NEW CLIMATE INSTITUTE

# EVOLUTION OF CORPORATE CLIMATE TARGETS

## Conceptualisation of frameworks for scope 3 emission targets and the prioritisation of key transitions

January 2025

## Authors

Thomas Day, Eve Fraser, Silke Mooldijk, Sybrig Smit, Frederic Hans, Juliette de Grandpré, Takeshi Kuramochi

## Design

Quentin Geluyckens, Curious Cowboy SRL – www.curiouscowboy.com
Cover photography by Vinay Tryambake (Unsplash).
Additional photography by Victor (Unsplash), Giorgio Trovato (Unsplash) and Darwin Vegher (Unsplash).

## Communications

Victoria Fischdick, Niki Yeh.



↓ **Download the report:** *http://newclimate.org/publications/*

# Table of Contents

# Summary

***Transition-specific alignment targets*** are metrics that directly measure a company's progress on key climate change mitigation transitions, tailored to their specific sectors and business activities. For example, vehicle manufacturers may set targets for the percentage of annual sales from zero-emission vehicles, or the proportion of near-zero-emission steel procured.

Transition-specific alignment targets may complement GHG emission reduction targets to provide a more targeted and accurate means to guide and measure the efforts and impacts of corporate climate strategies. This report examines the feasibility of such a target-setting concept, finding significant promise for applicability across several major sectors, and identifying recommendations to overcome challenges. We consider that transition-specific alignment targets should be a key element of target-setting frameworks for corporate climate standards in national regulations, ISO standards and voluntary standards such as the SBTi's Corporate Net Zero Standard.

## Limitations of GHG emission reduction targets without further substantiation

**Limitations of corporate GHG inventories raise critical questions about whether GHG emissions should remain the dominant metric for corporate target setting.** Long-term GHG targets send a clear signal to decarbonise value chains, which is needed to bring global emissions to net zero. But short-term GHG targets for scope 3 value chain emissions may not be a meaningful indication of effort or impact without further substantiation, due to several limitations:

- **GHG emission reduction targets are susceptible to obfuscation and creative accounting.** This can lead to a significant implementation gap between targets and actions. The real meaning of companies' targets is often muddied by reliance on false accounting solutions such as carbon credits, standalone renewable energy certificates or "insetting" approaches, or reliance on technologies like CCUS and bioenergy in sectors where they may not be appropriate for alignment with sector decarbonisation pathways from the scientific literature.
- **Companies' decarbonisation efforts can be misrepresented, when GHG inventories fluctuate due to changes in business activities, mergers, or market share.** This can favour companies with shrinking businesses, regardless of their true decarbonisation progress. On the flipside, absolute GHG emission reduction targets can disadvantage emerging innovators and companies marketing climate solutions whose interim emission growth could benefit overall sector decarbonisation.
- **Currently common methods for estimating scope 3 emissions such as the "spend method" are not suitable for reflecting actual emission reductions over time.** This approach cannot capture the impact of adopting lower-carbon procurement practices; linking a decrease in emission only to reduced spending. Adopting more accurate methods to better reflect emission reduction measures would require recalculating historical emissions, often impractical due to the unavailability of high-resolution data from past suppliers.

## Feasibility of a framework for transition-specific alignment targets

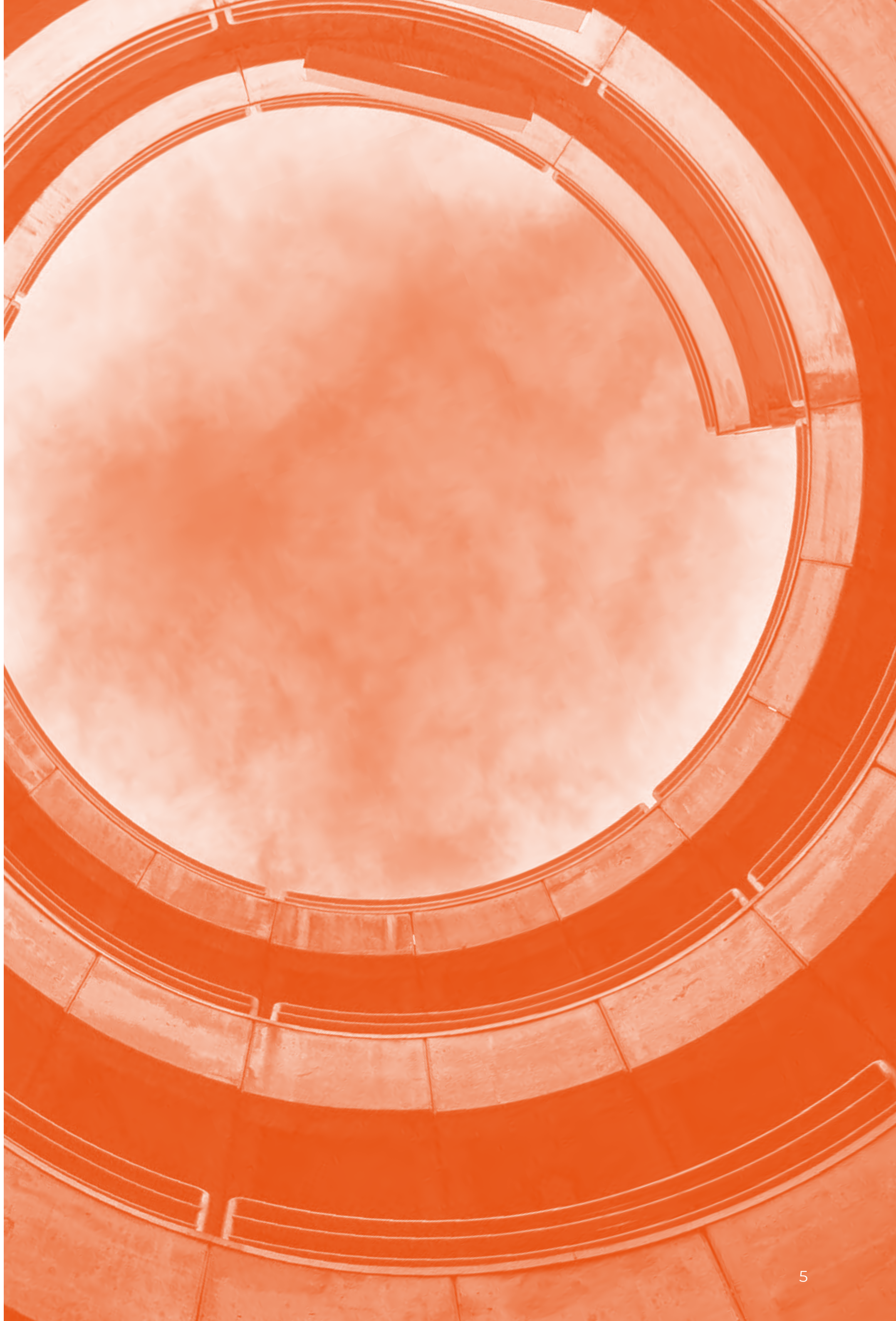
**To overcome these challenges, standard setters may need to rethink how corporate target-setting frameworks are structured.** Recognising net zero as a collective global goal, it is vital to ask: what role do we need companies to play towards this broader effort? The most meaningful contribution companies can make is to drive the necessary transitions of their sectors. Companies need to take responsibility for the key emission sources that are associated with their main business activities. Such efforts can align sectoral emissions trajectories with global climate objectives.

**We consider that transition-specific alignment targets may be a more targeted approach for voluntary standard setters and regulators to drive corporate climate leadership. This puts the spotlight on the necessary near-term actions and sector-specific transitions for companies.** For example, vehicle manufacturers could adopt near-term targets focused on the percentage of annual sales from zero-emission vehicles or the proportion of near-zero-emission steel procured (*see section B5*) or fashion companies could adopt targets for electrification and use of renewable electricity for garment manufacturing process in the supply chain (*see section B7*).

**We find that transition-specific alignment targets show significant promise for applicability across several major sectors.** In *section B* of this report, we identify the key transitions and appraise the feasibility of many possible target indicators for the scope 3 emissions of major companies from four sectors: automotive, tech, fashion and food and agriculture. For these sectors, we find that despite some challenges, it may be feasible to cover the large majority of most companies' scope 3 emissions with a maximum of five indicators that measure progress against key transitions (*see Table S1*). Based on the challenges and the factors which we identified as determining the feasibility of the alignment target framework for these four sectors, we estimate that transition-specific alignment targets may be a feasible approach to address scope 3 emissions for several other sectors (e.g. construction, electric utilities, freight and logistics, and retail; *see Table 2 section 2.2*).

**Transition-specific alignment targets may not always be possible to identify and prescribe at the sector-level.** There are some sectors (e.g. chemicals and consumer goods; *see Table 2 section 2.2*) where the homogeneity of activities, concentration of emission sources or clarity of technology pathways may be less conducive to the identification of specific transitions or indicators at the sector-level. In some cases, this may be possible at the level of specific sub-sectors. A standardised sector-transition framework may also not work for companies whose business activities fall within two or more sectors. Such companies should first identify key emission sources and then determine what transitions and alignment targets are relevant. This limitation holds equally for GHG emission reduction targets as it does for transition-specific alignment targets, since sector-specific benchmarks for GHG emission pathways also cannot adequately differentiate between differences between sub-sectors and specific business models in many cases.

**In the short term, alignment targets could be an addition but not a substitute for emission reduction targets for incumbent companies.** Setting 1.5°C-compatible alignment targets for key sectoral transitions may be the best way to focus on specific transitions, but it does not necessarily imply 1.5°C-compatibility of an entire business model in the long term without overarching GHG emission targets. Aggregated GHG emission reduction targets do not always have the specificity to reliably guide key transitions, but maintaining such targets in addition to more specific alignment targets is a key safeguard to ensuring that the full business – however it evolves – is subject to climate targets.



## Table S1: Feasibility of transition-specific alignment targets for four analysed sectors

*For many companies, it may be feasible to cover most of their scope 3 emissions with a maximum of five specific indicators that directly measure progress against key transitions.*

| AUTOMOBILE MANUFACTURERS | FASHION COMPANIES | TECH COMPANIES | AGRIFOOD COMPANIES |
|---|---|---|---|
| More than 95% of current and future scope 3 emissions for an average vehicle manufacturer would be covered by the following targets. | Approximately 85% of scope 3 emissions for an average major fashion company would be covered by the following targets. | We estimate that at least two thirds of scope 3 emissions for an average tech company would be covered by the following targets. | We estimate that approximately two thirds of scope 3 emissions for an average food producer would be covered by the following targets. |
| Our analysis indicates good feasibility for the use of these specific indicators for transition-specific alignment targets. | In addition to these indicators, targets related to circular business practices, overproduction and emissions from fibre extraction may be relevant. We could not identify suitable indicators due to the lack of consensus in the literature on the necessary transitions. | In addition to these indicators, measures to increase the lifespan of sold products and to increase the share of recycled materials in production may be relevant transitions, although we could not identify suitable indicators for target setting. | Our analysis indicates reasonable feasibility for the use of these indicators for transition-specific alignment targets. |
| **A Share of zero-emission vehicles / electric vehicles in sales.**<br>Emissions from the use of sold ICE vehicles accounts for ~80-90% of total emissions footprint from average ICE manufacturing company. | **A Share of electrification in heat and manufacturing processes in the supply chain**<br>Energy consumption in various stages of the garment production accounts for at least two thirds of fashion companies' footprints. Most energy demand sources can be electrified. | **A Share of electricity in data centres (own and third party-owned) that is matched by renewable electricity 24/7**<br>Approximately half of the emission footprint in the tech sector. The split between own operated and third-party data centres is changeable. | **A Zero deforestation commitment**<br>Land-use change is the biggest source of agricultural emissions. This is mostly driven by expansion of agricultural land into forests for livestock and commodity crops. |
| **B Power consumption (kWh) per vehicle-km for electric vehicles**<br>Downstream electricity consumption will become a major emission source as electric vehicles are phased in. Efficiency targets can influence the size and types of electric vehicles being produced. | **B Share of renewable energy in the supply chain**<br>We identify several promising indicators that companies could use to set targets on this transition. 24/7 renewable electricity targets could be most effective in driving the transition, but hourly data may not be available in many manufacturing regions, and a broader focus on energy rather than electricity may be relevant in some cases. | **B I. Share of supply chain electricity matched by 24/7 renewable electricity**<br>**II. Share of energy demand in the supply chain covered by on-site installations or PPAs (matching on an annual basis)**<br>We estimate that at least a third of the emissions footprint from tech sector companies comes from the use of energy in the supply chain to manufacture hardware. 24/7 matching targets would be most effective in driving the transition, but we consider annual matching with own generation and PPAs a promising option in the short term, where hourly data is not yet available. | **B Share of protein sales from plant-based products**<br>Livestock rearing is the largest single driver of emissions in global agricultural value chains. |
| **C Share of near-zero emission steel procured**<br>Steel procurement accounts for ~25–35% of upstream emissions for ICE vehicles, or ~5% of a company's total emission footprint. | | | **C % reduction in food loss and waste in supply chain and operations**<br>Relevant for reducing all emission sources (~30% of food is wasted throughout the value chain) |
| **D Share of near-zero emission aluminium procured**<br>Aluminium procurement accounts for ~20–30% of upstream emissions for ICE vehicles, or ~4% of a company's total emission footprint. | | | **D % reduction in fertiliser used per tonne of produce**<br>The production and use of fertilisers accounts for approximately 11% of emissions in global agricultural value chains. |
| **E GHG intensity per kWh battery capacity**<br>Battery production accounts for 40–60% of upstream emissions for electric vehicles. It will become the main emission source for vehicle manufacturing companies as they phase out ICE vehicles. | | | |

## Potential role of environmental attribute certificates towards transition-specific alignment targets

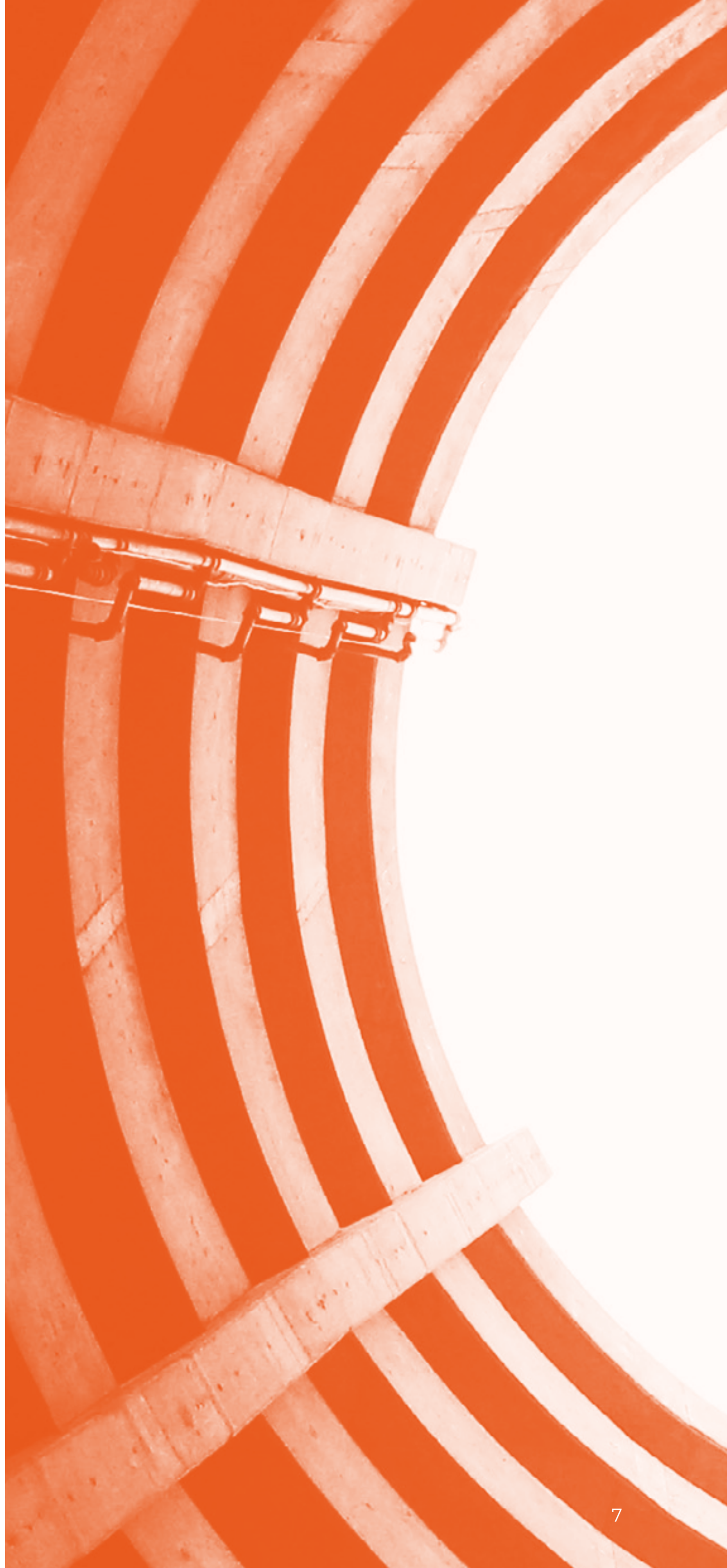
In examining the feasibility of transition-specific alignment targets for several sectors, we find that some of the most suitable targets in some sectors are specific to individual commodities. For example, automakers could set targets for the procurement of near-zero emission steel and aluminium, while fashion and tech companies could target increased shares of renewable electricity in their manufacturing supply chains.

Some stakeholders advocate for the increased use of commodity-specific environmental attribute certificates (commodity EACs) for use towards the fulfilment of companies' climate targets. Commodity EACs – such as certificates for green steel or low carbon cement – are instruments that certify and communicate specific environmental or sustainability about the production process of a given commodity (SBTi 2024a).

**The potential role of commodity EACs must take account of key nuances between commodities and sectors.** In a parallel report – *The role of environmental attribute certificates for corporate climate strategies* (NewClimate Institute 2024d) – we examined how the origin of EACs, their association to the supply chain, and the means through which they are procured, are critical factors that affect how EACs could support sector transitions. For many commodities, we find that the procurement of commodity EACs could only support the transitions if they derive from within the procuring company's *supply shed*.[1]

- **In some circumstances, commodity EACs derived from interventions *within a specific supply shed* may be a reasonable means to progress towards companies' transition-specific alignment targets.** Companies could face disincentives to take direct action if they can account for interventions within the broader supply shed rather than working with specific suppliers directly. Yet, interventions *within the broader supply shed* may be the most direct approach possible to decarbonise the value chain, if supplier traceability is not feasible. However, this would introduce significant risks: the landscape of potential commodity EACs is complex and fragmented, and the case-specific development of high integrity crediting mechanisms for each individual commodity will be highly challenging and susceptible to influence from actors with significant interests.
- **EACs from *beyond the supply shed* or with lower value chain traceability may be best suited for standalone targets and claims related to *contributions* to sector transformation.** In the context of more nuanced frameworks for scope 3 target setting, it may in some circumstances be reasonable to recognise *contribution*-framed interventions through the procurement of EACs, as a means of supporting 1.5°C aligned transitions. Given the high degree of uncertainty and improbability that the purchase of commodity EACs with lower traceability can really be equivalent to direct action within the value chain, such *contribution*-framed targets and claims should be distinct from companies' own transition-specific alignment targets or GHG emission reduction targets.

1 *The Value Change Initiative Guidance defines a Supply Shed as "a group of suppliers in a specifically defined market (preferably at sub-national level) providing similar goods and services (commodities) that can be demonstrated to be within the company's supply chain" (Value Change Initiative 2024). Supply Shed is a concept and approach that caters to situations where a company may not be able to directly trace sourcing to a specific upstream supplier, but it is known that sourcing comes from a group of suppliers within a "market" from which the company sources.*



## Recommendations for corporate climate standard setters including regulators, ISO and the SBTi

**Transition-specific alignment targets should be a key element of target-setting frameworks for corporate climate standards, as a complement to GHG emission reduction targets.** While challenges remain to define and implement a target setting framework for alignment targets, these targets show significant promise for applicability across several major sectors.

**The development and standardisation of precise definitions for key terms** — such as "renewable energy," "zero-emission vehicles," "zero-emission steel," and "plant-based products" — is critical to ensure consistency and clarity in transition-specific alignment targets.

**A scientific initiative may be needed to define transition pathways and indicators for different sectors.** Such a process could build upon the indicative frameworks demonstrated in this report. In particular, a coordinated effort to advance research and build consensus on complex issues like recycling, circularity, and fast-output business models is necessary to define the right transition-specific alignment targets in some sectors, especially in sectors that rely heavily on rapid product turnover.

**In some cases, transition-specific alignment indicators and targets may need to span business activities across scope 1, 2, and 3 emissions.** This acknowledges the fact that rigid separation of these categories may not accurately reflect the fluidity of emissions sources within some sectors. This means that transition-specific alignment targets should not be considered only as a means of addressing scope 3 emissions.

## Recommendations for the GHG Protocol

**The GHG Protocol should review the categorisation and granularity of scope 3 emission reporting, to support the identification of key emission sources and transitions.** The GHG Protocol is currently under a major revision process, to be completed by late 2026. The following recommendations may improve the extent to which the accounting framework of the GHG Protocol can support transition-specific alignment targets.

- **The GHG Protocol should require greater granularity in the categorisation of emission sources, to identify key emission sources and transitions.** The currently poor granularity of GHG emissions data for procured products and services (Scope 3 Category 1) can make it difficult to identify the key emission hotspots against which targets should be set.
- **The GHG Protocol should develop sector-specific reporting guidelines for certain sectors or business activities to ensure complete and consistent GHG emission inventories.** Incomplete and inconsistent GHG emission reporting remains an issue in some sectors, and means that the ability of target validators or other observers to identify key emission sources and the most relevant transition-specific alignment targets may only be an approximate estimate. In the tech sector for example, we did not identify consistent data on GHG emissions from third-party owned data centres. Similar issues with major inconsistencies exist for other sectors, such as inconsistent coverage of electric utilities' resale of electricity to sales partners and wholesalers, or inconsistent boundaries of downstream product use phase emissions for steel and machinery manufacturers (NewClimate Institute 2023).

**The transition to 24/7 matching of renewable electricity procurement should be expedited and mainstreamed into all appropriate accounting frameworks, data platforms and target setting standards.** The renewable electricity transition is a cross-cutting topic of key relevance in all sectors and for all actors of the corporate accountability system, including regulators, standard setters and the GHG Protocol. 24/7 matching of renewable electricity would be a pivotal transition-specific alignment target for companies in many sectors, but companies may not be able to set or effectively monitor progress against 24/7 renewable electricity until such accounting frameworks and infrastructure is available.

# Abbreviations

| | |
|---|---|
| **ADEME** | Agency for Ecological Transition |
| **AI** | Artificial Intelligence |
| **BOF** | Basic Oxygen Furnace |
| **CAT** | Climate Action Tracker |
| **CCUS** | Carbon Capture, Utilization, and Storage |
| **CDP** | Carbon Disclosure Project |
| **CSRD** | Corporate Sustainability Reporting Directive |
| **EAC** | Environmental Attribute Certificate |
| **ESG** | Environmental, Social, and Governance |
| **ESRS** | European Sustainability Reporting Standards |
| **EV** | Electric Vehicle |
| **FAO** | Food and Agriculture Organization (of the United Nations) |
| **FLAG** | Forest, Land, and Agriculture Guidance |
| **GFA** | Gross Floor Area |
| **GHG** | Greenhouse Gas |
| **HPCA** | High-Performance Computing Accelerator |
| **ICCT** | International Council on Clean Transportation |
| **ICE** | Internal Combustion Engine |
| **IEA** | International Energy Agency |
| **IPCC** | Intergovernmental Panel on Climate Change |
| **ISO** | International Organization for Standardization |
| **IT** | Information Technology |
| **MOU** | Memorandum of Understanding |
| **NUE** | Nitrogen Use Efficiency |
| **OECD** | Organisation for Economic Co-operation and Development |
| **PDF** | Portable Document Format |
| **PPA** | Power Purchase Agreement |
| **PV** | Photovoltaic |
| **RE** | Renewable Energy |
| **SDG** | Sustainable Development Goals |
| **TPI** | Transition Pathway Initiative |
| **UN** | United Nations |
| **UNEP** | United Nations Environment Programme |
| **UNFCCC** | United Nations Framework Convention on Climate Change |
| **UNITAR** | United Nations Institute for Training and Research |
| **WBA** | World Benchmarking Alliance |
| **WEF** | World Economic Forum |
| **WRAP** | Waste and Resources Action Programme |
| **WRI** | World Resources Institute |

# SECTION A
## Feasibility of transition-specific alignment targets for scope 3 emissions

***Transition-specific alignment targets*** are metrics that directly measure a company's progress on key climate change mitigation transitions, tailored to their specific sectors and business activities. For example, vehicle manufacturers may set targets for the percentage of annual sales from zero-emission vehicles, or the proportion of near-zero-emission steel procured.

Transition-specific alignment targets may complement GHG emission reduction targets to provide a more targeted and accurate means to guide and measure the efforts and impacts of corporate climate strategies. This report examines the feasibility of such a target-setting framework, finding significant promise for applicability across several major sectors, and identifying recommendations to overcome challenges. We consider that transition-specific alignment targets should be a key element of target-setting frameworks for corporate climate standards in national regulations, ISO standards and voluntary standards such as the SBTi's Corporate Net Zero Standard.

# 1 The concept of alignment targets as a complement to GHG emission reduction targets

**Aligning company-level target-setting frameworks with global net-zero goals is more complex than current voluntary standards and target setting approaches indicate. Transition-specific alignment targets may complement GHG emission reduction targets to provide a more specific and accurate means to measure the efforts and impacts of corporate climate strategies.**

**Limitations of corporate GHG inventories raise critical questions about whether GHG emissions should remain the dominant metric for corporate target setting.** Long-term GHG targets send a clear signal to decarbonise value chains, which is needed to bring global emissions to net zero. But short-term GHG targets for scope 3 value chain emissions may not be a meaningful indication of effort or impact without further substantiation:

- **GHG emission reduction targets are particularly susceptible to obfuscation and creative accounting, without further substantiation.** Our analysis in three annual iterations of the *Corporate Climate Responsibility Monitor* (NewClimate Institute 2024b) indicated a significant implementation gap between targets and actions: companies' 2030 emission reduction targets do not always translate into meaningful changes to companies' business models that address their most critical emission sources. The real meaning of companies' emission reduction targets is often muddied by reliance on false accounting solutions such as carbon credits, standalone renewable energy certificates or "insetting" approaches, or reliance on technologies like CCUS and bioenergy in sectors where they may not be appropriate for alignment with sector decarbonisation pathways from the scientific literature.
- **Common methods for approximately estimating scope 3 emission inventories are not conducive to accurately accounting emission reductions.** For example, the "spend method" calculates emissions based on how much a company spends on goods and services, applying generic economy-wide emissions factors. This approach cannot capture the impact of adopting lower-carbon procurement practices; only reductions in expenditure could lead to lower emissions through this method (Broekhoff and Gillenwater 2024). Switching to more accurate methods to better reflect emission reduction efforts would often require recalculating historical emissions data, which is unlikely to be possible since higher resolution data is unlikely to be available for historical suppliers.
- **Companies' scope 3 GHG emission inventories may not be comparable between years due to the dynamically changing nature of their business models and market shares.** Unlike countries, the boundaries of companies' GHG emission inventories effectively change each year due to, for instance, changes to business activities and product lines, mergers, or divestments. Companies that do not take any significant action to contribute to the decarbonisation of their sectors can incorrectly be perceived as having performed well in decarbonising their businesses, simply for contracting or losing their market share.
- **GHG emission reduction targets may not be a fair approach to measure ambition of sector innovators and disrupters in the short- and medium-term.** Target setting frameworks that often focus on simplified and aggregated GHG metrics, assume a common and uniform responsibility for companies to reduce the emissions of the sector they operate in. This does not sufficiently accommodate the differing circumstances and responsibilities of individual companies. For example, Robiou Du Pont et al (2024) argue that the current SBTi standards might be more advantageous to large incumbent polluters than they are to sector innovators and disrupters, including new or established companies marketing climate solutions. These newcomers' interim growth in production and related emissions may be beneficial for reducing the emissions of their sectors overall.

**To overcome these challenges, standard setters may need to rethink how corporate target-setting frameworks are structured.** Recognising net zero as a collective global goal, it is vital to ask: what role do we need companies to play towards this broader effort? The most meaningful contribution companies can make is to drive the necessary transitions of their sectors. Companies need to take responsibility for the key emission sources that are associated with their main business activities. Such efforts can align sectoral emissions trajectories with global climate objectives.

**Transition-specific alignment targets, as a complement to GHG reduction commitments, may offer a more targeted way to identify and incentivise corporate climate leadership.** Transition-specific alignment targets put the spotlight on the necessary near-term actions and sector-specific transitions for companies. For example, vehicle manufacturers could adopt near-term targets focused on the percentage of annual sales from zero-emission vehicles or the proportion of near-zero-emission steel procured (*see section B5*) or fashion companies could adopt targets for electrification and use of renewable electricity for garment manufacturing process in the supply chain (*see section B7*).

**Transition-specific alignment targets could be a framework for voluntary standard setters and regulators of corporate climate action:**

- The International Standards Organisation is in the process of development a standard for Net Zero Aligned Organisations (ISO 14060), which will include target setting approaches for corporates climate action to align with global net-zero emissions.
- SBTi's Discussion Paper on Scope 3 Target Setting (SBTi 2024a) sets out a potential framework for a major revision of the existing SBTi Corporate Net Zero Standard. The SBTi's proposed framework would first require companies to identify and prioritise the most critical emission sources and related transitions within their sectors. For these prioritised emission sources and transitions, companies would need to commit to specific 'alignment targets' and 'policies' over the interim period, on the way to their longer-term net-zero targets.
- For the European Sustainability Reporting Standards (ESRS) in compliance with European Union's Corporate Sustainability Reporting Directive (CSRD), transition-specific alignment targets could be a comparable means of reporting corporate transition plans and progress. Companies will be required to disclose information of their climate change mitigation transition plans including the actions they pursue, their targets, and their policy alignment.

