put further emphasis on determining sector-specific decarbonisation milestones for the pulp and paper industry in line with the Paris Agreement across the sector's entire value chain.

Shipping	**Use of sustainable aviation fuels (SAFs)** Several studies identify 1.5°C-aligned decarbonisation milestones for the use of sustainable aviation fuels (SAFs) in int. aviation (IEA, 2021, p. 138; Smith *et al.*, 2021, p. 11; UNFCCC, 2021, p. 16; Boehm *et al.*, 2022, p. 74; Teske, 2022, p. 212). **Intensity of ocean activities (scope 1)** The TPI defines 1.5°C-aligned intensity benchmarks for the scope 1 emissions intensity of international shipping (Dietz, Byrne, Hastreiter, *et al.*, 2021, p. 14). **Absolute emission reductions of global shipping sector** Several studies identify 1.5°-aligned absolute emission reductions for the global aviation sector (IEA, 2021, p. 199; IRENA, 2021a, p. 81; CAT, 2022b; SBTi, 2022e, pp. 11–19; Teske, 2022, p. 333).
Steel industry	**Intensity of steel production (scope 1 and 2)** Several studies identify 1.5°C-aligned decarbonisation milestones for the emissions intensity for steel production covering scope 1 and 2 (CAT, 2020; Boehm *et al.*, 2021; SBTi, 2021a, 2021c; Boehm *et al.*, 2022; SBTi, 2022c; Dietz *et al.*, 2022). In November 2022, SBTi released a draft steel sector guidance for public consultation (SBTi, 2022f), with its final publication planned for April 2023. We do not consider the *draft* guidance for the company analysis in the CCRM 2023. **Low-emission steel plants** Several studies identify global milestones to introduce low-carbon and near-zero steel plants by 2030 and 2050 (IEA, 2021, pp. 20; 129; UNFCCC, 2021, p. 15; Delasalle *et al.*, 2022, p. 69).
Supermarket retail	We could not identify sector-specific decarbonisation milestones for the mixed-good retailer industry in existing literature. For this reason, we compare mixed-good retailers to available 1.5°C-aligned benchmarks for agriculture (see above under *Agriculture & Food*) and global economy-wide benchmarks. The latter require to reduce GHG and CO_2 emissions by 43% and 48% respectively to stand a reasonable chance of limiting global warming to 1.5°C (IPCC, 2022).

2.1.2 Assessment criteria

In line with the guiding principles above, we evaluate the specificity of emission reduction targets in companies' short-and medium-term targets based on the assessment criteria in Table 5.

Table 5: Assessment criteria for the specificity and sufficiency of own emission reduction targets

OWN EMISSION REDUCTIONS IN SHORT- AND MEDIUM-TERM TARGETS		
	TRANSPARENCY	INTEGRITY
●	The target fulfils all the following criteria: • Clearly specifies the scope coverage and target year; *<AND>* • Specifically commits to *own* emission reductions along the value chain that are independent from neutralisation through carbon dioxide removals or emission reduction offsets.	The target fulfils all the following criteria, if applicable to the situation: • The specific emission reduction component(s) along the value chain are in line with 1.5°C compatible trajectories or benchmarks for the sector, according to available literature. • If the target is a net-zero or carbon neutrality target, the specific emission reduction component is equivalent to at least 90% below 2019 levels. This ensures that the net-zero terminology is not misleading, regardless of the target year, but it is not alone a measurement of sufficiency in terms of 1.5°C compatibility. This criterion is not applicable if the target does not use terminology akin to carbon neutrality or net-zero emissions. • The first short-term target(s) is set for a timescale of maximum 5 years in the future using terminology, scope and metrics that are directly comparable to medium-term targets for 2030.
◐	The target fulfils all the following criteria: • Clearly specifies the scope coverage and target year; *<AND>* • Dependents on neutralisation through carbon dioxide removals or emission reduction offsets, but the company's communication of that target also prominently specifies what portion of that target will be achieved through emission reductions.	The first criterion for high integrity is met for at least one of the company's major relevant emission scopes, while for other emission scopes the sufficiency or insufficiency of targets cannot be confirmed.
○	The communication of the company's target is not clear about the scope coverage or does not prominently specify what portion of that target will be achieved through emission reductions.	No specific emission reduction target is pledged, or the specific emission reduction target is not in line with 1.5°C trajectories or benchmarks for the sector, according to available literature.
?		The information provided does not facilitate an assessment; or the absence of sectoral decarbonisation benchmarks do not allow to determine whether a company's target is aligned with a 1.5°C trajectory for the sector at this point in time.

2.2 Long-term targets beyond 2030

2.2.1 Guiding principles

2.2.1.1 Coverage of emission sources

Long-term targets beyond 2030 should be explicit in their coverage of the complete spectrum of emission sources and greenhouse gases, to maximise impact and avoid misleading communication. The most comprehensive targets cover a company's full GHG emission footprint, including upstream and downstream scope 3 emissions, and non-GHG climate forcers where relevant (see Section 1). Targets with partial scope coverage have the potential to mislead: disclaimers get lost or may not be well understood by the audiences of climate pledge communications. Companies should explicitly set out the coverage of their headline climate pledges to avoid misinterpretation and to ensure accountability. For net-zero targets in particular, the United Nations' High-Level Expert Group (HLEG) recommendations and ISO Net Zero Guidelines, both released at COP27 in November 2022, both mandate the coverage of all emission scopes (ISO, 2022, p. 11; UN HLEG, 2022, p. 17).

Coverage of all mandatory scope 3 emission categories is highly relevant, despite uncertainties and indirect influence. Scope 3 emissions can entail a degree of uncertainty, particularly for complex emission sources related to land-use, such as upstream food processing, and downstream emissions associated with consumer behaviour and product use. The decarbonisation of these emissions may also depend partially on actions taken by others. Despite these uncertainties, the inclusion of all mandatory[3] scope 3 emission sources from the GHG Protocol's Scope 3 Standard in companies' targets is crucial. This provides a clear incentive for all actors with a potential influence on the decarbonisation of emission sources to take measures to do so. For manufacturers of cars, electric appliances, or electronic devices, scope 3 emissions often account for the major share of those companies' emissions, and the companies are the actors with the greatest influence to decarbonise those emission sources, by manufacturing products with alternative or more efficient technologies. Even in the cases where companies have a lower degree of influence in the reduction of scope 3 emissions, this does not justify their exclusion from targets; the full inclusion of scope 3 emissions in targets can incentivise companies to cooperate with suppliers and consumers to mutually support each other to reduce emissions, including to seek out new solutions where needed. Targets that omit Scope 3 emissions carry a significant potential to mislead, since Scope 3 emissions account for a large portion of most companies' climate impact.

2.2.1.2 Emission reductions along value chain

Long-term climate pledges beyond 2030 only send a meaningful signal for decarbonisation if they explicitly include deep emission reduction commitments that are independent of offsetting and carbon dioxide removals. Headline pledges may be directly specified in the form of emission reduction targets, they may be accompanied by such targets, or they may not specify any emission reduction targets at all. The achievement of the Paris Agreement objectives requires the deep decarbonisation of all companies across all industries (Rogelj *et al.*, 2018; IPCC, 2022). The depth of corporate emission reduction targets is critical for determining alignment with 1.5°C compatible emission trajectories.

A state of global net-zero CO_2 emissions that is compatible with limiting global warming to 1.5°C require the deep reduction of emissions to 91%–97% below 2010 by 2050 (Rogelj *et al.*, 2018; IPCC, 2022), alongside a limited role for carbon dioxide removals to neutralise a small volume of residual emissions from the emission sources that are hardest to abate. The HLEG recommendations mandate companies to inform their targets by these "latest IPCC net zero greenhouse gas emissions modelled pathways that limit warming to 1.5°C with no or limited overshoot, and where global emissions decline at least 50% below 2020 levels by 2030, reaching net zero by 2050 or sooner" (UN HLEG, 2022, p. 17). Corporate climate pledges only contribute to the Paris Agreement objectives in a meaningful way if they put emission reductions across the entire value chain in the spotlight. Such pledges are also more constructive if they avoid ambiguous terminology that can distract from this focus, for example by remaining unspecific on emissions reductions to be achieved without relying on offsets or carbon dioxide removal.

Corporate emission reduction commitments must be deep enough to align with a 1.5 °C compatible emission pathways. Recently published literature identified emission pathways and benchmarks globally, for countries, and for corporates aligned with the Paris Agreement's objective to hold global average temperature increase to well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5°C. For example, both the Net Zero Standard of the Science-Based Targets initiative (SBTi) and the ISO Net Zero Guidelines require companies from any sector with net-zero targets—except the

3 *The inclusion of* non-mandatory *scope 3 emissions is not always constructive. See section 1.1.*

forestry, land-use, and agriculture sectors—to explicitly commit to emission reductions of at least 90% below 2019 levels across all emission scopes (SBTi, 2021c; ISO, 2022, pp. 16–17). The commitment to such deep emission reductions ensures that the net-zero terminology is not misleading, regardless of the target year, but it is not alone a measurement of sufficiency in terms of 1.5°C compatibility. In this context, the ISO Net Zero Guidelines further elaborate that the use of a net-zero terminology for companies operating in sectors with significant technological challenges might lead to *false* claims whereas companies operating in such sectors should rather set a*chievable* targets (ISO, 2022, p. 18). Table 4 in Section 2.1.1.2 provides an overview of sector-specific 1.5°C-aligned decarbonisation benchmarks identified in existing literature for key sectors used for the integrity assessment of corporate targets towards 2030 and beyond.

2.2.2 Assessment criteria

In line with the guiding principles above, we evaluate the specificity of emission reduction targets in companies' long-term targets, based on the assessment criteria in Table 6.

Table 6: Assessment criteria for the specificity and sufficiency of own emission reduction targets

OWN EMISSION REDUCTIONS IN LONG-TERM TARGETS		
	TRANSPARENCY	INTEGRITY
●	The target fulfils all the following criteria: • Clearly specifies the scope coverage and target year; *<AND>* • Specifically commits to *own* emission reductions along the value chain that are independent from neutralisation through carbon dioxide removals or emission reduction offsets.	The target fulfils all the following criteria, if applicable to the situation: • The specific emission reduction component(s) along the value chain are in line with 1.5°C compatible trajectories or benchmarks for the sector, according to available literature. • If the target is a net-zero or carbon neutrality target, the specific emission reduction component is equivalent to at least 90% below 2019 levels. This ensures that the net-zero terminology is not misleading, regardless of the target year, but it is not alone a measurement of sufficiency in terms of 1.5°C compatibility. This criterion is not applicable if the target does not use terminology akin to carbon neutrality or net-zero emissions.
◐	The target fulfils all the following criteria: • Clearly specifies the scope coverage and target year; *<AND>* • Dependents on neutralisation through carbon dioxide removals or emission reduction offsets, but the company's communication of that target also prominently specifies what portion of that target will be achieved through emission reductions.	The first criterion for high integrity is met for at least one of the company's major relevant emission scopes, while for other emission scopes the sufficiency or insufficiency of targets cannot be confirmed.
○	The communication of the company's target is not clear about the scope coverage or does not prominently specify what portion of that target will be achieved through emission reductions.	No specific emission reduction target is pledged, or the specific emission reduction target is not in line with 1.5°C trajectories or benchmarks for the sector, according to available literature.
?		The information provided does not facilitate an assessment; or the absence of sectoral decarbonisation benchmarks do not allow to determine whether a company's target is aligned with a 1.5°C trajectory for the sector at this point in time.

3 Reducing own emissions

Encompassing measures for deep emission reductions are the backbone of ambitious corporate climate targets. As companies' emissions profiles vary widely, there is not a standardised set of measures that all companies can implement. The integrity and robustness of companies' decarbonisation efforts must be considered against each company's circumstances and emission profile (section 3.1).

Electricity-related emissions are relevant for all companies to address and are often a central feature of companies' plans and claims. For this reason, we single out renewable electricity procurement for deeper assessment (section 3.2).

3.1 Emission reduction measures

3.1.1 Guiding principles

Corporate actors must implement encompassing and deep decarbonisation measures. Decarbonisation efforts should focus on all relevant emission sources across all three scopes. Adopting readily available measures should be the first priority for companies that claim to be on a decarbonisation pathway, followed by the scaling up of proven flagship projects and—if necessary—investments in research and development to find new decarbonisation solutions. Demonstrated emission reduction measures vary per sector, although electrification and renewable energy are relevant for many sectors. For instance, a switch from combustion engines to electric vehicles in the automobile sector, and e-fuels instead of fossil-based fuels in the shipping sector. In addition, technological and operational efficiency improvements are necessary steps for every company. Further, companies should have a clear plan to phase out all carbon-intensive infrastructure and products. Net zero is a disingenuous vision for companies that continue to invest in and rely on fossil fuels. Ambitious companies should plan for and implement a set of measures that leads to complete or near decarbonisation of their activities, depending on the sector they are active in.

Transparent disclosure and information sharing can support replication and the identification of new solutions. Companies can show real climate leadership by prioritising transparent exchange on climate change mitigation over industry competition, to support replication of effective measures and to collaborate for the identification of new solutions. Reports that refer to individual flagship projects may potentially inspire readers, but further details are required to support replication and facilitate an assessment of the company's ambition. Companies' planned measures can only be fully appraised if their plans contain details on the scale of planned measures using indicators that demonstrate what proportion of a company's activities will be addressed by the measures, and what the anticipated impacts are for reductions in GHG emissions.

3.1.2 Assessment criteria

In line with the guiding principles above, the evaluation of companies' emission reduction measures is based on the assessment criteria in Table 7.

Table 7: Assessment criteria for companies' emission reduction measures.

EMISSION REDUCTION MEASURES

	TRANSPARENCY	INTEGRITY
●	The company provides detailed information on emission reduction measures for most sources of emissions. The information includes details on: • The expected amount of emission reductions or the emission levels the company expects to reach by its target year; *<AND>* • What share of relevant emission sources are addressed by the various measures	The company currently takes a proactive approach to the implementation of climate change mitigation measures and those measures are likely aligned with requirements to transition to net-zero emissions. This requires, at a minimum, that the company: ✓ Adopts demonstrated good practice emission reduction measures. These measures are widely considered to be essential for achieving mid-century decarbonisation and yet already commercially available. Representative measures include low-carbon energy supply such as renewables, energy efficiency improvement, and material efficiency improvement. ✓ Scales-up demonstrated flagship projects to mainstream those measures across the organisation. ✓ Invests in the development of new solutions where necessary. ✓ Sets out a clear plan to phase out all carbon-intensive infrastructure and all carbon-intensive products; *<AND>* ✓ Covers all relevant emission sources from the company's emission footprint (including scope 1, 2 and 3). Companies that use bioenergy need to meet the requirements for a high integrity rating outlined in section 3.2. *[The assessment is based on expert judgement. Current emission reduction trends and achievement of past targets may support the assessment that a given company implements adequate reduction measures.]*
◐	The company provides detailed information on reduction measures but only for some sources of emissions. *<OR>* The company provides information on reduction measures for most sources of emissions, but not on: • The expected amount of emission reductions or the emission levels the company expects to reach by its target year; *<AND/OR>* • What share of relevant emissions are targeted by the various measures	The company currently takes a semi-proactive approach to the implementation of climate change mitigation measures, but those measures may not necessarily be aligned with a sector specific 1.5 °C decarbonisation pathway, either because one of the above criteria is overlooked, or because the measures are too shallow. *<OR>* The company invests in the development of new and innovative solutions for some key emission sources, but does not have a comprehensive plan to cover all of its emission sources. *[The assessment is based on expert judgement. Current emission reduction trends and achievement of past targets may support the assessment that a given company implements adequate reduction measures.]*
○	The company provides no or limited information on reduction measures.	Either of the below: ✗ The company has adopted few or no good practice emission reduction measures that have been demonstrated by other companies; *<OR>* ✗ These measures cover only a small share of the company's carbon footprint. *[The assessment is based on expert judgement. Current emission reduction trends and achievement of past targets may support the assessment that a given company implements adequate reduction measures.]*
?		The company's measures are unclear, and no assessment is possible.

3.2 Bioenergy

3.2.1 Guiding principles

Companies demonstrating climate leadership plan and take decarbonisation measures that do not rely on bioenergy when possible; and ensure that any bioenergy they use does not have negative sustainability implications. Some sectors that are difficult to electrify and have limited alternatives to decarbonise might rely on bioenergy to some extent, for instance aviation, maritime shipping and heavy industry (Calvin *et al.*, 2020; Clarke *et al.*, 2022). However, increasing demand for bioenergy in industries where the mitigation potential of existing technologies remains limited will lead to competition for limited biomass resources (see e.g. Pavlenko and Kharina, 2018; ETC, 2021), which is likely to further exacerbate sustainability issues. It is estimated that sustainable biomass supply will amount to just 40 to 60 EJ per year by 2050, whereas potential *demand* could amount to over 65 EJ per year in just four sectors (wood materials, pulp and paper, plastic feedstocks and aviation) and higher if including other sectors that are also currently planning to rely on biomass in their decarbonisation trajectories (ETC, 2021).

Companies should therefore use alternative technologies that do not depend on combustion where those exist. If such alternative technologies are likely to emerge in the future, companies should consider using bioenergy only as a *temporary* solution and invest the development of alternative technologies at the same time.

The production of bioenergy may negatively impact food security, water resources and biodiversity (Calvin *et al.*, 2020; Clarke *et al.*, 2022). Large-scale bioenergy generation has adverse sustainability impacts, with the possible exception of biofuels from artificially cultivated algae. For instance, bioenergy production can lead to or exacerbate food insecurity, lead to deforestation, cause biodiversity loss, induce water scarcity and lead to contamination of freshwater resources.

- **Bioenergy can threaten food security through increased food prices and lower food production** (Calvin *et al.*, 2020; Ahmed *et al.*, 2021; Clarke *et al.*, 2022). Growing bioenergy crops may directly conflict with the production, availability, and price of food and feed crops. Increasing demand for bioenergy crops means that less land is available to produce food and feed, potentially leading to increased prices and lower production of food and feed stocks. At the same time, at an individual and community level, growing bioenergy crops may reduce poverty and ensure stable incomes in low-income countries, which could enhance food security (Calvin *et al.*, 2020).
- **Bioenergy production can harm biodiversity and ecosystems** (Kline *et al.*, 2015; Hof *et al.*, 2018; Clarke *et al.*, 2022; Hanssen *et al.*, 2022). For instance, forests may be cut down to use the wood for energy production or lands may be cleared and turned into agricultural land to grow biofuel crops. This likely has a range of implications, including a loss of habitat and soil erosion (Camia *et al.*, 2021; Hanssen *et al.*, 2022). However, planting bioenergy crops on degraded land may reduce emissions on the short term and improve soil fertility and ecosystems (Calvin *et al.*, 2020; Camia *et al.*, 2021).
- **Bioenergy production can induce water scarcity** (Stenzel *et al.*, 2021). The production of food and feed crops and woody biomass requires large amounts of water, which is a scarce resource in many regions. Water needs for bioenergy production may directly compete with food and feed production and sustaining ecosystems.
- **Using fertilisers to produce bioenergy crops may lead to water contamination** (Adeniyi *et al.*, 2018; Calvin *et al.*, 2020). The cultivation of food crops, such as oil palm and sugarcane, and algae requires nitrogen and phosphorus fertilisers. Fertiliser use may contaminate water sources, which can lead to oxygen depletion and algae bloom. This may have various consequences, including suffocating fish and poisoning of animals and humans drinking the water.
- **Third generation biofuels from artificially cultivated algae are the only type of bioenergy that can be produced at scale with limited negative effects.** Algae can be cultivated in open or closed systems. Open systems are easier and less expensive to build but face several sustainability challenges. As the system is open, other microalgae, bacteria and fungi may contaminate the water and there may be large water losses due to evaporation. There is also the risk of fertiliser leakage, which can contaminate ground water and lead to algae bloom in water bodies (Usher *et al.*, 2014; Beacham *et al.*, 2017). Further, the construction of open systems requires water and land, although significantly less than the production of other biomass feedstocks. Closed systems are more expensive than open ones but face fewer sustainability risks. However, leakage and spills may still occur (Beacham *et al.*, 2017).

Bioenergy is not an emissions-free energy source. Bioenergy is not a carbon neutral energy source and companies that use bioenergy need to apply emission factors when reporting on their energy emissions. Emissions may occur, for example, when land with a high carbon stock is cleared to produce bioenergy crops, when converting biomass into fuels or electricity and when transporting bioenergy crops to where they are consumed.

- Bioenergy production may lead to **direct land use emissions** if areas with high carbon stock (e.g. forests, wetlands) are converted into agricultural land to produce bioenergy crops (Calvin *et al.*, 2020). **Indirect land use emissions** may occur when as a result of increasing demand for bioenergy crops, existing agricultural lands are now used to produce bioenergy crops and natural areas are converted to produce food and feed crops.
- Harvesting forest residues results in the **release of carbon stored in the soil** (Achat *et al.*, 2015; Repo *et al.*, 2015; James and Harrison, 2016; Searchinger *et al.*, 2022). Creating revenue streams from forest residues may further incentivise the conversion of forestry land to crop land.
- **Biomass combustion** results in CO_2 emissions, as well as other air pollutants. Although this can potentially be counterbalanced with carbon sequestration by newly planted trees on the longer term, there will be higher CO_2 levels in the atmosphere for decades (Searchinger *et al.*, 2018). ,
- **Converting biomass into electricity or fuels is an energy-intensive process** (Clarke *et al.*, 2022).
- **Converting feedstocks with high oxygen levels (e.g. sugars and most biomass) to drop-in biofuels requires increased processing and greater volumes of hydrogen.** The source of hydrogen has a key impact on the lifecycle emissions of the final drop-in fuel (Dyk *et al.*, 2019). The supply of hydrogen may also be problematic in its own right, as demand for hydrogen across various sectors will likely increase exponentially in the coming years and its production is resource and energy intensive.
- Like for fossil fuels, demand for bioenergy is not necessarily located at the same place where crops are grown (Clarke *et al.*, 2022). **Transport of crops or biofuels** to where they are consumed leads to emissions.

Land used to grow bioenergy crops cannot be used for other purposes, such as sequestering carbon directly (Searchinger *et al.*, 2022). **This carbon opportunity cost of land should be factored in when calculating the net impact of bioenergy. Using woody biomass to generate energy risks overshooting the carbon budget in the near to medium future.** Given that global CO_2 emissions must reduce by almost 50% between 2019 and 2050 to stand a reasonable chance of limiting global warming to 1.5°C 2030 (IPCC, 2022), using woody biomass as an energy source is problematic. Cutting down trees to produce heat, electricity, or biofuels leads to the release of sequestered carbon; it can take several to hundreds of years to balance out this release of CO_2, depending on the type of trees used (Holsmark, 2012; Mitchell *et al.*, 2012; Ter-Mikaelian *et al.*, 2015; Searchinger *et al.*, 2018). Creating a "carbon debt" hinders realising the necessary emission reductions by 2030.

While use of wood residues does not necessarily lead to the *additional* release of CO_2 into the atmosphere (Madsen and Bentsen, 2018), companies demonstrating climate leadership do not pursue this pathway. Supply of sustainable wood residues is limited; an increase in demand from companies may push others to unsustainable biomass supply. In addition, harvesting forest residues is very likely to result in the release of carbon sequestered in soils (see above).

While BECCS can provide negative emissions, its potential is limited by sustainability concerns and insufficient to balance emissions from all industries. Bioenergy can be combined with carbon capture and storage (BECCS) to realise negative emissions, but its potential is constrained by scarcity of land and the limited number of geologic storage sites and environmental concerns (Hanssen *et al.*, 2020, 2022). BECCS' abatement potential is also highly dependent on the area where the biomass is cultivated, and the technologies used to convert biomass into energy. Further, BECCS is not yet available at scale and upscaling the technology from its current demonstration phase is challenging (Hanssen *et al.*, 2020).

Because of the limited number of storage sites, BECCS should be treated as a scarce resource and its mitigation potential should not be claimed by individual companies to neutralise their emissions footprint (see also Section 4.3.3). Instead, companies demonstrating climate leadership pursue a range of proven measures that lead to emission reductions on the short term.

3.2.2 Assessment criteria

Where relevant, we assess companies' use of bioenergy based on the assessment criteria in Table 8 below. These are in line with the guiding principles above. We assess the use of bioenergy as part of companies' emission reduction measures (i.e. element 3A) when bioenergy replaces fossil fuel energy in direct combustion processes. For instance, if companies use biomass instead of coal to fire their factories or use biofuels for their ships, aircraft or vehicles. In some cases, companies may claim to procure renewable electricity based on bioenergy.

Table 8: Assessment criteria for bioenergy

BIOENERGY

	TRANSPARENCY	INTEGRITY
●	The company provides detailed information on the bioenergy that it procures or plans to use in the future. This includes information on: • The amount of bioenergy used (in absolute and relative terms); • The type of bioenergy (e.g. food crops, primary woody biomass wood residues, algae) • The origin of the bioenergy feedstocks • Potential sustainability implications and how the company minimises those risks.	• The company operates sector where the technical mitigation potential of existing technologies remains limited and with very limited opportunities to electrify *<AND>* • Bioenergy is one of several decarbonisation measures that a company pursues *<AND>* • The bioenergy that a company uses does not have direct or indirect negative sustainability implications.
◐	The company provides detailed information on some but not all of the points above.	• The company operates in a sector where the technical mitigation potential of existing technologies remains limited and with very limited opportunities to electrify *<AND>* • The bioenergy that a company uses does not have negative sustainability implications <BUT> • The company has a very strong focus on bioenergy and does not invest in alternative technologies
◌	The company provides no or very limited information	• The company does not operate in a sector where the technical mitigation potential of existing technologies remains limited, and has alternatives to decarbonise its activities *<OR>* • The bioenergy has or is very likely to have negative sustainability implications

3.3 Renewable electricity generation and procurement

3.3.1 Guiding principles

Companies reduce electricity-related emissions in different ways. How a company goes about sourcing renewable electricity makes a big difference in the actual emission impact and the credibility of renewable electricity consumption claims. Importantly, in most cases, pursuing high quality procurement constructs does not imply a company consumes 100% renewable electricity. Electricity-related emissions are a relevant emissions source for all companies to address and represent a key component of many companies' climate change strategies and pledges. For some companies, those emissions account for the lion's share of their emissions. Other companies may have relatively fewer emissions from electricity consumption today, for instance those in the heavy industry, aviation, and shipping sectors. However, electricity is likely to become increasingly important for those companies, as they move away from fossil fuels to alternatives such as hydrogen and ammonia, for the production of which electricity is needed. As alternative fuels are not yet produced at scale, some companies are investing in new facilities that will produce, for instance, e-methanol or e-hydrogen. Those fuels are only zero carbon if they are based on green electricity.

It is best practice for companies to combine high quality renewable electricity procurement with the most accurate and transparent emission reporting. Companies have a variety of options for sourcing renewable electricity, including on-site installations, Power Purchase Agreements (PPAs) and Renewable Electricity Certificates (RECs) (Table 9). While for some options an emissions reduction claim may be legitimate, for others the impact is unclear. As the impact of projects vary and is often unclear, it is best practice for companies to combine high quality renewable electricity procurement with the most accurate and transparent emission reporting, including the location-based accounting method alongside the market-based accounting method (see section 1.1).

On-site renewable electricity generation with on-site storage offers the best guarantee that companies use renewable electricity without placing a significant burden on grid infrastructure. This approach reduces scope 1 emissions in the case that those renewable energy technologies replace existing on-site fossil-fuelled generators. Scope 2 emissions are reduced in the case that new renewable energy installations shift energy demand away from external energy procurement, bringing renewable energy generation under the direct control of actors (NewClimate Institute and Data-Driven EnviroLab, 2020). Companies that have on-site installations but no storage systems are very likely to continue to rely on the local grid. For instance, to inject surplus electricity or to consume electricity when their demand is higher than their electricity production. Therefore, the option of on-site generation with on-site storage is preferable and more likely to guarantee that companies use renewable electricity for their activities.

Monitoring and matching energy consumption with renewable energy on a 24/7 basis can significantly increase the credibility of claiming that electricity is derived from renewable sources, as long as the electricity is procured from high quality procurement options that would likely not have existed without the company's financial support. This procurement option ensures that a company's hourly energy consumption is matched with clean energy generation, including at times of peak demand. Monitoring and matching energy consumption at an hourly basis is a relatively new construct and still faces several challenges, such as the complexity of matching consumption with real-time electricity generation (Avelar and Boer, 2021).

Higher quality Power Purchase Agreements (PPAs) may lead to additional renewable electricity capacity and fewer GHG emissions. A PPA is a long-term contract between an electricity provider and an electricity consumer, usually spanning 10-20 years. The consumer agrees to purchase a certain amount of electricity from a specific asset under a pre-determined pricing arrangement. PPAs are generally signed with new renewable energy installations and form part of the project investment decision (NewClimate Institute and Data-Driven EnviroLab, 2020). PPAs can also be signed for existing installations, in which case it is less likely the PPA results in additional renewable electricity capacity. However, it may be that existing installations would cease operations if the operator cannot sign a new PPA. Renewable energy is economically more attractive than the cheapest fossil fuel options in many parts of the world (IRENA, 2021b), so PPAs may be less relevant for project developers in the decision to invest in renewable electricity projects.

Investments in renewable electricity capacity are likely to lead to additional renewable energy capacity but are not necessarily a suitable approach to reduce electricity-related emissions. Investments in renewable electricity projects are a business case in their own right. Companies can only claim a neutralisation of own electricity-related emissions if they set up an agreement to procure the electricity and RECs from the new installation. Only in this situation, other parties cannot enter into agreement

to claim renewable energy from those installations (NewClimate Institute and Data-Driven EnviroLab, 2020). Without the guarantee that other actors cannot claim the renewable electricity, there is a high risk of double counting renewable electricity.

Energy suppliers can charge a premium for renewable energy capacity expansion that is dedicated to the construction of additional renewable electricity capacity. Such a premium can be bundled with any form of energy procurement model, such as RECs or a PPA, regardless of the volume of energy procured. More ambitious electricity providers offer their clients an independently verified guarantee that their electricity generation stems from renewable energy installations not older than five or ten years (NewClimate Institute and Data-Driven EnviroLab, 2020). A capacity expansion premium alone cannot underpin the claim of the neutralisation of current electricity emissions, but rather it can be add-on to improve the quality of any other energy procurement model and contribute to more renewable electricity capacity in the near future.

Renewable Energy Certificates (RECs) – also known under various other names, such as Guarantees of Origin (GOs) or Energy Attribute Certificates (EACs) – often do not contribute to additional renewable electricity capacity. They are not a suitable approach for corporates to address electricity-related emissions. While the purchase of RECs could in theory send a signal to investors that there is demand for renewable energy, studies indicate that RECs have historically contributed very little to the development of additional renewable energy installations in Europe and the United States (Hulshof *et al.*, 2019). Oversupply of certificates and associated low prices, along with implicit double counting, are key reasons for this problem. For example, in Europe there is an oversupply of RECs at low prices that mostly stems from decades-old hydropower installations in Scandinavia (Hulshof *et al.*, 2019; NewClimate Institute and Data-Driven EnviroLab, 2020).

The very unlikely impact of RECs can have substantial consequences for the credibility of corporate claims related to renewable energy consumption and GHG footprint. Bjørn *et al.* (2022) found that the use of RECs by companies with SBTi-approved reduction targets leads to an inflated estimate of those companies' abatement efforts. The researchers concluded that 42% of committed scope 2 emission reductions may not result in real-world mitigation (Bjørn *et al.*, 2022).