## This report examines the feasibility of a transition-specific alignment target framework

Potential challenges like data availability and differences in emission sources between companies within a sector could make setting comparable alignment targets difficult. Accordingly, there is a concern that while this framework could be effective for many companies, it may not be directly applicable to all companies.

The objective of this report is to test the feasibility of alignment targets, to inform the development and revision of key standards for corporate climate action including national regulations, the development of the ISO 14060 standard for Net Zero Aligned Organisations and the revision of the SBTi Corporate Net Zero Standard. In this report, we consider the feasibility of developing a consistent and specific framework for setting targets on key transitions in four sectors: automotive manufacturers, agriculture and food, tech, and fashion.

## GHG emission targets remain relevant for many incumbent corporations

**Long-term targets to reduce GHG emissions to near zero send a clear signal for companies to decarbonise their value chains.** The aforementioned limitations of short-term emission reduction targets are less relevant for long-term targets in the order of 90–100% emission reductions. All sectors and activities need to reach either zero or near-zero emissions in the longer run, while we eventually need to reach net-negative emissions at the economy-wide level, so it is important that companies are steered by this long-term vision.

**In the short term, alignment targets could be an addition but not a substitution for emission reduction targets for incumbent companies.** Setting 1.5°C-compatible alignment targets for key sectoral transitions may be the best way to focus on specific transitions, but it does not necessarily imply 1.5°C-compatibility of an entire business model in the long term without overarching GHG emission targets. For example, an energy utility planning to phase out coal-fired power generation and transition from gas to hydrogen is not 1.5°C-aligned if the company also pivots its business model to derive a major portion of its revenue from fossil fuel extraction and trading, which may not be covered by the company's specific alignment targets. It is not realistic to expect standards developed by voluntary initiatives or regulators to foresee and cover all the potential current and future activities that companies may engage in, as companies and sectors adapt and evolve. We have seen that aggregated GHG emission reduction targets do not always have the specificity to reliably guide key transitions, but maintaining such targets in addition to more specific alignment targets is a key safeguard to ensuring that the full business – however it evolves – is subject to climate targets. This would also be an important safeguard, given the alignment target approach has not yet been implemented. We do not know yet whether the approach may present any unforeseen barriers, either methodologically or during implementation and monitoring over time.

**We see the argument that some companies and sectors – such as companies marketing climate solutions – could be treated differently in the near term.** For these companies, specific alignment targets without accompanying absolute GHG emission reduction targets might better recognise and reward their business activities. However, objectively segmenting companies according to this logic may be a considerable challenge: for example, companies marketing climate solutions – such as novel renewable energy or efficiency technologies – may also continue polluting business divisions in parallel. The definition of climate solutions is also not objectively clear: for example, tech companies often describe some applications of artificial intelligence as climate solutions, although many academics and civil society groups contest are concerned about the emissions impact associated with the rapidly expanding energy consumption of this technology.

# 2 Feasibility of transition-specific alignment target framework

## 2.1 Identifying alignment targets for automakers, fashion, tech and agrifood

**Transition-specific alignment targets may be a feasible approach to address scope 3 emissions for automotive manufacturers, tech companies, fashion companies and food and agriculture companies.** In *section B* of this report, we identify the key transitions and appraise the feasibility of several possible target indicators for the scope 3 emissions of major companies from four sectors: automotive, tech, fashion and food and agriculture (*see summary of findings in Table 2*). For these sectors, we find that despite some challenges, it may be feasible to cover the large majority of most companies' scope 3 emissions with a maximum of five indicators that measure progress against key transitions.

## Table 1: Feasibility of transition-specific alignment targets for four analysed sectors

| AUTOMOBILE MANUFACTURERS | FASHION COMPANIES | TECH COMPANIES | AGRIFOOD COMPANIES |
|---|---|---|---|
| More than 95% of current and future scope 3 emissions for an average vehicle manufacturer would be covered by the following targets. | Approximately 85% of scope 3 emissions for an average major fashion company would be covered by the following targets. | We estimate that at least two thirds of scope 3 emissions for an average tech company would be covered by the following targets. | We estimate that approximately two thirds of scope 3 emissions for an average food producer would be covered by the following targets. |
| Our analysis indicates good feasibility for the use of these specific indicators for transition-specific alignment targets. | In addition to these indicators, targets related to circular business practices, overproduction and emissions from fibre extraction may be relevant. We could not identify suitable indicators due to the lack of consensus in the literature on the necessary transitions. | In addition to these indicators, measures to increase the lifespan of sold products and to increase the share of recycled materials in production may be relevant transitions, although we could not identify suitable indicators for target setting. | Our analysis indicates reasonable feasibility for the use of these indicators for transition-specific alignment targets. |
| A **Share of zero-emission vehicles / electric vehicles in sales.**<br>Emissions from the use of sold ICE vehicles accounts for ~80-90% of total emissions footprint from average ICE manufacturing company. | A **Share of electrification in heat and manufacturing processes in the supply chain**<br>Energy consumption in various stages of the garment production accounts for at least two thirds of fashion companies' footprints. Most energy demand sources can be electrified. | A **Share of electricity in data centres (own and third party-owned) that is matched by renewable electricity 24/7**<br>Approximately half of the emission footprint in the tech sector. The split between own operated and third-party data centres is changeable. | A **Zero deforestation commitment**<br>Land-use change is the biggest source of agricultural emissions. This is mostly driven by expansion of agricultural land into forests for livestock and commodity crops. |
| B **Power consumption (kWh) per vehicle-km for electric vehicles**<br>Downstream electricity consumption will become a major emission source as electric vehicles are phased in. Efficiency targets can influence the size and types of electric vehicles being produced. | B **Share of renewable energy in the supply chain**<br>We identify several promising indicators that companies could use to set targets on this transition. 24/7 renewable electricity targets could be most effective in driving the transition, but hourly data may not be available in many manufacturing regions, and a broader focus on energy rather than electricity may be relevant in some cases. | B **I. Share of supply chain electricity matched by 24/7 renewable electricity**<br>**II. Share of energy demand in the supply chain covered by on-site installations or PPAs (matching on an annual basis)**<br>We estimate that at least a third of the emissions footprint from tech sector companies comes from the use of energy in the supply chain to manufacture hardware. 24/7 matching targets would be most effective in driving the transition, but we consider annual matching with own generation and PPAs a promising option in the short term, where hourly data is not yet available. | B **Share of protein sales from plant-based products**<br>Livestock rearing is the largest single driver of emissions in global agricultural value chains. |
| C **Share of near-zero emission steel procured**<br>Steel procurement accounts for ~25–35% of upstream emissions for ICE vehicles, or ~5% of a company's total emission footprint. | | | C **% reduction in food loss and waste in supply chain and operations**<br>Relevant for reducing all emission sources (~30% of food is wasted throughout the value chain) |
| D **Share of near-zero emission aluminium procured**<br>Aluminium procurement accounts for ~20–30% of upstream emissions for ICE vehicles, or ~4% of a company's total emission footprint. | | | D **% reduction in fertiliser used per tonne of produce**<br>The production and use of fertilisers accounts for approximately 11% of emissions in global agricultural value chains. |
| E **GHG intensity per kWh battery capacity**<br>Battery production accounts for 40–60% of upstream emissions for electric vehicles. It will become the main emission source for vehicle manufacturing companies as they phase out ICE vehicles. | | | |

We experienced several challenges while trying to identify potential transition-specific alignment targets for these sectors. These challenges may need to be overcome to improve the feasibility of transition-specific alignment targets as a target-setting framework in these and in other sectors:

## Challenges to identify the key emission sources and transitions

- **The non-homogeneity of business activities and emission sources** from companies operating in seemingly distinct sectors may make it difficult to predetermine and prescribe the key transitions at a sector level. For example, the emission profile of major tech companies is highly variable depending on the extent to which they are active in the provision of software and cloud services, the production of electronic devices, or larger electrical and technological devices and machinery. Most major tech companies cover a range of these business activities, and the focus of their activities is likely to change over time. The procurement of renewable electricity for data centres and for the production of components in the supply chain are likely to be key transitions for most major companies in this sector, but other relevant transitions could be identified in addition for companies producing household appliances, like Sony and Samsung.
- **Poor granularity of GHG emissions data for procured products and services (scope 3 Category 1)** can make it difficult to identify the key emission hotspots against which targets should be set. The current version of the GHG Protocol's Corporate Value Chain (scope 3) Standard combines companies' supply chain emissions into a single metric under scope 3 category 1. This is not conducive to the identification of hotspots, since companies' supply chains typically consists of a number of distinct emission sources from the procurement of different commodities or services, each of which could and should be addressed separately from another. Companies that compile their scope 3 inventories in a more granular fashion may have more detailed data on the key emission sources and hotspots within their supply chain, but many companies simply estimate the scale of supply chain emissions by applying an economy-wide emissions factor to their entire supply chain expenditure. In sectors like automotive manufacturers, the procurement of steel, aluminium and batteries can be identified as key distinct emission sources from the supply chain. However, for companies from less homogenic sectors or sectors where supply chain emissions are more distributed across many different services or commodities, this could be a significant challenge.
- **Incomplete and inconsistent GHG emission reporting** remains an issue in some sectors, and means that the ability of target validators or other observers to identify key emission sources may only be an approximate estimate. In the tech sector for example, we did not identify data on GHG emissions from third-party owned data centres. Companies may include these emissions in scope 3 categories 1 or 8, or merge it with emissions from own data centres under scope 2. Apple is the only company reporting on emissions from third-party owned data centres that we identified. However, Apple reports only market-based emissions and claims that these are zero (Apple 2024). For independent observers it is currently impossible to know the relevance of third-party data centres and associated emissions in tech companies' GHG inventories.
- **Unclear pathways related to raw materials, circularity and associated business model changes** make it difficult to prescribe transition-specific alignment targets in some sectors. In some cases, we note a lack of clear consensus in the scientific literature on what the right approaches should be for addressing some emission sources. This is particularly the case in sectors where potential emission reduction measures involve significant changes to consumption behaviours, which might be contentious and have limited societal acceptance. For example, fashion companies should reduce overproduction and overconsumption, but this would require a fundamental shift away from fast fashion business models. Such a shift, although widely acknowledged as necessary, is not included in current pathways for the fashion industry and so it is unclear how companies could undergo such a change, and the impact this will have on emissions and business operations (*see section B7.4*). For tech, there is a debate about the extent to which it would be appropriate to increase the lifespan of electronic devices (*see section B6.4*). For both of these sectors, the role and potential impact of recycling to reduce upstream production emissions seems intuitive but is also subject to debate and further research (*see sections B6.5 and B7.5*).

### Challenges to identify the right target indicators for key transitions

- **Transition-specific alignment indicators may in some cases have to span business activities across scope 1, 2 and 3 emissions, rather than treating scope 3 separately.** Under the GHG Protocol and the SBTi's Corporate Net Zero Standard, scope 1 and 2 emissions are often treated separately from scope 3 emissions for GHG accounting and target setting frameworks. However, there are some emission sources for which the underlying business activities may move fluidly between and across emission scopes from one year to the next. For example, for electric utilities the emissions related to electricity generation could be scope 1 emissions or scope 3 emissions depending on the extent to which companies generate electricity themselves or operate as energy retailers for energy generated by others. For tech companies, emissions from energy use in data centres could be scope 2 or scope 3 emissions, depending on the extent to which companies operate their own data centres or make use of third-party services. In both of these examples, the split may change on an annual basis, in some cases quite drastically. In some cases, it may be necessary to group these activities together and asses them with one metric, to measure performance on transitions, if having two separate targets could lead to misleading data trends as companies move their activities back and forth between their own operations and third-party contractors. This would require target setting frameworks for alignment targets to apply beyond the boundaries of scope 3 inventories. For example, the SBTi Corporate Net Zero Standard already recommends electric utilities to set targets for the emissions intensity of electricity generation covering both scope 1 and scope 3 generation.
- **Indicators with the ideal level of specificity are not always practically realistic.** For example, the most accurate and specific indicator to measure the use of renewable energy in production processes in the fashion sector would be the proportion of energy that is matched with renewables on a 24/7 basis, but 24/7 accounting is not yet standard accounting practice and may not be a realistic prospect in some key manufacturing regions for several years (*see section B7.3*). In such cases, other indicators may be more practical in the interim period, even if they may not be as effective in measuring efforts towards the transition.
- **Some indicators depend on strong standardised definitions for potentially ambiguous terms.** Targets for shares of near-zero emission steel, renewable energy, zero-emission vehicles and other similarly ambiguous terms require definitions for those terms. For example, there are highly variable definitions of what constitutes near-zero emission steel (NewClimate Institute 2024d). Different definitions for renewable or carbon free energy can include or exclude technologies such as bioenergy, hydropower, nuclear and CCS, which can significantly change what the targets and the transitions really mean. Such definitions are often being formed by industry groups in the context of coalition initiatives or the development of certification systems for EACs, although the vested interests of these groups could potentially undermine the integrity of those initiatives and definitions (NewClimate Institute 2024d).
- **Indicators based on absolute target levels may be the most comparable approach in some cases but are not always practically realistic when benchmarks are highly variable and specific.** For example, the most specific indicator for reducing emissions from fertilisers might be nitrogen use efficiency, but this is not practical to reliably measure and verify this indicator at the farm level (*see section B8.5*). An alternative indicator would be the absolute amount of fertiliser applied per unit of land or output. However, benchmarks for the application of fertilisers vary according to the type of crop, soil types, and climate zones among other factors, and it may not be realistic to identify appropriate benchmarks for this indicator that agricultural companies can use across their supply chains. In such cases, it might be more realistic for companies to set relative targets for reducing the amount of fertiliser used per unit of land or output. Such an indicator may be the most pragmatic approach for some transitions, although it is potentially unfair to companies that have already made more progress in the transition than their competitors.
- **For some transitions, there is no clearly superior indicator, although different indicators could lead to different outcomes.** For example, for the transition to plant-based protein we identified advantages and disadvantages of various indicators that could slightly change the meaning of the transition and the measures that companies take to implement it (*see section B8.2*). Setting a target to increase the share of *sales* from plant-based products may highlight that there is a business case for switching to plant-based protein. However, such products may be more expensive and so this indicator might not accurately reflect how many plant-based protein products are sold in comparison to animal-based protein products. Setting targets on the share of plant-based protein products sold (in tonnes) or on the share of plant-based protein products on offer would both more accurately reflect progress on the transition away from animal protein, but this data is currently not commonly reported or tracked by companies.

## 2.2 General feasibility of alignment targets for other sectors

*Section 2.1* listed some of the challenges that we experienced in trying to identify appropriate transitions and indicators for four sectors. Based on these, we consider that the use of standardised transition-specific alignment targets as a complement to GHG emission reduction targets may be most feasible for sectors with the following circumstances:

- **Homogeneity of activities and emission sources:** High homogeneity of business activities and emission sources from companies operating in the same sectors may make it more practical to predetermine and prescribe the key transitions at a sector level, compared to sectors with a higher diversity of different business activities and emission sources.
- **Relatively concentrated types of emission sources:** To maintain a manageable number of transition-specific alignment targets, such a framework may be more feasible for sectors where the types of emission sources are relatively concentrated and where a large portion of emissions could be covered with a small number of target indicators. For example, *Table 1* in *section 2.1* shows that a handful of alignment targets could cover the majority of scope 3 emissions for automakers, tech, and fashion companies.
- **Clear pathways or transition needs:** For sectors where there is a reasonable degree of scientific consensus on the need for specific technology developments or the need for more fundamental product or business model transitions, targets related to these specific issues can ensure that companies are prioritising or at least adequately addressing them. In contrast, sector-specific transition targets may be too prescriptive and therefore less reasonable for sectors and emission sources for which there is a more limited degree of scientific consensus or perceived feasibility for specific pathways and technologies.

**It may be possible to identify relevant transition-specific alignment targets at the sector level for many sectors, but some companies would require a more bespoke approach.** Based on the factors which we identified as determining the feasibility of the alignment target framework, *Table 2* presents an indication of the feasibility of the approach for twelve selected sectors with large scope 3 emission footprints. According to this high-level indicative estimate, transition-specific alignment targets may be a very suitable framework for many sectors, but there are some sectors (e.g. chemicals; consumer goods) where the homogeneity of activities, concentration of emission sources or clarity of technology pathways may be less conducive to the identification of specific indicators at the sector-level. In some cases, this may be possible at the level of specific sub-sectors. A standardised sector-transition framework may also not work for companies whose business activities fall within two or more sectors. For example, a company like Samsung produces electronic devices, chips, and household appliances, and offers cloud services. These activities cannot be classified within one sector (e.g. tech). Instead of applying a standardised sector-transition framework, companies whose activities span across sectors, should first identify key emission sources and then determine what transitions and alignment targets are relevant.

This limitation holds equally for GHG emission reduction targets as it does for transition-specific alignment targets, since sector-specific benchmarks for GHG emission pathways also cannot adequately differentiate between differences between sub-sectors and specific business models in many cases.

## Table 2: Ability to identify standardised transition-specific alignment targets at the sector level, for selected sectors (authors' estimate)

*It may be possible to identify some key transition-specific alignment targets at the sector level for many sectors, but some companies and sectors would require a more bespoke approach.*

| | AUTOMOTIVE MANUFACTURERS | TECH | FASHION | AGRICULTURE AND FOOD | CHEMICALS | CONSTRUCTION | CONSUMER GOODS | ELECTRIC UTILITIES | FREIGHT AND LOGISTICS | BIOTECH & PHARMA | RETAILING | TELECOMS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Major scope 3 emission sources** (example for typical companies) | Downstream use of vehicles; materials from supply chain. | Data centre energy; components from supply chain. | Energy for production of garments in supply chain. | Deforestation, livestock emissions and fertilisers in supply chain. | Downstream chemical use (highly diverse); upstream feedstocks. | Materials from supply chain; energy consumption of buildings. | Raw materials; packaging; use and disposal of products. | Third-party generation; downstream use of gas sales. | Third-party contracted aviation, maritime and ground transportation. | Supply chain energy; downstream use of inhalers, waste. | Upstream production; downstream use of electrical devices. | Supply chain and customer energy demand. |
| **Homogeneity of activities and emission sources** | ● High homogeneity of products | ◑ Emissions profile of software and hardware companies varies. | ◔ Reasonable homogeneity of emission sources. | ◑ Emissions profile of different agricultural products varies | ◑ Varied emissions profile according to sub-sector | ● High homogeneity of emission sources. | ◌ Highly varied emissions profile of different products | ● High homogeneity of emission sources | ● High homogeneity of emission sources | ◔ Reasonable homogeneity of emission sources. | ◑ Emissions profile of different types of retailers and products varies. | ● High homogeneity of emission sources |
| **Concentration of type of emission source** | ● Few materials account for most supply chain emissions. | ● Energy for data centres and electronic components account for most supply chain emissions. | ● Energy for production of garments accounts for most supply chain emissions. | ◑ Emission sources for agricultural commodities are variable and complex. | ● Within each sub-sector, emission sources are reasonably concentrated | ◑ Steel, cement and building energy performance account for most emissions | ◌ High fragmentation of emission sources. | ● 3rd party electricity generation and gas distribution account for large majority of emissions | ● Contracted aviation, maritime or ground transport account for most emissions. | ● Inhalers, supply chain energy and waste account for the majority of emissions | ◑ Variable, but agricultural emissions, supply chain energy and consumer energy are major sources | ● Energy for production of devices accounts for most supply chain emissions. |
| **Clarity of technology and business model pathways** | ● Clear pathways for vehicle types and materials. | ● Clear pathways for renewable energy. | ◑ Clear pathways for renewable energy, but unclear pathways for business models. | ◑ Limited acceptance of science-based pathways for livestock and other commodities | ◑ Technology pathways are clear for some but not all sub-sectors | ◑ Clear technology pathways; less clarity on division of responsibility among actors | ◑ Clear pathways for renewable energy, but less clarity chemicals and packaging. | ● Clear pathways for renewable energy. | ◔ Clear pathways for land- and maritime decarbonisation. Uncertainty for aviation. | ● Clear pathways for inhalers and renewable energy. | ◑ Clear pathways for renewable energy, but less clarity for agricultural emissions. | ● Clear pathways for renewable energy. |

**Source: Authors' estimate.**

**Key:** Prospects for identifying standardised transition-specific alignment targets at the sector level ● Very good ◔ Reasonable ◑ Moderate ◌ Poor

# 3 Potential role of environmental attribute certificates

In examining the feasibility of transition-specific alignment targets for several sectors, we find that some of the most suitable targets in some sectors are specific to individual commodities (*see section B, summarised in Table 1 section A2*). For example, automakers could set targets for the procurement of near-zero emission steel and aluminium, while fashion and tech companies could target increased shares or renewable electricity in their manufacturing supply chains.

Some stakeholders advocate for the increased use of commodity-specific environmental attribute certificates (commodity EACs) for market-based or project-based accounting in GHG inventories, and for use towards the fulfilment of companies' climate targets. Commodity EACs are instruments that certify and communicate specific environmental or sustainability about the production process of a given commodity (SBTi 2024a). For example, there are several forms of green steel certificates already available and under development, which automotive manufacturers may hope to use towards their supply chain emission reduction targets.

**The potential role of commodity EACs must take account of key nuances between commodities and sectors.** The origin of EACs, their association to the supply chain, and the means through which they are procured, are critical factors that affect how the procurement of EACs could support sector transitions. In a parallel report – *The role of environmental attribute certificates for corporate climate strategies* (NewClimate Institute 2024d) – we examined how these factors affect the ability to make a meaningful contribution to sector transitions. For many commodities, we find that the procurement of commodity EACs could only support the transitions if they derive from *within* the procuring company's *supply shed*:[2]

2 The Value Change Initiative Guidance defines a Supply Shed as "a group of suppliers in a specifically defined market (preferably at sub-national level) providing similar goods and services (commodities) that can be demonstrated to be within the company's supply chain" (Value Change Initiative 2024). Supply Shed is a concept and approach that caters to situations where a company may not be able to directly trace sourcing to a specific upstream supplier, but it is known that sourcing comes from a group of suppliers within a "market" from which the company sources.

**In some circumstances, commodity EACs derived from interventions *within a specific supply shed* may be a reasonable means to progress towards companies' transition-specific alignment targets.**

Companies could face disincentives to take direct action for supply chain decarbonisation if they are offered the ability to make and account for interventions within the broader supply shed rather than working with specific suppliers directly. Yet, interventions *within the broader supply shed* may be the most direct approach possible to decarbonise the value chain in some cases. This could be the case if supplier traceability is not feasible, for example with electricity flows within a grid, or when suppliers change on a frequent basis, as is often the case for the fragmented supply chains for several agricultural commodities.

Whether the procurement of EACs from the supply shed could be a reasonable approach for market-based accounting is likely dependent on the nature of the commodity and the definition of the supply shed.

- **For automotive manufacturers:** Commodity EACs for steel are already at a relatively advanced stage of development, although the quality of certificates is mixed. Our analysis on commodity EACs (NewClimate Institute 2024d) indicates that EACs for steel produced using near-zero emission technologies may be well-suitable to support the sector's pathway in the nascent phase, and could be a reasonable approach for use towards companies' steel procurement targets. However, EACs would need to derive from within companies' supply sheds to contribute to regional challenges and to avoid potential disincentives for direct action; the emergence of technologies is regionally differentiated, gaining moderate market penetration in some regions up to 2030 while remaining nascent in others. The definition of the EAC is also critical, since not all types of EACs contribute the same way to the sector transition. Existing certificates for improved conventional technologies such as ArcelorMittal's XCarb certificates may not be suitable as a 1.5°C-compatible transition hinges on the deployment of near-zero technologies, rather than the adoption of marginal emission reduction measures on conventional basic oxygen furnace (BOF) technologies. Some producers use so-called 'internal carbon banks' to pool emissions reduction projects for conventional BOF technologies, enabling them to artificially claim some of their products as zero-emissions steel (RMI 2024). Commodity EACs could have similar relevance for automakers' transition-specific alignment targets for aluminium and low carbon batteries.

- **For tech and fashion:** Energy-related EACs will be necessary to demonstrate progress towards renewable energy targets since electricity is mostly procured from a pool (a grid) rather than with direct physical traceability. However, the integrity of energy-related EACs is highly dependent on improvements to renewable energy accounting frameworks to recognise only local and hourly matching, and EACs will need to carry these location and time attributes to be used in this accounting system.
- **For agriculture and food producers:** We note that there is a lot of interest and activity in the development of EACs for specific agricultural commodities, indicating zero deforestation and low emission practices, although such EACs do not yet exist, and the risks associated with them are unclear.

**The approach to use commodity EACs toward transition-specific alignment targets would introduce risks that must be carefully considered.** The landscape of potential commodity EACs is complex and fragmented. We observe broad differences in the multiple types and definitions of certificates under development for commodity EACs. These range from those representing a transition to near-zero emission technologies to those that represent only marginal emission reductions on conventional technologies. The case-specific development of high integrity crediting mechanisms for each individual commodity will be highly challenging and susceptible to influence from actors with significant interests. The use of commodity EACs requires the development of a sound and reliable infrastructure and governance system, including a certification standard, a certification procedure, a claim standard, a registry and an accounting and reporting standard. A failure at any one of the steps risks undermining the entire system's integrity. Decades of experience with Renewable Energy Certificates has also shown that these challenges are not trivial, and that procurement of EACs *alone* without consideration of the specific procurement constructs may be unlikely to have a significant emission reduction impact (NewClimate Institute 2024c).

**EACs from *beyond the supply shed* or with *lower value chain traceability* may be best suited for standalone targets and claims related to *contributions* to sector transformation. Such targets and claims should be distinct from companies' own transition-specific alignment targets or GHG emission reduction targets.**

We question whether it is realistic for commodity EACs without traceability and close association to be effective and robust enough to be used as market-based accounting instruments. We recognise that flawed accounting systems can facilitate exaggerated claims and delay or distract from necessary transitions.

The SBTi's Scope 3 Discussion Paper (SBTi 2024a) suggests a more nuanced framework for scope 3 target setting. In this context, it may in some circumstances be reasonable to recognise *contribution*-framed interventions through the procurement of EACs, as a means of supporting 1.5°C aligned transitions. Such *contributions* must be clearly framed in those terms. Given the high degree of uncertainty and improbability that the purchase of commodity EACs can really be equivalent to direct action within the value chain, it would be inaccurate and counterproductive for *contribution*-framed commitments to be conflated with targets for emission reductions or other specific transitions within the value chain.

Commitments to contributions should only be considered a temporary option for supporting transitions where new technologies are geographically limited and require significant financial support to commercialise and scale. A clear distinction of such commitments should provide an incentive for companies to set targets for outcomes within the value chain as soon as they have the means to do so.

# 4 Recommendations for corporate climate standards

## Recommendations for corporate climate standard setters, including regulators, ISO and the SBTi

**We consider that transition-specific alignment targets should be a key element of target-setting frameworks for corporate climate standards, as a complement to GHG emission reduction targets.** This includes national regulations for corporate climate responsibility, ISO standards and voluntary standards such as the SBTi's Corporate Net Zero Standard. While challenges remain to define and implement a target setting framework for alignment targets, these targets show significant promise for applicability across several major sectors. Such targets provide a nuanced approach to addressing emissions by focusing on critical transitions and enabling alignment and accountability against sector-specific benchmarks.

**The development and standardisation of precise definitions for key terms** — such as "renewable energy," "zero-emission vehicles," "zero-emission steel," and "plant-based products" — is critical to ensure consistency and clarity in transition-specific alignment targets.

**A scientific initiative with broad representation may also be needed to engage in comprehensive stakeholder processes to define transition pathways and indicators for different sectors.** Such a process could build upon the indicative frameworks demonstrated in this report. In particular, a coordinated effort to advance research and build consensus on complex issues like recycling, circularity, and fast-output business models is necessary to define the right transition-specific alignment targets in some sectors, especially in sectors that rely heavily on rapid product turnover.

**A coordinated effort to advance research and build consensus on complex issues like recycling, circularity, and fast-output business models is necessary** to define the right transition-specific alignment targets in some sectors, especially in sectors that rely heavily on rapid product turnover.

**In some cases alignment indicators and targets should span business activities across scope 1, 2, and 3 emissions,** acknowledging that rigid separation of these categories may not accurately reflect the fluidity of emissions sources within some sectors. This means that transition-specific alignment targets should not be considered only as a means of addressing scope 3 emissions (*see, for example, discussion of electric utilities and tech companies in section 2.1*). For example, the SBTi Corporate Net Zero Standard already recommends electric utilities to set targets for the emissions intensity of electricity generation covering both own generation (scope 1) and the retail of electricity generated by other companies (scope 3). Emissions from energy use in data centres could be another example (*see section 6.3*): having two separate targets for own (scope 2) and third-party (scope 3) data centres could lead to misleading trends if companies move their data processing capacities back and forth over time, although the extent of this potential problem is unclear due to the poor transparency of reporting on emissions from third party data centers.

**The transition to 24/7 matching of renewable electricity procurement should be expedited and mainstreamed into all appropriate accounting frameworks, data platforms and target setting standards.** Perhaps a first priority for implementing effective transition-specific alignment targets would be to take the available measures to drastically improve the quality of corporate renewable electricity procurement. Renewable electricity procurement is a cross-cutting topic of key relevance in all sectors and for all actors of the corporate accountability system, including regulators, standard setters and the GHG Protocol. 24/7 matching of renewable electricity would be pivotal for companies in many sectors, making their scope 2 and scope 3 climate strategies more meaningful, and ensuring that corporates play a key role in in creating demand for additional renewable electricity generation on the grids where they use it. But companies may not be able to set or effectively monitor progress against 24/7 renewable electricity until such accounting frameworks and infrastructure is available.

## Recommendations for the GHG Protocol

**The GHG Protocol should review the categorisation and granularity of scope 3 emission reporting, to support the identification of key emission sources and transitions.** The GHG Protocol is currently under a major revision process, to be completed by late 2026.