Recent studies suggest that consumers' demand for RECs and their willingness to pay may increase, which could lead to the development of additional renewable electricity installations in the future. For instance, one study modelling the impacts of future corporate procurements in northern Europe found that a high and stable price for RECs can have a positive effect on future renewable electricity generation (Martinsen and Mouilleron, 2020). However, according to this study, the majority of future renewable electricity generation would continue to take place in the absence of a market for RECs, meaning that the procurement of one 1MWh certificate leads to *additional* generation of less than 1MWh (Martinsen and Mouilleron, 2020). The sale of RECs displaces more carbon-intensive energy to other consumers. When a customer purchases RECs, the actual energy mix that a certificate owner receives does not change, nor does the energy mix in the grid. If fossil-fired power plants and renewable energy technologies feed electricity into a grid, the actors who draw from that grid would all receive a combination of renewable- and fossil-fired electricity. Consequently, if the owner of a renewable energy generation facility were to sell RECs to one actor, that actor may claim a lower grid emission factor to determine its scope 2 GHG emissions but would still continue to receive the same combination of renewable and fossil-fired electricity. Other customers on the same grid need to apply a higher grid emissions factor, so their reported electricity-related emissions will increase (NewClimate Institute and Data-Driven EnviroLab, 2020).

RECs can be bundled or unbundled with the electricity that a company consumes:

- **Unbundled RECs:** the consumer purchase RECs on the spot market from a third party, separately from the purchase of electricity from another supplier.
- **Bundled RECs – third-party generated:** the consumer purchases electricity and RECs from one and the same supplier, but this supplier has procured the RECs from a third party. In this situation, the supplier may sell fossil fuel power electricity and green it with the sale of RECs.
- **Bundled RECs – supplier generated:** the consumer purchases renewable electricity and associated RECs from one and the same supplier.
- **Tailored renewable energy contracts combine key features of RECs and PPAs.** Under this model, customers sign a contract with a renewable energy supplier and commit to purchasing renewable electricity and associated RECs for a longer period of time and usually from a determined source or asset. The electricity often comes from a new installation, although this is not necessarily the case (NewClimate Institute and Data-Driven EnviroLab, 2020).

Bundled RECs and tailored renewable energy contracts carry a lower risk of implicit double counting and are likely to send a stronger signal to the market than unbundled RECs, although still a much weaker one than, for instance, PPAs.

Table 9: Overview of renewable electricity procurement options.

RENEWABLE ENERGY PROCUREMENT CONSTRUCT	LIKELIHOOD OF CONTRIBUTING TO ADDITIONAL INSTALLED RENEWABLES CAPACITY			
	HIGH	MODERATE	LOW	
Own RE installation with storage capacity	×			Constructs ensure the installation of capacity that would not have come online otherwise. New storage solutions in combination with these new installations can help reducing the impact on the local grid and support 24/7 matching of demand and supply. However, in many cases, companies may still rely on the local grid when their generation and storage does not cover their demand. They should use the location-based emissions factor for the emissions reporting for the energy that is consumed directly from the grid. The emissions factor for the energy that they generate themselves may be zero.
Own RE installation without storage capacity	×			
Power Purchase Agreement (PPA)	×	×	×	PPAs can contribute to additional capacity if the PPA is signed with a new RE installation *and* provides the energy provider with the necessary financial security to go ahead with the construction of the installation. To contribute to reducing a company's energy-related emissions, it is necessary that the PPA is signed for an installation connected to the same electricity grid as the company's facilities. To avoid double claiming of renewable electricity, companies should purchase RECs from the RE installation for which they signed a PPA. PPAs are unlikely to contribute to the installation of additional capacity if the PPA is signed for an existing installation (unless the energy provider would need to shut down the installation in the absence of a new PPA). PPAs that are signed for an installation in a different geographical area may lead to additional capacity but do nothing to reduce emissions on the company's local energy grid. PPAs do not lead to a direct and immediate reduction of emissions from the consumed electricity at all times of the day. Electricity is still procured from the grid, supplied by a mix of generation technologies. The emission impact is not comparable to a reduction in electricity demand through energy efficiency measures. A location-based emissions factor should be used to accurately indicate the emissions impact associated with electricity consumption.
Capacity premium	×	×	×	The likelihood of a capacity premium leading to additional capacity can be considered high, moderate or low depending on the integrity of the entity that collects the capacity premium and on the construct (see this table's overview) for which the collected funds are invested in.
RECs bundled		×	×	While some claim that RECs may signal to the market that there is demand for renewable electricity, studies have found no evidence that the procurement of RECs leads to the development of additional renewable electricity capacity (Bjørn *et al.*, 2022).
RECs unbundled			×	Bundled RECs may have a moderate or low likelihood of contributing to additional RE capacity. Likelihood is larger if: • RECs are bundled with the energy that a company purchases and generated by the energy supplier (i.e. on the same local grid as the company); • RECs are from a new installation. RECs do not lead to a direct and immediate reduction of emissions from the consumed electricity at all times of the day. Electricity is still procured from the grid, supplied by a mix of generation technologies. The emission impact is not comparable to a reduction in electricity demand through energy efficiency measures. A location-based emissions factor should be used to accurately indicate the emissions impact associated with electricity consumption.
Investments in renewable energy installations				Investments in renewable energy capacity are a business case. They can be combined with a PPA or RECs.
24/7 monitoring				24/7 monitoring and matching energy consumption with renewable energy generation can be an add-on to using PPAs or RECs. This improves the quality of those constructs by ensuring that consumption is matched with renewable energy production around the clock.

3.3.2 Assessment criteria

In line with the guiding principles above, our evaluation of companies' renewable electricity procurement is based on the assessment criteria in Table 10.

Table 10: Assessment criteria for procurement and generation of renewable electricity

PROCUREMENT AND GENERATION OF RENEWABLE ELECTRICITY		
	TRANSPARENCY	INTEGRITY
●	The company provides thorough details on the pursued renewable energy constructs. This includes details on the following: • Type of renewable energy/supply construct • Location of renewable energy generation capacity for each construct • Volume of electricity procured through each construct. • For PPAs, agreements regarding the bundling (or cancellation) of any associated certificates.	The company pursues one or a combination of the following options: • On-site renewable energy capacity with or without storage • High-quality PPAs with generation capacities within the same location as the electricity demand, including the bundling/transfer or cancellation of any associated RECs *<AND>* These account for more than 90% of the company's electricity consumptiom.
◐	The company provides a moderate level of detail on the pursued renewable energy constructs.	The company uses a capacity expansion premium to cover the majority of its electricity consumption *<OR>* The company uses one or a combination of the following options, but these account for between 50% and 90% of the company's energy/electricity consumption: • On-site renewable energy capacity with or without storage • High-quality PPAs with generation capacities within the same location as the electricity demand, including the bundling/transfer or cancellation of any associated RECs
○	The company provides very limited to no details on its pursued renewable energy supply constructs.	The company uses some higher quality procurement options, but these account for a minor share of its consumption *<OR>* The company procures electricity through PPAs without the bundling/transfer or cancellation of any associated RECs. *<OR>* The company uses unbundled or bundled RECs independently of a power purchase agreement; *<OR>* The company does not pursue any renewable energy procurement option for at least 50% of its electricity demand.
?		The company's renewable energy supply constructs are unclear, and an assessment is not feasible.

4 Climate contributions and neutralisation claims

4.1 Responsibility for unabated emissions

4.1.1 Guiding principles

Corporate climate leadership includes both setting ambitious targets for emission reductions in the company's own value chain, as well as taking responsibility for unabated emissions in the meantime. Most companies do not have the ability to immediately eliminate their entire GHG emissions footprint. While more and more companies are charting a pathway to complete decarbonisation and although far reaching reductions are possible and required in the next years, it will usually take years or decades until companies are able to entirely achieve this goal, even the most ambitious ones.

For some companies, taking responsibility for unabated emissions means making **climate contributions** to support climate change mitigation beyond the company's value chain without making a neutralisation claim, while for others it means **claiming to neutralise** their emissions through carbon dioxide removals or emission reduction offset credits. Some companies pursue both approaches in parallel. Sections 4.2 and 4.3 explore key considerations for the credibility of these two approaches.

4.1.2 Assessment criteria

Our evaluation of companies' responsibility for unabated emissions is dependent on the transparency and integrity of companies' approaches to climate contributions and offsetting. The rating is based on the assessment criteria in Table 11.

Table 11: Assessment criteria for responsibility for unabated emissions

RESPONSIBILITY FOR UNABATED EMISSIONS	
TRANSPARENCY	**INTEGRITY**
The transparency score for **responsibility for unabated emissions** reflects the combined average transparency score for **climate contributions** (section 4.2 table 12) and **offsetting claims today** (section 4.3 Table 14).	The integrity score for **responsibility for unabated emissions** reflects the combined average integrity score for **climate contributions** (section 4.2 table 12) and **offsetting claims today** (section 4.3 Table 14).
The company does not provide any information on an approach to assume **responsibility for unabated emissions**, either through **climate contributions** (section 4.2 table 12) and **offsetting claims today** (section 4.3 Table 14).	?

4.2 Climate contributions without a neutralisation claim

4.2.1 Guiding principles

In recognition of the limitations of offsetting and the need to ramp up financial support for climate action worldwide, some actors – including companies, standard setting initiatives and even providers of carbon offsets – are moving away from the offsetting model to making a climate contribution without any neutralisation claim.

We define climate contributions as the financial support provided by a company to support climate change action beyond the company's own value chain, without claiming to neutralise its own emissions. A company can claim to *contribute* to climate change mitigation activities, without claiming ownership of the emission reduction outcomes and without subtracting associated reductions from their own GHG inventory or net-zero target. Climate contributions, which represent an alternative approach to neutralisation claims, are a central feature of NewClimate Institute's *Climate Responsibility* approach (NewClimate Institute, 2020) and the WWF-BCG *Climate Blueprint* (WWF and BCG, 2020). The Climate contribution model has been anchored in the framework of the Paris Agreement by the COP27 decision to create a type of unit under Article 6.4 that can be used only for this purpose (a 'Mitigation contribution A6.4ER', see section 4.4). Some established providers of arbon credits and carbon neutrality labels, are transitioning to this alternative model.

An internal carbon price on emissions can inform the volume of financial support. This way, climate contributions are linked to a company's responsibility for its own unabated emissions. The volume of financial contributions can serve as a key indicator of climate leadership. Ambitious companies could, for example, use the proceeds of an internal carbon price that is set at a high enough level to send a clear incentive signal for embarking on a 1.5°C-compatible decarbonisation trajectory. The High-Level Commission on Carbon Prices (2017) found a carbon price range of USD 40-80/tCO_2e in 2020 to be consistent with the Paris Agreement's "well below 2˚C" goal, provided a supportive policy environment is in place, rising to USD 50-100/tCO_2e in 2030. The *IPCC Special Report on Global Warming of 1.5 °C* (IPCC, 2018) found with high confidence that the global average discounted marginal abatement costs for limiting warming to 1.5°C were likely about 3–4 times higher compared to the costs for limiting warming to below 2°C. For indicative purposes only, this *could* imply a price range of USD 120-320/tCO_2e to be consistent with limiting warming to 1.5°C, compared to the 2°C compatible range of the High-Level Commission on Carbon Prices. The full range of values identified from the literature review in the IPCC Special Report included a range of USD 15-220/ tCO_2e in 2030 for compatibility with limiting warming to below 2°C, compared with a range of USD 135-6,050/ tCO_2e in 2030 for compatibility with limiting warming to below 1.5°C (IPCC, 2018, p. 152). The IPCC also found that a carbon price of around USD 25/ tCO_2e alongside a supportive policy environment would be sufficient at least to reduce a further 10 $GtCO_2e$ compared to countries' NDCs in 2030 (IPCC, 2018, p. 153).

Given that sufficient supportive policy environments are not in place in most countries (CAT, 2022c), and in the absence of a comparable price range for 1.5°C compatibility, we consider that companies with ambitions to be aligned with 1.5°C should aim at least at the upper end of the USD 40-80/tCO_2e range that the High-Level Commission on Carbon Prices (2017) established to be compatible with "well below 2˚C".

Companies can channel their climate contributions towards a wide range of activities. Since they are not planning to claim to neutralise their emissions, companies making climate contributions are not tied to procuring carbon credits and enjoy far greater flexibility in the type of activities they can support to advance global decarbonisation. This could include, for example, support for carbon removals through nature-based solutions, which does not offer sufficient guarantees of permanence to truly neutralise emissions (see section 4.3.3), but which is critical to addressing climate change and requires more financial support globally. Other examples include emerging technologies and measures for sectors where the technical mitigation potential of existing technologies remains limited, where innovation and investment are needed to find new solutions. Uncertainties regarding the eventual emissions reductions delivered by more immature technologies and higher-risk investments may make them less attractive to project developers looking to generate offset credits, but a more suitable avenue for those channelling financial support in the form of climate contributions.

Climate contributions without neutralisation claims can provide a transparent, constructive, and ambitious approach to take responsibility for unabated emissions:

- **More transparent:** Targets that are formulated independently from offsetting, without any netting-out of actual climate impacts, are more transparent and provide a clearer signal to decarbonise the company's own value chain.
- **More constructive:** Developing countries need more financial support to ramp up their mitigation action; voluntary action from companies is a vital channel of such support. A constructive environment is required, where this finance positively reinforces ambition raising, rather than one that provides perverse incentives to limit the ratcheting up of national climate commitments. In contrast to offsetting approaches, if the financial support from voluntary action results in emission reductions that are owned by the actors supported and the host country they operate in, this action will not conflict with the host country's GHG emission reduction target. Instead it can provide support for reaching and ratcheting up those targets.
- **More ambitious:** The contribution claim model is aligned with the concept of ratcheting ambition through a race to the top, a concept that underpins the Paris Agreement. If companies are free to self-determine their own ambition for their climate contributions – as countries do through Nationally Determined Contributions – this may result in a race to the top to demonstrate the highest ambition, without limits. This would mark a significant shift from the offsetting approach in which many companies race to the bottom and exploit loopholes to deliver a fixed target at the lowest cost.

Despite these potential advantages, there are still open issues to address with the climate contribution model to ensure that the approach can lead to high quality action. The increased flexibility regarding the types of projects that can be supported under this model can be beneficial for supporting carbon dioxide removals or emerging technologies, but it will also be a challenge to ensure that this flexibility is not used to pursue lower quality projects. In this regard, their remains a significant role for existing market players and standard setting initiatives to contribute to the discussion and tools available for quality assurance.

Companies should disclose details on their climate contributions, including the basis for determining the volume of their financial contributions, the amount that they contribute each year, the recipients and the anticipated or measured impacts. It is critical that communication around these climate contributions avoids any implication that they serve to offset the actual emissions of the company.

4.2.2 Assessment criteria

In line with the guiding principles above, our evaluation of companies' climate contributions is based on the assessment criteria in Table 12.

Table 12: Assessment criteria for good practice climate contributions

CLIMATE CONTRIBUTIONS WITHOUT NEUTRALISATION CLAIM	TRANSPARENCY	INTEGRITY
●	The company discloses information on its approach to climate contributions, including details on all of the following: ✓ the basis for determining the volume of the financial contributions; ✓ the total volume of finance (per year); ✓ the project recipients; ✓ the rationale for selection of project recipients; and ✓ the expected impact of support provision.	✓ The company assumes responsibility for its unabated emissions through climate contributions, without using any credits arising from those contributions to claim the neutralisation of its own emissions. ✓ The volume of finance is derived from, or at least equivalent to, an internal carbon tax across all scope 1, 2 and 3 emissions that may be aligned with a 1.5 °C-compatible price level (usually at least USD 80/tCO_2e, unless otherwise demonstrated by the company).
◐	The company discloses some information on its approach to climate contributions, including the volume of finance provided, but without covering all of the good practice transparency criteria.	✓ The company assumes responsibility for its unabated emissions through climate contributions, without using any credits arising from those contributions to claim the neutralisation of its own emissions. ✓ The volume of finance is derived from, or equivalent to, an internal carbon tax that is likely sufficient to provide a signal for moderate emission reductions (usually at least USD 25/tCO_2e, unless otherwise demonstrated by the company), but is not sufficient to align with a 1.5 °C-compatible price level.
○	The company alludes to possible climate contributions but without providing sufficient clarity on the volume of finance provided and other details.	The company does not assume responsibility for its unabated emissions through climate contributions without a neutralisation claim, or the volume of finance is insufficient to provide a signal for moderate emission reductions.
?		The company provides insufficient information to assess the sufficiency of its climate contributions.
N/A	The company does not assume responsibility for its unabated emissions through climate contributions without a neutralisation claim.	