- **The GHG Protocol should require greater granularity in the categorisation of emission sources, to identify key emission sources and transitions.** The currently poor granularity of GHG emissions data for procured products and services (Scope 3 Category 1) can make it difficult to identify the key emission hotspots against which targets should be set. Companies' supply chains typically consist of a number of distinct emission sources from the procurement of different commodities or services, each of which could and should be addressed separately from one another. In sectors like automotive manufacturers the procurement of steel, aluminium and batteries can be identified as key distinct emission sources from the supply chain. However, for companies from less homogenic sectors or sectors where supply chain emissions are more distributed across many different services or commodities, this could be a significant challenge. Requirements to compile scope 3 inventories in a more granular fashion – at least for a selection of the largest emission sources – may support companies to better identify the right transitions and indicators for transition-specific alignment targets.
- **The GHG Protocol should develop sector-specific reporting guidelines for certain sectors or business activities to ensure complete and consistent GHG emission inventories.** Incomplete and inconsistent GHG emission reporting remains an issue in some sectors, and means that the ability of target validators or other observers to identify key emission sources and the most relevant transition-specific alignment targets may only be an approximate estimate. In the tech sector for example, we did not identify consistent data on GHG emissions from third-party owned data centres. Most companies do not report on this emission source at all, or report the emission source as zero emissions with market-based accounting alone. Companies may in theory include these emissions in scope 3 categories 1 or 8, or merge it with emissions from own data centres under scope 2. For independent observers it is currently impossible to know the relevance of third-party data centres and associated emissions in tech companies' GHG inventories. Third-party controlled data centres could be included as a separate GHG accounting category in the updated GHG Protocol guidance, or as a compulsory sub-category of Category 1 for tech companies. Similar issues with major inconsistencies exist for other sectors, such as inconsistent coverage of electric utilities' resale of electricity to sales partners and wholesalers, or inconsistent boundaries of downstream product use phase emissions for steel and machinery manufacturers (NewClimate Institute 2023).

# SECTION B

## Identification of key transitions and indicators

In the following sections, we identify the key transitions and appraise the feasibility of possible target indicators for the scope 3 emissions of major companies from four sectors: automotive, tech, fashion and food and agriculture.

# 5 Automotive manufacturers

## 5.1 Sector transition framework

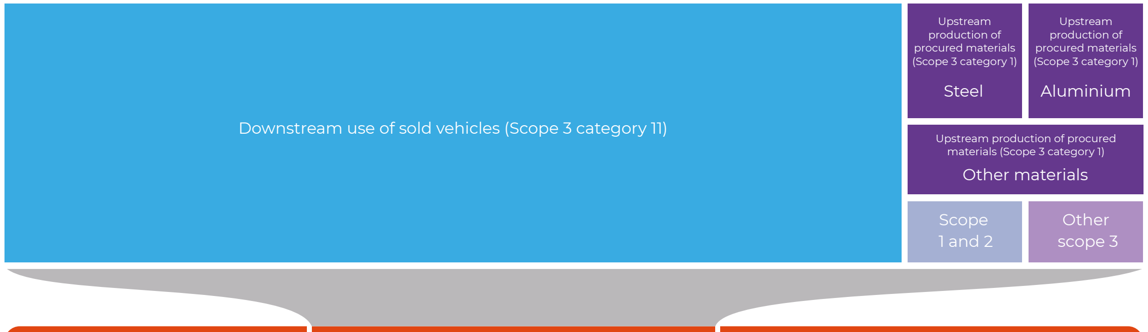
**The use of sold vehicles is the main source of emissions for conventional vehicle manufacturers. Procurement of steel, aluminium and renewable electricity are also key emission sources.** Figure 1 shows that the use of sold vehicles (downstream scope 3 category 11 emissions) usually accounts for around 80–90% of the emission footprint of a conventional vehicle manufacturer. Most of the remaining emission footprint comes from the upstream production of materials for manufacturing vehicles, in particular steel and aluminium.

**The emissions associated with the production of batteries will become a far larger emission source for the sector in the coming years.** Battery production today accounts for 40–60% of upstream emissions for electric vehicles (McKinsey 2023). It may become the main emission source for vehicle manufacturing companies as they phase out internal combustion (ICE) vehicles.

### Figure 1: Overview of key emission sources and key transitions for vehicle manufacturers

**GHG EMISSION FOOTPRINT**

Indicative distribution of emission sources for average ICE vehicle manufacturer




**KEY TRANSITIONS**

Most relevant transitions to address major emission sources

| TRANSITION | RELEVANCE FOR CURRENT EMISSIONS | RELEVANCE FOR FUTURE EMISSIONS |
| --- | --- | --- |
| A Phase in of zero-emission vehicles | ~80-90% of total emissions footprint from average ICE manufacturing company. | |
| B Efficiency of electric vehicles | | Downstream electricity consumption will become a major emission sources as electric vehicles are phased in. Efficiency targets can influence the size and types of electric vehicles being produced. |
| C Procurement of near-zero emission steel | ~25-35% of upstream emissions for ICE vehicles. ~5% of total emission footprint | |
| D Procurement of near-zero emission aluminium | ~20-30% of upstream emissions for ICE vehicles. ~4% of total emission footprint. | |
| E Procurement of low-carbon batteries | Limited relevance today, as EVs make up a small share of traditional automotive manufacturers' sales share. | Battery production accounts for 40-60% of upstream emissions sources for electric vehicles. It will become a major emission as ICE vehicles are phased out. |
| F Procurement of renewable electricity (scope 2) | Procurement of renewable electricity should be a priority transition for any company due to the major climate relevance, urgency and accessibility of the energy transition. This transition is related to scope 2 emissions and is not covered in this paper which focuses on target setting frameworks for scope 3. | |
| Reduction of other scope 3 emission sources | Other scope 3 emissions are of limited relevance to the overall footprint and key business activities | |
| Contribution to the mobility transition | The mobility transition – i.e. a shift from the model or personal vehicle ownership to public transportation and shared services – is highly relevant for reducing emissions in this sector, but there is no clear consensus on the role of individual companies to support the mobility transition. | |

## Key transitions for automotive manufacturers

A comprehensive and specific target setting framework would include indicators and targets for each of these key transitions. In sections 5.2-5.4, we assess the feasibility of setting targets with indicators that are specific to each of these transitions.

### A Phase-in of zero emission vehicles

*(Addressing emissions from downstream use of sold vehicles – scope 3 category 11)*

Electric vehicles powered by decarbonised electricity have a large potential to reduce land-based transport greenhouse gas emissions on a life cycle basis (IPCC 2022). 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 (UNFCCC 2021a, 10–11; Boehm *et al.* 2023, 77–78; Teske *et al.* 2022, 4; WBA 2022; CAT 2020, 27; IEA 2023a, 88,93).

#### Global

- The global sales share for zero emission vehicles must reach **67–95% by 2030** and **100% between 2035–2040** (Boehm *et al.* 2023, 77–78; CAT 2020, 27; IEA 2023a, 88,93).
- These decarbonisation milestones lead to a **complete phase-out of ICE sales by 2035–2040**. This is in line with the COP26 declaration on zero emission cars mandating **100% of total sales of passenger vehicles and vans by 2040 globally** (COP26 Presidency 2021; SBTi 2024b).

#### Advanced economies

- Advanced economies such as China, US, the EU27 and Japan must already reach a **95–100% sales share of zero emission vehicles by 2030** and **100% at the latest by 2035** (UNFCCC 2021a, 10–11; Teske *et al.* 2022, 4; CAT 2020, 27).
- These decarbonisation milestones are fully in line with the COP26 declaration on zero emission cars mandating **100% of total sales of passenger vehicles and vans in leading markets by 2035** (COP26 Presidency 2021; SBTi 2024b).

### B Efficiency of electric vehicles

*(Addressing emissions from downstream use of sold vehicles – scope 3 category 11)*

Downstream electricity consumption will become a major emissions source as electric vehicles are phased in. Improving the energy efficiency of electric vehicles is a measure over which automative manufacturing companies have direct control, since it depends largely on a business decision regarding the type and size of vehicles that the company produces . Efficiency targets can influence the size and types of electric vehicles being produced (Agora Verkehrswende 2019).

### C&D Sourcing near-zero emission steel

*(Addressing emissions from procured products and services – scope 3 category 1)*

The sourcing of low-carbon steel, aluminium and other upstream materials is highly relevant for the decarbonisation of an automotive manufacturer's value chain as the production of these materials is currently an emissions-intensive process (W. Liu, Hao, and Kong 2023; WEF 2020, 15).

To support the procurement of zero-carbon upstream materials, automotive manufacturers can, among other solutions, partner with suppliers committed to producing zero-emission upstream materials, invest in research and development of innovative production methods, or adopt responsible sourcing practices. Additionally, they can engage in circular economy practices, such as recycling and reusing components, to further minimise environmental impact and promote a more sustainable and decarbonised automotive industry.

| E | **Sourcing and/or production of low carbon batteries**<br>*(Addressing emissions from procured products and services – scope 3 category 1)* |
|---|---|
| | The manufacture of electric-vehicle batteries can account for up to 60% of the embedded greenhouse-gas emissions in electric vehicle production (Linder *et al.* 2023, 2). For this reason, reducing emissions during the battery manufacturing stage is indispensable to fully harness the emissions mitigation capabilities of electric vehicles (Shukla *et al.* 2022, 98). To support the external procurement or in-house production of zero-carbon batteries, automotive manufacturers can support the switch to renewable energy at every step throughout the battery value chain, invest in research and development of innovative production methods, and enter into strategic collaboration with suppliers of zero-carbon batteries. |
| F | **Procurement of renewable electricity**<br>*(Addressing emissions from use of electricity – scope 2)* |
| | Procurement of renewable electricity should be a priority transition for any company due to the major climate relevance and urgency of the energy transition, and the maturity and accessibility of renewable energy technologies.<br><br>This transition is related to scope 2 emissions and is not covered in this paper which focuses on target setting frameworks for scope 3. |

## 5.2 Transition A: Phase-in of zero-emission vehicle technology

### Potential influence and actions at the company level

Phasing in zero-emission vehicle technologies is a measure under direct company control, as it involves business decisions about the types of products the company manufactures. Zero-emission vehicles are technically mature and accounted for 13% of new passenger vehicle sales globally in 2022 (IEA 2023b).

Despite a general surge of electric vehicle sales in many regions, some of the major incumbent vehicle manufacturers still face considerable barriers, for example with regards to consumer preference to electric vehicle purchases or the need to overhaul established supply chains.

Companies have several levers available to support the transition:

- **Business decision to phase out ICE vehicles:** Stellantis announced plans to sell 100% battery electric vehicles (BEVs) by 2030 (Stellantis 2024). Volvo Cars plans to become a fully electric car company and to reach at least 90% BEVs and plug in hybrids by 2030 (Volvo Cars 2024).
- **Investments in enabling measures:** Volkswagen announced plans in 2023 to invest USD 131 billion in technology development for electric vehicles over a five-year period (Forbes 2023). Tesla and Hyundai are among the world's top-10 companies for investments in charging infrastructure (Emergen Research 2024).
- **Advocating for conducive policy:** Tesla and Ford Motors have been supportive of policy development in some regions between 2022 and 2024, according to a global analysis of automakers' climate policy advocacy (InfluenceMap 2024). Most automakers assessed by InfluenceMap have opposed climate policy development in key markets during this period.
- **Coalitions for collective commitments:** Fourteen vehicle manufacturing companies – including Ford, General Motors and Mercedes Benz – have signed the Zero Emission Vehicle Declaration launched at COP26 in 2021, pledging 100% zero-emission vehicle sales by 2040 and by 2035 in leading markets (COP26 Presidency 2021).

### Potential indicators for transition targets

The availability of 1.5°C-aligned benchmarks for the transition of road vehicle transportation is relatively good, and the indicators used for these benchmarks are broadly consistent (NewClimate Institute 2024a).

The vast majority of benchmarks that we identified are based on two indicators: carbon intensity per vehicle-kilometre (Teske 2022, 333; SBTi 2024b, 16–17; CAT 2020; IEA 2023b, 93, 196) and zero-emission vehicle shares in sales (Teske 2022, 333; SBTi 2024b, 16–17; CAT 2020; IEA 2023b, 93, 196; Boehm *et al.* 2023, 77–78; ACT 2020; WBA 2022).

Considering the potential influence and actions at the company level, and the availability of indicators from the literature of benchmarks, *Table 3* provides an overview of potential indicators or other target setting approaches for the phase-in of zero emission vehicles.

Based on the scan of six potential indicators in *Table 3*, we consider that the following indicators are promising options for targets to phase in zero-emission vehicle technologies:

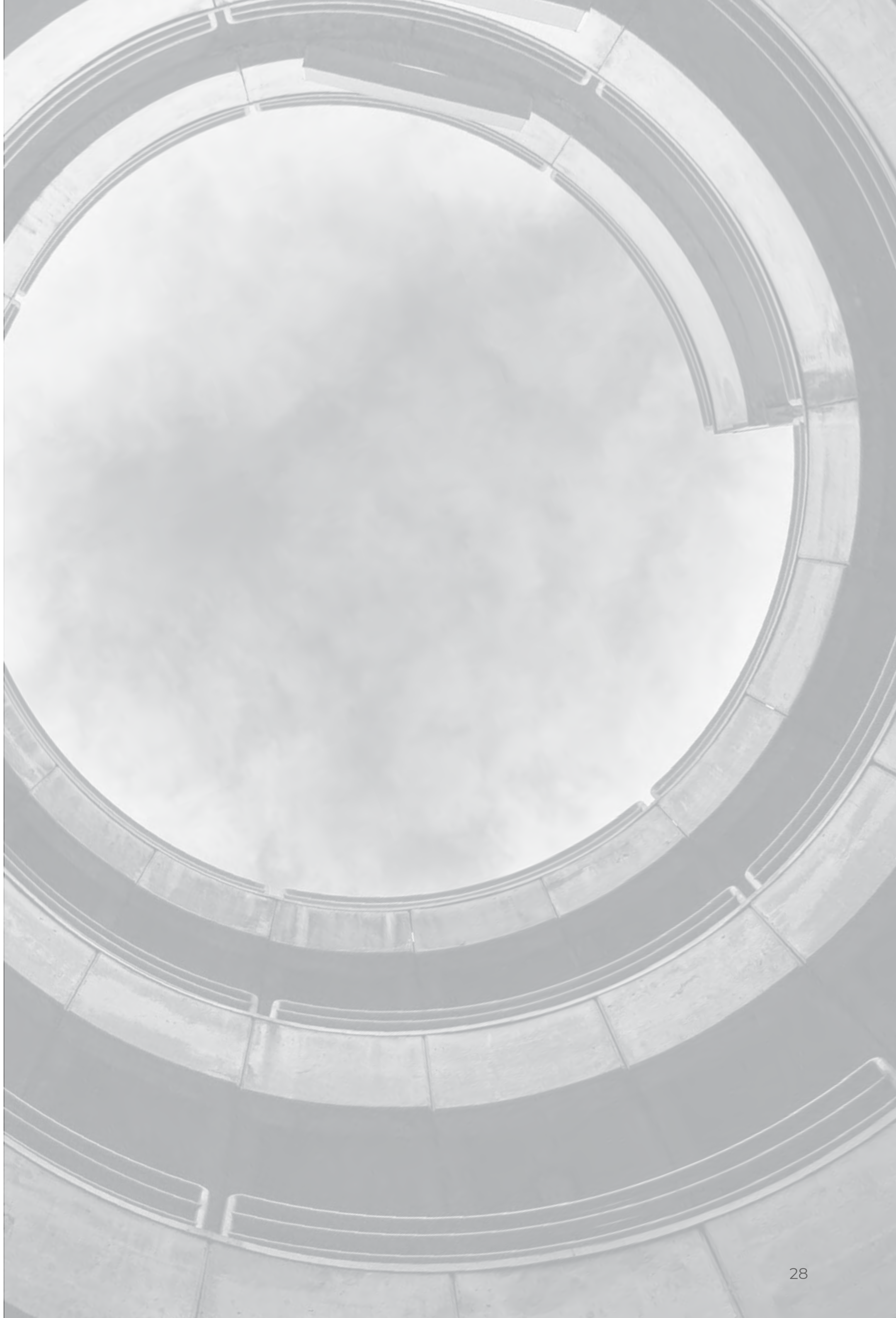
**2. GHG emission intensity of vehicle-kilometres for vehicles sold.**

**3. Share of zero-emission vehicles or electric vehicles in sales.**

These indicators are widely used by many major companies for reporting and setting targets. They are also incorporated into existing regulations in several key jurisdictions. Additionally, global and regional benchmarks for these indicators are relatively well-documented in scientific literature.

We consider indicator 3 to be slightly more promising than indicator 2 for targeting the transition, due to the susceptibility and specificity of the indicators:

- Real outcome indicators (indicator 3) are less vulnerable to uncertainties and creative accounting compared to GHG-based indicators (1 and 2). These can be influenced by methodological inconsistencies and the use of tools like carbon credits or other certificates.
- Indicator 2 lacks direct focus on the critical transition away from ICEs, despite strong scientific consensus supporting this shift. For indicator 3 the specification of “electric vehicles” may overlook the potential role of other zero-emission vehicle technologies. Conversely, “zero-emission vehicles” depends on a clear definition for this term. If this definition is politicised to include ICE technologies which is not in line with scientific evidence, it could be compromised.



## Table 3: Potential target indicators for phase out of ICEs

| | INDICATOR / COMMITMENT | STATUS | REGULATORY ALIGNMENT | SUSCEPTIBILITY | SPECIFICITY | FAIRNESS | PRACTICALITY |
|---|---|---|---|---|---|---|---|
| | | Are companies already reporting or setting targets on the indicator? | Does the indicator already feature in regulations? | What is the vulnerability of the metric to accounting loopholes? | Is the indicator too prescriptive, or not enough, for 1.5°C aligned pathways? | Could the indicator favour dominant or incumbent companies? | How realistic is it to develop 1.5°C compatible benchmarks for the indicator? |
| **Absolute GHG emission targets** | **1** [Moderate] **% reduction in GHG emissions from downstream use of LDVs sold.** | [Very good] Indicator regularly used for targets | [Poor] No identified examples. | [Moderate] GHG metric vulnerable to balance sheet netting instruments. | [Moderate] Not specific to the necessary shift from ICEs. | [Poor] Bias in favour of incumbent companies. | [Moderate] Benchmarks don't consider companies' different starting points. |
| **GHG emission intensity targets** | **2** [Reasonable] **GHG intensity of vehicle-km (fleet average)** | [Very good] Indicator regularly used for targets | [Very good] Commonly featured in regulations. | [Moderate] GHG metric vulnerable to balance sheet netting instruments. | [Moderate] Not specific to the necessary shift from ICEs. | [Very good] No bias for incumbent companies. | [Very good] Good availability of regional-specific benchmarks. |
| **Technology share targets** | **3** [Very good] **% share of zero emission vehicles / electric vehicles sold** | [Very good] Indicator regularly used for targets | [Very good] Sometimes featured in regulations, but rarely prescriptive to EVs. | [Very good] Real outcome metrics are less susceptible to creative accounting. | [Reasonable] "ZEVs" could be too ambiguously defined. EVs may be too technology specific. | [Very good] No bias for incumbent companies. Advantage for new disrupters focused on ZEVs. | [Very good] Good availability of regional-specific benchmarks. |
| **Commitment to specific actions** | **4** [Poor] **Investments in R&D for enabling technologies as % of revenue, or as of total R&D investments.** | [Moderate] Reporting on R&D to CDP entails inconsistent definitions. | [Poor] Regulatory requirements not common or practical. | [Poor] Data reported is not necessarily verifiable or comparable. | [Poor] Enabling measure that does not guarantee the transition. | [Poor] Larger companies may be better placed to protect their investments in R&D and generate profit from charging station infrastructure. | [Poor] Impractical to define objectively comparable benchmarks. |
| | **5** [Moderate] **Installation of charging stations** | [Moderate] Indicator sometimes used for targets. | [Moderate] Several jurisdictions set targets, but not at company level. | [Very good] Real outcome metrics are less susceptible to creative accounting. | [Moderate] Indirectly enables the specific transition. | | [Moderate] Sector benchmarks don't consider companies' different roles. |
| **Commitment to coalitions / buyer clubs** | **6** ? **Joining a coalition for a 1.5 °C-aligned transition.** | N/A | N/A | ? Dependent on integrity of coalition criteria. | ? Dependent on integrity of coalition criteria. | [Poor] Major companies have larger influence. | N/A |

**Source: Authors' estimate.**

**Key:** Prospects for identifying standardised transition-specific alignment targets at the sector level — Very good; Reasonable; Moderate; Poor

# 5.3 Transition B: Energy efficiency of electric vehicles

## Potential influence and actions at the company level

Improving the energy efficiency of electric vehicles is a measure over which automative manufacturing companies have direct control, since it depends largely on a business decision regarding the type and size of vehicles that the business produces.

While consumer preference plays a significant role in driving demand for larger vehicles, automotive companies also play an active part in shaping and amplifying these preferences. Through targeted marketing, product design, and brand positioning, companies often promote larger models, such as SUVs and trucks, as desirable options due to their perceived safety, status, and versatility. These efforts can reinforce consumer demand for larger, heavier vehicles that typically consume more energy. By strategically promoting these vehicle types, manufacturers contribute to a cycle where demand for less efficient models remains strong, even as the industry as a whole strives toward lower emissions and increased efficiency. Recognising their influential role, automotive companies have the opportunity to shift marketing and production priorities toward smaller, more energy-efficient vehicles, which could help align consumer behaviour with sustainability goals.

Companies have several levers available to improve the energy efficiency of electrical vehicles:

- **Influence consumer preference through marketing strategies and incentives:** Companies can emphasise the benefits of smaller, efficient vehicles to consumers, highlighting their environmental advantages, lower operational costs, and ease of use in urban areas. Companies can also increase the appeal of smaller and more efficient vehicles through customisable options, making those vehicles feel like premium tailored products rather than basic options. Financial incentives can also make smaller models more attractive to consumers.
- **Develop crossover models:** To meet consumer preference for more spacious vehicles in a more sustainable way, many companies have invested in the design and development of compact SUVs and crossovers that provide some of the desired features of larger vehicles while being lighter and more energy efficient.
- **Innovation to optimise technical efficiency:** Improving vehicle aerodynamics can reduce drag and enhance efficiency. Companies can adopt lightweight materials like aluminium, carbon fibre, and advanced composites for body panels, chassis, and other structural components. Optimising the powertrain—such as the electric motor, transmission, and inverter—can increase overall EV efficiency.

## Potential indicators for transition targets

*Table 4* sets out some potential indicators for the efficiency of electric vehicles. Some regulations already require the disclosure of power consumption indicators (e.g. kWh per vehicle-km in the European Union) or fuel economy equivalent indicators (e.g. Miles per gallon equivalent in the United States) and some groups call for standards to be set on these indicators (ACEEE 2023; Agora Verkehrswende 2019).

Regulations also require the disclosure of vehicle weight indicators, which is a key determinant of the efficiency of electric vehicles.

Based on the scan of four potential indicators in *Table 4*, we consider that the following indicators are promising options for the definition of efficiency targets for electric vehicles.

**2. kWh per vehicle-km (fleet average)**

**3. Miles per gallon equivalent (MPGe) (fleet average)**

These indicators are already regularly reported by EV manufacturers and disclosure is required in some jurisdictions. The indicators are specific to the transition to improve energy efficiency and encompass all potential measures to achieve that transition.

kWh per vehicle-km is an informative indicator that is less susceptible to accounting inconsistencies or uncertainties than GHG emission metrics. By comparison, there are significant assumptions in methodologies for calculating MPGe which are not necessarily accurate and do not necessarily give users a clear indication of the electricity consumption required, although this metric may be favourable for comparing the efficiency of electric and non-electric vehicles.

We did not identify readily available benchmarks for 1.5 °C compatibility but we consider that it would be feasible to construct benchmarks from available scenarios and pathways for passenger transport energy.

## Table 4: Potential target indicators for efficiency of electric vehicles

| | INDICATOR / COMMITMENT | STATUS | REGULATORY ALIGNMENT | SUSCEPTIBILITY | SPECIFICITY | FAIRNESS | PRACTICALITY |
|---|---|---|---|---|---|---|---|
| | | Are companies already reporting or setting targets on the indicator? | Does the indicator already feature in regulations? | What is the vulnerability of the metric to accounting loopholes? | Is the indicator too prescriptive, or not enough, for 1.5°C aligned pathways? | Could the indicator favour dominant or incumbent companies? | How realistic is it to develop 1.5°C compatible benchmarks for the indicator? |
| Absolute GHG emission targets | ***Not applicable; new or expanding technology and emission source*** | | | | | | |
| GHG emission intensity targets | 1 [Moderate] **GHG emissions from electricity used for drive train per vehicle-km (fleet average)** | [Moderate] Sometimes used by vehicle manufacturers. | [Moderate] Under consideration in the EU. | [Poor] Potentially inconsistent methods for accounting downstream electricity-related emissions; GHG metric vulnerable to balance sheet netting instruments. | [Poor] Indicator may reflect decarbonisation of the electricity grid and RE procurement more than vehicle efficiency. | [Very good] No bias for incumbent companies. | [Moderate] Could be constructed from benchmarks for passenger transport emissions. |
| Quantitative non-GHG targets | 2 [Very good] **kWh (or other energy metric) per vehicle-km (fleet average)** | [Very good] Manufacturers disclose this information for vehicles routinely. | [Very good] Obligatory disclosure in some regions. | [Very good] Accurate and informative metric; less susceptible to obfuscation. | [Very good] Specific to the transition. | [Very good] No bias for incumbent companies. | [Moderate] Could be constructed from benchmarks for passenger transport emissions. |
| | 3 [Reasonable] **Mile per gallon equivalent (MPGe) (fleet average)** | [Very good] Manufacturers disclose this information for vehicles routinely. | [Very good] Obligatory disclosure in some regions. | [Moderate] Data reported is not necessarily verifiable or comparable. | [Very good] Specific to the transition. | [Very good] No bias for incumbent companies. | [Moderate] Could be constructed from benchmarks for passenger transport emissions. |
| | 4 [Reasonable] **Vehicle weight targets (fleet average)** | [Very good] Manufacturers disclose this information for vehicles routinely | [Very good] Obligatory disclosure in many regions. | [Very good] Metric is less susceptible to creative accounting. | [Moderate] Only addresses one aspect of vehicle efficiency. | [Very good] No bias for incumbent companies. | [Poor] No benchmarks identified. |
| Commitment to coalitions / buyer clubs | 5 ? **Joining a coalition for a 1.5 °C-aligned transition.** | N/A | N/A | ? Dependent on integrity of coalition criteria. | ? Dependent on integrity of coalition criteria. | [Poor] Major incumbent companies more likely to influence coalition criteria. | N/A |

**Source:** Authors' estimate.

**Key:** Prospects for identifying standardised transition-specific alignment targets at the sector level: Very good; Reasonable; Moderate; Poor

## 5.4 Transitions C and D: Sourcing near-zero emission steel and aluminium

The production and decarbonisation pathways of steel and aluminium are separate processes, and these materials serve different purposes in vehicle manufacturing. As such, we consider that **the procurement of near-zero emission steel and aluminium should be treated as two separate transitions** with their own specific commitments and indicators. We consider both of these transitions together in this section due to similarities in the types of indicators possible and the advantages and disadvantages of each of them.

### Potential influence and actions at the company level

Until recent years, vehicle manufacturing companies may have had very limited direct influence on decarbonising the production of the steel and aluminium that they procure, due to the immaturity of technologies for low carbon steel and aluminium production and the scarcity of steel and aluminium produced with those technologies.

- **Steel:** According to the IEA, less than 1% of steel produced in 2022 came from near-zero emission production techniques (IEA 2023b). However, technologies for near-zero emission production have significantly matured in recent years. The IEA estimates that globally announced projects as of 2023 will meet 12% of the global 2030 near zero emission iron production needs (IEA 2023b). Most of these projects are located in Europe. While this leaves a major gap in installed zero-steel production capacity needed for a successful transition by 2030 and beyond, some jurisdictions like the European Union might already reach a significant market penetration with their target to produce 30% of the EU's primary steel using renewables-based hydrogen by 2030 (European Commission 2022).
- **Aluminium:** The emissions intensity of aluminium production has been declining only at a very limited rate while near zero emission technologies still need to be developed and deployed (IEA 2023c). The European Aluminium Association believes that emissions from the sector can be reduced by up to 95% by implementing breakthrough technologies like inert anode electrolysis and increasing recycling rates (European Aluminium Association 2023).

Some vehicle manufacturing companies are already entering into agreements with steel suppliers to procure this steel and aluminium, either directly or through chain of custody certification schemes.

Companies have several levers available to support the transition to near-zero emission steel:

- **Direct partnerships with steelmakers:** Companies could directly procure steel and aluminium from new production facilities operating near-zero emission technologies, although direct procurement may not be possible for many companies. Several major automakers including Ford, General Motors, Volkswagen, Mercedez Benz and BMW have established partnership plans with specific steelmakers such as H2 Green Steel, SSAB, and Salzgitter, but the specific details of those partnerships are sometimes ambiguous (W. Liu, Hao, and Kong 2023).
- **Buying clubs:** Companies could commit to "buying clubs", pooling their procurement of near-zero emission steel and aluminium with other companies. The Sustainable Steel Buyers Platform (SSBP) aims to facilitate the set-up of a first near-zero steel production facility in North America for generation of commodity EACs (*see below*).
- **Procurement of EACs:** The procurement of commodity-specific environmental attribute certificates for near-zero emission steel could send a demand signal for the emergence of nascent technologies, but entail several risks for undermining the integrity of accounting (*see section 3*). ArcelorMittal Europe is already marketing XCarb Green Steel certificates although these represent only a marginal emission reduction on conventional basic oxygen furnace technologies. The Sustainable Steel Buyers Platform has plans to develop an EAC system from near-emission compatible production technologies (NewClimate Institute 2024d).
- **Advocacy:** Companies could advocate for policy changes that may incentivise steel and aluminium producers to accelerate the shift to near-zero emission steel and aluminium.

## Potential indicators for transition targets

The current availability of 1.5°C-aligned benchmarks for the procurement of near-zero emission steel and aluminium is relatively good, but there is quite a variety of different indicators used for these benchmarks (NewClimate Institute 2024a). The broad range of indicators is indicative of the complexity of the technology pathways for near-zero carbon steel and aluminium, and the fact that the indicators appropriate to measure progress at the sector level may not always be relevant at the level of individual companies.

- The Science Based Targets initiative (SBTi 2023b, 67), Climate Action Tracker (CAT 2020), the State of Climate Action report (Boehm *et al.* 2023) and the Transition Pathways Initiative (Dietz, Amin, and Scheer 2023, 22) specify benchmarks based on *emissions intensity of production per tonne of output*.
- The Climate Action Tracker (CAT 2020), the State of Climate Action report (Boehm *et al.* 2023) also specify benchmarks in terms of the *share of electricity in primary energy demand for the steel production process.*
- The UNFCCC (2021b, 15), the State of Climate Action report (Boehm et al. 2023), the Mission Possible Partnership (Delasalle *et al.* 2022, 69) and IEA (2023b, 95,198) publish benchmarks expressed in terms of the *number or share of low carbon steel production facilities*.
- IEA (2023b, 95,198) also specify benchmarks for the *share of low carbon steel and aluminium*, the *share of scrap materials as input into the steel and aluminium production processes*.

Not all emission reduction measures contribute the same way to the sector transition; a clear definition of low-carbon or zero-emission technologies is necessary for effective alignment targets based on technology shares. A 1.5°C-compatible transition hinges on the deployment of near-zero technologies, rather than the adoption of marginal emission reduction measures on conventional basic oxygen furnace (BOF) technologies. Some producers use so-called 'internal carbon banks' to pool marginal emissions reduction projects for conventional BOF technologies, enabling them to artificially claim some of their products as zero-emissions steel (RMI 2024).

Considering the potential influence and actions at the company level, and the availability of indicators from the literature of benchmarks, *Table 5* provides an overview of potential indicators or other target setting approaches for the procurement of near-zero emission steel and aluminium.

Based on the scan of seven potential indicators in *Table 5*, we consider that the following indicators are promising options for the definition of targets for the transition to near-zero emission steel and aluminium procurement.

**2. GHG emission intensity (GHG emissions per tonne) of steel/aluminium procured**

**3. Share of near-zero emission steel/aluminium in procured steel/aluminium**

Although these indicators are not commonly reported by procuring companies, they are often discussed at the national and sector-level, and it may be feasible to obtain this type of data from suppliers. The availability of global and regional benchmarks for these indicators in the scientific literature is relatively good, compared to other potential benchmarks.

We consider indicator 3 – as a real outcome indicator – to be less susceptible to uncertainty and creative accounting, compared to indicator 2 which is based on GHG metrics and could be clouded by methodological uncertainties and balance-netting instruments such as carbon credits and other certificates. However, **indicator 3 is dependent on a strong definition for *near-zero emission steel* and *near-zero emission aluminium*** that only includes 1.5°C-compatible technologies.

## Table 5: Potential target indicators for procurement of near-zero emission steel and aluminium

| | INDICATOR / COMMITMENT | STATUS | REGULATORY ALIGNMENT | SUSCEPTIBILITY | SPECIFICITY | FAIRNESS | PRACTICALITY |
|---|---|---|---|---|---|---|---|
| | | Are companies already reporting or setting targets on the indicator? | Does the indicator already feature in regulations? | What is the vulnerability of the metric to accounting loopholes? | Is the indicator too prescriptive, or not enough, for 1.5°C aligned pathways? | Could the indicator favour dominant or incumbent companies? | How realistic is it to develop 1.5°C compatible benchmarks for the indicator? |
| **Absolute GHG emission targets** | 1 **% reduction in GHG emissions from procured steel/aluminium** | Quality of commodity-level data may be limited. | No identified examples. | GHG metric vulnerable to balance sheet netting instruments. | Non-specificity appropriate due to technology options. | Bias in favour of incumbent companies. | Benchmarks don't consider companies' different starting points. |
| **GHG emission intensity targets** | 2 **GHG intensity (emissions per tonne) of steel/aluminium procured** | Quality of commodity-level data may be limited. | No identified examples. | GHG metric vulnerable to balance sheet netting instruments. | Non-specificity appropriate due to technology options. | No bias for incumbent companies. | Good availability of regional-specific benchmarks. |
| **Technology share targets** | 3 **% share of near-zero emission steel/aluminium procured** | Data not commonly reported but may be available from suppliers. | No identified examples. | Real outcome metrics are less susceptible to creative accounting. | "Near-zero emission steel/aluminium" could be ambiguously defined. | No bias for incumbent companies. | Good availability of regional-specific benchmarks. |
| | 4 **% share of scrap-derived steel/aluminium procured** | | | | Too specific to recycling; Not covering production. | | Some availability of benchmarks. |
| | 5 **% share of electricity in primary energy demand of procured steel/aluminium** | Data unlikely to be easily available for procuring companies. | | | Specific to production. Not covering recycling | | |
| **Commitment to specific actions** | 6 **Signing MoUs with (green) steel/aluminium producers.** | Information easy to report but not conducive to target setting. | No identified examples. | Data reported is not necessarily verifiable or comparable. | Indirectly enables the specific transition. | Major companies better placed to establish MoUs. | Non-specificity is not conducive to benchmarks. |
| **Commitment to coalitions / buyer clubs** | 7 ? **Joining a coalition for a 1.5 °C-aligned transition.** | N/A | N/A | ? Dependent on integrity of coalition criteria. | ? Dependent on integrity of coalition criteria. | Major incumbent companies more likely to influence coalition criteria. | N/A |

**Source: Authors' estimate.**

**Key:** Prospects for identifying standardised transition-specific alignment targets at the sector level — Very good, Reasonable, Moderate, Poor

# 5.5 Transition E: Sourcing or production of low carbon batteries

## Potential influence and actions at the company level

Battery production is responsible for up to 40-60% of the total carbon emissions associated with manufacturing EVs (McKinsey 2023). Despite the increased focus on EVs as a solution to reduce tailpipe emissions, the production of batteries still presents a significant challenge in the overall decarbonisation of the automotive sector.

Companies are increasingly looking toward low-carbon battery production as a critical lever for achieving their climate goals. Breakthroughs in battery chemistry, such as solid-state batteries and advancements in materials recycling, combined with the shift to renewable energy in manufacturing, offer promising pathways to reduce battery-related emissions.

Vehicle manufacturers can influence the shift to low-carbon batteries through several strategies:

- **Direct procurement or partnerships with battery producers:** Companies can source batteries from suppliers that utilise renewable energy in their production processes. Collaborating with battery manufacturers to develop new technologies, such as solid-state batteries or more efficient lithium-ion batteries, can accelerate the shift to low-carbon batteries, and allows automakers to align the supply of low-carbon batteries with their production timelines. In 2022, Ford announced a partnership with Rio Tinto to procure batteries and low carbon materials (Rio Tinto 2022).
- **Supply chain collaboration:** By working closely with raw material suppliers, companies can influence upstream processes, ensuring that materials like lithium, nickel, and cobalt are extracted and processed using lower-carbon methods. This can include shifting to less energy-intensive mining techniques or sourcing from regions that use renewable energy.
- **Commitment to recycling:** Companies can support the development of closed-loop battery recycling systems, which significantly reduce the need for raw material extraction and lower the overall carbon footprint of battery production. Advanced recycling technologies can recover up to 95% of valuable metals (Tankou, Bieker, and Hall 2023).
- **Advocacy for green policies:** Vehicle manufacturers can also advocate for stricter environmental standards and incentives that encourage the production of low-carbon batteries. This could include pushing for higher carbon taxes or supporting initiatives that promote the use of clean energy in battery manufacturing.

## Potential indicators for transition targets

As with other sectors, there are a variety of benchmarks for measuring progress in the procurement and production of low-carbon batteries. These benchmarks help companies set clear transition targets and track their alignment with 1.5°C-compatible pathways:

- **Carbon intensity of battery production:** The emissions intensity per kilowatt-hour (kWh) of battery capacity produced is already an indicator in use. Some companies collect this indicator under the Battery Passport initiative of the Global Battery Alliance (Global Battery Alliance 2024).
- **Recycling rates:** Increasing the share of recycled materials in battery production can be a key performance indicator, as it significantly reduces emissions from raw material extraction and processing.
- **Sustainable sourcing of materials:** Companies can track the share of raw materials sourced through certified low-carbon processes, such as those adhering to the Responsible Cobalt Initiative or other similar standards for lithium and nickel sourcing.

Considering the potential influence and actions at the company level, and the availability of indicators from the literature of benchmarks, *Table 6* provides an overview of potential indicators or other target setting approaches for the procurement or production of low carbon batteries.

Based on the scan of six potential indicators in *Table 6*, we consider that the following indicator is the most promising option for the definition of targets for the transition to low carbon battery production or procurement.

**2. GHG intensity (emissions per kWh) of battery capacity**

This indicator is already in use and being collected by some companies under the Battery Passport initiative of the Global Battery Alliance (Global Battery Alliance 2024). Several car manufacturers have already piloted the Battery Passport and collected information on the GHG emissions per kWh of battery capacity. A key issue is related to the calculation methodology, since a large proportion of the embedded emissions derive from electricity, and the means of calculating emission factors and renewable electricity shares could vary significantly across suppliers in different places of the value chain. We recommend that electricity related emissions should be calculated based on 24/7 matching rates for renewable electricity in all parts of the value chain, for consistency.

## Table 6: Potential target indicators for procurement or production of low carbon batteries

| | | INDICATOR / COMMITMENT | STATUS | REGULATORY ALIGNMENT | SUSCEPTIBILITY | SPECIFICITY | FAIRNESS | PRACTICALITY |
|---|---|---|---|---|---|---|---|---|
| | | | Are companies already reporting or setting targets on the indicator? | Does the indicator already feature in regulations? | What is the vulnerability of the metric to accounting loopholes? | Is the indicator too prescriptive, or not enough, for 1.5°C aligned pathways? | Could the indicator favour dominant or incumbent companies? | How realistic is it to develop 1.5°C compatible benchmarks for the indicator? |
| **Absolute GHG emission targets** | 1 | **% reduction in GHG emissions from battery productions** | An absolute reduction target for emissions from battery production and procurement is not relevant since this is a new and expanding emission source for the sector due to the transition from ICE vehicles to EVs. Base year emissions from batteries would be very low for many companies due to their limited production of EVs to date. | | | | | |
| **GHG emission intensity targets** | 2 | **GHG emissions per kWh battery capacity** | Battery passports including this data are piloted by some companies. | No identified examples. | GHG metric vulnerable to balance sheet netting instruments. | Non-specificity is appropriate due to multiple possible technology pathways. | No bias for incumbent companies. | Reasonable availability of global benchmarks. |
| **Technology share targets** | 3 | **% share of renewable electricity in primary energy demand through the supply chain** | Data unlikely to be easily available for procuring companies. | No identified examples. | Means of calculating RE shares and role of EACs could vary across suppliers in the chain. | Too specific to cover non-electricity related emissions | No bias for incumbent companies. | No identified examples for batteries specifically but could be linked to benchmarks for renewable electricity. |
| | 4 | **% share of recycled or repurposed batteries used** | No identified examples. | No identified examples. | Difficult to comparably verify due to complexity of definitions. | Too specific to cover other production related emissions. | No bias for incumbent companies. | Some availability of benchmarks. |
| **Commitment to specific actions** | 5 | **Investments in R&D for enabling technologies as % of revenue** | Reporting on R&D to entails inconsistent definitions. | Regulatory requirements for R&D are not common or practical. | Data reported is not necessarily verifiable or comparable. | R&D is an enabling measure that does not guarantee progress on the transition. | Major companies may be better placed to protect their investments in R&D. | Impractical to objectively define R&D investments in a comparable way. |
| **Commitment to coalitions / buyer clubs** | 6 | ? **Joining a coalition for a 1.5 °C-aligned transition.** | N/A | N/A | ? Dependent on integrity of coalition criteria. | ? Dependent on integrity of coalition criteria. | Major incumbent companies more likely to influence coalition criteria. | N/A |

**Source:** Authors' estimate.

**Key:** Prospects for identifying standardised transition-specific alignment targets at the sector level — Very good, Reasonable, Moderate, Poor

# 6 Tech

## 6.1 Sector transition framework

**Electricity use in data centres is the main source of emissions for many tech companies. Upstream hardware production is also a key emission source.** Figure 2 shows that we estimate electricity use in data centres accounts for around half of the emission footprint of a tech company (scope 2 in the case of own data centres, and scope 3 categories 1 and 8 in the case of third-party owned data centres). None of the big tech companies report on the number and size of data centres they rent, nor on the actual emissions from third-party data centres. Research suggests that half of tech companies' data centre capacity comes through third-party contracts (Synergy Research Group 2023). Most of the remaining emission footprint comes from the upstream production of electronic devices and server hardware, which requires large amount of electricity and other energy carriers (scope 3, categories 1 and 2).

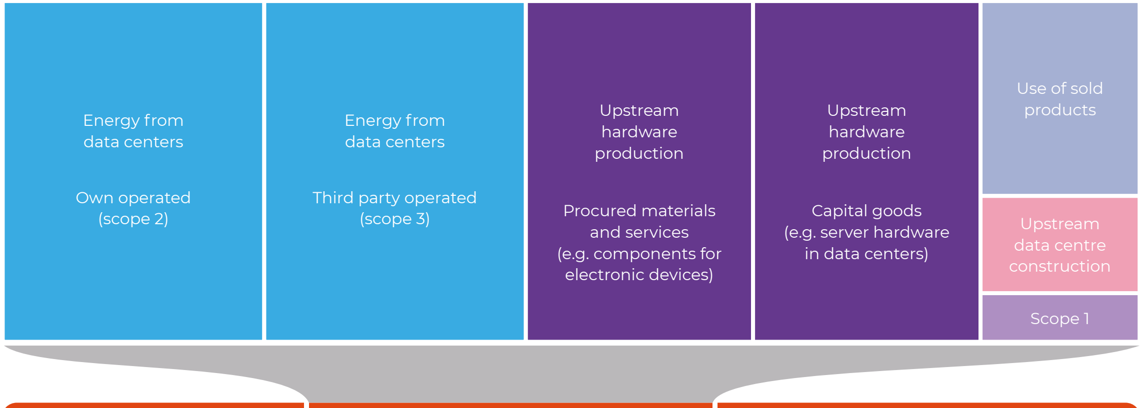
**Artificial intelligence (AI) is driving an increase in energy demand – and GHG emissions – in the tech sector.** Training AI models requires a lot of computing power – and is therefore a relatively emissions-intensive process. The bigger an AI model and the larger the data set that is used to train AI models, the higher the electricity consumption. The IEA expects that electricity demand from data centres will increase rapidly until the end of the decade (IEA 2024). AI and data centres have already increased tech companies' emissions in recent years. For instance, Microsoft and Google reported that their location-based scope 2 emissions, mostly from data centre energy consumption, almost doubled in recent years (Microsoft 2024; Google 2024). However, the exact growth remains highly uncertain, as these use of third-party data centers remains underreported, and as data centre expansion may be slowed by supply chain bottlenecks and electricity grid permitting processes, among others issues (IEA 2024).

In this report, the tech sector covers companies selling electronic devices and/or software and (cloud) services.

**Figure 2: Overview of key emission sources and key transitions for tech companies.**

**GHG EMISSION FOOTPRINT**

Indicative distribution of emission sources for average tech company




**KEY TRANSITIONS**

Most relevant transitions to address major emission sources

| TRANSITION | RELEVANCE FOR CURRENT EMISSIONS | RELEVANCE FOR FUTURE EMISSIONS |
|---|---|---|
| A Switch to 24/7 matching of renewable energy in own and third-party controlled data centres | ✓ Approximately half of the emission footprint in the tech sector. Split between own operated and third-party data centres is changeable. | ↑ Data centre capacities expanding rapidly to accommodate AI applications |
| B Switch to 24/7 matching of renewable energy in the supply chain | ✓ We estimate that at least a third of the emissions footprint from tech sector companies comes from the use of energy in the supply chain to manufacture hardware. | ↑ Data centre capacities expanding rapidly to accommodate AI applications. Server hardware production is increasing simultaneously. |
| C Increase the lifespan of sold (and used) products | ✓ At least a third of tech companies' emissions occur in the upstream hardware production process | |
| D Increase share of recycled materials in electronic devices | ? We are unable to estimate the emissions associated with mining of minerals and other materials used for electronic devices. | ↑ Demand for materials and critical minerals expected to increase. |
| Improved energy efficiency of electronic devices | Unclear if companies need further incentives and pressure to focus on energy efficiency in electronic devices when this is already a key part of the business for improving devices. | |

## Key transitions for tech companies

A comprehensive and specific target setting framework would include indicators and targets for each of these key transitions. In sections 6.2-6.5, we assess the feasibility of setting targets with indicators that are specific to each of these transitions.

### A — Switch to 24/7 matching of renewable electricity in own and third-party controlled data centres

*(Addressing emissions from scope 2 and various scope 3 categories )*

Emissions from data centres are a key emissions source for tech companies. For instance, Microsoft reported that data centres account for 95% of operational emissions in 2022, mostly from purchased electricity (i.e. scope 2) (Microsoft 2023). The magnitude of emissions from *third-party owned data centres* is unclear. Most tech companies do not report on the number and size of data centres they rent, nor on the actual emissions from third-party data centres. Research suggests that half of tech companies' data centre capacity comes through third-party contracts (Synergy Research Group 2023). Electricity demand from data centres is expected to increase rapidly until 2030, although the extent of growth is uncertain (IEA 2024).

Switching to 24/7 matching of renewable electricity can substantially reduce emissions from data centres, controlled by third parties or tech companies themselves. We recommend that companies transparently report on emissions from own data centres (scope 2) and third-party owned data centres (scope 3), and set separate 24/7 targets for both categories.

Whereas matching renewable energy on an hourly basis has potential to drive grid decarbonisation, research has shown that matching renewable electricity on an annual basis has very limited to no effect (Xu *et al.* 2023). Companies who do not source renewable electricity around the clock remain dependent on – often times – carbon-intensive electricity grids. For instance, a data centre operator may sign a contract to procure electricity from a solar park, but data centres consume electricity also at night or on cloudy days. During these times, the data centre relies on the grid for its electricity and most likely consumes fossil-power.

#### Global

- Electricity systems need to reach **zero GHG emissions between 2040 and 2050** (Simon Dietz *et al.* 2024; Climate Action Tracker 2023; Boehm *et al.* 2023; IEA 2023b; Teske 2022).
- The **share of renewables in electricity generation** should reach 59%-89% by 2030, 85%-98% by 2040 and 89-100% by 2050 (Climate Action Tracker 2023; Boehm *et al.* 2023; IEA 2023b). Scenarios at the lower end of these ranges (e.g., (IEA 2023b)) include more nuclear generation than the scenarios at the higher end.

#### Advanced economies

- Electricity systems need to reach **net zero by 2035** in advanced economies (Simon Dietz *et al.* 2024; Climate Action Tracker 2023; IEA 2023b), where many data centres are located.
- The **share of renewables in electricity generation** should reach 87-89% in the EU and 68-86% in the US by 2030; 96-99% in the EU and 93-97% in the US by 2040; and 99-100% in both jurisdictions by 2050 (CAT 2023).

| B | **Switch to 24/7 matching of renewable electricity in the supply chain**<br>*(Addressing emissions from procured products and services, and capital goods – scope 3 categories 1 and 2)* |
|---|---|

A large share of tech companies' scope 3 emissions stem from procured materials and services, such as components for electronic devices, and capital goods, for instance the server hardware in data centres. Switching to renewable electricity in the supply chain can significantly reduce these emission sources.
Regional benchmarks show that electricity systems should reach net zero by 2045 in East and Southeast Asia (IEA 2023), which are key manufacturing areas (NewClimate Institute 2024c; Stand.earth 2023).

### Global

- Electricity systems need to reach **zero GHG emissions between 2040 and 2050** (Simon Dietz *et al.* 2024; Climate Action Tracker 2023; Boehm *et al.* 2023; IEA 2023b; Teske 2022).
- The **share of renewables in electricity generation** should reach 59%-89% by 2030, 85%-98% by 2040 and 89-100% by 2050 (Climate Action Tracker 2023; Boehm *et al.* 2023; IEA 2023b). Scenarios at the lower end of these ranges (e.g., (IEA 2023b)) include more nuclear generation than the scenarios at the higher end.

### Advanced economies

- Electricity systems need to reach **net zero by 2035** in advanced economies (Simon Dietz *et al.* 2024; Climate Action Tracker 2023; IEA 2023b).
- The **share of renewables in electricity generation** should reach 87-89% in the EU and 68-86% in the US by 2030; 96-99% in the EU and 93-97% in the US by 2040; and 99-100% in both jurisdictions by 2050 (CAT 2023).

| C | **Increase the lifespan of sold (and used) products**<br>*(Addressing emissions from procured products and services, and capital goods – scope 3 categories 1 and 2)* |
|---|---|

The majority of emissions from electronic devices and hardware occurs during the production phase, in particular chip manufacturing (Gupta *et al.* 2020). Companies can reduce emissions from procured materials and capitals by increasing the life span of electronic devices sold to consumers and hardware used in, for instance, data centres (Narendra Singh and Oladele A. Ogunseitan 2022). Repair and replacement of spare parts can also prolong the lifespan of electronic devices.

We were unable to identify clear indicators or benchmarks for increasing product lifespan. More research is necessary to understand what measures aimed of increasing product lifespan are effective, and what potential caveats could be.

| D | **Increase the share of recycled materials in electronic devices**<br>*(Addressing emissions from procured products and services – scope 3 category 1)* |
|---|---|

We were unable to identify what share of tech companies' emissions stem from mining critical minerals, such as manganese and cobalt, and other raw materials. However, we suggest that tech companies may set targets on the share of recycled minerals and materials in their electronic devices for four reasons (IEA 2021b):

1. Mining and processing critical minerals are energy-intensive processes;
2. Mining for critical minerals and materials has negative environmental effects, including land-use change, water depletion and pollution and biodiversity loss;
3. Mining for critical minerals and materials can have negative social impacts, such as displacement of local communities, fatalities and injuries to mine workers, and child labour;
4. Demand for critical minerals is expected to significantly increase in future years, which would exacerbate the issues mentioned above.

More research is necessary to understand what share of tech companies' emissions come from mining and processing minerals and other materials, and what kind of alignment indicators could be used.

## 6.2 Transition A: Switch to 24/7 matching of renewable electricity in own and third-party controlled data centres

**It is unclear how relevant third-party controlled data centres are compared to own data centres for most big tech companies.** Companies usually do not report on the number or size of third-party controlled data centres, nor on the emissions from these data centres. The few tech companies that report on third-party controlled data centres as a separate emission source, disclose market-based emissions only. For example, Apple reports zero emissions from third-party cloud services in 2023 (Apple 2024). Research suggests that half of tech giants' data centre capacity comes through third-party contracts (Synergy Research Group 2023).

**The lack of guidance on accounting for emissions in third party-owned data centres is a major shortcoming that allows tech companies to hide the real climate impact of their activities.** This problem will only become pressing with the increase in artificial intelligence (AI) training and use, which are energy-intensive processes and require rapid data centre expansion. As a result of data centre expansion, tech companies have already seen a stark increase in their 2 emissions in recent years. Google and Microsoft report that their location-based scope 2 emissions almost doubled since 2019 and 2020, respectively (Microsoft 2024; Google 2024). The IEA (2024) expects that electricity consumption from data centres will rapidly increase until the end of this decade, although the exact growth rate is difficult to project.

**To reduce emissions from data centres, tech and electronics companies should move towards matching the electricity consumption of all data centres with renewable electricity generation 24/7.** Moving to 100% renewable energy consumption on an annual basis is insufficient to drive grid decarbonisation and reduce emissions from data centres (NewClimate Institute 2024c). Many tech companies are procuring renewable energy through long-term power purchase agreement (PPA) for a specific renewable electricity installation. However, these installations do not provide sufficient electricity throughout the year, so companies remain dependent on – often times – carbon intensive electricity grids.

Google and Microsoft, along with few other companies, are moving to matching energy consumption on an hourly basis (Microsoft 2024; Google 2024). This is also known as "24/7 matching". Companies that match their electricity consumption with the generation of renewable electricity on an hourly basis provide a critical demand pull for additional and novel renewable energy generation and storage technologies that will be necessary to completely decarbonise power systems (Xu *et al.* 2023)

Matching electricity consumption in third party-owned data centres is critical to reduce scope 3 emissions and could be implemented alongside efforts to match energy demand in own data centres. To the best of our knowledge, tech companies are not yet extending the 24/7 approach to third party-owned data centres.

**Tech companies would need to set transition-specific alignment targets for own data centres (scope 2) and third-party owned data centres (scope 3).** We recommend that companies set separate targets for 24/7 matching of renewable electricity for their own data centres and data centres leased from others. While the big tech companies may have a lot of influence over third parties from whom they lease data centres, this might not be the case for smaller tech companies. Companies may be able to commit to 100% 24/7 by, for instance, 2030 in their own data centres, but cannot necessarily target the same level of ambition for third-party owned data centres.

We understand that it is not straightforward for tech companies to migrate data centres. We therefore see limited risk that tech companies would switch activities from own data centres (scope 2) to leased data centres (scope 3). However, in some cases, tech companies may have subsidiaries specialising in data centre management, which could allow them to switch activities and related emissions from one scope to another. Also for this reason, voluntary standards should require tech companies to transparently report on the use of third-party data centres and who those third parties are.

## Potential influence and actions at the company level

The influence of tech companies over providers of third party-owned data centres will vary. Companies that have a long-term contract to use a full data centre will have more influence than a company that shares a data centre with ten others.

Technologies to track electricity consumption and generation on an hourly basis are mature in North America, Europe and India, but not yet in use at a large scale. It may be more challenging to implement the technologies in some other regions, where companies have little experience with hourly matching, and shares of renewable electricity penetration are relatively low (IEA 2024).

Companies have several levers available to support the transition to 24/7 matching of electricity consumption in third party-data centres:

- **Companies could ask their suppliers to commit to matching (close to) 100% of electricity consumption in data centres with renewable generation by a given year.** Such a commitment would be a first step towards transitioning to 100% renewable electricity consumption around the clock.
- **Companies could require their suppliers to match a certain share of electricity consumption with renewables around the clock.** This goes further than merely asking suppliers to commit to pursuing 24/7 matching. The share of electricity demand matched with renewable generation on an hourly basis would likely differ between regions.
- **Companies could extend their efforts for 24/7 matching of electricity in own operations (scope 2) to cover also leased data centres.** For instance, when companies sign a contract with a system operator for 24/7 renewable electricity in own operations, they could bring in the consumed electricity in third party-owned data centres into this contract.
- **Companies could share technologies and know-how with operators of leased data centres.** Companies that have experience, or are getting started on 24/7 matching in own operations, could share technologies and lessons learned with their suppliers.

## Potential indicators for transition targets

Considering the potential influence and actions at the company level, and the availability of indicators from the literature of benchmarks, *Table 7* provides an overview of potential indicators or other target setting approaches for switching to 24/7 matching of renewable electricity in third party-owned data centres.

Based on the scan of seven potential indicators in *Table 7*, we consider the following indicator is a promising option for targets that can contribute to scaling renewable electricity deployment in data centres.

**4. % share of electricity in third party-owned data centres that is matched by renewable electricity 24/7**

Reporting on 24/7 matched renewable electricity is relatively new and not yet common practice. However, the technologies for 24/7 matching are mature and available to big tech. Also, many data centres are located in advanced economies, where companies have multiple options for procuring renewable electricity. When companies sign agreements with energy utilities for hourly matching, they could consider involving third party-data centre owners in this process. We recommend that tech companies set separate targets for the share of 24/7 renewable electricity in own and third-party owned data centres.

Tech companies may share a data centre with other companies. In this case, there is a potential loophole that the share of 24/7 matched electricity in a data centre is attributed to only one of the companies, who may not need to take additional action to reach their 24/7 target. Clear definitions and protocols are necessary to avoid this potential issue.

## Table 7: Potential target indicators for switching to RE in third-party owned data centres

| | | INDICATOR / COMMITMENT | STATUS | REGULATORY ALIGNMENT | SUSCEPTIBILITY | SPECIFICITY | FAIRNESS | PRACTICALITY |
|---|---|---|---|---|---|---|---|---|
| | | | Are companies already reporting or setting targets on the indicator? | Does the indicator already feature in regulations? | What is the vulnerability of the metric to accounting loopholes? | Is the indicator too prescriptive, or not enough, for 1.5°C aligned pathways? | Could the indicator favour dominant or incumbent companies? | How realistic is it to develop 1.5°C compatible benchmarks for the indicator? |
| GHG emission targets for specific emission sources | 1 | % reduction in GHG emissions from third-party controlled data centres | Most major companies do not transparently report on this indicator | No identified examples. | GHG metric vulnerable to balance sheet netting instruments. | Not specific to the necessary shift to RE | Bias in favour of incumbent companies. | Benchmarks don't consider companies' different starting points |
| | 2 | GHG intensity per kWh consumed by data centres | No identified examples | No identified examples. | GHG metric vulnerable to balance sheet netting instruments | Not specific to the necessary shift to RE | No bias in favour of incumbent companies | Benchmark development feasible. |
| Quantitative non-GHG targets for specific emission sources | 3 | % share of third-party controlled data centres that match (close to) 100% RE 24/7 | No identified examples | No identified examples. | Misleading if a small share of data centres accounts for a large share of capacity. | Specific to the transition to 24/7 RE | No bias in favour of incumbent companies | Benchmark development feasible. |
| | 4 | % share of energy consumed in third-party controlled data centres matched by (close to) 100% RE 24/7 | No identified examples. | No identified examples. | Potential for loopholes if the share of RE is attributed to only one user of a data centre | Specific to the transition to 24/7 RE | No bias in favour of incumbent companies | Benchmark development feasible. |
| | 5 | % share of third-party data centre operators that have committed to match energy consumption with RE 24/7 | No identified examples. | No identified examples. | Misleading if a small share of data centres accounts for a large share of capacity. | Only specific enough if commitments are followed up by action | No bias in favour of incumbent companies | Benchmark development feasible. |
| Commitment to specific actions | 6 | Technical support to match RE 24/7 for data centre operators | No identified examples. | No identified examples. | Data reported is not necessarily verifiable or comparable. | Technical support does not guarantee a transition to 24/7 RE | Potential bias to incumbent companies with more resources and influence. | Impractical to objectively define benchmarks. |

**Source:** Authors' estimate.
**Key:** Prospects for identifying standardised transition-specific alignment targets at the sector level: Very good, Reasonable, Moderate, Poor

## 6.3 Transition B: Switch to renewable electricity in the supply chain (capital goods and purchased goods and services)

The category **purchased goods and services** (category 1) includes all upstream emissions that are not covered by the other scope 3 categories (GHG Protocol 2011). For tech and electronics companies, category 1 covers the emissions from raw materials and manufacturing hardware components, among others. Purchased goods and services are a significant emissions source in the tech and electronics sector. For example, Google and Apple report that these emissions make up a third and half of their total footprint, respectively (Google 2024; Apple 2024).