4.3 Offsetting claims

4.3.1 Multiple faces of offsetting claims

4.3.1.1 Equivalent terminologies

Companies make an offsetting claim when they assert that GHG emissions within their value chain are 'neutralised', 'netted-out', 'offset', 'inset' or 'counterbalanced' through other emission reduction activities or carbon dioxide removals – inside or outside of their value chain.

The practice of claiming to offset emissions has been afflicted by controversy and contention due to significant uncertainties in the real impact of carbon credit use as well as the suitability of carbon dioxide removals for offsetting emissions. Accordingly, terminology for claiming to have offset emissions is highly sensitive and inconsistent. Many actors now avoid the term offsetting entirely; companies and initiatives more often refer to "neutralisation", "netting-out", "compensation", "reducing the footprint", "counterbalancing", or other equivalent terminologies. "Insetting" is also gaining traction as a term to claim to have offset emissions through carbon dioxide removals or emission reductions within a company's own value chain (see section 4.3.1.2).

Some standards and companies propose the use of multiple terminologies to distinguish between offsetting in different circumstances and at different times. We consider that the complication of this single concept creates additional and unnecessary confusion which may detract from the ability of consumers, investors and regulators to critically assess claims made by companies.

We assess all claims that unabated GHG emissions within the value chain are neutralised as *offsetting claims*, including all synonymous terminologies and project types.

4.3.1.2 Insetting and climate-positive

"Insetting" is a business-driven concept with no universally accepted definition. The approach can lead to low credibility offsetting claims and the double counting of emission reductions.

The concept of insetting is promoted by some actors as a better alternative to offsetting, mainly for companies with links to agriculture and land-use sectors in their supply chains. Insetting is sometimes described as *offsetting within the value chain*. This can mean two different things, both of which are highly contentious:

- **Emission reduction projects in the value chain:** Here, an emission reduction project – similar to an offsetting project – is implemented within the company's value chain, rather than outside of it. Describing this as insetting is a false concept; this is simply a measure for the reduction of the company's own emissions. In claiming that the reduction of certain emissions neutralises the company's other GHG emissions, the company is either: a) rejecting responsibility for those sources and excluding them from the scope of its target or claim; or b) counting the emission reductions of those measures twice to claim reductions for some emission sources *and* neutralisation of other emission sources. The credibility of the claim is critically compromised in either case.

  In the most extreme case, companies may claim the complete carbon neutrality of their scope 1 and 2 emissions, by claiming the *reallocation* of marginal reductions from their scope 3 emissions. Given that scope 3 emissions account for the major share of many companies' emissions, such a claim may be possible with only very marginal reductions to scope 3 emissions that could possibly be achieved under business-as-usual trajectories. The possible outcome is that a company claims to be carbon neutral without haven taken any action to reduce its scope 1 and 2 emissions.

- **Carbon dioxide removals in the value chain:** In this case, measures are taken within a company's value chain to achieve carbon dioxide removal and storage. This may include carbon storage in agricultural soils, and carbon storage in harvested wood and wood-based products. Here, the same environmental integrity issues apply as for any other carbon dioxide removal offsetting projects (see section 4.3.3): the suitability of these measures for claiming the neutralisation of GHG emissions is compromised by the lack of permanence of the carbon storage and the scarcity of nature-based solutions for carbon dioxide removals. An apparent key difference between carbon dioxide removals under an 'insetting' approach, as opposed to carbon dioxide removals through certified offsets, is that the companies implementing an insetting approach may not seek independent measurement and verification of the carbon dioxide removals. As such, this is simply a weaker variation of an already non-credible offsetting approach.

Several major companies are currently advocating for standards that legitimise insetting as valid carbon compensation, including through holding prominent roles on advisory committees and technical working groups of key standard setting initiatives such as GHG Protocol's *Guidance for corporate accounting of land sector emissions and removals* (GHG Protocol, 2021).

Climate Positive pledges are based on the principles of insetting and avoided emissions, neither of which is recognised as a legitimate approach for claiming to offset emissions.

In recent years, a small group of companies have started to use the terminology "Climate Positive" for their climate targets. Those companies define climate positive as a state of reducing more greenhouse gas emissions than the value chain emits. We understand that those companies seek to differentiate this approach from offsetting, but we believe that observers are highly likely to interpret the terminology climate positive to mean that unabated emissions have been neutralised.

Companies' *climate positive* targets typically include a combination of insetting measures and claims of *avoided emissions*. 'Avoided emissions' is defined by the ISO Net Zero Guidelines as "a potential effect on greenhouse gas emissions that occurs outside the boundaries of the organization but arising through the use of its products or services, outside scope 1 emissions, scope 2 emissions and scope 3 emissions" (ISO, 2022). A key difference here from emission reduction offsets is that there is no case for demonstrating the additionality of these avoided emission claims. For example, a company which sells PV modules to its customers may claim a*voided emissions* from the customers' use of those PV modules over their expected lifetime. If the sales of these PV systems constitute normal commercial transactions to supply an existing market demand, rather than special interventions from the company, it cannot be determined that these estimated avoided emissions are in any way additional to what may have occurred had the company not participated in this market. The GHG Protocol already specified in 2004 that any claims of *avoided emission* may not be accounted against scope 1, scope 2 or scope 3 emissions (WRI and WBCSD, 2004). Most recently, the ISO Net Zero Guidelines confirmed this position (ISO, 2022).

Recognising that neither the concepts of insetting nor avoided emissions are legitimate approaches for claiming the neutralisation of emissions, we understand that companies using the *climate positive* terminology seek to differentiate this approach from offsetting, by arguing that *climate positive* does not constitute a neutralisation claim. On the contrary, we believe that observers are very likely to interpret the terminology *climate positive* to mean that unabated emissions have been neutralised and that the company has a net-positive impact on the climate through a net-negative GHG emissions balance.

4.3.2 Criteria for credible offsetting claims

The global governance framework of the Paris Agreement represents a different context from the Kyoto-era, under which most existing offsetting mechanisms and standards were developed.

The environmental integrity of an offsetting claim has always been dependent on various factors, including but not limited to additionality, permanence, avoidance of double counting, leakage, and the accuracy of quantified impacts (CCQI, 2021). In addition to these long-established principles, several new factors are now of key importance to the integrity of an offsetting claim, since the coming into force of the Paris Agreement:

- **Avoiding double counting:** Corresponding adjustments on offset credit transactions are a minimum requirement to limit double counting of the emission reduction (see *Section 4.3.2.3*).
- **Avoiding the risk of distraction and delay:** Offsetting claims must be limited and transparent enough to ensure that they do not distract from the necessity of immediate emission reductions (see *Section 4.3.2.1*).
- **Additionality in the context of safeguarding Paris ambition:** Under the global governance framework of the Paris Agreement, offset credits can only provide an appropriate guarantee of additionality if they are generated from **high-hanging-fruit** mitigation projects (see *Section 4.3.2.2*).
- **Net zero compatibility:** Credits should only be procured from projects that are compatible with net-zero emission technology and infrastructure (see *Section 4.3.2.4*).
- **Permanence and scarcity of carbon dioxide removals:** Carbon dioxide removal projects are rarely suitable for offsetting due to lack of permanence, scarcity and environmental damages (see *Section 4.3.3 Carbon dioxide removals: additional criteria for credibility*).

These key concepts are addressed in more detail in the following sub-sections.

4.3.2.1 Avoiding risk of distraction and delay

Offsetting claims must be limited and transparent enough to ensure that they do not distract from the necessity of immediate emission reductions.

To maintain a chance of meeting the 1.5°C temperature limit, all sectors need to embark now on deep decarbonisation trajectories to reach net-zero GHG emissions and eventually net-negative GHG emissions worldwide (IPCC, 2018). In this ever more urgent context, the most pressing issue for offsetting claims is the risk that they may pose for distracting from the need for immediate emission reduction measures. If consumers, investors and regulators are led to believe that a company's emissions are lower than they really are, this may lead to a reduction in the extent to which these actors provide further pressure, incentives or support for necessary emission reductions. The relevance of this issue is independent of the quality of the means used to claim offsetting.

Targets and claims that significantly depend on offsetting claims are not conducive to the achievement of the Paris Agreement objectives, which require the full decarbonisation of all economies, and transparent dialogue to support that achievement. The Paris Agreement highlights the importance of transparency and facilitative dialogue for ambition raising. In this regard, we consider that a transparent communication of an organisation's own emissions and the plans and challenges faced in reducing emissions further, is more constructive than a subjective claim that emissions have been offset through whatever means.

Regardless of the quality of offsetting claims against the other criteria identified in this section, we consider that offsetting claims can only minimise the risk of distraction and delay under the following conditions:

- Carbon neutrality and net-zero claims should not rely on offsets for a substantial proportion of the company's emissions: the ISO Net Zero Guidelines recommends that offsets towards net-zero targets should only be used to account for 'residual emissions', which it defines and illustrates as accounting for 0-5% of the 2019 emissions from most sectors (ISO, 2022). We consider that the same logic applies to other synonymous terminologies, including carbon neutrality claims. Alternatively, this risk may be less relevant, if companies communicate targets and emission reduction measures that are clearly sufficient for sector-specific 1.5°C-compatible decarbonisation trajectories.
- Offsetting claims must be transparently communicated, including the provision of clear information on what emissions the company still has and the proportion of the company's 2019 emissions the company has claimed to offset.

4.3.2.2 Additionality in the context of the Paris Agreement

Under the global governance framework of the Paris Agreement, offset credits can only provide an appropriate guarantee of additionality if they are generated from high-hanging-fruit mitigation projects.

The high hanging fruit of mitigation potential refers to the technologies and measures to decarbonise emission sources that remain otherwise entirely inaccessible to host country governments in the near- and mid-term future, on account of extraordinary costs or other insurmountable barriers that cannot reasonably be overcome.

A key condition for determining the integrity of carbon credits is the *additionality* of the emission reduction project; that is, the guarantee that credited emission reductions are additional to what could be achieved without the incentives of the offsetting programme. In historical offsetting mechanisms, additionality could be proven by showing that local legislation did not require the activity and that offsetting revenues could help overcome barriers which would otherwise prevent implementation. Since the coming into force of the Paris Agreement, the concept of additionality needs to be redefined and should imply certainty that the project supported could not realistically have been implemented otherwise through unilateral ambition enhancements on the part of host-country governments.

The impact from carbon credits cannot be considered *additional* if it presents credit-selling territories with a perverse incentive to limit the extent to which they ratchet up their own ambition during NDC revision cycles. The prospect of potential revenues from emission reduction credits presents a risk that, to maximise foreign investment, countries or subnational territories may limit their own national GHG reduction targets so that more of their mitigation potential can be tapped by international offsetting mechanisms.

To overcome this potential ambition pitfall, offsetting projects should be sufficiently ambitious that they avoid presenting any conflict with the host country's own ambition.

An increasing number of crediting standards, companies and countries already advocate for high-hanging fruit mitigation projects as an attractive or even preferable option for offsetting mechanisms in the future. It is important that all crediting standards recognise targeting truly inaccessible mitigation options as the only credible option today. No other proposed safeguards for pursuing offsetting mechanisms can reliably overcome the perverse incentive ambition pitfall for host countries.

High-hanging fruit projects may incentivise further decarbonisation and lead to the identification of new solutions.

High-hanging fruit mitigation projects also partially safeguard against the risk of delayed decarbonisation action on the part of the buyer: a potential ambition pitfall of offsetting mechanisms in the context of the Paris Agreement, is that credit procurement can offer a cheap alternative to the decarbonisation of one's own emissions, which could lead to delayed action and a continuation of misaligned investments into new infrastructure that is not compatible with long-term decarbonisation trajectories. High-hanging fruit projects are more likely to mitigate against this risk to some extent, since they are likely to fetch a significantly higher price, sending a clearer signal to the buyer for further decarbonisation of their own emissions.

In addition to being the only credible option for post-2020 offsetting mechanisms to overcome potential ambition pitfalls, high-hanging fruit mitigation projects can also be an attractive prospect for advancing on deeper decarbonisation trajectories at the global level, if this results in the identification and implementation of solutions to address harder-to-abate emission sources.

The identification and development of high hanging fruit projects requires a radical shift of the offsetting market.

A shift to high-hanging fruit offsetting projects marks a significant transition. There are very few, if any, examples of existing credited projects that represent "high-hanging fruit" and could be considered truly additional in the context of safeguarding ambition in the Paris-era. Most emission reduction projects registered under crediting programmes to date have been developed in the context of cost-saving mechanisms under a pre-Paris governance framework in which not all countries had climate targets, rather than in the context of an ambition-raising mechanism that is aligned with the new post-Paris global climate governance framework. Accordingly, shifting the focus towards high hanging fruit projects requires a radical transformation of the offsetting market. These "high-hanging fruit" projects are nascent worldwide, require specific know-how, and/or come at high cost (Warnecke *et al.*, 2018).[4]

Project developers that look to operate in post-2020 offsetting mechanisms with high-hanging fruit mitigation projects will need to adjust their market search to move from upscaling more accessible mitigation technologies, to the development and implementation of more innovative technologies for harder-to-abate emission sources. This will take considerable time and resources to develop. Moreover, the scope of technologies and measures that would count as high-hanging fruits will be a gradually decreasing niche of activities, as countries' ambition and capabilities increase over the years.

On these considerations, it seems unlikely that high-hanging fruit mitigation projects can serve the mass demand for offsets that some analysts have forecast for the coming decades, and which some companies currently plan for. Rather, if offsetting mechanisms are to be implemented in a credible way that safeguards against ambition pitfalls, offsets can only play an ever increasingly niche role in companies' and nations' climate change mitigation strategies.

More accessible mitigation projects and nature-based solutions should still be supported without offsetting claims.

Although many existing carbon crediting projects represent relatively low-hanging fruit and come at low costs, they may still be attractive to support, either to support other actors to implement their climate targets or on account of the associated sustainable development benefits. However, support providers should re-consider whether an offsetting claim is appropriate in cases where the climate impact is uncertain, or whether a climate contribution without an offsetting claim may be more credible (see section 4.2).

4 *Specific examples include geothermal heat pumps to replace coal-fired heating plants in Mongolia and Net-Zero Energy Buildings in Colombia (Kachi et al., 2020; Nascimento et al., 2020).*

4.3.2.3 Double counting

Corresponding adjustments on carbon credit transactions for offsetting purposes are a minimum requirement to limit double counting of the emission reduction.

A corresponding adjustment requires that the country hosting an activity is required to make adjustments to their GHG emissions inventory to account for the volume of internationally transferred mitigation outcomes. Corresponding adjustments help ensure that the same emission reduction cannot be used towards multiple purposes, such as the national target of the project host country (referred to as "Nationally Determined Contribution", or NDC, under the Paris Agreement) as well as the NDC of another country, or in support of a corporate's climate claim or target. While this is an intuitive concept, it is not yet a standard facilitated practice for any offsetting standards.

Under the rules for Article 6 of the Paris Agreement, agreed at COP26 in 2021 and COP27 in 2022, corresponding adjustments are required for the transaction of any authorised A6.4ERs for any purpose. Alternatively, actors are not required to apply corresponding adjustments in the case that carbon credits are designated for a 'mitigation contribution' rather than 'authorised for the international transfer of mitigation outcomes' (see section 4.4). Given the potential complexities of establishing a functional system for corresponding adjustments, it remains unclear whether the voluntary offsetting standards will also introduce systems for corresponding adjustments, or if they will align and integrate with the Article 6.4 project registry.