The GHG Protocol defines **capital goods** (category 2) as "final products that have an extended life and are used by the company to manufacture a product, provide a service; or sell, store, and deliver merchandise." (GHG Protocol 2011). This would include, for instance, computing and server hardware in data centres, as well as the emissions from data centre construction (e.g. Alphabet 2024). Emissions from capital goods (category 2) may be substantial, in particular for companies that provide cloud services. Meta and Microsoft report that capital goods account for 43% and 20% of total emissions, respectively (Meta 2024; Microsoft 2024).

The main lever to reduce emissions from both categories is to switch to renewable energy in the supply chain (NewClimate Institute 2024c). Chip manufacturing accounts for the majority of emissions associated with hardware systems, mostly from electricity, and can be reduced by over 50% by switching to renewables (Gupta *et al.* 2020; Julia Christina Hess 2024).

### Potential influence and actions at the company level

The supply chains of tech and electronics companies are often concentrated among a relatively small number of key suppliers that account for a high volume of the supply chain activity (NewClimate Institute 2024c; Stand.earth 2023). This means that companies have a relatively large degree of influence over their suppliers. Despite this, very few companies are setting renewable energy targets for their suppliers.

While renewable energy technologies are mature, their uptake remains slow in key manufacturing regions. Policy barriers have been a key obstacle to increasing the share of renewable energy consumption in many East and Southeast Asian countries (NewClimate Institute 2024c). However, recent years have seen progress in removing policy barriers in these regions (e.g. Taiwan, South Korea, Vietnam). Upfront capital costs may also be a barrier to renewable energy deployment in certain regions.

Companies have several levers available to support the transition to renewable energy in their supply chain:

- **Companies could require their suppliers to procure renewable energy for their operations.** Few major tech companies are setting targets for the supply chain. Apple requires its suppliers to use 100% renewable electricity for Apple outputs by 2030 (Apple 2024) and Microsoft requires its main suppliers to use carbon-free electricity for Microsoft products by 2030 (Microsoft 2024). While these targets include some loopholes[3], they are a key step towards decarbonising the supply chain.
- **Companies could advocate for policy changes with governments.** Some major tech companies report they already engage in such advocacy efforts, for instance Samsung in Vietnam (Samsung 2024).
- **Companies could provide their suppliers with knowledge, financial and/ or technical support to increase the share of renewables.** Many major tech companies provide some sort of support to their suppliers. For example, Apple offers its suppliers internal training and resources that are tailored to each supplier's country, and connects suppliers to experts and renewable energy industry associations (Apple 2022). Tech companies could also provide direct finance for on-site solar PV, for example.
- **Companies could set up umbrella PPAs for their suppliers.** This option has received some traction in recent years. For example, Apple reports to have implemented co-investment models for suppliers, in which Apple and suppliers invest in a common fund that is used to create new renewable electricity capacity for suppliers (Apple 2022). And the Taiwanese chip maker TSMC signed an aggregated PPA in Taiwan with ARK Power, under which both TSMC and its suppliers in Taiwan will be able to procure renewable electricity (TSMC 2023).

3 *Both targets allow manufacturers to simply allocate any renewable electricity on the grid to Microsoft or Apple output. Microsoft's target asks for "carbon free" electricity, thereby allowing for existing nuclear electricity. This may hinder investments in new renewable capacity. Both targets cover only electricity and not other energy carriers.*

## Potential indicators for transition targets

There are no emission reduction benchmarks specifically for tech companies or their upstream suppliers. Benchmarks for the share of renewable energy generation or installed renewable energy capacity give an indication of the share of renewables that should be used in the supply chain. However, benchmarks are generally not available at the country level and provide a relatively wide range of data points.

To the best of our knowledge, there are no benchmarks for the level of financial or technical support that companies should give to their suppliers.

Considering the potential influence and actions at the company level, and the availability of indicators from the literature of benchmarks, *Table 8* provides an overview of potential indicators or other target setting approaches for switching to renewable energy in the supply chain.

Based on the scan of seven potential indicators in *Table 8*, we consider that the following indicator is a promising option for targets that can contribute to scaling renewable electricity deployment in data centres.

**5. % share of energy demand in the supply chain matched with renewable energy 24/7**

In addition, we consider the following indicator a promising option on the shorter term, as data on energy consumption matched on an hourly basis is not yet available:

**4. % share of energy demand in the supply chain covered by on-site installations or PPAs (matching on an annual basis)**

- Asking tech and electronics companies to set targets on the **share of supply covered by 24/7 matching (indicator 5)** would be most effective in driving down scope 3, category 1 and 2 emissions. This indicator, however, may not be practical on the short term, as few companies are reporting on hourly matched energy demand.
- **PPAs and on-site installations** are likely contributing to additional renewable capacity and, on the longer term, grid decarbonisation. Due to policy barriers and high upfront costs, renewable energy deployment remains low in key manufacturing countries. If tech and electronics companies would be required to set targets on the share of energy demand in their supply chains covered by on-site installations or PPAs (**indicator 4**), they would have a strong incentive to engage with local governments to remove policy barriers, and to provide technical and financial support to their suppliers.

## Table 8: Potential target indicators for switching to RE in the supply chain

| | INDICATOR / COMMITMENT | STATUS | REGULATORY ALIGNMENT | SUSCEPTIBILITY | SPECIFICITY | FAIRNESS | PRACTICALITY |
|---|---|---|---|---|---|---|---|
| | | Are companies already reporting or setting targets on the indicator? | Does the indicator already feature in regulations? | What is the vulnerability of the metric to accounting loopholes? | Is the indicator too prescriptive, or not enough, for 1.5°C aligned pathways? | Could the indicator favour dominant or incumbent companies? | How realistic is it to develop 1.5°C compatible benchmarks for the indicator? |
| **Absolute GHG emission targets** | 1 **% reduction in GHG emissions from procured goods and services (category 1) and from capital goods (category 2)** | Major companies report on this indicator | No identified examples. | GHG metric vulnerable to balance sheet netting instruments. | Not specific to the necessary shift to RE | Bias in favour of incumbent companies. | Benchmarks don't consider companies' different starting points |
| **GHG emission intensity targets** | 2 **% reduction in GHG emissions intensity from procured goods and services (category 1) and from capital goods (category 2)** | No identified examples | No identified examples. | GHG metric vulnerable to balance sheet netting instruments. | Not specific to the necessary shift to RE | Bias in favour of incumbent companies. | Benchmarks don't consider companies' different starting points |
| **Quantitative non-GHG targets for specific emission sources** | 3 **% share of suppliers using 100% RE on an annual basis** | Some companies report on this indicator | No identified examples. | Potential for loopholes when suppliers serve various consumers, not all of them requiring the supplier to switch to RE | Using 100% RE on an annual basis does not necessarily lead to more RE generation | No bias for incumbent companies. | Regional-specific benchmarks available, but no benchmarks on country level. |
| | 4 **% share of energy demand in the supply chain covered by on-site installations or PPAs (matching on an annual basis)** | Some companies report on this indicator | No identified examples. | Real outcome metrics are less susceptible to creative accounting | Using 100% RE on an annual basis does not necessarily lead to more RE generation | No bias for incumbent companies | Regional-specific benchmarks available, but no benchmarks on country level. |
| | 5 **% share of energy demand in the supply chain matched with RE 24/7** | No identified examples. | No identified examples. | Real outcome metrics are less susceptible to creative accounting. | Indicator focuses on the necessary technology | No bias for incumbent companies. | Benchmarks for hourly RE not available and practical limitations on the short term |
| | 6 **% share of suppliers that have committed to switch to (close to) 100% 24/7 RE by year X** | No identified examples. | No identified examples. | Potential for loopholes when a small share of suppliers produces the majority of output | Only specific enough if commitments are followed up by action | No bias for incumbent companies | Commitments are easy to track |

| | INDICATOR / COMMITMENT | STATUS | REGULATORY ALIGNMENT | SUSCEPTIBILITY | SPECIFICITY | FAIRNESS | PRACTICALITY |
|---|---|---|---|---|---|---|---|
| | | Are companies already reporting or setting targets on the indicator? | Does the indicator already feature in regulations? | What is the vulnerability of the metric to accounting loopholes? | Is the indicator too prescriptive, or not enough, for 1.5°C aligned pathways? | Could the indicator favour dominant or incumbent companies? | How realistic is it to develop 1.5°C compatible benchmarks for the indicator? |
| **Quantitative non-GHG targets for specific emission sources** | 7 **% share of supply covered by a commitment to 100% 24/7 by year X** | No identified examples. | No identified examples. | Real outcome metrics are less susceptible to creative accounting | Only specific enough if commitments are followed up by action | No bias for incumbent companies. | Practical limitations on the short term |
| | 8 **% share of suppliers that commit to phasing out fossil fuels** | No identified examples | Regulatory requirements regarding phasing out fossil fuels may be implemented in the near future | Potential for loopholes when a small share of suppliers produces the majority of output | Indicator does not necessarily prescribe a switch to RE or a specific matching approach | No bias for incumbent companies | Good availability of regional-specific benchmarks and easy to track |
| **Commitment to specific actions** | 9 **Financial support to suppliers for RE consumption, as % of revenue** | Anecdotal evidence on financial and technical support, but usually not on the exact amount and scale. | No identified examples. | Data reported is not necessarily verifiable or comparable. | Financial and technical support are enabling measures that does not guarantee progress on the transition. | No bias for incumbent companies. | Impractical to objectively define financial and technical support in a comparable way. |
| | 10 **Technical support to suppliers for RE consumption** | | | | | | |
| | 11 **Engage with policy makers in manufacturing countries to remove barriers to RE procurement** | Anecdotal evidence on engagement but not full details. | N/A | Information reported is not necessarily verifiable or comparable | Engagement is an enabling measure that does not guarantee progress on the transition. | Bias for large companies with more clout | Impractical to objectively define engagement efforts in a comparable way. |
| **Commitment to coalitions / buyer clubs** | 12 **Joining a coalition for a 1.5 °C-aligned transition.** ? | No identified examples. | N/A | ? Dependent on integrity of coalition criteria. | ? Dependent on integrity of coalition criteria. | Major incumbent companies more likely to influence coalition criteria | N/A |

**Source: Authors' estimate.**

**Key:** Prospects for identifying standardised transition-specific alignment targets at the sector level — Very good, Reasonable, Moderate, Poor

## 6.4 Transition C: Increase the lifespan of sold (and used) products

While switching to renewable energy in the supply chain can significantly reduce upstream emissions of tech companies, there are environmental, social and practical limitations to how much renewable energy can be generated. Prolonging the lifespan of sold electronic devices and data centre hardware can contribute to reducing tech companies' GHG footprint (Narendra Singh and Oladele A. Ogunseitan 2022).

### Potential influence and actions at the company level

We understand that there is not yet consensus on what measures tech companies should take to prolong the lifespan of products. Potential measures could include:

- **Refurbished products.** Refurbishing an electronic devices leads to emission reductions of 18-80%, compared to the production of a new device (ADEME 2022). The exact emission reduction potential depends on, among other factors, the device's first and second lifespan and rate and type of part replacements.
- **Modular devices.** More research is needed to understand whether and under what conditions modular devices can lead to a reduction in emissions. Modular phones, for instance, usually need larger batteries to pre-empt future technologies (Marina Proske and Marieke Lienert 2020). This means that modular devices only have lower lifecycle emissions if they are used for longer than standard phones.
- **Repair services.** This could include providing manuals to consumers on how to replace phone screens, or repairing broken devices for a reasonable price, even after the end of the warranty period. Recent legislative efforts introduced the "right to repair" in various US states and the European Union. In Oregon, for example, manufacturers of electronic devices and household appliances must provide the repair tools and information required to diagnose and repair their products (Justin Brookman 2024). This means that consumers can go to an independent repair shop or repair the product themselves. The EU's "right to repair" Directive requires manufacturers of products such as smartphones, servers and data storage products, electronic displays, dishwashers and washing machines to repair products, when possible (*Directive (EU) 2024/1799 on Common Rules Promoting the Repair of Goods 2024*).

## 6.5 Transition D: Increase the share of recycled materials in electronic devices

Increasing the share of recycled minerals and materials is an additional measure that tech companies can take. We were unable to identify what share of tech companies' emissions stem from mining critical minerals, such as manganese and cobalt, and other raw materials. However, the mining industry is a significant contributor to global GHG emissions, and negatively impacts biodiversity, environment and local communities (IEA 2021b).

Tech companies could implement the following measures, among others:

- **Increasing the share of recycled materials in new electronic devices.** However, more research is needed to understand the emissions reduction impact of recycled materials. There should also be clear definitions of what counts as "recycled" to avoid potential loopholes.
- **Increasing the number of electronic devices taken back from consumers.** Less than a quarter of discarded electronic devices are recycled (Cornelis P. Baldé *et al.* 2024). This number would be even lower if accounting for unused electronic devices that end up in people's drawers are not disposed of. A 2019 study in the United Kingdom, for instance, estimated that 40 million phones, tablets and other electronic gadgets lie around unused in UK homes (Victoria Gill 2019) If tech companies set targets on the share or number of used electronic devices taken back, they may have a stronger incentive to implement effective take-back policies.

# 7 Fashion

## 7.1 Sector transition framework

**Energy consumption in the supply chain for manufacturing garments is the main source of emissions for fashion companies.** The global fashion industry currently emits 0.9-1.2 $GtCO_2e$ per year, or around 4-5% of global emissions (Perkins and Sadowski 2024). Emissions from major fashion brands are mostly located in the supply chain. For apparel companies, scope 1 emissions only account for 1% of their total emissions, while scope 3 represents around 96% (Ley *et al.* 2021). Purchased goods and services account for 80-88% of scope 3 emissions, excluding indirect use-phase emissions (Sadowski, Perkins, and McGarvey 2021; Berg *et al.* 2020).

The supply chain of fashion companies can be broken down into four distinct categories (Sadowski, Perkins, and McGarvey 2021; Perkins and Sadowski 2024):

- Tier 4 refers to raw material extraction. This includes crop cultivation for cotton, use of timber for viscose, and fossil fuel extraction for materials such as nylon and polyester. It is responsible for around 21% of scope 3 upstream emissions.
- Tier 3 refers to raw material processing. This stage includes processing raw materials to produce yarn and other intermediate products. It is responsible for around 15% of scope 3 upstream emissions.
- Tier 2 refers to material production. This stage includes processes such as weaving, knitting, scouring, dyeing, printing, and finishing or heat setting. Yarn is converted into fabric at this stage. It is responsible for around 55% of scope 3 upstream emissions.
- Tier 1 refers to the assembly of different components into finished products. This stage includes cutting and sewing of fabric into garments. It is responsible for around 9% of scope 3 upstream emissions.

Fossil fuel use to produce electricity and heat for manufacturing is a key driver of emissions in processing raw materials, producing fabrics and other materials for clothing, and assembling the final product (NewClimate Institute 2024b). The use of coal to produce thermal heat in material production (tier 2) is a key emission source.

### Figure 3: Overview of key emission sources and transitions for fashion companies

**GHG EMISSION FOOTPRINT**

Indicative distribution of emission sources for average fashion company


**KEY TRANSITIONS**

Most relevant transitions to address major emission sources

| TRANSITION | RELEVANCE FOR CURRENT EMISSIONS | RELEVANCE FOR FUTURE EMISSIONS |
|---|---|---|
| A Electrification of Tier 1-3 production processes | ✓ Energy consumption in various stages of the garment production accounts for at least two thirds of fashion companies' footprints. Most energy demand sources can be electrified. | ↑ Shift away from coal-based boilers risks to lock in unsustainable biomass. A focus on electrification is key. |
| B Procurement of RE in Tier 1-3 production processes | ✓ | |
| C Reduce overproduction and move towards a more sustainable business model | ✓ Reducing overproduction addresses all upstream scope 3 emissions (>90% of emissions footprint) | |
| D Use lower-GHG alternatives in raw materials | ✓ ~10% of emissions derive from raw material extraction | |
| E Procurement of renewable electricity (scope 2) | ✓ Procurement of renewable electricity should be a priority transition for any company due to the major climate relevance, urgency and accessibility of the energy transition. This transition is related to scope 2 emissions and is not covered in this paper which focuses on target setting frameworks for scope 3. | |
| Reduction of other scope 3 emission sources | ✗ Other scope 3 emissions are of limited relevance to the overall footprint and key business activities | |

## Key transitions for fashion companies

The following transitions are considered critical for the fashion industry to be aligned with 1.5 °C-compatible trajectories.

### A — Electrification of Tier 1-2 production processes

*(Addressing emissions from procured products and services – scope 3 category 1)*

Electrification of heat generation processes is necessary to decarbonise the manufacturing process. Most thermal energy processes occur in tier 2, specifically in textile mills, and a bit in tier 1. Coal use makes up to 75% of current thermal energy, and eliminating coal use by 2030 could reduce emissions by 6% compared to a business as usual scenario (Sadowski, Perkins, and McGarvey 2021). Where relevant, corporates should commit to electrifying all energy processes that can be electrified and to phasing out onsite fossil fuel power-generators.

Alternatives to coal face a high barrier to entry because coal is cheap and easily accessible. One option is to transition to natural gas- or biomass-fired boilers but, while this option is more affordable, it will also lock-in emissions from energy generation compared to electrifying heat processes or shifting to concentrated solar power (Sadowski, Perkins, and McGarvey 2021). Shifting to technologies such as dry-heat processing, which eliminates the need to heat water, also reduces the need for thermal energy while leading to energy efficiencies (Fashion Revolution 2024).

### B — Switch to renewable energy in Tier 1-3 production processes

*(Addressing emissions from procured products and services – scope 3 category 1)*

Switching to renewable energy is key to decarbonise the fashion industry manufacturing process. The breakdown of energy between thermal and electricity varies by tier. Tier 3 energy is nearly all electricity, tier 2 is mostly thermal energy, and tier 1 is mostly electricity (Sadowski, Perkins, and McGarvey 2021). Most emissions from tier 1 and 3 of the manufacturing process stem from electricity consumption. Switching to 100% renewable electricity by 2030 using high-quality procurement constructs would reduce industry emissions by just over 25% compared to a business as usual scenario, but would account for approximately 65% of total emission reductions by 2030 (Ley *et al.* 2021; Sadowski, Perkins, and McGarvey 2021; Perkins and Sadowski 2024; Sadowski 2023). For manufacturing processes that cannot be electrified, on-site coal boilers should be replaced with renewable heat processes.

Transitioning to renewable electricity can be limited by insufficient local renewable electricity resources and space limits for on-site renewable energy production (Sadowski, Perkins, and McGarvey 2021). In some cases, the regulatory environment may not allow companies to purchase renewable energy, but companies can advocate for national governments and utility companies to decarbonise the grid. In other cases, on-site solar energy generation is feasible and economically viable (Sadowski, Perkins, and McGarvey 2021).

### C — Reduce overproduction and move towards a more sustainable business model

*(Addressing emissions from procured products and services – scope 3 category 1)*

The fashion industry produces between 100 and 150 billion items of clothing each year, while at the same time 92 million metric tons of textile are wasted (GFA and BCG 2017). One out of every five garments ends up in a landfill, without ever being sold or used (Berg *et al.* 2020).

Reducing the number of products being discarded throughout the value chain, but especially at the retail level, would enable fashion companies to significantly and immediately reduce emissions. According to some estimates, reducing the quantity of pre-consumer unsold clothing by 10% through more efficient supply chains and more accurate demand forecast tools could reduce industry-wide emissions by 9% by 2030 (Berg *et al.* 2020). Most roadmaps do not account for the impact of reducing overproduction, except through maximising material efficiency (Sadowski, Perkins, and McGarvey 2021; Textile Exchange 2023b). More research is needed to better understand the impact of significantly reducing the number of clothes, both sold and unsold.

Companies can implement several measures to reduce the sale of new clothing. Extending the lifetime of garments can reduce emissions in the fashion sector if such extensions are accompanied by slowed growth in production of new items of clothing. Fashion companies are also starting to implement circularity solutions, including reuse, resale, rental and repair programmes, although these are generally very small in scale. In addition to adapting their business models to integrate circularity at every stage of the clothing life-cycle process, companies need to clearly communicate the scope and scale of their programmes, and transparently show how they can help reduce consumption by extending product life.

| D | **Use lower-GHG alternative fibres**<br>*(Addressing emissions from procured products and services – scope 3 category 1)* |
|---|---|

Emissions from raw materials are currently some of the hardest to eliminate from the fashion industry value chain, as there are no zero-GHG alternatives. However, these emissions can be reduced by increasing the use of *lower*-GHG alternatives (Textile Exchange 2023b).

Mainstream fibres, such as polyester and cotton, have a high GHG footprint, while existing lower-GHG alternatives have yet to be scaled successfully due to insufficient research into alternative materials, lack of infrastructure and impact data gaps (Textile Exchange 2023b). Commonly used synthetic materials such as polyester and nylon are made from crude oil and have a substantially higher GHG footprint than natural materials (Nature Climate Change Editorial 2018).

Current lower-emission alternatives to commonly used fibres include mechanically-recycled polyester, mechanically-recycled nylon, organic and regenerative cotton, mechanically-recycled cotton and viscose sourced from responsible feedstocks (Ley *et al.* 2021; Sadowski, Perkins, and McGarvey 2021; Perkins and Sadowski 2024; Sadowski 2023). However, these fibres are generally more expensive, GHG emission reductions can vary or remain marginal, and transitioning to such fibres does not necessarily address other key issues such as microplastic pollution (Textile Exchange 2023b). One especially important aspect is that recycled materials should stem from apparel and related products (also called textile-to-textile recycling), however current infrastructure is not set up to enable the deployment of such large-scale recycling supply chains (Textile Exchange 2023b). It is therefore especially important for companies to also address the barriers to scaling textile-to-textile recycling of post-consumer waste (i.e., clothing that was sold and then discarded), specifically designing clothing with recyclability in mind and increasing textile waste collection through improved recycling infrastructure (Textile Exchange 2023b).

In addition to developing lower-GHG alternatives to commonly used fibres, companies should invest in scaling the production of innovative alternatives such as biosynthetic fibres and alternatives to cotton to accelerate their development. Current efforts have tended to remain in the research and development stage. Innovative alternatives include biosynthetic fibres, including Bio-PET (Polyethylene terephthalate), Bio-PA (Polyamide e.g. nylon) and polyhydroxyalkanoates (PHA). They also include the use of other natural fibre alternatives to cotton, such as hemp, which can be "cottonised" to resemble the properties of cotton (Ley *et al.* 2021; Sadowski, Perkins, and McGarvey 2021; Perkins and Sadowski 2024; Sadowski 2023).

| E | **Procurement of renewable electricity**<br>*(Addressing emissions from use of electricity – scope 2)* |
|---|---|

Procurement of renewable electricity should be a priority transition for any company due to the major climate relevance and urgency of the energy transition, and the maturity and accessibility of renewable energy technologies.

This transition is related to scope 2 emissions and is not covered in this paper which focuses on target setting frameworks for scope 3.

## 7.2 Transition A: Electrification of tier 1-2 production processes

### Potential influence and actions at the company level

Electrifying manufacturing processes in tiers 1-2, especially tier 2 where thermal energy constitutes most energy use, is critical for fashion companies to decarbonise their supply chains. Tier 1 uses mostly electricity, but there are fewer barriers to electrifying tier 1 processes and so this could constitute a low-hanging fruit. Electrification in tier 2 can be done through switching to alternative technologies like waterless dyeing, dry processing and electrified dyeing, which use electric boilers and heat pumps (Fashion Revolution 2024). Tier 2 emissions, which represent over half of the industry's emissions, come from the generation of hot water for textile processing, often with coal boilers. Switching to dry processing (waterless dyeing) can decrease tier 2 processes' energy use by around 80% and will play an especially key role in the electrification of textile supply chains (Ley *et al.* 2021). While transitioning to renewable energy and efficiency improvements from alternative technologies can lead to cost savings, the substantial upfront financial investments are a barrier to many tier 2 suppliers (Fashion Revolution 2024). Fashion retailers have an important role to play by investing in alternatives to thermal coal and by collaborating with other fashion companies and apparel sector actors throughout the supply chain (Sadowski, Perkins, and McGarvey 2021).

## Companies have several levers available to support the transition:

- **Financing supplier adoption of alternative technologies:** Companies can help finance supplier electrification and installation of new manufacturing technology, such as electric boilers, industrial heat pumps and thermal energy storage (Hasanbeigi, Springer, and Wei 2024).
- **Setting targets to electrify tier 1 and 2 processes:** Setting clear targets to electrify tier 1 and 2 processes, or to switch to specific technologies, can drive innovation and investment in new technologies (Fashion Revolution 2024). Canada Goose was the only brand evaluated by Fashion Revolution (2024) to disclose information on supply chain electrification, disclosing that they aim to electrify two or three sites per year until 2025, a number that remains low (Canada Goose 2023, 20). Electrification is a key first step towards transitioning towards renewable energy.
- **Financing pilot projects:** Companies can organise and finance pilot projects to demonstrate that new technologies such as electric boilers, industrial heat pumps, and thermal energy storage are feasible (Hasanbeigi, Springer, and Wei 2024).
- **Pushing for electrification of steam production:** Companies can push for increased electrification of steam production. Although encouraging suppliers to electrify their equipment is a first step, without seriously accompanying suppliers, they may simply switch to biomass and natural gas fired boilers, both of which do not necessarily lead to significantly lower GHG emissions.

## Potential indicators for transition targets

We have not identified benchmarks for the electrification of tier 1-2 production processes.

Considering the potential influence and actions at the company level, and the availability of indicators from the literature of benchmarks, *Table 9* provides an overview of potential indicators or other target setting approaches for electrification of tier 1-2 production processes.

Based on the scan of seven potential indicators in *Table 9*, we consider that the following indicators are promising options for targets to electrify Tier 1-2 textile manufacturing processes:

**3. Share of electrification of heat and manufacturing processes**

**4. Share of electrification of heat and manufacturing processes (excluding processes supplied directly by non-combustible renewables).**

Although we understand that these indicators are rarely used by many major companies for reporting and target setting, these are highlighted in key industry decarbonisation transition frameworks. Electrification is also a key step for reaching ambitious shares of renewable energy use. Indicator 3 does not specify what share of electrification is necessary, while indicator 4 would require companies to reach 100% electrification of processes which are not supplied directly by non-combustible renewables, such as solar thermal energy. For this reason, while indicator 3 could still be a useful indicator for this transition, indicator 4 is preferred as it enables companies to set a 100% target.

## Table 9: Potential target indicators for electrification of tier 1-2 production processes

| | INDICATOR / COMMITMENT | STATUS | REGULATORY ALIGNMENT | SUSCEPTIBILITY | SPECIFICITY | FAIRNESS | PRACTICALITY |
|---|---|---|---|---|---|---|---|
| | | Are companies already reporting or setting targets on the indicator? | Does the indicator already feature in regulations? | What is the vulnerability of the metric to accounting loopholes? | Is the indicator too prescriptive, or not enough, for 1.5°C aligned pathways? | Could the indicator favour dominant or incumbent companies? | How realistic is it to develop 1.5°C compatible benchmarks for the indicator? |
| **Absolute GHG emission targets** | 1 [Poor] **% reduction in absolute GHG emissions from supply chain energy use.** | [Poor] Indicator rarely used for targets; data unlikely to be easily available | [Poor] No regulations specific to fashion or supply chain use identified. | [Moderate] GHG metric vulnerable to balance sheet netting instruments e.g. RECs. | [Poor] Non-specificity is not appropriate due to one clear pathway needed. | [Poor] Bias in favour of incumbent companies and those with limited historical action. | [Moderate] Benchmarks don't consider companies' different starting points. |
| **GHG emission intensity targets** | 2 [Moderate] **% reduction in GHG emissions from supply chain energy use per product.** | [Moderate] Indicator rarely used for targets; data likely to be easily available | [Moderate] Some policies (EU, France) introduce product emission lifecycle measurements but do not specify energy use requirements. | [Moderate] GHG metric vulnerable to balance sheet netting instruments. | [Poor] Indicator might not lead to electrification. | [Very good] No bias in favour of incumbent companies. | [Moderate] No intensity products for energy identified. |
| **Quantitative non-GHG targets for specific emission sources** | 3 [Reasonable] **Share Tier 1-2 manufacturing processes electrified** | | | | [Reasonable] Doesn't account for energy supplied directly by non-combustible renewables, e.g. solar heat). | | |
| | 4 [Reasonable] **Share of Tier 1-2 manufacturing processes electrified (excl. processes supplied directly by non-combustible renewables)** | [Moderate] Indicator rarely used for targets, but data could be made available. | [Poor] No identified examples specific to the fashion industry. | [Very good] Real outcome metrics are less susceptible to creative accounting. | [Very good] Specificity is appropriate for the transition framework. | [Very good] No bias for incumbent companies. | [Poor] No benchmarks exist on this indicator. |
| | 5 [Moderate] **Share of tier 2 processing done using dry heat processing** | | | | [Poor] Indicator doesn't include other effective measures to increase electrification. | | |
| **Commitment to specific actions** | 6 [Poor] **Investments in R&D (e.g., electrification of thermal processes)** | [Poor] Information is usually an industry secret. | [Poor] Regulatory requirements for R&D are not common or practical. | [Poor] Data reported is not necessarily verifiable or comparable. | [Poor] Enabling measure that does not guarantee progress on the transition. | [Poor] Major companies may be better placed to protect their investments in R&D. | [Poor] Impractical to objectively define R&D investments in a comparable way. |
| **Commitment to coalitions / buyer clubs** | 7 ? **Join UN Fashion Industry Charter for climate action** | N/A | N/A | ? Dependent on integrity of coalition criteria. | ? Dependent on integrity of coalition criteria. | [Poor] Major incumbent companies more likely to influence coalition criteria. | N/A |

**Source:** Authors' estimate.

**Key:** Prospects for identifying standardised transition-specific alignment targets at the sector level — Very good, Reasonable, Moderate, Poor

## 7.3 Transition B: Switch to renewable energy in Tier 1-3 production processes

### Potential influence and actions at the company level

In addition to electrifying production processes (*see section 7.2*), moving to renewable energy is a key transition measure. Switching production to renewable *electricity* (i.e. excluding other energy carriers) across the fashion supply chain constitutes up to 65% of potential GHG emission reductions by 2030 under current decarbonisation scenarios (Fashion Revolution 2024; Sadowski, Perkins, and McGarvey 2021). Switching to renewable energy is costly and requires both changing manufacturing technology by electrifying heat processes, in some cases, and switching energy supply. Companies may face barriers to transitioning to renewable energy due to differences in local renewable electricity availability, but companies can also gain financially from transitioning their supply chains to renewable electricity as this will increase the energy efficiency of energy processes.