Some offset providers and companies continue to reject the concept of corresponding adjustments and claim that this should not be required for companies. More ambitious standards and companies will view corresponding adjustments as a minimum requirement.

This accounting adjustment alone does not guarantee the environmental integrity of anoffsetting claim, but is a minimum requirement to uphold integrity in combination with the following criteria.

4.3.2.4 Net-zero emission compatibility

Carbon credits must only come from activities that are compatible with net-zero emission technology and infrastructure to avoid lock-in to technologies and practices that are not aligned with the long-term objectives of the Paris Agreement.

To support the objectives of the Paris Agreement, financial support must be channelled to the identification and scaling of long-term solutions. Investments in bridging technologies that represent marginal emission reductions, but which are not compatible with zero emission technologies, may result in stranded assets, and can delay investment in the cleanest technologies.

For sectors that should be fully decarbonised before 2050, the supported technologies and measures must be compatible with a zero-emission sector. For sectors where the technical mitigation potential of existing technologies remains very limited, the supported technologies should be compatible with other best available or emerging decarbonisation technologies within those sectors.

To evaluate technologies and measures against this criterion, it is necessary to distinguish between sectors where technology options for zero emissions theoretically exist, and sectors where such technologies remain in research and development:

- **Emission sources where technology options for zero emissions theoretically exist**

  For sectors where technical options for full decarbonisation exist, whether they are commercially established or emerging, the supported technologies and measures must be compatible with a zero-emission sector. Emission reduction projects would not meet this criterion if they involved the continued use of technologies that would actually need to be eventually phased out – rather than optimised – to reach zero emissions. For example, technologies that increase the efficiency or otherwise marginally reduce the emissions of fossil fuel combustion would not qualify, unless they are also compatible with renewable energy technologies.

- **Emission sources where technology options for zero emissions remain in R&D**

  For these harder-to-abate sectors, the supported technologies should be compatible with other best available or emerging decarbonisation technologies within those sectors.

This requirement is established in the Article 6 rules, although weak language may lead to deviating interpretations. Companies should take care of the projects from which their credits originate to ensure the environmental integrity of the credit and the credibility of their claims.

4.3.3 Carbon dioxide removals: additional criteria for credibility

It can be good practice for companies to support the development of carbon dioxide removals (CDR) inside or outside their value chain, in parallel to emission reductions.

All scenarios consistent with a 1.5°C temperature increase include a major role for carbon dioxide removals (CDR) (Rogelj *et al.*, 2018). This includes nature-based solutions for carbon sequestration in forests, soils, peatlands and mangroves, technological solutions such as bioenergy with carbon capture and storage (BECCS) and direct air carbon capture with storage (DACCS), and solutions with mineral storage. Finance is needed to scale up carbon dioxide removal efforts, and corporates could play a key role.

However, issues related to non-permanence of carbon storage, scarcity of storage potential, and environmental damages, mean that CDR measures can rarely be considered a credible means of offsetting emissions.

Sections 4.3.3.1 and 4.3.3.2 explain the issues associated with **permanence** and **scarcity** of carbon dioxide removals. Based on these issues, we conclude that it could in theory only be credible for companies to claim to offset their emissions under the specific conditions that they only offset residual emissions from emission sources where the technical mitigation potential of existing technologies remains limited, with carbon dioxide removals that have a high likelihood of sufficient permanence. Scarce potential and environmental damages mean that CDR measures cannot be considered a credible offset of emissions that could be feasibly reduced.

Given these significant limitations, we find that it is more credible for corporates to set separate targets for emission reductions and carbon dioxide removals, and to channel support for carbon dioxide removals through climate contributions without neutralisation claims.

Table 13 gives an overview of the suitability of carbon dioxide removal measures and technologies for offsetting claims, in line with the issues of permanence and scarcity set out in sections 4.3.3.1 and 4.3.3.2, according to best available information in 2022.

Table 13: Overview of the factors affecting suitability of CDR technologies for neutralising GHG emissions

APPROACH		FACTORS AFFECTING SUITABILITY FOR OFFSETTING				
		LIKELY PERMANENCE	SCARCITY IN TERMS OF ADDITIONAL POTENTIAL [A] ($GtCO_2e$-yr)		ENVIRONMENTAL CONSTRAINTS	DISPLACEMENT OF EMISSIONS
			TOTAL TECHNICAL POTENTIAL	ENVIRONMENTALLY CONSTRAINED POTENTIAL		
CDR measures with mineral storage have a reasonable likelihood to meet the criteria of *permanence* and *additional potential* to be considered a credible neutralisation of residual emissions from hard-to-abate emission sources. Uncertainties on the environmental limitations mean that the credibility of claiming the neutralisation of other unabated emissions is contentious.	Enhanced weathering	Centuries to millenniums	Likely vast 4-95 (Lenton, 2014; Taylor *et al.*, 2015; Strefler *et al.*, 2018)	Finite but possibly moderate 2-4 (Fuss *et al.*, 2018)	Loss of habitats, water and air pollution from rock mining.	No issue
	Mineral carbonation	Centuries to millenniums	Likely vast 8,200-34,700 $GtCO_2e$ cumulative (Kelemen *et al.*, 2019)	Unknown, likely vast	High-water requirements; induced seismicity; groundwater contamination.	No issue
For BECCS and DACCS with underground storage, high storage permanence is possible, although uncertainty on the risk of leaks remains. The limited additional potential of these measures, as well as the considerable environmental concerns and energy system inefficiencies, mean that these measures are not a reasonable equivalent alternative to emission reductions for unabated emissions when further emission reductions are feasible.	Bioenergy with carbon capture and storage (BECCS)	Theoretically centuries to millenniums, (uncertain)	Finite and possibly scarce 0.4-11.3 (Roe *et al.*, 2019)	Finite and possibly scarce 0.5-5 (Fuss *et al.*, 2018)	Land scarcity; monoculture affecting biodiversity and soil health; very high-water requirements.	No issue
	Direct air carbon capture and storage (DACCS)	Theoretically centuries to millenniums, (uncertain)	Likely vast 5-40 (Fuss *et al.*, 2018)	Finite and possibly scarce 0.5-5 (Fuss *et al.*, 2018)	High water and energy requirements; pollution from by-products.	No issue
CDR measures based on biological capture and storage do not have the necessary degree of permanence, nor the additional potential, to be credibly considered an equivalent to emission reductions. These measures are also vulnerable to the displacement of emissions to other locations.	Soil carbon sequestration	Years to decades	Finite and possibly scarce 0.3-6.8 (Roe *et al.*, 2019)	Finite and possibly scarce 0.9-1.9 (Hepburn *et al.*, 2019)	Soil saturation; land scarcity.	Vulnerable
	Biochar	Decades to centuries	Finite and possibly scarce 0.03-6.6 (de Coninck *et al.*, 2018)	Finite and possibly scarce 0.3-2 (Fuss *et al.*, 2018)	Plant resilience; ecosystem albedo; land degradation; loss of habitat.	Vulnerable
	Afforestation & reforestation (AR)	Years to decades	Finite and possibly scarce 0.5-10.1 (Roe *et al.*, 2019)	Finite and possibly scarce 0.5-3.6 (Fuss *et al.*, 2018)	Land availability; food security.	Vulnerable

4.3.3.1 Permanence of carbon dioxide removals

The permanence of carbon-dioxide removals must be guaranteed over a timeframe of centuries to millenniums. The use of non-permanent carbon dioxide removals to offset emissions will lead to an *increase* in atmospheric concentration of CO_2.

The permanence of a carbon dioxide removal refers to the degree of certainty that the sequestered carbon will not be released at a later point in time. The permanence of different technologies depends on where in the earth's system the carbon is sequestered. Sequestration in the lithosphere (such as injection into depleted fossil fuel reservoirs and aquifers or mineralisation into rocks) and in the hydrosphere (storage in deep oceans) have a more robust (and thus longer) degree of permanence compared to the biosphere (such as in trees or soils) due to its vulnerability to natural and anthropogenic disturbances. The release of previously sequestered carbon negates any benefits of the sequestration: at the point at which the carbon dioxide is released, the atmospheric concentration of carbon dioxide is restored to the same value that it would have been had the CDR activity never taken place. If non-permanent removals are used to offset emissions, the global CO_2 concentration will increase as a result (Jeffery *et al.*, 2020). A sufficient guarantee of permanence requires a high likelihood that the captured carbon will remain stored over a timeframe of centuries to millenniums. Significant reliance on measures that have a reasonable likelihood of releasing captured carbon over a timeframe of decades present a risk of materially increasing atmospheric carbon concentrations either this century or in the next.

4.3.3.2 Scarcity of carbon dioxide removal potential

Scarce carbon dioxide removal potential must be reserved for balancing out residual emissions in sectors where the technical mitigation potential of existing technologies remains very limited, for it to remain technically possible to achieve global net-zero emissions.

The maximum potential of most carbon dioxide removal measures is technically limited, and further restricted by environmental constraints. Due to issues such as land requirements, high water consumption, high energy consumption, land degradation and pollution, carbon dioxide removal technologies can only be scaled up so far without significantly endangering sustainable development goals, including food security.

The scarcity of carbon dioxide removal measures is an important consideration when evaluating net-zero claims at the level of individual actors. Robust future use of scarce carbon dioxide removal options must be consistent with achieving net-zero and eventually net-negative emissions at the global level, which is required to avoid the most damaging effects of climate change over the coming decades. To align with 1.5°C compatible pathways at the global level, some sectors with the technical ability to fully decarbonise will need to reach zero emissions, while carbon dioxide removals are likely needed to balance out the residual emissions from other sectors where the technical mitigation potential of existing technologies remains very limited. Any allocation of rights of ownership to scarce carbon dioxide removals will require international oversight as well as detailed (and likely highly complex) considerations of fairness and appropriate use to ensure efficient and effective efforts to contain and then reduce the atmospheric stock of emissions.

Accordingly, it is not appropriate for companies today to make climate pledges which assume they will have the right to use scarce carbon dioxide removals to neutralise their own emissions decades in the future. If specific companies – for example in the energy industries – claim ownership of scarce carbon dioxide removals now or for a time in the future, then it will not be possible for those removals to balance out residual emissions in sectors where the technical mitigation potential of existing technologies remains very limited, and it will not be possible to reach net-zero emissions at the economy-wide level.

We consider the technical potential of carbon dioxide removal measures considering environmental constraints, since these potentials cannot be exceeded without causing significant environmental damages and major conflicts with other resource demands. We consider the scarcity of technical potential against the understanding that 1.5°C-compatible pathways may require carbon dioxide removals of up to approximately 20 $GtCO_2e$-yr by 2050 (Rogelj *et al.*, 2018), to balance out residual emissions from sectors where the technical mitigation potential of existing technologies remains very limited, and go beyond to overall net-negative emissions thereafter.

4.3.4 Assessment criteria

In line with the guiding principles of the previous sections, the evaluation of companies' offsetting claims is based on the assessment criteria in Table 14. The assessment criteria are the same for offsetting claims made today and future offsetting plans.

It is unlikely that an offsetting claim today can deliver on the criteria necessary for that claim to be credible. These limitations are an important reality, rather than a reason to identify more lenient rules for offsetting claims today. Existing offset market conditions make it far more difficult – potentially unrealistic – for companies to make offsetting claims that can be assessed as having high integrity today. The integrity of offsetting claims today is first and foremost hampered by the reality that there are currently no carbon credits available from any markets that can meet all the criteria for robust environmental integrity identified in sections 4.3.2 and 4.3.3:

- Although the Paris Agreement is already in force, an accounting mechanism for avoiding **double counting** is yet to be established under any international offsetting standard, though this will be possible through the procurement of authorised A6.4ER credits in the future.
- There are also currently very few – if any – examples of existing offsetting projects that represent the high-hanging fruit of mitigation potential that can be considered **additional in the context of the Paris Agreement**, given that offsetting markets to date have mainly focused on reaching the most cost-effective mitigation potential.

The simple *inability* of the current market to supply carbon credits that can credibly underpin carbon neutrality claims was given by myclimate as the reason for their decision to discontinue their carbon neutrality label and transition to an impact label in the vein of a climate contribution (myclimate, 2022).

Credible offsetting plans for the future depend on solid mechanisms and accounting frameworks. Companies can already be transparent about their intentions and how they plan to navigate the many issues that affect the integrity of offsetting claims. Following from the limitations for offsetting claims today, the ability to follow through on high integrity plans for future offsetting will likely depend on the transformation of existing offsetting markets, or the development of new mechanisms that can serve the criteria for credible neutralisation claims. Companies planning to offset their emissions in the future may not be able to identify specific projects today, but they can make an explicit statement of intent to restrict offsetting activity to high-hanging fruit projects with corresponding adjustments, along with other necessary conditions for environmental integrity.

While the credibility of offsetting claims is fundamentally flawed without compliance with the identified criteria, there are differences in the quality of offsetting claims and offset projects that must be assessed on a case-by-case basis. Given the level of fragmentation and obfuscation in current offsetting markets, as well as the limited availability of truly objective and independent advice on credible approaches, we try to distinguish claims and plans that at least represent goodwill and reasonable efforts.

On account of the huge surplus of carbon offset credits available from existing projects and the low market prices for offset credits, among other factors, many available offset credits today may represent little-to-no meaningful climate impact. Emission reduction credits generated by existing and more easily accessible projects are generally sold at relatively low prices on both compliance and voluntary markets. Buyers paid an average USD 3/tCO_2e for voluntary offset credits in 2018 (Donofrio *et al.*, 2019), with the 99-percentile upper range outliers at a price of USD 16/tCO_2e, substantially less than the carbon price range of USD 40-80/tCO_2e which the High-Level Commission on Carbon Prices (2017) found to be consistent with the Paris Agreement "well below 2°C" temperature goal. Such prices cannot sufficiently incentivise companies to make operational changes to further reduce their own scope 1, 2 and 3 emissions.

A small niche of higher-quality existing offset projects that rely on carbon revenues may represent a moderate chance of meaningful climate impact, but none of these projects carry a complete guarantee of additional action that can be considered equivalent to emission reductions and few, if any, send a meaningful signal for decarbonisation of the buyer's own emissions footprint.

To differentiate between a moderate and low rating for integrity, the merits and drawbacks of claims and plans are discussed and assessed on a case-by-case basis. As a minimum for a moderate rating, offsetting claims should not be framed in misleading terms, offset projects must be additional, and carbon dioxide removals must carry a high likelihood of permanence.

Table 14: Assessment criteria for offsetting claims

OFFSETTING CLAIMS TODAY AND FUTURE OFFSETTING PLANS TOWARDS ACHIEVEMENT OF TARGETS		
	TRANSPARENCY	INTEGRITY
●	The company claims – or plans to claim – the offsetting of its emissions with carbon dioxide removal or emission reduction projects, and all of the following criteria are met: ✓ The dependence on offsetting is presented prominently alongside the target or claim as a clear disclaimer. ✓ The company discloses the (maximum) portion of its emissions that it claims – or plans to claim – to have offset. ✓ The company sets out details on the specific projects supported, or sets out clear principles for how it will make these decisions in the future. ✓ For offsetting claims today, the company discloses information on prices paid for offset credits.	Companies ensure that any offsetting claims do not mislead, or distract from the need for emission reductions: ✓ The offsetting claim applies to all emission scopes. ✓ Carbon neutrality claims involve the offsetting of only residual emissions as defined by the ISO (0–5% of 2019 emissions from most sectors; ISO, 2022); or the company also has 1.5°C-aligned targets for the short-, medium- and long-term. Companies use certified credits that comply with the following criteria: ✓ Projects are additional in the context of the Paris Agreement (*high-hanging fruits*). ✓ Measures are in place to guarantee that the mitigation outcome cannot be double counted (for example through corresponding adjustments). ✓ Projects are compatible with net-zero emission technology and infrastructure. In the case of credits procured from carbon dioxide removal projects, the following criteria are required in addition: ✓ Carbon dioxide removals have a high likelihood of high permanence. ✓ The specific means of carbon dioxide removal and storage is not "scarce" and not associated with high environmental costs.
◐	The company claims – or plans to claim – to offset its emissions with carbon dioxide removal or emission reduction projects, and at least the following criteria are met: ✓ The company discloses the (maximum) portion of its emissions that it claims – or plans to claim – to have offset. ✓ The company sets out details on the specific projects supported, or sets out clear principles for how it will make these decisions in the future.	Offsetting claims can only be credible if the criteria for high integrity are fulfilled. These criteria are necessary to avoid posing a risk to global climate ambition. Given the level of fragmentation and obfuscation in current offsetting markets, as well as the limited availability of truly objective and independent advice on credible approaches, we try to distinguish claims and plans that at least represent goodwill and reasonable efforts. To differentiate between a moderate and low rating for integrity, the merits and drawbacks of claims and plans are discussed and assessed on a case-by-case basis. As a minimum for a moderate rating, offsetting claims should not be framed in misleading terms, offset projects must be additional in the context of the Paris Agreement, and carbon dioxide removals must carry a high likelihood of permanence.
◌	It is not clear whether the company offsets any emissions today, or plans to do so in the future; *<OR>* The company claims – or plans to claim – to offset its emissions, without fulfilling the above transparency criteria.	
?		The company provides insufficient details on its offsetting plans for an assessment of integrity.
N/A	The company does not claim to offset any emissions today, or does not plan to do so in the future.	The company does not claim to offset any emissions today, or does not plan to do so in the future.

4.4 Relevance of Article 6 mechanisms

The rules for the use of Article 6.4 of the Paris Agreement — agreed at COP26 in November 2021 and further elaborated at COP27 in November 2022 — establish a mechanism which may be used in the future for climate contributions and offsetting claims. The final agreement of COP27 created two *types* of units for future transactions in voluntary and regulatory carbon markets and has anchored the climate contribution model in the rulebook of the Paris Agreement (UNFCCC, 2022):

- **Corresponding adjustments with "authorised A6.4ERs":** Host countries can *authorise* Article 6.4 Emission Reduction credits (authorised A6.4ERs) for the international transfer of mitigation outcomes to the buyer. This means that the mitigation outcome is accounted to the GHG inventory of the buying party, and cannot also be counted towards the targets of the host country. A "corresponding adjustment" is required to ensure that the mitigation outcome is not double counted.
- **Climate contributions with "mitigation contribution A6.4ERs":** This "mitigation contribution" unit, is not directly recognised as a sale of an emission reduction by a country, and hence not accounted for as such by the country. These credits represent emission reductions (or removals) that are counted towards the host country's climate target, and using these credits towards any other emissions target would amount to double counting.

The agreed rules governing Article 6.4 are important because they represent the first and only internationally agreed standard for carbon trading in the Paris era, with a framework that *can in theory* be used to ensure environmental integrity and credible offsetting claims. For this reason, the use of authorised A6.4ERs may represent a credible option for companies making offsetting claims through emission reductions or carbon dioxide removals outside of their own value chains.

However, the use of authorised A6.4ERs alone will not be sufficient to predetermine environmental integrity. Although the agreed rules may lead to the establishment a framework that could be used to develop projects with robust environmental integrity, the rules also include loopholes as well as weak language on important issues. These loopholes can be used – and the weak language can be interpreted – in ways that could completely undermine the integrity of transactions and lead to an increase in emissions. The credibility of companies' offsetting claims will still depend on the specific credits that they accept, the projects that they come from, and the procedure for accounting the transaction.

This COP27 decision to create a separate unit for "mitigation contributions" is also a clear signal that when emission reductions are counted by a country, they should not also be claimed by a company through the purchase of a carbon credit. Companies could frame their purchase of these units as *contributions* to domestic mitigation, but must not make misleading offset claims. Through the creation of this type of unit, the concept of the "climate contribution" is now anchored in the rulebook of the Paris Agreement and this sends another signal to companies to start shifting from an offsetting paradigm to financing emissions reductions through a climate contribution claim model.

Glossary and abbreviations

Additional potential (of CDR)	*See "Scarcity (of CDR)"*
BECCS	Bioenergy with carbon capture and storage
BEV	Battery electric vehicles
Biological capture and storage	*See "Nature-based solutions"*
CAR	Climate Action Reserve
CCS	Carbon capture and storage
CCU	Carbon capture and utilisation
Climate contribution	We define climate contributions as the financial support provided by a company to support climate change action beyond the company's own value chain, without claiming the neutralisation of its own emissions in return.
Carbon dioxide removals (CDR)	All scenarios consistent with a 1.5°C temperature increase include a major role for carbon dioxide removals.(Rogelj *et al.*, 2018) This includes nature-based solutions for carbon sequestration in forests, soils, peatlands and mangroves, technological solutions such as BECCS and DACCS with underground storage, and solutions with mineral storage.
Carbon offset credit	A carbon offset credit is a certified unit of a reduction of GHG emissions, or a removal of carbon dioxide (*see Carbon dioxide removals*), which is used to balance out GHG emissions elsewhere. The practice of offsetting is often contentious (see section 4.1.2).
CDM	Clean Development Mechanism
CDP	Formerly the Carbon Disclosure Project: Many companies report emissions as well as other details of their climate strategies to CDP. CDP provide companies with a certified rating of their level of climate transparency, which is often used in company's marketing materials.
CEO	Chief Executive Officer
CO_2	Carbon dioxide
COP	Conference of the Parties (*see UNFCCC*).
DACCS	Direct Air Carbon Capture and Storage, see also "Carbon dioxide removals (CDR)"
DRI-EAF	Direct reduced iron – Electric arc furnace
ESG	Environmental Social Governance
EU	European Union

EV	Electric vehicle
FLAG	Forest, Land and Agriculture Science Based Target Setting Guidance (a standard by the Science Based Targets initiative for land-based emissions disclosure and target setting).
GHG Protocol	The GHG Protocol is an initiative driven by the World Resources Institute and World Business Council for Sustainable Development, that provides international guidance and standards for GHG emissions accounting.
GHG	Greenhouse gas
Guarantees of origin (GOs)	Other terminology for Renewable Energy Certificates (REC), see "Renewable Energy Certificates (REC)"
High-hanging fruit	The high-hanging fruit of mitigation potential refers to the technologies and measures to decarbonise emission sources that remain otherwise entirely inaccessible to host country governments in the near- and mid-term future, on account of high costs or other insurmountable barriers that cannot reasonably be overcome.
HLEG	The United Nations' High-Level Expert Group on the Net-Zero Emissions Commitments of Non-State Entities
ICT	Information and communications technology
IEA	International Energy Agency
Insetting	'Insetting' is a business-driven concept used by a limited number of actors with no universally accepted definition. Insetting is often described as offsetting within the value chain. The approach can lead to low credibility GHG emission offsetting claims and presents a significant risk of double counting the same emission reductions (*see section 4.4.4*).
Integrity (rating)	The *Corporate Climate Responsibility Monitor* assesses the transparency and integrity of companies' climate pledges. Integrity, in this context, is a measure of the quality, credibility and comprehensiveness of a company's approaches towards the various elements of corporate climate responsibility.
IPCC	Intergovernmental Panel on Climate Change
ISO	*International Organisation for Standardisation*
LEV	Low-emission vehicles
LNG	Liquified natural gas
Location-based method (for scope 2 emissions accounting)	The location-based method for scope 2 emissions accounting reflects the average emission intensity of the electricity grid from which the consumer's energy is delivered.
Market-based method (for scope 2 emissions accounting)	The market-based method for scope 2 emissions accounting reflects the emissions from electricity generation specifically procured by the consumer (which may not reflect the electricity they actually consume from a grid that features multiple buyers and sellers). It derives emission factors from contractual renewable electricity procurement instruments.

Nationally determined contributions (NDCs)	Nationally determined contributions (NDCs) are the pledges made by national governments to the United Nations Framework Convention on Climate Change to mitigate climate change. The Paris Agreement requires all Parties to submit and regularly update their NDCs to represent their possible highest level of ambition. Recognising the insufficiency of climate change mitigation commitments in existing NDCs, the Glasgow Pact from COP26 urged all Parties to update their NDCs again ahead of COP27.
Nature-based solutions	Nature-based solutions refer to measures for carbon dioxide removal that involve biological carbon capture and storage in natural ecosystems, such as soils, forests, peatland and mangroves.
Neutralisation	Neutralisation of emissions is usually a term that is synonymous with offsetting and refers to the balancing out of emissions released into the atmosphere with the avoidance, or removal from the atmosphere, of an equivalent volume of emissions elsewhere. Many actors now avoid the term offsetting entirely; companies and initiatives more often refer to "neutralisation", "netting-out", "compensation", "reducing the footprint", while some actors use multiple terminologies to distinguish between offsetting in different circumstances and at different times. We define all claims that unabated GHG emissions within the value chain are offset as *offsetting claims*, including all synonymous terminologies and all project types.
Non-GHG climate forcers	Non-GHG climate forcers include the emission of gases and aerosols, and processes that change cloud abundance, leading to radiative forcing. Radiative forcing is a change in the balance of radiation in the atmosphere, which contributes to global warming. For example, the non-GHG climate forcers are estimated to increase the climate impact of GHG emissions from the aviation industry by a factor of approximately 3 (Atmosfair, 2016).
Offsetting	*See carbon offset*.
Permanence (of CDR)	The *permanence* of a CDR outcome refers to the timescale and degree to which sequestered carbon remains stored and not released into the atmosphere.
Power purchase agreement (PPA)	A PPA is a long-term contract between an electricity provider and an electricity consumer, usually spanning 10-20 years. The consumer agrees to purchase a certain amount of electricity from a specific asset under a pre-determined pricing arrangement. PPAs are generally signed with new renewable energy installations and form part of the project investment decision (NewClimate Institute and Data-Driven EnviroLab, 2020). PPAs can also be signed for existing installations, in which case it is less likely the PPA results in additional renewable electricity capacity. However, it may be that existing installations would cease operations if the operator cannot sign a new PPA.
PV	Photovoltaics
R&D	Research & development

Renewable energy certificate (REC)	Renewable Energy Certificates (RECs) are also known under various names, such as Guarantees of Origin (GOs) or Energy Attribute Certificates (EACs). RECs can be bundled or unbundled with the electricity that a company consumes: • *Unbundled RECs* – the consumer purchases RECs from a third party, separately from their procurement of electricity from another supplier. • *Bundled RECs* – third-party generated: the consumer purchases electricity and RECs from the same supplier, but this supplier has procured the RECs from a third party. In this situation, the supplier may sell electricity generated using fossil fuels but market it as 'low-carbon' electricity by bundling an equivalent volume of RECs into the sale. • *Bundled RECs* – supplier generated: the consumer purchases renewable electricity and associated RECs from the same supplier.
Residual emissions	Residual emissions are the remaining GHG emissions from hard-to-abate emission sources where no known feasible options remain for further decarbonisation. (See also *unabated emissions*)
Scarcity (of CDR)	The maximum potential of most carbon dioxide removal measures is technically limited, and even further restricted by environmental constraints. Due to issues such as land requirements, high water consumption, high energy consumption, land degradation and pollution, among other environmental costs, carbon dioxide removal technologies can only be scaled-up so far without significantly endangering sustainable development goals, including food security. The scarcity of carbon dioxide removals measures – in terms of their maximum absolute or annual technical potential – is an important consideration when evaluating the feasibility of net-zero claims at the level of individual actors. Robust future use of scarce carbon dioxide removal options must be consistent with achieving net-zero and eventually net-negative emissions at the global level, which is required to avoid the most damaging effects of climate change over the coming decades.
Science Based Targets initiative (SBTi)	SBTi reviews and certifies the climate targets of companies who join the initiative as members. Companies' climate targets are certified as 1.5°C or 2°C compatible if they align with SBTi's own methodology and benchmarks.
Scope (of GHG emissions)	The GHG Protocol Corporate Standard classifies a company's GHG emissions into three 'scopes' (WBCSD and WRI, 2004):
Scope 1 emissions	Scope 1 emissions are direct emissions from owned or controlled sources.
Scope 2 emissions	Scope 2 emissions are indirect emissions from the generation of purchased energy (see also *location-based method* and *market-based method*).
Scope 3 emissions	Scope 3 emissions are all indirect emissions (not included in scope 2) that occur in the value chain of the reporting company, including both upstream and downstream emissions (WRI and WBCSD, 2013).
Upstream scope 3 emission sources	Upstream emissions are indirect GHG emissions related to purchased or acquired goods and services (WRI and WBCSD, 2013).
Downstream scope 3 emission sources	Downstream emissions are indirect GHG emissions related to sold goods and services (WRI and WBCSD, 2013).
Normal scope 3 emission sources	The GHG Protocol's Scope 3 Standard identifies 15 distinct reporting categories for scope 3 emission sources, and requires companies to quantify and report scope 3 emissions from each category (WRI and WBCSD, 2013).

Optional scope 3 emission sources (indirect use-phase emissions)	*Indirect use-phase emissions* are described by the GHG Protocol Scope 3 Standard (WRI and WBCSD, 2013) as an optional reporting component. In contrast to direct use-phase emissions from products, such as the energy consumption of vehicles and appliances, indirect use-phase emissions refer to the emissions that occur indirectly from the use of a product. For example, apparel requires washing and drying; soaps and detergents are often used with heated water.
Sustainable aviation fuels (SAF)	Sustainable aviation fuels are aviation fuels derived from renewables or waste considering certain sustainability criteria.
Transparency (rating)	The *Corporate Climate Responsibility Monitor* assesses the transparency and integrity of companies' climate pledges. Transparency ratings refer to the extent to which a company publicly discloses the information necessary to fully understand the integrity of that company's approaches towards the various elements of corporate climate responsibility.
UN	United Nations
UNFCCC	United Nations Framework Convention on Climate Change
Unabated emissions	Unabated emissions are GHG emissions from emission sources for which further emission reductions are technically feasible at that point in time. (See also *residual emissions*)
Value chain emissions	A company's full value chain emissions refers to the entirety of scope 1, scope 2, and scope 3 emissions.
US	United States
Value chain emissions	A company's full value chain emissions refers to the entirety of scope 1, scope 2, and scope 3 emissions.

Data sources

Public documentation

For our assessments, we only consider documentation that is publicly available, for two reasons. Firstly, we consider that when companies make public announcements on claims to climate leadership, they have a responsibility to make available to the same public audience the information that would be required to understand and appraise those claims. Secondly, we do not consider that there is any *accountable commitment* associated with any targets or plans that are not made public.

CDP responses

Many companies report on aspects of their climate-related targets and strategies through annual disclosures to CDP. Companies' CDP responses are available either through the purchase of data from CDP, through registration on the CDP website (with limitations), or from the website of the specific companies in the case that companies choose to publish those responses.

Assessing transparency

We do not consider companies' CDP responses to be accessible public documentation, on the grounds that the information is only available either behind a paywall, or behind a registration-wall with significant limitations. Even in the case that companies publish the responses to their websites, we still do not consider these documents to be accessible public documentation given the technical nature of CDP response documents and their limited accessibility for a non-expert audience. It is not transparent practice if specific information that is fundamental for an understanding of the meaning or integrity of a company's climate strategy can *only* be found in those documents.

Assessing integrity of commitments ex-ante

We do not consider the details of future commitments if these details can only be found in CDP responses, and are not published in accessible public documentation. This is in line with the aforementioned position that we do not consider that there is any *accountable commitment* associated with any targets or plans that are not made public.

Assessing integrity of chronicled facts ex-post

For historical ex-post data – such as GHG emission disclosures for historical years, or reporting on renewable energy constructs in historical years – we may refer to chronicled facts from individual CDP responses to understand gaps in companies' public communications, and to identify inconsistencies in reported information. This information may be used to determine the integrity of companies' approaches.