Companies have several levers available to support the transition:

- **Supporting suppliers switch away from coal:** Companies can ban the installation of additional coal-fired boilers and support suppliers to switch away from on-site coal boilers. Adidas, for example, does not allow its suppliers to install new coal-fired boilers, heaters, or power generation systems, although the company still allows them to switch to natural gas or biomass (Adidas 2024, 87).
- **Committing to phasing out coal:** Companies can commit to phasing out coal consumption completely. Decathlon, for example, plans to phase-out coal consumption in its tier 1 production sites by 2025 and tier 2 production sites by 2030, however the company does not mention what energy source will replace coal (Decathlon 2024, 7). Switching directly from coal-fired boilers to renewable electricity may require upfront costs, however using biomass or natural gas as transitional energy sources on-site does not necessarily reduce emissions compared to fossil fuels, and it can have other adverse effects. Adidas, Inditex, H&M and other companies mention the use of such energy sources as in-betweens before electrification and transition to renewable energy sources (NewClimate Institute 2024c).
- **Helping suppliers set up transition plans:** Once they have set coal elimination commitments, companies can work with suppliers to set up plans to achieve such targets. For example, Decathlon helps its suppliers set up new renewable energy generation capacities, participate in existing off-site renewable energy projects, and purchasing RECs, prioritising the former two options (Decathlon 2024, 58). Nike works with Tier 2 suppliers to shift from coal to sustainably sourced, lower carbon options, and in the longer term to new low-carbon thermal innovation (Nike 2024, 74). However, Nike also helps suppliers transition to natural gas and biomass (Nike 2024, 85).
- **Committing to using renewable electricity in the supply chain:** Companies can commit to the use of 100% renewable electricity in their supply chains, to encourage manufacturers, governments and competitors to prioritise clean energy (Fashion Revolution 2024). H&M Group, for example, has committed to sourcing 100% renewable electricity in its own operations and in its supply chain, and is also financially supporting suppliers to transition to solar power and thermal energy from agricultural residues (H&M Group 2024, 21).
- **Helping to build supplier capacity:** Companies can help build capacity among their suppliers. Nike helps suppliers to receive technical assistance to help them decide how much onsite solar PV to install and to receive financial reviews to assist them in assessing financial return on renewable energy investments (Nike 2024, 84).
- **Co-financing mechanisms:** Companies can collaborate with other actors or co-finance with other stakeholders in the sector to invest in renewable electricity projects in the countries where suppliers are located (Ley *et al.* 2021). For example, H&M plans to invest in Bangladesh's first offshore wind project in a joint initiative with other actors in the industry (H&M Group 2024).
- **Advocating for legislation in supplier countries:** Companies could also advocate for legislation to decarbonise garment production in the countries where their supply chains are located. In parts where there are barriers to sourcing renewable electricity, unreliable grid connections, or both, companies can engage with local policy makers or set up "umbrella PPAs". H&M, Nike and other companies have urged the Vietnamese government to introduce Direct Power Purchase Agreements, and H&M has now signed a memorandum of understanding with energy company Power Construction Consulting Joint Stock Company 2 under the Vietnamese government's Direct Power Purchase Agreements (DPPA) scheme (Glover 2024).
- **Providing financial support:** Companies can provide financial support for suppliers to transition to renewable electricity. H&M Group, along with lululemon and other companies, contribute to the Fashion Climate Fund (NewClimate Institute 2024c; Apparel Impact Institute, n.d.).

## Potential indicators for transition targets

The following benchmarks could be identified from the literature:

- Switch to 100% renewable electricity in manufacturing processes by 2030 (Sadowski, Perkins, and McGarvey 2021).
- Eliminate coal in textile mills and manufacturing facilities by 2030 (Sadowski, Perkins, and McGarvey 2021).

Considering the potential influence and actions at the company level, and the availability of indicators from the literature of benchmarks, *Table 10* provides an overview of potential indicators or other target setting approaches for the procurement of renewable electricity in tier 1-3 manufacturing processes.

Based on the scan of twelve potential indicators in *Table 10*, we consider that the following indicators are promising options for targets to procure renewable electricity in Tier 1-3 processes:

**4. Share of renewable energy in supply chain (matching on an annual basis)**

**5. Share of renewable energy in supply chain (matched on 24/7 basis)**

**6. Share of renewable electricity in supply chain (matching on an annual basis)**

**7. Share of renewable electricity in supply chain (matched on 24/7 basis)**

Companies are not setting indicators on the share of renewable energy in their supply chains (indicators 4 and 5). A few companies are setting targets on the share of renewable electricity in their supply chains (indicators 6 and 7). Despite this difference, we think that indicators 4 and 5 are more appropriate for decarbonising energy use in fashion supply chains, as these also address the need to transition not just to renewable electricity, but also to solar heat or other non-combustible heat technologies.

- Requiring fashion companies to set targets on the **share of supply covered by 24/7 matching (indicator 5)** would be most effective in driving down scope 3, category 1 and 2 emissions. This indicator, however, may not be practical on the short term, as no fashion companies are reporting on hourly matched energy demand.
- If companies were to set targets on the **share of supply covered by annual matching (indicator 3)** in the short term, they would have a strong incentive to engage with local governments to remove policy barriers, and to provide technical and financial support to their suppliers. Electricity supply would need to be met through **PPAs and on-site installations**, as these are likely contributing to additional renewable capacity and, on the longer term, grid decarbonisation.

## Table 10: Target indicators for switching to renewable energy in tier 1-3 production processes

| | INDICATOR / COMMITMENT | STATUS | REGULATORY ALIGNMENT | SUSCEPTIBILITY | SPECIFICITY | FAIRNESS | PRACTICALITY |
|---|---|---|---|---|---|---|---|
| | | Are companies already reporting or setting targets on the indicator? | Does the indicator already feature in regulations? | What is the vulnerability of the metric to accounting loopholes? | Is the indicator too prescriptive, or not enough, for 1.5°C aligned pathways? | Could the indicator favour dominant or incumbent companies? | How realistic is it to develop 1.5°C compatible benchmarks for the indicator? |
| **Absolute GHG emission targets** | 1 **% reduction in absolute GHG emissions from energy consumption/use in the supply chain.** | Indicator rarely used for targets; data unlikely to be easily available. | No regulations specific to fashion or supply chain use identified. | GHG metric vulnerable to balance sheet netting instruments, such as use of RECs. | Non-specificity is not appropriate due to one clear pathway needed. | Bias in favour of incumbent companies and those with limited historical action. | Benchmarks don't consider different starting points of companies. |
| **GHG emission intensity targets** | 2 **% reduction in GHG emissions from energy use in the supply chain per product.** | Indicator rarely used for targets; data likely to be easily available. | Some policies (EU, France) for product emission lifecycle measurements but not specifically energy use. | GHG metric vulnerable to balance sheet netting instruments. | Non-specificity is appropriate due to multiple possible technology pathways. | No bias in favour of incumbent companies. | No intensity benchmarks for energy identified. |
| **Quantitative non-GHG targets for specific emission sources** | 3 **Commit to phasing out coal in supply chain by year X** | Indicator often used for targets, data likely to be available. | Several countries with large textile industries are increasing renewable energy capacity (Sadowski, Perkins, and McGarvey 2021). | Real outcome metrics are less susceptible to creative accounting. | Indicator does not necessarily prescribe a switch to RE. | No bias for incumbent companies. | Global benchmarks available at economy-wide level and at sectoral level. |
| | 4 **Share of renewable energy in supply chain (annual matching)** | Indicator rarely used for targets, data likely to be available. | | | Includes bioenergy. Annual matching does not necessarily lead to more RE generation. | | |
| | 5 **Share of renewable energy in supply chain (24/7 matching)** | Indicator rarely used for targets; data unlikely to be available. | | | May include bioenergy. | | |
| | 6 **Share of renewable electricity in supply chain (annual matching)** | Indicator sometimes used for targets, data likely to be available | | | Excludes other direct RE technologies e.g. solar thermal. Annual matching does not necessarily lead to more RE generation. | | |

| | INDICATOR / COMMITMENT | STATUS | REGULATORY ALIGNMENT | SUSCEPTIBILITY | SPECIFICITY | FAIRNESS | PRACTICALITY |
|---|---|---|---|---|---|---|---|
| | | Are companies already reporting or setting targets on the indicator? | Does the indicator already feature in regulations? | What is the vulnerability of the metric to accounting loopholes? | Is the indicator too prescriptive, or not enough, for 1.5°C aligned pathways? | Could the indicator favour dominant or incumbent companies? | How realistic is it to develop 1.5°C compatible benchmarks for the indicator? |
| Quantitative non-GHG targets for specific emission sources | 7 [Very good] **Share of renewable electricity in supply chain (24/7 matching)** | [Poor] Indicator rarely used for targets; data unlikely to be available | [Very good] Several countries with large textile industries are increasing renewable energy capacity (Sadowski, Perkins, and McGarvey 2021). | [Very good] Real outcome metrics are less susceptible to creative accounting. | [Moderate] Specificity leaves out transitions to renewable energy options e.g. solar thermal. | [Very good] No bias for incumbent companies. | [Very good] Global benchmarks available at economy-wide level and at sectoral level. |
| | 8 [Poor] **% reduction in energy use per product** | [Moderate] Indicator rarely used for targets, data likely to be easily available | [Poor] No examples identified. | | [Poor] Enabling measure, indicator does not directly address transition. | [Poor] Bias in favour of incumbent companies and those with limited historical action. | [Very good] Global benchmarks available at sectoral level. |
| Commitment to specific actions | 9 [Poor] **Investments in R&D (e.g., electrification of thermal processes)** | [Poor] Information is usually an industry secret. | [Poor] Regulatory requirements for R&D are not common or practical. | [Poor] Data reported is not necessarily verifiable or comparable. | [Poor] R&D is an enabling measure that does not guarantee progress on the transition. | [Poor] Major incumbent companies may be better placed to protect their investments in R&D. | [Poor] Impractical to objectively define R&D investments in a comparable way. |
| | 10 [Moderate] **Invest in renewable energy projects in supplier country/in creation of additional renewable energy capacity in supplier country** | [Very good] Examples exist, for example H&M's investment in one of Bangladesh's renewable energy projects. | [Poor] No examples identified. | [Moderate] This metric is not clearly defined, and so might be susceptible to creative accounting. | [Very good] Specific to the transition. | [Poor] Major incumbent companies may be better placed to establish and coordinate projects with suppliers | [Poor] Impractical to objectively define investments in renewable energy capacity in a comparable way. |
| | 11 [Poor] **Engage with policy makers in manufacturing countries to remove barriers to RE procurement** | [Poor] Anecdotal evidence on engagement but not full details. | N/A | [Poor] Information reported is not necessarily verifiable or comparable | [Poor] Engagement is an enabling measure that does not guarantee progress on the transition. | [Poor] Bias for large companies with more influence | [Poor] Impractical to objectively define engagement efforts in a comparable way. |
| Commitment to coalitions / buyer clubs | 12 ? **Join UN Fashion Industry Charter for climate action or similar coalitions.** | N/A | N/A | ? Dependent on integrity of coalition criteria. | ? Dependent on integrity of coalition criteria. | [Poor] Major incumbent companies more likely to influence coalition criteria | N/A |

**Source:** Authors' estimate.

**Key:** Prospects for identifying standardised transition-specific alignment targets at the sector level — Very good — Reasonable — Moderate — Poor

## 7.4 Transition C: Reduce overproduction and move towards a circular business model

**Overproduction, overconsumption and waste are embedded in fashion companies' linear "take, make, dispose" business model (Niinimäki *et al.* 2020). Instead of slowing down, the fast fashion model is picking up speed with ultra-fast fashion also now on the rise (Fashion Revolution 2024).** Global consumption is expected to surge by 63% by 2030, with total clothing sales potentially reaching 160 million tonnes by 2050, more than triple the current levels (Fashion Revolution 2024). However, only 1% of garments are recycled into new clothing each year, and in the UK, 80% of donated clothing is incinerated (Fashion Revolution 2024). The primary causes of overproduction, overconsumption, and waste can be traced back to a feedback loop between companies and manufacturers. Manufacturers often impose minimum order quantities, while the system incentivises high-volume orders, leading to lower garment prices (Buchel *et al.* 2022). Simultaneously, companies pressure manufacturers to further reduce costs, sometimes resulting in orders that are too large for the manufacturer to handle, pushing them to outsource production to another supplier (Buchel *et al.* 2022). Additionally, brands perceive it as less risky to overproduce than to be faced with the possibility of running out of stock (Chan 2023). Factors such as rapid retail cycles with frequent new product releases and a failure to accurately gauge market demand contribute to this (Coscieme, Akenji, *et al.* 2022).

**Overproduction, overconsumption, and waste can be addressed through circularity measures, the first and most effective of which is to reduce production volumes.** Most large fashion brands have integrated circular programmes into their business models, offering reuse, resale, repair or repurposing (sometimes called upcycling). Such programs enable companies to generate profit without producing new clothes, therefore reducing overall emissions in most cases (Coscieme, Manshoven, *et al.* 2022). However, circularity initiatives remain small because companies face multiple barriers towards scaling circularity, such as considerable logistic costs and lower profit margins (Coscieme, Manshoven, *et al.* 2022). Even recycling and material reuse, which are covered in Transition D, remain low, partly due to the lack of collection and sorting schemes, and to the technical and economic barriers to integration of recycling into design and manufacturing processes (Coscieme, Manshoven, *et al.* 2022).

**Companies should invest in scaling circularity programmes while also committing to reducing overall production volumes.** Information on companies' production volumes is sparse, with only 11% out of top 250 brands disclosing their annual production volumes (Fashion Revolution 2024). Moreover, this data tends to be presented in tonnes of garments, not items of clothing produced (Fashion Revolution 2024). If companies are not tracking data on production volumes, it will be hard for companies to set targets on such an indicator, however it is crucial that they do. Measuring production volumes is also necessary to ensure that the production and sale of new clothing is reduced through reuse, resale and repair and that the overall volume of clothing in circulation does not continue to grow (The Or Foundation 2023). Setting such an indicator would be ambitious not just because data and benchmarks are missing, but also because high integrity overproduction targets would require companies to restructure their entire businesses.

**Very few large fashion companies mention or commit to reducing overproduction. In their special report, 'What fuels fashion', Fashion Revolution finds that only two brands mention degrowth or overproduction, although the numbers reported remain low and do not indicate that the companies are shifting away from fast fashion business models.** In its 2023 CDP questionnaire, Superdry discloses that the company is "implementing a degrowth strategy to ensure [they] are buying less and reducing product waste" (Superdry 2023). The concept of degrowth "generally aims to balance economic activity with planetary boundaries through a planned reduction in production and consumption" (Fashion Revolution 2024, 40). Between FY22 and FY23, Superdry reported a "12% reduction in total buy volumes and a 23% reduction in historic excess" (Superdry 2024). The rationale behind this strategy was to reduce exposure to risks associated with market and environmental volatility, with plans to continue this approach through 2030, aligning with their medium-term financial planning horizon (Superdry 2024). Similarly, United Colours of Benetton has committed to "decoupling the company's economic performance from the increase in the volume of garments" (Benetton Group, n.d.). In 2023, the total production volume for Benetton Group was "reduced by 10% compared to the previous year and by 20% compared to 2019, with a commitment to maintain this trend in the coming years" (Benetton Group, n.d.). These indicators do not point to profound shifts in company operations, nor do they show that these companies are seriously tackling the issues of overproduction and waste in their supply chains.

**Limited research has been conducted to translate overproduction and circularity strategies into specific benchmarks for companies.** Recently, research has established potential clothing consumption targets on the consumption side, but not on the production side. Coscieme *et al.* (2022) establish an equity-based footprint target for per capita fashion consumption in 2030 for G20 countries. Yet there is a lack of understanding for specific targets at company level. The OR Foundation, a charitable organization focused on identifying and implementing alternatives to the prevailing fashion model, recommends that companies "set reduction targets for new clothing production of at least 40% over five years, balanced by an increase in the reuse and remanufacture of existing materials" (The Or Foundation 2023, 1). However, there is a lack of information on how this approach would impact company revenue and shareholders, as well as how companies can practically implement these strategies, aside from through circularity. Sadowski *et al.* (2021) find that increasing material efficiency, or increasing the fibre to product ratio by 10% for all fibre types, emissions would be reduced by 24 Mt $CO_2e$ by 2030, relative to 2019 levels.

Companies could consider the following indicators if wishing to set targets on this transition, however more benchmarks are needed for this transition:

- Increase material efficiency, or increase the fibre to product ratio
- Increase the share of revenue from rental, resale and repair business models
- Reduce the number of clothes produced
- Reduce the number of unsold clothes

**More can and should be done to understand and implement circularity and overproduction strategies, roadmaps and targets at the company level.** Publishing production volume data, in the form of number of clothing items produced, is a crucial first step in the right direction. It is certainly feasible to require companies to develop overproduction strategies and to identify appropriate indicators for measuring progress, by at least setting targets to reduce the number of unsold clothes. The right financial and political incentives need to also be in place so that companies are not only encouraged but required to switch away from current "take, make, dispose" business models. Additionally, uncertainty persists regarding which alignment targets should be adopted and the rationale behind their selection. We view this as a critical transition for companies to align with a 1.5°C pathway, but we call on others to further investigate, clarify the role of corporations, and identify the most suitable alignment targets for this transition.

## 7.5 Transition D: Use lower-GHG alternative fibres

Material extraction takes place in the final and further tier of the supply chain, tier 4, and represents 21% of upstream scope 3 emissions. We have decided not to evaluate indicators for this transition due to several factors. The first is that each material requires a separate transition pathway and that there is no single technology that could lead to a "preferred" or "sustainable" fibre, and even a material with lower-GHG emissions could put pressure on other planetary boundaries if overused (Jensen *et al.* 2023). While the UN Fashion Industry Charter for Climate Action requires companies to set targets to source 100% priority materials that are both preferred and low climate impact by 2030, there are no scientific benchmarks for reducing emissions from fashion through switching to alternative fibres (UNFCCC 2023). Textile Exchange assesses preferred fibres along these pillars (Textile Exchange 2023c, 5):

- Sustainability criteria developed through a formalised multi-stakeholder process
- A recognised industry standard in place which confirms its status as preferred
- A robust chain of custody system in place to track or trace the material through the supply chain and back to its origin
- Objectively and scientifically tested or verified as having greater sustainability attributes, such as through a peer-reviewed Life Cycle Assessment

Textile Exchange then defines preferred fibres or materials as "*A fiber or raw material that delivers consistently reduced impacts and increased benefits for climate, nature, and people against the conventional equivalent, through a holistic approach to transforming production systems*" (Textile Exchange 2023c, 7). Textile Exchange defines low climate impact fibres as "*A fiber or material that generates a lower level of GHG emissions, as measured by $CO_2$ equivalent, when compared to the conventional method of production*" (Textile Exchange 2023c, 9). There is no minimum threshold for what counts as a 'reduced impact', and Textile Exchange's online "Preferred fibre and materials matrix" shows that few preferred fibres have a significant positive impact on climate (Textile Exchange, n.d.). Setting a target to increase the share of preferred materials might therefore not necessarily lead to significant emission reductions and is not transparent enough for external stakeholders to assess.

Even companies wishing to implement alternatives with marginal GHG mitigation impacts will face a lack of infrastructure and higher prices. This is also true for innovative fibres, which are not included under the 'preferred materials' umbrella. More investment into new cutting-edge fibre replacements is required in the medium- to long-term to replace materials that cannot be easily decarbonised (Textile Exchange 2023b).

Overall, while switching to preferred and innovative fibres is important for companies to increase the sustainability of their products, the GHG emissions impact of switching to such fibres is still uncertain, which is why we have decided not to evaluate indicators for this transition. The complexity of creating such an indicator for this transition when there are so many options may also mean that such a framework may not be feasible. Companies can still reduce emissions from fibre and material production slowing the growth in raw material production, substituting materials and filling the innovation gap (Textile Exchange 2023b), however we argue that companies should prioritise reducing overproduction and switching to circular business models (excluding recycling).

**Companies have several levers available to support the transition:**

- Companies can commit to shifting away from known high-GHG impact materials. Tier 4 suppliers need a stronger signal from brands that they are committing and willing to invest in such materials, and these signals have not been strong enough so far (Jensen *et al.* 2023). Several companies, such as lululemon and Inditex commit to sourcing 100% preferred materials in line with Textile Exchange's definition (lululemon 2024; Inditex 2024).
- Some companies have commitments to phase out virgin fossil-based fibres, such as Bonprix and Aldi (Changing Markets Foundation 2024).
- Companies can fill the innovation gap by investing in innovative alternatives or next generation materials such as biosynthetic fibres and cotton alternatives to accelerate their development. Alternative materials also include the use of other natural fibres such as hemp, which can be "cottonised" to resemble the properties of cotton (Ley *et al.* 2021; Sadowski 2023; Sadowski, Perkins, and McGarvey 2021). H&M invests in and scales new materials, technologies and production processes through its Circular Innovation Lab and the investment arm H&M Group Ventures (H&M Group 2024).
- Beyond committing to source higher shares of sustainable materials, companies can also help their tier 4 suppliers (suppliers of raw materials), which can sometimes be smaller businesses and farmers, to implement best practices to reduce the GHG-intensity of their products. It can be hard for farmers to switch from conventional production to lower-impact production, and brands can engage directly with farmers to claim emission reductions. For instance, some brands are helping farmers receive organic and regenerative organic cotton certifications, which requires farmers to use fewer or no artificial fertilisers and no pesticides (H&M Group 2024).
- Brands can support farmers financially so that they do not make a loss when transitioning to organic or regenerative organic cotton. Companies can also purchase cotton from farms that are transitioning to organic and regenerative practices, a process which takes up to 36 months. Sourcing this so-called "in-conversion" or "transitional" cotton can provide the financial incentive for farmers to undergo the costs of converting to organic practices and certification (Textile Exchange 2023a).
- Implementing changes with suppliers located in tier 4 requires that companies increase their traceability and know their suppliers. Supply chain transparency is increasing, although slowly (Fashion Revolution 2023).

# 8 Agriculture and food producers

## 8.1 Sector transition framework

Companies covered by this exercise include food producers and processers. Almost 90% such companies' disclosed emissions are attributable to scope 3 emissions (T. C. Liu, Wu, and Chau 2023). Procurement of agricultural products is the main source of emissions for food and agriculture companies. Major emissions generated from the food system include deforestation and land clearing, livestock rearing, especially ruminants (cows, sheep, goats), production and use of fertilisers and other agrichemicals, paddy rice cultivation, livestock manure and combustion of fossil fuels in food production and supply chains (Clark *et al.* 2020).

Emissions also occur elsewhere in the supply chain, with processing, distribution and end-of-life treatment of products representing a smaller but still significant portion of food and agriculture supply chain emissions (Crippa *et al.* 2021).

**Figure 4: Overview of key emission sources and transitions for good and agriculture companies**

**GHG EMISSION FOOTPRINT**

Indicative distribution of emission sources across the agricultural value chain


**KEY TRANSITIONS**

Most relevant transitions to address major emission sources

| TRANSITION | RELEVANCE FOR CURRENT EMISSIONS | RELEVANCE FOR FUTURE EMISSIONS |
|---|---|---|
| A Zero deforestation | ✓ Land-use change is the biggest source of agricultural emissions. This is mostly driven by expansion of agricultural land for livestock and commodity crops. | |
| B Transition from animal- to plant-based proteins | ✓ Livestock rearing is the largest single driver of emissions in global agricultural value chains. | ↑ Trends for consumption of animal source-protein continue to increase. |
| C Reduce food loss and waste | ✓ Relevant for reducing all emission sources (~40% of food is wasted throughout the value chain) | |
| D Reduce emissions from fertilisers | ✓ ~5% of total emissions footprint. | ↑ Trends for fertiliser use continue to increase. |
| E Procurement of renewable electricity (scope 2) | ✓ Procurement of renewable electricity should be a priority transition for any company due to the major climate relevance, urgency and accessibility of the energy transition. This transition is related to scope 2 emissions and is not covered in this paper which focuses on target setting frameworks for scope 3. | |
| Reduction of other scope 3 emission sources | Other emission sources may be of relevance for transition-specific alignment targets, but are not covered by this report. | |

The food and agriculture industry is a complex industry characterised by a large geographical spread, large multinational corporations alongside numerous small and medium enterprises, a broad heterogeneity of products that cut across very different processes, and stringent requirements related to rapid postproduction shelf life and health considerations (UNEP 2022). This leads to a specific set of requirements and challenges in setting sector-wide transition targets, but key aspects to the transition are cross-cutting, and explored in the following section.

## Key transitions for food and agriculture companies

### A — Stop deforestation and reduce land conversion

*(Addressing emissions from procured products and services – scope 3 category 1)*

Land use and land use change (LULUC) are responsible for 32% of emissions from food and agriculture (Crippa *et al.* 2021), and deforestation is the main driver of such emissions (Boehm *et al.* 2023). Over the period from 2015 to 2022, emissions from deforestation amounted to 28 $GtCO_2e$, and 48 million hectares of forests were lost over the same period (Boehm *et al.* 2023). One of the drivers of such deforestation is the conversion of forests to pastures for livestock to graze. Addressing deforestation, as well as the conversion of other key ecosystems such as peats and mangroves is crucial to reaching the Paris Agreement 1.5°C temperature limit. Annual deforestation rates and associated GHG emissions need to fall by 70 percent by 2030 and 95 percent by 2050, versus 2018 levels (Roe *et al.* 2019).

Companies wishing to set emission reduction targets under the SBTi Forest, Land and Agriculture Guidance (FLAG) must also commit to no-deforestation targets covering all scopes of emissions (SBTi 2023a). The SBTi also recommends that such commitments be aligned with the Accountability Framework initiative (Afi) guidance, and that companies also set "no-conversion" and "no peat burning" commitments (SBTi 2023a). Such commitments should also be accompanied by measures to reduce demand for key products linked to expanding agricultural area, to avoid leakage (Searchinger, Waite, Hanson, Ranganathan, *et al.* 2019).

### B — Transition from animal- to plant-based protein

*(Addressing emissions procured goods and services, scope 3 category 1)*

The livestock sector is responsible for 80% of agricultural (CH4) emissions – a very potent greenhouse gas with an immediate warming effect (Reisinger *et al.* 2021). According to life cycle analyses, the carbon footprint of meat production – from inputs during production to retail – is significantly higher than that of alternative plant-based sources of protein (Poore and Nemecek 2018). Legumes (including soy) and nuts (including peanuts) are among the plant-based foods that are high in protein (Willett *et al.* 2019).

Several levers will be needed to reduce emissions from animal-source foods. The first is shifting consumption away from animal protein, especially ruminants (beef, sheep, and goat), as this can significantly reduce land requirements and GHG emissions (Searchinger, Waite, Hanson, Ranganathan, *et al.* 2019). Especially in regions where consumption of animal protein products exceeds daily health recommendations, a shift towards plant-based proteins with lower environmental impacts is crucial to increasing health and reducing the land and emission footprints of food systems (Searchinger, Waite, Hanson, Ranganathan, *et al.* 2019; Willett *et al.* 2019). Land currently used for livestock systems could also be replaced with more carbon efficient uses without affecting food security (Reisinger *et al.* 2021). More carbon efficient uses include ecosystem restoration to increase carbon sequestration, or conversion of pastures to crops where such conversion is possible, in order to feed more people adequately while using less land (Hayek *et al.* 2020).

Reducing animal-based food consumption by 30% against projected consumption levels by 2050 could almost eliminate net cropland expansion and cause a net reduction in grazing area from 2010 levels (Searchinger, Waite, Hanson, Ranganathan, *et al.* 2019, 80). Such a shift would be highly ambitious, as it would require certain high-consuming regions like North America and Europe to reduce animal-based food consumption by 50%, to allow for other regions to consume more of such foods (Searchinger, Waite, Hanson, Ranganathan, *et al.* 2019, 80). However, even a 10% cut could reduce emissions by 22%, and switches towards healthier diets that include lower amounts of meat and greater amounts of fruits, vegetables, nuts and legumes could reduce GHG emissions by 29% (Searchinger, Waite, Hanson, Ranganathan, *et al.* 2019, 80; Springmann *et al.* 2018).

While the shift to plant-based protein comes with many benefits, there are also social, economic, and cultural challenges related to it that need to be addressed to reach ambitious reductions in animal-based food consumption. It must also entail a just transition for livestock farmers, as roughly 1.3 billion people depend on livestock systems for their livelihood (Reisinger *et al.* 2021). Retailers and food processors therefore have an important role to play in the shift toward more plant-based protein. Large agrifood companies can influence the availability, affordability, convenience and desirability of certain foods (Searchinger, Waite, Hanson, Ranganathan, *et al.* 2019). Moving from educational campaigns to effective marketing of plant-based products is one of many tools at companies' disposal to shift social norms around food (Searchinger, Waite, Hanson, Ranganathan, *et al.* 2019). There is also a strong incentive for companies to contribute to this shift, as the market for plant-based foods presents a strong business case for companies (Bloomberg Intelligence 2021).

Other levers that can reduce emissions from animal-sourced protein include technical measures to reduce methane emissions from livestock and increased productivity of livestock farming (Boehm *et al.* 2023). Novel technologies such as use of feed additives and methane vaccines could help achieve further supply-side methane emissions reductions, but cost and R&D constraints still need to be overcome (Reisinger *et al.* 2021). Increases in productivity of livestock farming are also associated with significant reductions in emissions per quantity of meat produced and will be necessary as an enabling measure, in order to slow growth in livestock numbers (Searchinger, Waite, Hanson, and Ranganathan 2019), however such calculations do not consider the carbon opportunity cost of land used for livestock farming (Hayek *et al.* 2020).