References

- Achat, D.L., Fortin, M., Landmann, G., *et al.* (2015) 'Forest soil carbon is threatened by intensive biomass harvesting', *Scientific Reports*, 5, p. 15991. doi:10.1038/srep15991.
- Adeniyi, O.M., Azimov, U. and Burluka, A. (2018) 'Algae biofuel: Current status and future applications', *Renewable and Sustainable Energy Reviews*, 90, pp. 316–335. doi:https://doi.org/10.1016/j.rser.2018.03.067.
- Ahmed, S., Warne, T., Smith, E., *et al.* (2021) 'Systematic review on effects of bioenergy from edible versus inedible feedstocks on food security', *npj Science of Food*, 5(9). doi:10.1038/s41538-021-00091-6.
- Atmosfair (2016) *Atmosfair Flight Emissions Calculator.* BQerlin, Germany: Atmosfair gGmbH. Available at: https://www.atmosfair.de/wp-content/uploads/atmosfair-flight-emissions-calculator-englisch-1.pdf (Accessed: 27 January 2023).
- Avelar, L. and Boer, Y. de (2021) Why 24/7 clean energy beats carbon offsetting, Forum COP26 Live. World Economic Forum. Available at: https://www.weforum.org/agenda/2021/11/no-more-greenwashing-24-7-clean-energy/ (Accessed: 27 January 2023).
- Beacham, T.A., Sweet, J.B. and Allen, M.J. (2017) 'Large scale cultivation of genetically modified microalgae: A new era for environmental risk assessment', *Algae Research*, 25, pp. 90–200. doi:10.3109/9781420081831-8.
- Bjørn, A., Lloyd, S.M., Brander, M. and Matthews, H.D. (2022) 'Renewable energy certificates threaten the integrity of corporate science-based targets', *Nature Climate Change*, 12, pp. 539–546. doi:https://doi.org/10.1038/s41558-022-01379-5.
- Boehm, S., Lebling, K., Levin, K., *et al.* (2021) *State of Climate Action 2021: Systems Transformations Required to Limit Global Warming to 1.5°C*. Washington, D.C., United States of America: World Resources Institute (WRI). doi:10.46830/wrirpt.21.00048.
- Boehm, S., Jeffery, L., Levin, K., *et al.* (2022) *State of Climate Action 2022*. Berlin and Cologne, Germany, and San Francisco and Washington, D.C., United States of America: Bezos Earth Fund, Climate Action Tracker, World Resources Institute. Available at: https://www.wri.org/research/state-climate-action-2022 (Accessed: 2 November 2022).
- Calvin, K., Cowie, A., Berndes, G., *et al.* (2020) 'Bioenergy for climate change mitigation: Scale and sustainability', *GCB Bioenergy*, 13, pp. 1346–1371. doi:10.1111/gcbb.12863.
- Camia, A., Giuntoli, J., Jonsson, R., *et al.* (2021) The use of woody biomass for energy production in the EU and impacts on forests. Luxembourg: Publications Office of the European Union. doi:10.2760/831621.
- CAT (2020) *Paris Agreement Compatible Sectoral Benchmarks: Elaborating the decarbonisation roadmap*. Berlin, Germany: Climate Action Tracker (Climate Analytics, NewClimate Institute). Available at: https://climateactiontracker.org/documents/753/CAT_2020-07-10_ParisAgreementBenchmarks_FullReport.pdf (Accessed: 1 December 2022).
- CAT (2022a) *Sector Assessment: International Aviation*. Climate Action Tracker (CAT). Available at: https://climateactiontracker.org/sectors/aviation/ (Accessed: 27 January 2023).
- CAT (2022b) *Sector Assessment: International Shipping*. Climate Action Tracker (CAT). Available at: https://climateactiontracker.org/sectors/shipping/ (Accessed: 27 January 2023).
- CAT (2022c) *Warming Projections Global Update*. Climate Action Tracker (CAT). Available at: https://climateactiontracker.org/documents/1094/CAT_2022-11-10_GlobalUpdate_COP27.pdf.
- CCQI (2021) *The Carbon Credit Quality Initiative*. Carbon Credit Quality Initiative (CCQI). Available at: https://carboncreditquality.org/ (Accessed: 20 January 2023).
- Clarke, L., Wei, Y.-M., Navarro, A. de la V., *et al.* (2022) 'Chapter 6 - Energy Systems', in Shukla, P.R. *et al.* (eds) IPCC, 2022: *Climate Change 2022: Mitigation of Climate Change. Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge, UK and New York, NY, USA: Cambridge University Press. doi:10.1017/9781009157926.008.
- de Coninck, H., Revi, A., Babiker, M., *et al.* (2018) 'Strengthening and Implementing the Global Response', in Masson-Delmotte, V. *et al.* (eds) *Global warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty*. Cambridge, UK and New York, NY, USA: Cambridge University Press, pp. 313–444. Available at: https://www.ipcc.ch/site/assets/uploads/sites/2/2019/02/SR15_Chapter4_Low_Res.pdf.
- Day, T., Mooldijk, S., Smit, S., *et al.* (2022) *Corporate Climate Responsibility Monitor 2022*. Cologne and Berlin, Germany: NewClimate Institute, Carbon Market Watch. Available at: https://newclimate.org/wp-content/uploads/2022/02/CorporateClimateResponsibilityMonitor2022.pdf (Accessed: 27 January 2023).
- Delasalle, F., Speelman, E., Graham, A., *et al.* (2022) *Making net-zero steel possible - An industry-backed, 1.5°C-aligned transition strategy*. Mission Possible Partnership. Available at: https://missionpossiblepartnership.org/wp-content/uploads/2022/09/SteelTSExecutiveSummary.pdf (Accessed: 5 October 2022).
- Dietz, S., Irwin, W., Rauis, B., *et al.* (2020) *Carbon Performance Assessment of automobile manufacturers: Note on methodology [December 2020]*. London, United Kingdom: Transition Pathway Initiative (TPI). Available at: https://www.transitionpathwayinitiative.org/publications/70.pdf?type=Publication (Accessed: 22 December 2022).

- Dietz, S., Byrne, R., Sheer, A. and Komar, V. (2021) Carbon Performance assessment of airlines: note on methodology [November 2021]. London, United Kingdom: Transition Pathway Initiative (TPI). Available at: https://www.transitionpathwayinitiative.org/publications/101. pdf?type=Publication (Accessed: 27 January 2023).
- Dietz, S., Byrne, R., Hastreiter, N., *et al.* (2021) *Carbon performance assessment of international shipping: note on methodology [November 2021]*. London, United Kingdom: Transition Pathway Initiative (TPI). Available at: https://www.transitionpathwayinitiative.org/publications/102.pdf?type=Publication (Accessed: 23 September 2022).
- Dietz, S., Gardiner, D., Hastreiter, N., et al. (2021) Carbon Performance Assessment of Oil & Gas Producers: Note on Methodology. London, United Kingdom: Transition Pathway Initiative (TPI). Available at: https://www.transitionpathwayinitiative.org/publications/96.pdf?type=Publication.
- Dietz, S., Gardiner, D., Jahn, V., et al. (2021) Carbon performance assessment of electricity utilities: Note on methodology [November 2021]. London, United Kingdom, United Kingdom: Transition Pathway Initiative (TPI). Available at: https://www.transitionpathwayinitiative.org/publications/94.pdf?type=Publication.
- Dietz, S., Irwin, W., Rauis, B., et al. (2021) Carbon performance assessment of paper producers: note on methodology [February 2021]. London, United Kingdom: Transition Pathway Initiative (TPI). Available at: https://www.transitionpathwayinitiative.org/publications/78.pdf?type=Publication (Accessed: 28 February 2023).
- Dietz, S., Gardiner, D. and Scheer, A. (2022) *Carbon performance assessment of steelmakers: note on methodology [March 2022]*. London, United Kingdom: Transition Pathway Initiative (TPI). Available at: https://www.transitionpathwayinitiative.org/publications/103.pdf?type=Publication (Accessed: 26 September 2022).
- Dietz, S., Hastreiter, N. and Jahn, V. (2021) *Carbon performance assessment of cement producers: note on methodology [updated version, November 2021]*. London, United Kingdom: Transition Pathway Initiative (TPI). Available at: https://www.transitionpathwayinitiative.org/publications/104.pdf?type=Publication (Accessed: 23 September 2022).
- Donofrio, S., Maguire, P., Merry, W. and Zwick, S. (2019) 'State of the Voluntary Carbon Markets 2019'. Washington, D.C, USA: Ecosystem Marketplace. Available at: https://www.ecosystemmarketplace.com/carbon-markets/ (Accessed: 27 January 2023).
- Dyk, S. van, Su, J., McMillan, J.D. and Saddler, J. (John) N. (2019) *'Drop-in' biofuels: The key role that co-processing will play in its production*. IEA Bioenergy. Available at: https://www.ieabioenergy.com/blog/publications/new-publication-drop-in-biofuels-the-key-role-that-co-processing-will-play-in-its-production/ (Accessed: 22 September 2022).
- ETC (2021) *Bioresources within a Net-Zero Emissions Economy: Making a Sustainable Approach Possible*. Energy Transitions Commission. Available at: https://www.energy-transitions.org/wp-content/uploads/2022/07/ETC-Bioresources-Report-Final.pdf (Accessed: 20 October 2022).
- Fuss, S., Lamb, W.F., Callaghan, M.W., *et al.* (2018) 'Negative emissions—Part 2: Costs, potentials and side effects', *Environmental Research Letters*, 13(6), p. 063002. doi:10.1088/1748-9326/aabf9f.
- GHG Protocol (2021) *Update - Greenhouse Gas Protocol Carbon Removals and Land Sector Initiative*. Available at: https://ghgprotocol.org/blog/update-greenhouse-gas-protocol-carbon-removals-and-land-sector-initiative (Accessed: 18 January 2022).
- Graver, B., Zheng, X.S., Rutherford, D., *et al.* (2022) *Vision 2050: Aligning aviation with the Paris Agreement*. Washington, D. C., USA: International Council on Clean Transportation (ICCT). Available at: https://theicct.org/publication/global-aviation-vision-2050-align-aviation-paris-jun22/ (Accessed: 30 November 2022).
- Hanssen, S. V., Daioglou, V., Steinmann, Z.J.N., *et al.* (2020) 'The climate change mitigation potential of bioenergy with carbon capture and storage', *Nature Climate Change*, 10, pp. 1023–1029. doi:10.1038/s41558-020-0885-y.
- Hanssen, S. V., Steinmann, Z.J.N., Daioglou, V., *et al.* (2022) 'Global implications of crop-based bioenergy with carbon capture and storage for terrestrial vertebrate biodiversity', *GCB Bioenergy*, 14(3), pp. 307–321. doi:10.1111/gcbb.12911.
- Hepburn, C., Adlen, E., Beddington, J., *et al.* (2019) 'The technological and economic prospects for CO_2 utilization and removal', *Nature*, 575, pp. 87–97. doi:https://doi.org/10.1038/s41586-019-1681-6.
- High-Level Commission on Carbon Prices (2017) *Report of the High-Level Commission on Carbon Prices*. Washington, D. C.: Carbon Pricing Leadership Coalition. Available at: https://static1.squarespace.com/static/54ff9c5ce4b0a53decccfb4c/t/59244eed17bffc0ac-256cf16/1495551740633/CarbonPricing_Final_May29.pdf (Accessed: 27 January 2023).
- Hof, C., Voskamp, A., Biber, M.F., *et al.* (2018) 'Bioenergy cropland expansion may offset positive effects of climate change mitigation for global vertebrate diversity', *PNAS*, 115(52), pp. 13294–13299. doi:10.1073/pnas.1807745115.
- Holsmark, B. (2012) 'Harvesting in boreal forests and the biofuel carbon debt', *Climate Change*, 112, pp. 415–428. doi:10.1007/s10584-11-0222-6.
- Hulshof, D., Jepma, C. and Mulder, M. (2019) 'Performance of markets for European renewable energy certificates', *Energy Policy*, 128, pp. 697–710. doi:10.1016/j.enpol.2019.01.051.
- IEA (2020) *Energy Technology Perspectives 2020*. Paris, France: International Energy Agency (IEA). doi:10.1787/ab43a9a5-en.
- IEA (2021) *Net Zero by 2050: A Roadmap for the Global Energy Sector*. Paris, France: International Energy Agency. Available at: https://www.iea.org/reports/net-zero-by-2050 (Accessed: 10 August 2022).
- IPCC (2018) *Special Report: Global Warming of 1.5°C*. Geneva, Switzerland: Intergovernmental Panel on Climate Change (IPCC). Available at: https://www.ipcc.ch/sr15/ (Accessed: 27 January 2023).

- IPCC (2022) 'Summary for Policymakers', in Shukla, P.R. et al. (eds) Climate Change 2022: Mitigation of Climate Change. Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge, UK and New York, NY, USA: Cambridge University Press. doi:10.1017/9781009157926.002.
- IRENA (2021a) A pathway to decarbonise the shipping sector by 2050. Abu Dhabi, United Arab Emirates: International Renewable Energy Agency. Available at: https://www.irena.org/publications/2021/Oct/A-Pathway-to-Decarbonise-the-Shipping-Sector-by-2050 (Accessed: 21 October 2022).
- IRENA (2021b). Renewable power generation costs in 2020. Abu Dhabi, United Arab Emirates: International Renewable Energy. Available at: https://www.irena.org/news/pressreleases/2021/Jun/Majority-of-New-Renewables-Undercut-Cheapest-Fossil-Fuel-on-Cost (Accessed: 10 February 2023).
- ISO (2022) *Net Zero Guidelines – Accelerating the transition to net zero*. Geneva, Switzerland: International Organization for Standardization (ISO). Available at: https://www.iso.org/obp/ui/en/#iso:std:iso:iwa:42:ed-1:v1:en (Accessed: 25 November 2022).
- James, J. and Harrison, R. (2016) 'The Effect of Harvest on Forest Soil Carbon: A Meta-Analysis', *Forests*, 7, p. 308. doi:10.3390/f7120308.
- Jeffery, L., Höhne, N., Moisio, M., *et al.* (2020) *Options for supporting Carbon Dioxide Removal*. Cologne and Berlin, Germany: NewClimate Institute. Available at: https://newclimate.org/wp-content/uploads/2020/07/Options-for-supporting-Carbon-Dioxide-Removal_July_2020.pdf (Accessed: 22 December 2022).
- Kachi, A., Warnecke, C., Hagemann, M., *et al.* (2020) *Net-zero energy housing virtual Article 6 pilot*. Cologne and Berlin, Germany: NewClimate Institute. Available at: https://newclimate.org/wp-content/uploads/2020/01/Colombia-Art-6-Virtual-Pilot-15-January-2020.pdf (Accessed: 27 January 2023).
- Kelemen, P., Benson, S.M., Pilorgé, H., *et al.* (2019) 'An Overview of the Status and Challenges of CO_2 Storage in Minerals and Geological Formations', *Frontiers in Climate*, 1. doi:10.3389/fclim.2019.00009.
- Kline, K.L., Martinelli, F.S., Mayer, A.L., *et al.* (2015) 'Bioenergy and Biodiversity: Key Lessons from the Pan American Region', *Environmental Management*, 56, pp. 1377–1396. doi:10.1007/s00267-015-0559-0.
- Lee, D.S., Fahey, D.W., Skowron, A., *et al.* (2021) 'The contribution of global aviation to anthropogenic climate forcing for 2000 to 2018', *Atmospheric Environment*, 244, p. 117834. doi:10.1016/J.ATMOSENV.2020.117834.
- Lenton, T.M. (2014) 'The Global Potential for Carbon Dioxide Removal', in Harrison, R. and Hester, R. (eds) *Geoengineering of the Climate System*. Royal Society of Chemistry, pp. 52–79.
- Madsen, K. and Bentsen, N.S. (2018) 'Carbon debt payback time for a biomass fired CHP plant - A case study from northern Europe', *Energies*, 11, p. 807. doi:10.3390/en11040807.
- Martinsen, T. and Mouilleron, M. (2020) *Guarantees of origin for electricity - an analysis of its potential to increase new renewable energy in the North European energy system, MINA fagrapport 67*. Ås, Norway: Norwegian University of Life Sciences Faculty of Environmental Sciences and Natural Resource Management. Available at: https://nmbu.brage.unit.no/nmbu-xmlui/handle/11250/2680991 (Accessed: 27 January 2023).
- Mitchell, S.R., Harmon, M.E. and O'Connell, K.E.B. (2012) 'Carbon debt and carbon sequestration parity in forest bioenergy production', *GCB Bioenergy*, 4, pp. 818–827. doi:10.1111/j.1757-1707.2012.01173.x.
- myclimate (2022) *myclimate presents climate protection label of the future*. Available at: https://de.myclimate.org/en/information/news-press/news/newsdetail/myclimate-presents-climate-protection-label-of-the-future/ (Accessed: 16 December 2022).
- Nascimento, L., Kachi, A., Mooldijk, S. and Warnecke, C. (2020) *Renewable heating virtual Article 6 pilot. Ground source heat pumps in Khovd, Mongolia.* NewClimate Institute. Available at: https://newclimate.org/2020/01/29/renewable-heating-virtual-article-6-pilot-ground-source-heat-pumps-in-khovd-mongolia/ (Accessed: 18 June 2021).
- NewClimate Institute (2020) *Our climate responsibility approach - A new approach for organisations to take responsibility for their climate impact*. Cologne, Germany: NewClimate Institute. Available at: https://newclimate.org/climateresponsibility (Accessed: 5 December 2022).
- NewClimate Institute and Data-Driven EnviroLab (2020) *Navigating the nuances of net-zero targets*. Thomas Day, Silke Mooldijk and Takeshi Kuramochi (NewClimate Institute) and Angel Hsu, Zhi Yi Yeo, Amy Weinfurter, Yin Xi Tan, Ian French, Vasu Namdeo, Odele Tan, Sowmya Raghavan, Elwin Lim, and Ajay Nair (Data-Driven EnviroLab). Available at: https://newclimate.org/2020/10/22/navigating-the-nuances-of-net-zero-targets/ (Accessed: 27 January 2023).
- Pavlenko, N. and Kharina, A. (2018) *Policy and Environmental Implications of using HEFA+ for aviation*. Washington D.C., USA: International Council on Clean Transportation (ICCT). Available at: https://www.theicct.org/sites/default/files/publications/Green-Diesel-Aviation_IC-CT-Working-Paper_20180321_vF.pdf (Accessed: 27 January 2023).
- Repo, A., Böttcher, H., Kindermann, G. and Liski, J. (2015) 'Sustainability of forest bioenergy in Europe: land-use-related carbon dioxide emissions of forest harvest residues', *GCB Bioenergy*, 7, pp. 877–887. doi:10.1111/gcbb.12179.
- Roe, S., Streck, C., Obersteiner, M., *et al.* (2019) 'Contribution of the land sector to a 1.5°C world', *Nature Climate Change*, 9, pp. 817–828. doi:https://doi.org/10.1038/s41558-019-0591-9.