C

## Reduce food loss and waste

*(Addressing emissions from procured goods and services – scope 3 category 1 – and downstream end-of-life treatment of sold products – scope 3 category 12)*

About a quarter of food is lost or wasted between production and consumption each year, leading to higher levels of emissions linked to additional food production, as well as downstream landfill emissions (Boehm *et al.* 2023, 124; Searchinger, Waite, Hanson, and Ranganathan 2019, 51). Food waste and loss contributes to emissions by creating additional demand for agricultural goods. Addressing food loss and waste could therefore curb emissions by slowing project growth in demand for food in coming years (Boehm *et al.* 2023, 124). Halving food loss and waste by 2050 would also reduce environmental pressures by 6-16%, including reducing GHG emissions, cropland use, water use and chemical fertiliser application (Springmann *et al.* 2018). Food waste, through waste treatment and landfill emissions only, generates approximately 8% of global GHG emissions annually. If food loss and waste were a country, it would be the third-largest GHG emitter on the planet (Searchinger, Waite, Hanson, Ranganathan, *et al.* 2019).

Food loss occurs during the production, post-harvest and processing stages, whereas food waste occurs when safe food is discarded from the retail store to the point of intended consumption (Searchinger, Waite, Hanson, Ranganathan, *et al.* 2019, 53). Causes of food loss (e.g., lack of refrigeration) and waste (e.g., behaviour) differ substantially in developed and developing countries, as well as across regions (Mbow *et al.* 2022). Companies can combat food loss by engaging with their suppliers and distributors to reduce waste and by implementing food loss and waste programmes (Boehm *et al.* 2023). For example, better storage and handling technologies such as refrigeration or optimal packaging can reduce losses at the supplier and distributor level, and companies can put in place programs to help these actors transition towards better practices. Companies can reduce food waste in their own operations through improvements to infrastructure or innovative methods to sell food that would otherwise be wasted (Clark *et al.* 2020). Supply chain improvements to reduce food loss include improved harvesting techniques, on-farm storage, infrastructure, and packaging (Mbow *et al.* 2022).

D

## Reduce emissions from fertiliser production and use

*(Addressing emissions from procured products and services – scope 3 category 1)*

Approximately 94% of emissions from fertilizing soils are the result of nitrogen application (Searchinger, Waite, Hanson, Ranganathan, *et al.* 2019, 341). Nitrogen fertilisers cause emissions both through their production and their use, representing approximately 5% of global GHG emissions (Gao and Serrenho 2023). Fertiliser use, which releases nitrous oxide, is the second largest source of emissions in the agriculture sector (excluding LULUC), accounting for 25% of total agricultural GHG emissions in 2019 (UNEP 2022). One-third of fertiliser emissions occurs during synthetic fertiliser production due to the synthesis of ammonia, from which all synthetic fertilisers are produced, and two-thirds of emissions from fertilisers are attributable to nitrogen emissions during fertiliser use (Gao and Serrenho 2023). Synthetic fertilisers make up half of nitrogen fertilisation production, while the other half comes from a combination of cow manure and residues of nitrogen fixing crops (Searchinger, Waite, Hanson, Ranganathan, *et al.* 2019).

To address fertiliser emissions, fertiliser use can be carried out according to the so-called 4 R strategy, where fertilisers are applied at the right rate, with the right type, at the right time and the right place (de Vries *et al.* 2022). Emissions from fertiliser production can be reduced by decarbonising the process through which ammonia is synthesised, or by switching to non-chemical or green fertilisers (IEA 2021a; Mbow *et al.* 2022).

During fertiliser use, up to 50% of applied fertiliser is lost, either to the atmosphere as GHGs, or via leaching, causing eutrophication of waterways (Ferguson *et al.* 2019). Reducing emissions from fertiliser application will therefore require increasing nitrogen-use efficiency and phosphorous recycling, which reduce demand for additional nitrogen and phosphorus inputs (Springmann *et al.* 2018). Innovations such as precision application of fertilisers and controlled-release fertilisers, which slowly release nutrients over time, can help increase nitrogen-use efficiency (Boehm *et al.* 2023). Introducing nitrogen-fixing crops like legumes onto pastures and as cover crops can in some cases also reduce the need for nitrogen fertiliser inputs (Ferguson *et al.* 2019).

E

## Procurement of renewable electricity

*(Addressing emissions from use of electricity – scope 2)*

Procurement of renewable electricity should be a priority transition for any company due to the major climate relevance and urgency of the energy transition, and the maturity and accessibility of renewable energy technologies.

This transition is related to scope 2 emissions and is not covered in this paper which focuses on target setting frameworks for scope 3.

## 8.2 Transition A: Stop deforestation and reduce land conversion

**Deforestation is a critical issue for food producers, as agricultural supply chains are among the largest drivers of global forest loss.** Crops like soy, palm oil, and coffee, along with livestock production, often require land converted from forests, disrupting ecosystems and contributing to GHG emissions. Land use change accounts for approximately one third of GHG emissions from agricultural value chains (FAO 2022).

**Major companies should play a pivotal role in addressing this challenge** by implementing robust policies and ensuring sustainable sourcing practices throughout their supply chains. Their influence can cascade through smaller suppliers, driving systemic change across industries. Continued deforestation also represents a business risk for major corporates: it jeopardizes the long-term viability of supply chains through increased regulatory, reputational, and operational risks.

**The Science Based Targets initiative (SBTi) Forest, Land, and Agriculture (FLAG) guidance mandates that all companies in relevant sectors adopt zero-deforestation commitments as part of their science-based targets.** This policy requires companies to eliminate deforestation from their operations and supply chains by 2025, ensuring that agricultural commodities are produced without contributing to forest loss (SBTi 2023a).

Although deforestation is a critical component of climate action for food and agriculture companies, this report does not further investigate this issue, since it is already well established in corporate standards like the SBTi FLAG guidance.

## 8.3 Transition B: Transition from animal- to plant-based protein

### Potential influence and actions at the company level

Transitioning away from animal-source foods and towards plant-rich foods is a measure over which companies have direct control but face considerable transformational challenges. Moving towards plant-based foods depends on a business decision regarding the type of products that the business sources, markets and sells. Backing plant-based products could also help companies reach their company-level targets to sell more nutritious and healthy foods: if everyone on the planet consumed meat within the recommended health levels, meat production would not need to increase beyond current levels (Springmann *et al.* 2018). While the level of technology readiness is also generally high for plant-based products, the transition towards these products is complex and would involve many stakeholders, from farmers to policymakers. More research is also needed to increase taste, marketability and acceptance of plant-based products (Searchinger, Waite, Hanson, and Ranganathan 2019).

The market for plant-based foods presents a strong business case (Bloomberg Intelligence 2021; Searchinger, Waite, Hanson, Ranganathan, *et al.* 2019, 92–94). Total consumption of meat substitutes has almost tripled and consumption of total milk substitutes almost doubled between 2013 and 2020 worldwide (UNEP 2022). Vegetarian diets are becoming more popular in Europe and North America (UNEP 2022), and in 2023, a survey found that 51% of European meat consumers reported reducing their annual meat intake, up from 21% in 2021 (ProVeg International 2023). The same survey found that 27% of Europeans self-identify as flexitarians (ProVeg International 2023). Overall, there is a huge opportunity for incumbent businesses and entrepreneurship in this sector, as implementing this target and other food related Sustainable Development Goals (SDGs) is estimated to represent a business opportunity of around USD 4.5 trillion per year by 2030 (UNEP 2022).

Despite this strong business case, many companies are not yet reducing their share of higher emission-intensive animal products, even if they are diversifying their plant-based offers. This is especially true for beef and dairy companies. Moreover, we have not identified countries which mention transitioning towards healthier, plant-rich diets as a key transition measure in their nationally determined contributions (NDCs). Key barriers to the transition to plant-based protein are, among others: the cultural dimension of food preferences and its impact on consumer preferences, and the high number of farmers depending on livestock systems. Indeed, progress on changing diets outside of some OECD countries (as discussed above) has been very limited (UNEP 2022).

Companies have several levers available to support the transition:

- **Diversifying offer:** The first step companies could implement is diversifying offer (without necessarily scaling back animal products initially). Some businesses are already taking steps towards this shift. For example, Danone has purchased plant-based companies like Alpro and Silk, expanding the range of plant-based products the company offers (Beckett 2017). Unilever has increased plant-based ice cream options and alternatives (Unilever 2024).
- **Setting sales targets:** Food retailers have led the way in setting plant-based protein sales targets, showing producers that there is demand for this type of product. For instance, 11 major Dutch supermarkets are aiming to increase the share of plant-based protein sold to 50% by 2025 and 60% by 2030, from 40% today (ANP and NL Times 2024).

- **Helping farmers transition away from livestock:** Companies could help their farmers transition away from farming livestock; however this is a complicated process and requires extensive financial support and skill retraining. We could not identify examples of companies currently communicating on such measures.
- **Influencing consumer habits:** Food and agriculture companies have many tools at their disposal to influence increases in plant-based protein consumption and can play a key role in shifting consumers preferences directly, by for example making plant-rich food displays more engaging and improving the appearances of plant-rich dishes or emphasising nutritional benefits (Attwood *et al.* 2020). They could combine their plant-based strategies with nutrition targets, highlighting the synergies between public health and reducing emissions (Springmann *et al.* 2018; Willett *et al.* 2019).
- **Research and investment into alternatives:** Companies could pursue enabling measures such as investments in researching and increasing the appeal and nutrition benefits of plant-based alternatives.

## Potential indicators for transition targets

The availability of 1.5°C-aligned benchmarks for the transition of food systems towards more healthy plant-rich diets is high, but these sometimes differ in level and in kind and cannot necessarily be translated to the corporate or sectoral level. These benchmarks range from a 50% adoption of plant-based diets by 2050 (Roe *et al.* 2019) to a reduction in meat consumption from 91 kcal/capita/day to 60/kcal/capita/day from 2020 to 2050 (Boehm *et al.* 2023), or a shift in diets to plant-based protein by 10-25% by 2050 compared to a business as usual scenario (Costa *et al.* 2022). Other benchmarks focus on reducing meat consumption, presenting a 30% percentage reduction in ruminant meat demand compared to a business-as-usual growth scenario (Searchinger, Waite, Hanson, Ranganathan, *et al.* 2019). The EAT Lancet Commission recommends that a healthy diet would require 13% of protein intake to come from meat, with a majority coming from legumes and nuts, and 12% of kcal/capita/day to come from animal products (around 300 kcal) (Willett *et al.* 2019). In a letter to the President of the House of Representatives, the previous Dutch government's Agricultural Minister explicitly set a goal for the country to aim a protein consumption made up 50% from animal sources and 50% from plant sources ('Brief van de Minister van Landbouw, Natuur En Veordselkwaliteit' 2022), but this target is not in law. At the corporate level, this target could be translated into a goal to reach 50% products sold from plant-based sources. Corporate actors play a role in helping societies reach these benchmarks, especially in countries where animal product consumption is above health recommendations.

Benchmarks for livestock emissions are available, most of which focus on methane emissions from enteric fermentation. They show that methane emissions from ruminants should be reduced 30% by 2050 (Searchinger, Waite, Hanson, Ranganathan, *et al.* 2019).

The heterogeneity of company sales profiles could make identifying a single benchmark for the industry more complicated. For example, a dairy company will face different challenges in transitioning towards higher plant-based sales than a cereal manufacturer.

Considering the potential influence and actions at the company level, and the availability of indicators from the literature of benchmarks, *Table 11* provides an overview of potential indicators or other target setting approaches to transition from animal- to plant-based protein.

Based on the scan of eight potential indicators in *Table 11*, we consider that the following indicators are promising options for targets that can contribute to the transition from animal- to plant-based protein.

**4. % protein sales from plant-based products (share of volume in tonnes)**

**5. % protein sales from plant-based products (share of revenue)**

**6. % of protein products offered for sale that are plant-based**

Some companies are setting targets on indicators 5 and 6, while no companies are setting targets on indicator 4. Companies are already tracking and publishing data on the total revenue from plant-based protein sales, but do not disclose the share of total revenue generated from those sales (indicator 5). Indicator 4 is the most accurate reflection of progress on a transition to increasing plant-based protein, however indicator 6 might be easier for companies to set targets on. Indicator 5 might not accurately reflect how many plant-based products are sold as plant-based protein alternatives can be more expensive, and thus generate higher revenue while representing a smaller share of overall protein sales in tonnes (indicator 4).

Indicators 5 and 6 are sometimes already implemented by food retailers but we did not identify any examples from food producers, although food retailers often also have their own product brands and are therefore partly food producers. Most of these targets are implemented by companies located within Europe, where the context may be more favourable for plant-based targets.

## Table 11: Reduce animal-source food and increase plant-rich foods sales

| | INDICATOR / COMMITMENT | STATUS | REGULATORY ALIGNMENT | SUSCEPTIBILITY | SPECIFICITY | FAIRNESS | PRACTICALITY |
|---|---|---|---|---|---|---|---|
| | | Are companies already reporting or setting targets on the indicator? | Does the indicator already feature in regulations? | What is the vulnerability of the metric to accounting loopholes? | Is the indicator too prescriptive, or not enough, for 1.5°C aligned pathways? | Could the indicator favour dominant or incumbent companies? | How realistic is it to develop 1.5°C compatible benchmarks for the indicator? |
| Absolute GHG emission targets | 1 (Moderate) % reduction in methane emissions from livestock | (Very good) Indicator regularly used for targets. | (Moderate) Some countries' methane pledges cover livestock agriculture (e.g. Canada). | (Moderate) GHG metric vulnerable to accounting loopholes (e.g. using advantageous GWP). | (Moderate) This indicator might not lead to a transition to plant-based proteins. | (Poor) Bias against newer companies with lower historical methane emissions. | (Very good) Benchmarks exist to reduce emissions form livestock enteric fermentation. |
| GHG emission intensity targets | 2 (Moderate) GHG intensity per kilocalories (kcal) of food sold | (Moderate) Indicator rarely used for targets; data can be made available. | (Poor) No identified examples. | (Moderate) GHG metric vulnerable to balance sheet netting instruments. | (Moderate) An intensity indicator as well as using kilocalories instead of protein might not lead to a plant-based protein transition. | (Very good) No bias for incumbent companies. | (Very good) Indicators using GHG/kcal for individual foods and for the entire agricultural sector exist. |
| | 3 (Moderate) GHG intensity per ton of protein of food sold | | | | (Moderate) This indicator might not lead to a transition to plant-based proteins. | | (Moderate) Indicators using GHG/protein for individual foods exist, but overall benchmarks do not. |
| Quantitative non-GHG targets for specific emission sources | 4 (Reasonable) % protein sales from plant-based products (tonnes) | (Moderate) Indicator rarely used for targets; data can be made available. | (Moderate) No major jurisdictions require companies to report or set targets on this indicator specifically. One country, the Netherlands, has implemented a National Protein Strategy with an overall target to double the consumption of legumes by 2030. | (Very good) Real outcome metrics are less susceptible to creative accounting. | (Reasonable) Emission reduction depends on the definition of plant-based products. | (Very good) No bias for incumbent companies. | (Moderate) Good availability of regional and global benchmarks but these cover plant-based diets, not sales. |
| | 5 (Moderate) % protein sales from plant-based products (revenue) | (Reasonable) Indicator sometimes used for targets and data available. | | (Poor) This metric is an enabling measure and does not automatically lead to progress on the transition pathway. | (Poor) This indicator is not specific enough as it does not include share of products. | | |
| | 6 (Reasonable) % of protein products offered for sale that are plant-based | | | (Very good) Real outcome metrics are less susceptible to creative accounting. | (Reasonable) Emission reduction depends on the definition of plant-based products | | |
| Commitment to specific actions | 7 (Poor) Investments in R&D for enabling technologies as % of revenue (e.g. alternative plant-based protein development) | (Poor) Information is usually an industry secret. | (Poor) Regulatory requirements for R&D are not common or practical. | (Poor) Data reported is not necessarily verifiable or comparable. | (Poor) R&D is an enabling measure that does not guarantee progress on the transition. | (Poor) Major incumbent companies may be better placed to protect their investments in R&D. | (Poor) Impractical to objectively define R&D investments in a comparable way. |
| | 8 (Moderate) % of suppliers committed to a coalition/agreement to transition to plant-based products | (Poor) Indicator never used for targets. | (Poor) No identified examples | (Very good) Real outcome metrics are less susceptible to creative accounting. | (Poor) This indicator is likely too specific in a context where such transitions are not communicated. | (Very good) No bias for incumbent companies | (Poor) No benchmarks on this target. |

**Source:** Authors' estimate.

**Key:** Prospects for identifying standardised transition-specific alignment targets at the sector level: Very good; Reasonable; Moderate; Poor

## 8.4 Transition C: Reduce food loss and waste

### Potential influence and actions at the company level

Post-harvest, households and retail are stages in the value chain with the highest percentages of food loss and waste across multiple countries and commodities. Approximately 14% of food is lost in the supply chain, while 17% ends of being wasted at the retail and consumer levels (Hommes 2023). Meaningfully reducing food loss and waste will require measures across the entire food-supply chain.

To address food loss, emphasis should be placed on investments in agricultural infrastructure, technological skills, storage, transport, and distribution. However, addressing food losses that take place further upstream, such as on-farm food losses, may also be harder for companies to prevent. This is especially true as there tends not to be a single food loss hotspot, meaning food loss is distributed between several stages of production and distribution.

Various measures can be implemented to significantly reduce food waste. These include: education and awareness campaigns, food labelling, improved packaging that prolongs shelf life, and changes in legislation and business behaviour that promote closed-loop supply chains in which waste is recycled back into the system (Searchinger, Waite, Hanson, Ranganathan, *et al.* 2019). There is also an incentive for companies to reduce food waste, as this tends to lead to a positive return on investment (Hanson and Mitchell, Peter 2017).

Companies have several levers available to support the transition:

- **Create close-loop supply chains:** Companies can maximise food surplus redistribution and propose closed-loop supply chains, where waste is recycled back into the system (WRAP and IGD 2023).
- **Support consumers reduce waste:** Companies can support citizens to reduce their food waste through a wide range of actions, such as adopting best practice guidance for product labelling and storage, selling less pre-cut fresh produce, raising awareness through campaigns and innovating product packaging (WRAP and IGD 2023). Danone, for example, seeks to reduce waste in its supply chain by "means of partnerships, consumer education or improved product markings" (Danone 2023, 165).
- **Public-private partnerships:** One of the avenues through which companies can reduce food waste is also through public-private partnerships or campaigns.
- **Capacity building with suppliers:** Companies also play a role in increasing capacity building to accelerate the transfer of best practices or increase innovation and scaling of appropriate technologies.
- **Implement technical measures:** Use of certain technological innovations can decrease waste. Some examples of technological innovations are better forecasting algorithms, markdown policies and better replenishment systems. For instance, internet-based apps are now being used by food retailers and restaurants to quickly transport unsold but safe food to charities (Searchinger, Waite, Hanson, Ranganathan, *et al.* 2019). Processing, more durable packaging, and greater usage of coproducts can also reduce food waste (Poore and Nemecek 2018).
- **Increasing refrigeration along the supply chain:** Improved refrigeration and shorter supply chains could also significantly reduce food loss. More than 100m tonnes of fruit and vegetables each year in south and south-east Asia could be saved through such measures (Friedman-Heiman and Miller 2024).

## Potential indicators for transition targets

Most transition frameworks for the food industry include a benchmark for reducing food loss and waste, which is often based on SDG Target 12.3. This target calls for cutting in half per capita global food waste at the retail and consumer levels and reducing food losses along production and supply chains, including postharvest losses, by 2030.

Different frameworks consider different levels of waste reduction to be feasible without technological breakthrough. Springmann et al (2018) find that reducing food loss and waste by 50% is achievable and reducing by 75% is highly ambitious. Searchinger *et al.* (2019) consider reducing food loss and waste by 25% to be highly ambitious, and that a 50% reduction in food loss and waste is unlikely to take place without innovative, simple, and inexpensive technologies that enable foods to be stored for far longer without spoilage. The European Parliament raised its food waste reduction targets to 40% for the consumption level (retail, distribution, restaurants and food services and households) and to 20% for food processing and manufacturing (European Parliament 2024).

Considering the potential influence and actions at the company level, and the availability of indicators from the literature of benchmarks, *Table 12* provides an overview of potential indicators or other target setting approaches for reducing food loss and waste.

Based on the scan of six potential indicators in *Table 12*, we consider that the following indicators are promising options for targets that can contribute to the transition for reducing food waste and loss.

**2. % reduction food loss and waste in supply chain and operations**

**4. Share of food lost and wasted in supply chain and operations**

Indicator 2 will favour companies with higher levels of food waste and loss; however it is already well established as a key measure in the food and agriculture sector. Reducing food loss and waste is one of the UN SDGs. Emission reduction pathways for the food and agriculture industry all include reducing food loss and waste as a key measure, although the literature is not aligned on the level of achievable reduction. Choosing a benchmark for allowable share of food lost and wasted (indicator 4) might be harder for companies to determine and will depend on each company's product offer.

Most companies are already tracking and reporting on food waste, for example, by publishing total quantity of food waste generated. However, some companies only report and set targets on food waste for their own operations– it is unclear what percentage of total waste (operations and supply chain) such targets cover. Few companies track food loss, over which they have less direct influence, but setting targets on this indicator is crucial to reducing emissions from food loss and waste.

## Table 12: Target indicators for reducing food loss and waste

| | Indicator / Commitment | Status | Regulatory alignment | Susceptibility | Specificity | Fairness | Practicality |
|---|---|---|---|---|---|---|---|
| | | Are companies already reporting or setting targets on the indicator? | Does the indicator already feature in regulations? | What is the vulnerability of the metric to accounting loopholes? | Is the indicator too prescriptive, or not enough, for 1.5°C aligned pathways? | Could the indicator favour dominant or incumbent companies? | How realistic is it to develop 1.5°C compatible benchmarks for the indicator? |
| **GHG emission targets for specific emission sources** | **1** **Reduce emissions from food waste (end-of-life emissions)** | Indicator rarely used for targets; data already available. | Policies on landfills and waste treatment but not on emissions from food waste. | GHG metric vulnerable to balance sheet netting instruments. | Not specific to the necessary shift to RE | Bias in favour of incumbent companies. | Benchmarks don't consider companies' different starting points |
| **Quantitative non-GHG targets for specific emission sources** | **2** **% reduction food lost and wasted in supply chain and operations** | Indicator often used for targets, data on food loss and waste available. | Major jurisdictions include targets on food waste in NDCs. | Real outcome metrics are less susceptible to creative accounting. | This indicator excludes household emissions, over which companies have some influence. | This indicator is biased in favour of companies that have higher quantities of food loss and waste today. | Good availability of regional and global benchmarks. |
| | **3** **% reduction food lost and wasted per tonne of food handled** | Indicator sometimes used for targets and data available. | No identified examples. | | | | Few benchmarks available on these indicators. The only intensity benchmark available is food waste in kg/capita. |
| | **4** **Share of food lost and wasted in supply chain and operations** | Indicator not used for targets; data available. | | | This indicator covers all stages of food loss and waste, including household waste. | No bias in favour of incumbent companies | |
| | **5** **Ratio of quantity of non-recovered food waste per metric tonne of product sold** | Sometimes used for targets, data available. | | | Too specific, doesn't include food loss. | | |
| **Commitment to specific actions** | **6** **Investments in R&D for enabling technologies as % of revenue (e.g. better algorithms and low-emission cooling technology)** | Information is usually an industry secret. | Regulatory requirements not common or practical. | Data reported is not necessarily verifiable or comparable. | Enabling measure that does not guarantee the transition. | Major companies may be better placed to protect investments in R&D. | Impractical to objectively define R&D investments in a comparable way. |

**Source: Authors' estimate.**

**Key:** Prospects for identifying standardised transition-specific alignment targets at the sector level — Very good, Reasonable, Moderate, Poor

## 8.5 Transition D: Reduce emissions from fertilisers

### Potential influence and actions at the company level

Use-phase emissions from fertilisers, which occur on-farm and represent 70% of emissions from synthetic fertilisers (Gao and Serrenho 2023), require farm-level changes. However, companies face barriers in changing on-farm policies, because it is difficult to influence and monitor farmer practices (Kanter *et al.* 2019). Reducing fertiliser use without impacting yields is not straightforward, as fertiliser application needs will differ by crop, topography and weather conditions (UNEP 2022). Despite these barriers, increasing on-farm nitrogen use efficiency (NUE) is a particularly attractive lever for emission reductions, because it reduce costs for farmers if yield levels are maintained and can deliver co-benefits for air pollution and water quality (UNEP 2022).

Although emissions take place on-farm, different actors along the agrifood chain share responsibility for nitrogen emission abatement, as the change needed far exceeds what farmers can achieve alone (Kanter *et al.* 2019; Searchinger, Waite, Hanson, Ranganathan, *et al.* 2019). Fertiliser companies, policymakers and companies should both advance research into technologies that can increase fertiliser efficiencies, while also creating commercial incentives for farmers to adopt best fertiliser management practices and source lower-carbon fertilisers (Searchinger, Waite, Hanson, and Ranganathan 2019).

Reducing emissions from fertilisers also requires that synthetic fertiliser production and transport, which represent around 30% of emissions from fertilisers, are decarbonised and that the share of low-carbon or organic fertilisers is increased (Gao and Serrenho 2023). These measures are costly and require real technological advancements. Emissions from the production of synthetic fertilisers are mostly attributable to ammonia synthesis and the chemical reactions used in the production process (Gao and Serrenho 2023). Lower-carbon fertilisers are more expensive than fossil fuel fertilisers, and some of the most promising technologies for reducing fertiliser emissions, such as electrolysis, methane pyrolysis or fossil-based routes with CCS are not yet available at a commercial scale (IEA 2021a).

Companies have several levers available to support the transition:

- **Engaging with suppliers:** Companies can engage with suppliers to help measure and manage fertiliser use, and reward farmers for changes in fertiliser application, whether through sourcing low-carbon fertilisers, using controlled-release fertilisers or increasing fertiliser efficiency (International Fertilizers Association and Systemiq 2022; Kanter *et al.* 2019).
- **Setting minimal standards:** Food producers and retailers can set minimum standards on the chemical inputs used to farm the produce they buy (International Fertilizers Association and Systemiq 2022).
- **Increasing ambition and funding for low carbon fertilisers:** Companies can set targets to source lower-carbon fertilisers and invest in the development and research of cutting-edge technologies for fertilisers.
- **Form partnerships with fertiliser products:** Companies can partner with fertiliser producers and form commercial partnerships to reward farmers for making changes to their practices (International Fertilizers Association and Systemiq 2022). For instance, Yara, a fertiliser company, and PepsiCo have partnered to provide a small number of farmers with lower carbon footprint fertilisers, precision farming tools, and agronomic advice (PepsiCo 2024).

## Potential indicators for transition target

Several benchmarks exist for fertiliser emissions – focused on either production-phase or use-phase (on-farm fertiliser application) emissions. Concerning fertiliser production, the IEA focuses on ammonia decarbonisation and production targets. In the IEA Net Zero Emissions by 2050 Scenario, near-zero-emission technologies achieve nearly 95% of total production by 2050 (IEA 2021a).

Reducing emissions from fertiliser use requires improving nitrogen management and use efficiency (NUE). NUE is a common indicator for measuring use-phase emissions reduction:

- Searchinger *et al.* (2019) propose three benchmarks: a 25% NUE gap closure (coordinated effort), a 50% NUE gap closure (highly ambitious) and a 75% NUE gap closure (breakthrough technologies).
- The EAT-Lancet Commission calls for a 30% increase in NUE in its PROD+, high level ambition scenario (Willett *et al.* 2019).
- Zhang *et al.* (2015) developed global benchmarks for major crop categories, with a total NUE target set at an increase from 42% to 68% (a more than 60% increase in NUE).

Gao and Serrenho (2023) estimate that by implementing a range of mitigation measures, emissions from the fertiliser sector could be reduced by as much as 80% by 2050. Other benchmarks include better fertiliser use management and lower-carbon fertiliser production practices among many measures and do not attribute a certain amount of emissions reductions to specific fertiliser measures (Springmann *et al.* 2018; Costa *et al.* 2022).

Considering the potential influence and actions at the company level, and the availability of indicators from the literature of benchmarks, *Table 13* provides an overview of potential indicators or other target setting approaches for reducing emissions from fertilisers.

Based on the scan of nine potential indicators in *Table 13*, we consider that the following indicators are promising options for targets that can contribute to the transition for reducing emissions from fertilisers, although these face several constraints.

**2. % Reduction in fertiliser used per tonne of produce**

**4. % increase in NUE in supply chain**

Most food producers and retailers do not disclose GHG emissions from fertilisers or data on total quantity of fertilisers used in the supply chain. Companies also do not disclose or track nitrous oxide emissions, which are related to fertiliser use. It is likely that accessing this data is complicated, given that farmers do not necessarily have fertiliser management plans.

Emissions from fertilisers occur in two main ways: through energy use during the production of fertilisers, especially the production of ammonia, and through nitrous oxide emissions due to application of fertilisers (both chemical and organic, such as compost or manure) to fields and pastures. This makes setting an overarching but also specific target more difficult, as the measures needed to address both stages of emissions are different. Ideally, companies would need to set two separate targets: one on optimising or reducing fertiliser use, and one on procuring more low-carbon or organic fertilisers.

Despite these difficulties, optimising fertiliser use or increasing nitrogen use efficiency will already have a significant effect on emissions from fertilisers as this represents the largest source of fertiliser emissions. While indicator 4 is aligned with benchmarks and the scientific literature, it might be easier for companies to set targets on indicator 2. Although indicators 2 and 4 do not require companies to reach a maximum level of fertiliser use, these are appropriate for the sector given different fertiliser needs for different crops and regions.

For these reasons, we propose indicator 2 as the most appropriate for transition C.