- Rogelj, J., Shindell, D., Jiang, K., et al. (2018) 'Mitigation Pathways Compatible with 1.5°C in the Context of Sustainable Development', in Masson-Delmotte, V. et al. (eds) Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty. Cambridge, UK and New York, NY, USA: Cambridge University Press, pp. 93–174. Available at: https://www.ipcc.ch/sr15/chapter/chapter-2/.
- SBTi (2018a) 'Sectoral Decarbonization Approach - Transport Tool, Version 1.1'. Science Based Targets Initiative (SBTi); CDP; World Resources Institute (WRI); World Wide Fund for Nature (WWF). Available at: https://view.officeapps.live.com/op/view.aspx?src=https%3A%2F%2Fsciencebasedtargets.org%2Fresources%2Flegacy%2F2018%2F10%2FSDA-Transport-tool_v1.1_locked.xlsx&wdOrigin=BROWSELINK (Accessed: 14 March 2022).
- SBTi (2018b) Transport Science-Based Target Setting Guidance. Science Based Targets Initiative (SBTi). Available at: https://sciencebasedtargets.org/wp-content/uploads/2018/05/SBT-transport-guidance-Final.pdf (Accessed: 30 November 2022).
- SBTi (2020) *Guidance for ICT Companies Setting Science Based Targets: Mobile networks operators, fixed networks operators, and data centres operators*. Science Based Targets Initiative (SBTi); CDP; World Resources Institute (WRI); World Wide Fund for Nature (WWF). Available at: https://sciencebasedtargets.org/resources/legacy/2020/04/GSMA_IP_SBT-report_WEB-SINGLE.pdf (Accessed: 17 October 2022).
- SBTi (2020b) Guidance on setting science-based targets for Oil, Gas and Integrated Energy companies. Science Based Targets Initative (SBTi); CDP; United Nations Global Compact; World Resources Institute (WRI); World Wide Fund for Nature (WWF). Available at: https://sciencebasedtargets.org/resources/legacy/2020/08/OG-Guidance.pdf (Accessed: 20 April 2023)
- SBTi (2020c) Setting 1.5°C-Aligned Science-Based Targets: Quick Start Guide for Electric Utilities. Science Based Targets initiative (SBTi). Available at: https://sciencebasedtargets.org/resources/legacy/2020/06/SBTi-Power-Sector-15C-guide-FINAL.pdf (Accessed: 28 February 2023)
- SBTi (2021a) *Pathway to Net-Zero: SBTi Technical Summary (Version 1.0)*. Science Based Targets Initiative (SBTi); CDP; World Resources Institute (WRI); World Wide Fund for Nature (WWF). Available at: https://sciencebasedtargets.org/resources/files/Pathway-to-Net-Zero.pdf (Accessed: 25 January 2022).
- SBTi (2021b) 'SBT Aviation Tool (Version 1.1)'. Science Based Targets Initiative (SBTi). Available at: https://view.officeapps.live.com/op/view.aspx?src=https%3A%2F%2Fsciencebasedtargets.org%2Fresources%2Ffiles%2FSBTi_Aviation_Tool_v1.1_locked.xlsx&wdOrigin=BROWSELINK (Accessed: 17 January 2023).
- SBTi (2021c) *SBTi Corporate Net-Zero Standard, Version 1.0*. Science Based Targets Initiative (SBTi); CDP; United Nations Global Compact; World Resources Institute (WRI); World Wide Fund for Nature (WWF). Available at: https://sciencebasedtargets.org/resources/files/Net-Zero-Standard.pdf (Accessed: 1 December 2022).
- SBTi (2021d) *Science-Based Target Setting for the Aviation Sector (Version 1.0)*. Science Based Targets Initiative (SBTi); CDP; United Nations Global Compact; World Resources Institute (WRI); World Wide Fund for Nature (WWF). Available at: https://sciencebasedtargets.org/resources/files/SBTi_AviationGuidanceAug2021.pdf (Accessed: 19 January 2022).
- SBTi (2022a) *Cement Science Based Target Setting Guidance (Version 1.0, September 2022)*. Science Based Targets Initative (SBTi); CDP; United Nations Global Compact; World Resources Institute (WRI); World Wide Fund for Nature (WWF). Available at: https://sciencebasedtargets.org/resources/files/SBTi-Cement-Guidance.pdf (Accessed: 5 October 2022).
- SBTi (2022b) *Forest, Land and Agriculture Science Based Target-Setting Guidance*. Science Based Targets Initative (SBTi); CDP; United Nations Global Compact; World Resources Institute (WRI); World Wide Fund for Nature (WWF). Available at: https://sciencebasedtargets.org/resources/files/SBTiFLAGGuidance.pdf (Accessed: 28 September 2022).
- SBTi (2022c) 'Net-Zero Tool (v1.0.3, April 2022)'. Science Based Targets Initiative (SBTi); CDP; United Nations Global Compact; World Resources Institute (WRI); World Wide Fund for Nature (WWF). Available at: https://view.officeapps.live.com/op/view.aspx?src=https%3A%2F%2Fsciencebasedtargets.org%2Fresources%2Ffiles%2FNet-Zero-tool.xlsx&wdOrigin=BROWSELINK (Accessed: 5 October 2022).
- SBTi (2022d) 'Science-based Target Setting Tool (v2.1, July 2022)'. Science Based Targets Initiative (SBTi). Available at: https://view.officeapps.live.com/op/view.aspx?src=https%3A%2F%2Fsciencebasedtargets.org%2Fresources%2Ffiles%2FSBTi-target-setting-tool.xlsx&wdOrigin=BROWSELINK (Accessed: 5 October 2022).
- SBTi (2022e) *Science Based Target Setting for the Maritime Transport Sector (v1.0)*. Science Based Targets Initiative (SBTi); CDP; United Nations Global Compact; World Resources Institute (WRI); World Wide Fund for Nature (WWF). Available at: https://sciencebasedtargets.org/resources/files/SBTi-Maritime-Guidance.pdf (Accessed: 6 December 2022).
- SBTi (2022f) *Steel Science-Based Target Setting Guidance - Draft for Public Consultation*. Science Based Targets Initiative (SBTi); CDP; United Nations Global Compact; World Resources Institute (WRI); World Wide Fund for Nature (WWF). Available at: https://sciencebasedtargets.org/resources/files/SBTi-Steel-Guidance-draft.pdf (Accessed: 8 December 2022).
- SBTi (2022g) *Transport - Our updated OEMS policy (Status: October 2022)*. Science Based Targets Initiative (SBTi). Available at: https://sciencebasedtargets.org/sectors/transport#our-updated-oems-policy (Accessed: 11 October 2022).
- Searchinger, A.T., James, O. and Dumas, P. (2022) *Europe's Land Future? Opportunities to use Europe's land to fight climate change and improve biodiversity - and why proposed policies could undermine both*. Princeton, New Jersey, United States of America: Center for Policy Research on Energy and the Environment (C-PREE) at Princeton University. Available at: https://scholar.princeton.edu/tsearchi/publications/europes-land-future (Accessed: 4 November 2022).

- Searchinger, T.D., Beringer, T., Holtsmark, B., et al. (2018) 'Europe's renewable energy directive poised to harm global forests', Nature Communications, 9, p. 3474. doi:10.1038/s41467-018-06175-4.
- Smith, T., Baresic, D., Fahnestock, J., et al. (2021) A Strategy for the Transition to Zero-Emission Shipping: An analysis of transition pathways, scenarios, and levers for change. London, United Kingdom: UMAS and Getting to Zero Coalition. Available at: https://www.u-mas.co.uk/wp-content/uploads/2021/10/Transition-Strategy-Report.pdf (Accessed: 29 November 2022).
- Stenzel, F., Greve, P., Lucht, W., et al. (2021) 'Irrigation of biomass plantations may globally increase water stress more than climate change', Nature Communications, 12(1512). doi:10.1038/s41467-021-21640-3.
- Strefler, J., Amann, T., Bauer, N., et al. (2018) 'Potential and costs of carbon dioxide removal by enhanced weathering of rocks', Environmental Research Letters, 13(3). doi:https://doi.org/10.1088/1748-9326/aaa9c4.
- Taylor, L., Quirk, J., Thorley, R., et al. (2015) 'Enhanced weathering strategies for stabilizing climate and averting ocean acidification', Nature Climate Change, 6, pp. 402–406. doi:https://doi.org/10.1038/nclimate2882.
- Ter-Mikaelian, M.T., Colombo, S.J., Lovekin, D., et al. (2015) 'Carbon debt repayment or carbon sequestration parity? Lessons from a forest bioenergy case study in Ontario, Canada', GCB Bioenergy, 7, pp. 704–716. doi:10.1111/gcbb.12198.
- Teske, S. (2022) Achieving the Paris Climate Agreement Goals. Part 2: Science-based Target Setting for the Finance industry – Net-Zero Sectoral 1.5˚C Pathways for Real Economy Sectors. Cham, Switzerland: Springer. Available at: https://link.springer.com/content/pdf/10.1007/978-030-99177-7.pdf (Accessed: 24 August 2022).
- Teske, S., Bratzel, S., Tellermann, R., *et al.* (2022) *The Internal Combustion Engine Bubble*. Hamburg, Germany: Greenpeace. Available at: https://www.greenpeace.de/publikationen/ICE-Bubble_2.pdf (Accessed: 11 November 2022).
- UN HLEG (2022) *Integrity Matters: Net Zero Commitments by Businesses, Financial Institutions, Cities and Regions*. United Nations' High-Level Expert Group on the Net Zero Emissions Commitments of Non-State Entities. Available at: https://www.un.org/sites/un2.un.org/files/high-level_expert_group_n7b.pdf (Accessed: 29 November 2022).
- UNFCCC (2021) *Upgrading our systems together: A global challenge to accelerate sector breakthroughs for COP26 – and beyond*. UNFCCC Climate Champions. Available at: https://racetozero.unfccc.int/wp-content/uploads/2021/09/2030-breakthroughs-upgrading-our-systems-together.pdf (Accessed: 1 December 2022).
- UNFCCC (2022) *Rules, modalities and procedures for the mechanism established by Article 6, paragraph 4, of the Paris Agreement. FCCC/PA/CMA/2022/L.14*. UNFCCC. Available at: https://unfccc.int/documents/621906 (Accessed: 12 January 2023).
- UNFCCC (2023) *NAZCA Global Climate Action portal.* Available at: https://climateaction.unfccc.int/ (Accessed: 27 January 2023).
- Usher, P.K., Ross, A.B., Camargo-Valero, M.A., *et al.* (2014) 'An overview of the potential environmental impacts of large-scale microalgae cultivation', *Biofuels*, 5(3), pp. 331–349. doi:10.1080/17597269.2014.913925.
- Warnecke, C., Höhne, N., Tewari, R., *et al.* (2018) Opportunities and safeguards for ambition raising through Article 6: The perspective of countries transferring mitigation outcomes. Berlin: NewClimate Institute. Available at: https://newclimate.org/resources/publications/opportunities-and-safeguards-for-ambition-raising-through-article-6.
- WBA (2022) *Automotive - Methodology [Status: 11.10.2022]*. World Benchmarking Alliance; CDP; French Environment and Energy Mana-gement Agency (ADAME). Available at: https://www.worldbenchmarkingalliance.org/publication/automotive/methodology/ (Accessed: 11 October 2022).
- WRI and WBCSD (2004) *The GHG Protocol Corporate Accounting and Reporting Standard.* Geneva, Switzerland and New York, USA: World Resources Institute and World Business Council for Sustainable Development. Available at: https://ghgprotocol.org/corporate-standard (Accessed: 27 January 2023).
- WRI and WBCSD (2011) *Corporate Value Chain (Scope 3) Accounting and Reporting Standard: Supplement to the GHG Protocol Corporate Accounting and Reporting Standard*. Geneva, Switzerland and New York, USA: World Resources Institute and World Business Council for Sustainable Development. Available at: https://ghgprotocol.org/standards/scope-3-standard (Accessed: 27 January 2023).
- WRI and WBCSD (2013) *Technical Guidance for Calculating Scope 3 Emissions (version 1.0). Supplement to the Corporate Value Chain (Scope 3) Accounting & Reporting Standard*. Geneva, Switzerland and New York, USA: World Resources Institute, World Business Council for Sustainable Development. Available at: http://www.ghgprotocol.org/sites/default/files/ghgp/standards/Scope3_Calculation_Guidance_0. pdf (Accessed: 27 January 2023).
- WWF and BCG (2020) *Beyond Science-Based Targets: A Blueprint for Corporate Action on Climate and Nature.* World Wide Fund For Nature, Gland, Switzerland and Boston Consulting Group, Boston MA, USA. Available at: https://wwfint.awsassets.panda.org/downloads/beyond_science_based_targets___a_blueprint_for_corporate_action_on_climate_and_nature.pdf (Accessed: 23 December 2022).

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