## Table 13: target indicators for reducing emissions from fertilisers

<table>
<tr><th></th><th></th><th>INDICATOR / COMMITMENT</th><th>STATUS</th><th>REGULATORY ALIGNMENT</th><th>SUSCEPTIBILITY</th><th>SPECIFICITY</th><th>FAIRNESS</th><th>PRACTICALITY</th></tr>
<tr><td></td><td></td><td></td><td>Are companies already reporting or setting targets on the indicator?</td><td>Does the indicator already feature in regulations?</td><td>What is the vulnerability of the metric to accounting loopholes?</td><td>Is the indicator too prescriptive, or not enough, for 1.5°C aligned pathways?</td><td>Could the indicator favour dominant or incumbent companies?</td><td>How realistic is it to develop 1.5°C compatible benchmarks for the indicator?</td></tr>
<tr><td rowspan="2">Absolute GHG emission targets</td><td>1</td><td>Absolute reduction nitrous oxide emissions during use</td><td>Indicator rarely used for targets; data unlikely to be easily available.</td><td>More than 15 countries have signed the Colombo declaration to halve nitrogen waste (not nitrous oxide) by 2030.</td><td>GHG metric vulnerable to balance sheet netting instruments.</td><td>The indicator addresses the bulk of emissions but doesn't include emissions from fertiliser production.</td><td>Bias in favour of incumbent companies and those with limited historical action.</td><td>Benchmarks for the food and agriculture sector exist.</td></tr>
<tr><td>2</td><td>Absolute reductions in GHG emissions related to fertilisers (production and use)</td><td>Indicator rarely used for targets; data unlikely to be easily available.</td><td>Few examples identified. Canada has set a target to reduce GHG emissions from fertiliser use by 30% by 2030 vs 2020.</td><td>GHG metric vulnerable to balance sheet netting instruments.</td><td>This indicator covers all emissions from fertilisers.</td><td>Bias in favour of incumbent companies and those with limited historical action.</td><td>Benchmarks don't consider different starting points of companies.</td></tr>
<tr><td>GHG emission intensity targets</td><td>3</td><td>Nitrous oxide emissions per hectare of agricultural land</td><td>Indicator rarely used for targets; data unlikely to be easily available</td><td>More than 15 countries have signed the Colombo declaration to halve nitrogen waste (not nitrous oxide) by 2030.</td><td>GHG metric vulnerable to balance sheet netting instruments.</td><td>The indicator addresses the bulk of emissions but doesn't include emissions from fertiliser production.</td><td>No bias for incumbent companies.</td><td>No benchmarks on this indicator specifically.</td></tr>
<tr><td rowspan="3">Quantitative non-GHG targets for specific emission sources</td><td>4</td><td>Optimise fertiliser use for X% of hectares</td><td rowspan="2">Indicator sometimes used for targets; data could be made available.</td><td rowspan="3">No identified examples.</td><td rowspan="3">Real outcome metrics are less susceptible to creative accounting.</td><td>'Optimising' use could lead to different levels of reduction in fertiliser use.</td><td rowspan="3">Bias in favour of incumbent companies with limited historical action on fertiliser efficiency.</td><td rowspan="2">No benchmarks on this indicator specifically.</td></tr>
<tr><td>5</td><td>% reduction in fertiliser used per tonne of produce</td><td rowspan="2">The indicator addresses the bulk of emissions but doesn't include emissions from fertiliser production.</td></tr>
<tr><td>6</td><td>% increase in NUE in supply chain</td><td>Indicator rarely used for targets; data could be made available.</td><td>Good availability of global benchmarks.</td></tr>
</table>

| | INDICATOR / COMMITMENT | STATUS | REGULATORY ALIGNMENT | SUSCEPTIBILITY | SPECIFICITY | FAIRNESS | PRACTICALITY |
|---|---|---|---|---|---|---|---|
| | | Are companies already reporting or setting targets on the indicator? | Does the indicator already feature in regulations? | What is the vulnerability of the metric to accounting loopholes? | Is the indicator too prescriptive, or not enough, for 1.5°C aligned pathways? | Could the indicator favour dominant or incumbent companies? | How realistic is it to develop 1.5°C compatible benchmarks for the indicator? |
| **Quantitative non-GHG targets for specific emission sources** | 7 **% of 'green' (compost, green manures) and low-carbon fertilisers used** | Indicator rarely used for targets; data could be made available. | No identified examples. | Real outcome metrics are less susceptible to creative accounting. | There are varying definitions for green and low-carbon fertilisers. This indicator does not necessarily address emissions from fertiliser use. | No bias for incumbent companies. | Some availability of benchmarks for transitioning to low-carbon fertilisers, but for fertiliser companies. |
| **Commitment to specific actions** | 8 **Investments in R&D for enabling technologies as % of revenue (e.g. low-carbon fertilisers)** | Information is usually an industry secret. | Regulatory requirements for R&D are not common or practical. | Data reported is not necessarily verifiable or comparable. | R&D is an enabling measure that does not guarantee progress on the transition. | Major incumbent companies may be better placed to protect their investments in R&D. | Impractical to objectively define R&D investments in a comparable way. |
| **Commitment to coalitions / buyer clubs** | 9 ? **Joining a coalition that agrees to work towards a 1.5 °C transition pathway.** | N/A | N/A | ? Dependent on integrity of coalition criteria. | ? Dependent on integrity of coalition criteria. | Major incumbent companies more likely to influence coalition criteria | N/A |

**Source: Authors' estimate.**

**Key:** Prospects for identifying standardised transition-specific alignment targets at the sector level — Very good, Reasonable, Moderate, Poor

# 9 References


- ACEEE. 2023. 'Boosting EV Efficiency Would Cut Emissions and Reduce Strain on the Grid | ACEEE'. 2023. https://www.aceee.org/blog-post/2023/04/boosting-ev-efficiency-would-cut-emissions-and-reduce-strain-grid.
- ACT. 2020. 'Assessing Low-Carbon Transition - Auto Sector Methodology (Version 1.2)'. CDP; French Environment and Energy Management Agency (ADAME). https://actinitiative.org/wp-content/uploads/pdf/act-auto-vf-2020-11-13.pdf.
- ADEME. 2022. 'Assessment of the Environmental Impact of a Set of Refurbished Products'. Angers, France: The French Agency for Ecological Transition. https://librairie.ademe.fr/economie-circulaire-et-dechets/5833-assessment-of-the-environmental-impact-of-a-set-of-refurbished-products.html.
- Adidas. 2024. 'Annual Report 2023'. Herzogenaurach: Adidas AG. https://www.adidas-group.com/media/filer_public/78/51/7851fed6-4255-482e-ab74-2a5873ba2988/2023_annual_report_adidas_en_final.pdf.
- Agora Verkehrswende. 2019. 'Why We Need Rules for the Efficiency of Electric Vehicles'. 2019. https://www.agora-verkehrswende.org/publications/why-we-need-rules-for-the-efficiency-of-electric-vehicles.
- Alphabet. 2024. 'CDP Climate Change Response'. Alphabet (Google). https://www.gstatic.com/gumdrop/sustainability/alphabet-2023-cdp-climate-change-response.pdf.
- ANP, and NL Times. 2024. 'Aldi, Lidl and Other Big Supermarkets Want to Switch to More Plant-Based Products'. *NL Times*, 2 March 2024. https://nltimes.nl/2024/03/02/aldi-lidl-big-supermarkets-want-switch-plant-based-products#:~:text=The%20supermarkets%20promise%20that%20by%202030,%2060%20percent%20of%20the.
- Apparel Impact Institute. n.d. 'The Fashion Climate Fund: Funding Measurable Impacts'. https://apparelimpact.org/fashion-climate-fund/.
- Apple. 2022. 'Supplier Clean Energy: 2022 Program Update'. Apple. https://www.apple.com/environment/pdf/Apple_Supplier_Clean_Energy_Program_Update_2022.pdf.
- ———. 2024. 'Environmental Progress Report'. https://www.apple.com/environment/pdf/Apple_Environmental_Progress_Report_2024.pdf.
- Attwood, Sophie, Paula Voorheis, Cecelia Mercer, Karen Davies, and Daniel Vennard. 2020. 'Playbook for Guiding Diners Toward Plant-Rich Dishes in Food Service'. *Worlds Resources Institute*, 80.
- Beckett, Emma Liem. 2017. 'Danone Completes Acquisition of Organic-Foods Producer WhiteWave'. *Food Dive*, 12 April 2017. https://www.fooddive.com/news/danone-completes-acquisition-of-organic-foods-producer-whitewave/440356/#:~:text=Since%20Danone%20first%20announced%20it%20would%20acquire%20the%20fast-growing%20organic.
- Benetton Group. n.d. 'Company Approach'. Accessed 30 September 2024. https://www.benettongroup.com/en/sustainability/company-approach/.
- Berg, Achim, Karl-Hendrik Magnus, Sara Kappelmark, Anna Granskog, Libbi Lee, Corinne Sawers, and Poorni Polgampola. 2020. 'Fashion on Climate: How the Fashion Industry Can Urgently Act to Reduce Its Greenhouse-Gas Emissions'. McKinsey & Company and Global Fashion Agenda. https://www.mckinsey.com/industries/retail/our-insights/fashion-on-climate.
- Bloomberg Intelligence. 2021. 'Plant-Based Foods Market to Hit $162 Billion in Next Decade, Projects Bloomberg Intelligence.' *Bloomerg*, 11 August 2021.
- Boehm, S., L. Jeffery, J. Hecke, C. Schumer, J. Jaeger, C. Fyson, K. Levin, *et al.* 2023. 'State of Climate Action 2023'. Berlin and Cologne, Germany; San Francisco, CA; Washington, DC: Bezos Earth Fund, Climate Action Tracker, Climate Analytics, ClimateWorks Foundation, NewClimate Institute, the United Nations Climate Change High-Level Champions, and World Resources Institute. https://climateactiontracker.org/documents/1179/State_of_Climate_Action_2023_-_November_2023.pdf.
- 'Brief van de Minister van Landbouw, Natuur En Veordselkwaliteit'. 2022. The Hague. https://zoek.officielebekendmakingen.nl/dossier/kst-31532-271.html.
- Broekhoff, Derik, and Michael Gillenwater. 2024. 'Is Scope 3 Fit for Purpose: Alterenative GHG Accounting Frameworks for Inventories and Intervention Impacts'. GHG Management Institute. https://ghginstitute.org/2024/10/28/is-scope-3-fit-for-purpose-alternative-ghg-accounting-frameworks-for-inventories-and-intervention-impacts/#_ftnref3.
- Buchel, Sophie, Aniek Hebinck, Mariangela Lavanga, and Derk Loorbach. 2022. 'Disrupting the Status Quo: A Sustainability Transitions Analysis of the Fashion System'. *Sustainability: Science, Practice and Policy* 18 (1): 231–46. https://doi.org/10.1080/15487733.2022.2040231.
- Canada Goose. 2023. 'Environmental, Social and Governance Report FY 23'. https://s203.q4cdn.com/764564379/files/doc_sustainability/FY23-Sustainability-Report.pdf.
- CAT. 2020. 'Paris Agreement Compatible Sectoral Benchmarks'. Berlin: Climate Action Tracker (Climate Analytics, NewClimate Institute). https://climateactiontracker.org/documents/753/CAT_2020-07-10_ParisAgreementBenchmarks_FullReport.pdf.
- ———. 2023. 'Pulling the Plug on Fossils in Power'. Berlin: Climate Action Tracker (NewClimate Institute, Climate Analytics). https://climateactiontracker.org/publications/pulling-the-plug-on-fossils-in-power/.
- Chan, Emily. 2023. 'Why Are Billions Of Clothes Never Even Sold?' *Vogue*, 8 September 2023. https://www.vogue.co.uk/article/overproduction-fashion.
- Changing Markets Foundation. 2024. 'Fashion's Plastic Paralysis: How Brands Resist Change and Fuel Microplastic Pollution'. Changing Markets Foundation. https://changingmarkets.org/wp-content/uploads/2024/09/Fashions-Plastic-Paralysis.pdf.
- Clark, Michael A., Nina G.G. Domingo, Kimberly Colgan, Sumil K. Thakrar, David Tilman, John Lynch, Inês L. Azevedo, and Jason D. Hill. 2020. 'Global Food System Emissions Could Preclude Achieving the 1.5° and 2°C Climate Change Targets'. *Science* 370 (6517): 705–8. https://doi.org/10.1126/science.aba7357.
- Climate Action Tracker. 2023. 'Clean Electricity within a Generation: Paris-Aligned Benchmarks for the Power Sector'. Berlin: Climate Action Tracker (Climate Analytics, NewClimate Institute). https://climateactiontracker.org/publications/paris-aligned-benchmarks-power-sector/.
- COP26 Presidency. 2021. 'Policy Paper: COP26 Declaration on Accelerating the Transition to 100% Zero Emission Cars and Vans'. UK Government. https://www.gov.uk/government/publications/cop26-declaration-zero-emission-cars-and-vans#full-publication-update-history.
- Cornelis P. Baldé, Ruediger Kuehr, Tales Yamamoto, Rosie McDonald, Elena D'Angelo, Shahana Althaf, Garam Bel, *et al.* 2024. 'Global E-Waste Monitor 2024'. Geneva, Switzerland and Bonn, Germany: International Telecom- munication Union (ITU) and United Nations Institute for Training and Research (UNITAR). https://ewastemonitor.info/wp-content/uploads/2024/03/GEM_2024_18-03_web_page_per_page_web.pdf.
- Coscieme, Lucas, L Akenji, E Latva-Hakuni, K Vladimirova, C Henninger, C Joyner-Martinez, K Nielsen, S Iran, and E D'Itria. 2022. 'Unfit, Unfair, Unfashionable: Realizing Fashion for a Fair Consumption Space'. Berlin: Hot or Cool Institute. https://hotorcool.org/wp-content/uploads/2022/12/Hot_or_Cool_1_5_fashion_report_.pdf.
- Coscieme, Lucas, Saskia Manshoven, Jeroen Gillabel, Francesca Grossi, and Lars F Mortensen. 2022. 'A Framework of Circular Business Models for Fashion and Textiles: The Roleof Business-Model, Technical, and Social Innovation'. *Sustainability: Science, Practice and Policy* 18 (1): 451–62. https://doi.org/10.1080/15487733.2022.2083792.
- Costa, Ciniro, Eva Wollenberg, Mauricio Benitez, Richard Newman, Nick Gardner, and Federico Bellone. 2022. 'Roadmap for Achieving Net-Zero Emissions in Global Food Systems by 2050'. *Scientific Reports* 12 (1): 1–11. https://doi.org/10.1038/s41598-022-18601-1.
- Crippa, M., E. Solazzo, D. Guizzardi, F. Monforti-Ferrario, F. N. Tubiello, and A. Leip. 2021. 'Food Systems Are Responsible for a Third of Global Anthropogenic GHG Emissions'. *Nature Food* 2 (3): 198–209. https://doi.org/10.1038/s43016-021-00225-9.
- Danone. 2023. '2022 Universal Registration Document'. Danone S.A. https://www.danone.com/content/dam/corp/global/danonecom/investors/en-all-publications/2022/registrationdocuments/danoneurd2022eng.pdf.

- Decathlon. 2024. 'Decathlon 2023 Non-Financial Reporting Declaration'. https://www.decathlon-united.media/shared/pressfiles/modules/fichiers/decathlon_nfrd2023.pdf.
- Delasalle, Faustine, Eveline Speelman, Alasdair Graham, Rafal Malinowski, Hannah Maral, Andrew Isabirye, Marc Farre Moutinho, *et al.* 2022. 'Making Net-Zero Steel Possible - An Industry-Backed, 1.5°C-Aligned Transition Strategy'. September. Mission Possible Partnership. https://missionpossiblepartnership.org/wp-content/uploads/2022/09/SteelTSExecutiveSummary.pdf.
- Dietz, Simon, Ali Amin, and Antonina Scheer. 2023. 'Carbon Performance Assessment of Steelmakers : Discussion Paper'. July. Transition Pathway Initiative (TPI). https://www.transitionpathwayinitiative.org/publications/117.pdf?type=Publication.
- *Directive (EU) 2024/1799 on Common Rules Promoting the Repair of Goods*. 2024. https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:L_202401799.
- Emergen Research. 2024. 'Electric Vehicle Charging Station Market Size, Share, Industry Forecast by 2032'. 2024. https://www.emergenresearch.com/industry-report/electric-vehicle-charging-stations-market.
- European Aluminium Association. 2023. 'Net-Zero by 2050: Science-Based Decarbonisation Pathways for the European Aluminium Industry'. 2023. https://european-aluminium.eu/wp-content/uploads/2023/11/23-11-14-Net-Zero-by-2050-Science-based-Decarbonisation-Pathways-for-the-European-Aluminium-Industry_FULL-REPORT.pdf.
- European Commission. 2022. 'EU Climate Targets: How to Decarbonise the Steel Industry - European Commission'. 2022. https://joint-research-centre.ec.europa.eu/jrc-news-and-updates/eu-climate-targets-how-decarbonise-steel-industry-2022-06-15_en.
- European Parliament. 2024. 'Textiles and Food Waste Reduction: New EU Rules to Support Circular Economy'. *European Parliament*, 14 February 2024. https://www.europarl.europa.eu/news/en/press-room/20240212IPR17625/textiles-and-food-waste-reduction-new-eu-rules-to-support-circular-economy.
- FAO. 2022. 'Greenhouse Gas Emissions from Agrifood Systems. Global, Regional and Country Trends, 2000-2020'. https://openknowledge.fao.org/server/api/core/bitstreams/121cc613-3d0f-431c-b083-cc2031dd8826/content.
- Fashion Revolution. 2023. 'Fashion Transparency Index 2023'. Fahion Revolution. https://issuu.com/fashionrevolution/docs/fashion_transparency_index_2023_pages.
- ———. 2024. 'What Fuels Fashion?' Fashion Revolution. https://issuu.com/fashionrevolution/docs/full_report_31_july?fr=xKAE9_zU1NQ.
- Ferguson, Brett J., Céline Mens, April H. Hastwell, Mengbai Zhang, Huanan Su, Candice H. Jones, Xitong Chu, and Peter M. Gresshoff. 2019. 'Legume Nodulation: The Host Controls the Party'. *Plant, Cell & Environment* 42 (1): 41–51. https://doi.org/10.1111/pce.13348.
- Forbes. 2023. 'Volkswagen Commits To $131 Billion In EV And Digital Development By 2028'. 2023. https://www.forbes.com/sites/michaeltaylor/2023/03/14/volkswagen-commits-to-131-billion-in-ev-and-digital-development-by-2028/.
- Friedman-Heiman, Aaron, and Shelie A Miller. 2024. 'The Impact of Refrigeration on Food Losses and Associated Greenhouse Gas Emissions throughout the Supply Chain'. *Environmental Research Letters* 19:064038. https://doi.org/10.1088/1748-9326/ad4c7b.
- Gao, Yunhu, and André Cabrera Serrenho. 2023. 'Greenhouse Gas Emissions from Nitrogen Fertilizers Could Be Reduced by up to One-Fifth of Current Levels by 2050 with Combined Interventions'. *Nature Food* 4 (2): 170–78. https://doi.org/10.1038/s43016-023-00698-w.
- Gao, Yunhu, and André Cabrera Serrenho. 2023. 'Greenhouse Gas Emissions from Nitrogen Fertilizers Could Be Reduced by up to One-Fifth of Current Levels by 2050 with Combined Interventions'. *Nature Food* 4:170–78. https://doi.org/10.1038/s43016-023-00698-w.
- GFA, and BCG. 2017. 'Pulse of the Fashion Industry'. Global Fashion Agenda & The Boston Consulting Group. https://globalfashionagenda.org/download-resource/?file-name=Pulse-of-the-Fashion-Industry_2017%20(2)&file-id=4270&file-resource-id=30469.
- GHG Protocol. 2011. 'Corporate Value Chain (Scope 3) Accounting and Reporting Standard'. World Resources Institute and World Business Council for Sustainable Development. https://ghgprotocol.org/sites/default/files/standards/Corporate-Value-Chain-Accounting-Reporing-Standard_041613_2.pdf.
- Global Battery Alliance. 2024. 'Battery Passport'. 2024. https://www.globalbattery.org/battery-passport/.
- Glover, Simon. 2024. 'H&M Signs Green Energy Agreement in Vietnam'. *Ecotextile News*, 21 November 2024. https://www.ecotextile.com/2024112132730/fashion-retail-news/h-m-signs-green-energy-agreement-in-vietnam.html.
- Google. 2024. 'Enviornmental Report 2024'. Google. https://www.gstatic.com/gumdrop/sustainability/google-2024-environmental-report.pdf.
- Gupta, Udit, Young Geun Kim, Sylvia Lee, Jordan Tse, Hsien-Hsin S. Lee, Gu-Yeon Wei, David Brooks, and Carole-Jean Wu. 2020. 'Chasing Carbon: The Elusive Environmental Footprint of Computing'. *IEEE International Symposium on High-Performance Computer Architecture (HPCA 2021).* https://arxiv.org/pdf/2011.02839.
- Hanson, Craig, and Mitchell, Peter. 2017. 'The Business Case for Reducing Food Loss and Waste: A Report on Behalf of Champions 12.3'. https://champions123.org/sites/default/files/2020-08/business-case-for-reducing-food-loss-and-waste.pdf.
- Hasanbeigi, Ali, Cecilia Springer, and Dennis Wei. 2024. 'Low-Carbon Thermal Energy Technologies for The Textile Industry'. Global Efficiency Intelligence, LLC. https://apparelimpact.org/wp-content/uploads/2024/08/Low-Carbon-Thermal-Energy-8.27.24.pdf.
- Hayek, Matthew N., Helen Harwatt, William J. Ripple, and Nathaniel D. Mueller. 2020. 'The Carbon Opportunity Cost of Animal-Sourced Food Production on Land'. *Nature Sustainability* 4 (1): 21–24. https://doi.org/10.1038/s41893-020-00603-4.
- H&M Group. 2024. 'Sustainability Disclosure 2023'. H&M Group. https://hmgroup.com/wp-content/uploads/2024/03/HM-Group-Sustainability-Disclosure-2023.pdf.
- Hommes, Carla. 2023. '2023 Food and Agriculture Benchmark'. April. World Benchmarking Alliance. https://assets.worldbenchmarkingalliance.org/app/uploads/2024/04/2023-Food-and-Agriculture-Insights-Report.pdf.
- IEA. 2021a. 'Ammonia Technology Roadmap'. Paris: IEA. https://iea.blob.core.windows.net/assets/6ee-41bb9-8e81-4b64-8701-2acc064ff6e4/AmmoniaTechnologyRoadmap.pdf.
- ———. 2021b. 'The Role of Critical World Energy Outlook Special Report Minerals in Clean Energy Transitions'. Paris, France: International Energy Agency. https://iea.blob.core.windows.net/assets/ffd2a83b-8c30-4e9d-980a-52b6d9a86fdc/TheRoleofCriticalMineralsinCleanEnergyTransitions.pdf.
- ———. 2023a. 'Global EV Outlook 2023: Catching up with Climate Ambitions'. Paris, France: International Energy Agency (IEA). https://iea.blob.core.windows.net/assets/dacf14d2-eabc-498a-8263-9f97fd5dc327/GEVO2023.pdf.
- ———. 2023b. 'Net Zero Roadmap: A Global Pathway to Keep the 1.5 °C Goal in Reach (2023 Update)'. Paris, France: International Energy Agency. https://iea.blob.core.windows.net/assets/9a698da4-4002-4e53-8ef3-631d8971bf84/NetZeroRoadmap_AGlobalPathwaytoKeepthe1.5CGoalinReach-2023Update.pdf.
- ———. 2023c. 'Tracking Clean Energy Progress 2023'. https://www.iea.org/energy-system/industry/aluminium.
- ———. 2024. 'World Energy Outlook 2024'. Paris, France: International Energy Agency. https://iea.blob.core.windows.net/assets/5e9122fc-9d5b-4f18-8438-dac8b39b702a/WorldEnergyOutlook2024.pdf.
- Inditex. 2024. 'System of Non-Financial Information 2023'. https://www.inditex.com/itxcomweb/api/media/cc6b203a-de08-4ff9-8989-e0ca52e03472/Statement_of_Non_Financial_Information_2023.pdf?t=1710759711321.
- InfluenceMap. 2024. 'Automakers and Climate Policy Advocacy: A Global Analysis'. https://influencemap.org/report/Automakers-and-Climate-Policy-Advocacy-A-Global-Analysis-27906.
- International Fertilizers Association, and Systemiq. 2022. 'Reducing Emissions from Fertilizer Use'. https://www.systemiq.earth/reducing-emissions-fertilizer/.
- IPCC, ed. 2022. 'Technical Summary'. In *Climate Change 2022 - Mitigation of Climate Change*, 1st ed., 51–148. Cambridge University Press. https://doi.org/10.1017/9781009157926.002.
- Jensen, Beth, Megan Stoneburner, Catharina Martinez-Pardo, Jocelyn Wilkinson, Haafizah Khodabocus, Lidia Durbiano, Mireille Faist, Stefan Frehland, Philipp Meister, and Marcial Vargas-Gonzalez. 2023. 'Sustainable Raw Materials Will Drive Profitability for Fashion and Apparel Brands'. BCG, Textile Exchange, Quantis. https://web-assets.bcg.com/2f/a3/8bf925184dfe969547a484ddc5d4/bcg-sustainable-raw-materials-will-drive-profitability-oct-23.pdf.
- Julia Christina Hess. 2024. 'Chip Production's Ecological Footprint: Mapping Climate and Environmental Impact'. Berlin, Germany: interface. https://www.interface-eu.org/publications/chip-productions-ecological-footprint.
- Justin Brookman. 2024. 'Oregon Governor Signs Landmark Right to Repair Bill into Law'. *Oregon Governor Signs Landmark Right to Repair Bill into Law* (blog). 27 March 2024. https://advocacy.consumerreports.org/press_release/oregon-governor-signs-landmark-right-to-repair-bill-into-law/.
- Kanter, David R., Fabio Bartolini, Susanna Kugelberg, Adrian Leip, Oene Oenema, and Aimable Uwizeye. 2019. 'Nitrogen Pollution Policy beyond the Farm'. *Nature Food* 1 (1): 27–32. https://doi.org/10.1038/s43016-019-0001-5.
- Ley, Katrin, Rogier van Mazijk, Rory Hugill, Lewis Perkins, and Ryan Gaines. 2021. 'Unlocking the Trillion-Dollar Fashion Decarbonisation Opportunity: Existing and Innovative Solutions'. Apparel Impact Institute (Aii) and Fashion for Good. https://apparelimpact.org/reports/unlocking-the-trillion-dollar-fashion-decarbonisation-opportunity-report/.

- Linder, Martin, Tomas Nauclér, Stefan Nekovar, and Alexander Pfeiffer. 2023. 'The Race to Decarbonize Electric-Vehicle Batteries'. McKinsey & Company. https://www.mckinsey.com/$\sim$/media/mckinsey/industries/automotive and assembly/our insights/the race to decarbonize electric vehicle batteries/the-race-to-decarbonize-electric-vehicle-batteries-vf.pdf.
- Liu, Ting Chun, Yi Ching Wu, and Chi Fai Chau. 2023. 'An Overview of Carbon Emission Mitigation in the Food Industry: Efforts, Challenges, and Opportunities'. *Processes* 11 (7). https://doi.org/10.3390/pr11071993.
- Liu, Wenjie, Jiangbei Hao, and Ada Kong. 2023. 'Breaking The Mold: The Role of Automakers In Steel Decarbonisation'. Greenpeace East Asia. https://www.greenpeace.org/static/planet4-eastasia-stateless/2023/05/e45b70a3-auto_steel_report_2023_-greenpeace.pdf.
- lululemon. 2024. 'Impact Report 2023'. https://corporate.lululemon.com/~/media/Files/L/Lululemon/our-impact/reporting-and-disclosure/2023-lululemon-impact-report.pdf.
- Marina Proske and Marieke Lienert. 2020. 'Modular Electronics – A Sustainable Solution for the Smartphone Era?' 9 January 2020. https://blog.izm.fraunhofer.de/modular-electronics-a-sustainable-solution-for-the-smartphone-era/.
- Mbow, Cheikh, Cynthia Rosenzweig, Luis G. Barioni, Tim G. Benton, Mario Herrero, Murukesan Krishnapillai, Emma Liwenga, *et al.* 2022. *Food Security. Climate Change and Land: An IPCC Special Report on Climate Change, Desertification, Land Degradation, Sustainable Land Management, Food Security, and Greenhouse Gas Fluxes in Terrestrial Ecosystems*. https://doi.org/10.1017/9781009157988.007.
- McKinsey. 2023. 'The Race to Decarbonize Electric-Vehicle Batteries'. https://www.mckinsey.com/industries/automotive-and-assembly/our-insights/the-race-to-decarbonize-electric-vehicle-batteries.
- Meta. 2024. '2023 CDP Climate Change Response'. Meta. https://sustainability.fb.com/wp-content/uploads/2024/02/2023_Meta_CDP_Climate-Change-Survey.pdf.
- Microsoft. 2023. 'Microsoft Corporation CDP Climate Change Questionnaire 2023'. CDP. https://query.prod.cms.rt.microsoft.com/cms/api/am/binary/RW1g0Xl.
- ———. 2024. 'How Can We Advance Sustainability? 2024 Environmental Sustainability Report'. Microsoft. https://query.prod.cms.rt.microsoft.com/cms/api/am/binary/RW1lMjE.
- Narendra Singh and Oladele A. Ogunseitan. 2022. 'Disentangling the Worldwide Web of E-Waste and Climate Change Co-Benefits'. *Circular Economy* 1 (2): 100011. https://doi.org/10.1016/j.cec.2022.100011.
- Nature Climate Change Editorial. 2018. 'The Price of Fast Fashion'. *Nature Climate Change* 8 (1): 1. https://doi.org/10.1038/s41558-017-0058-9.
- NewClimate Institute. 2023. 'Corporate Climate Responsibility Monitor 2023: Assessing the Transparency and Integrity of Companies' Emission Reduction and Net-Zero Targets'. Berlin and Cologne: NewClimate Institute. https://newclimate.org/resources/publications/corporate-climate-responsibility-monitor-2023.
- ———. 2024a. 'A Repository of Sector-Specific Decarbonisation Benchmarks Informing 1.5°C-Aligned Corporate Climate Action'. https://newclimate.org/sites/default/files/2024-04/NewClimate_CorporateBenchmarksRepository_April2024.pdf.
- ———. 2024b. 'Corporate Climate Responsibility Monitor 2024: Assessing the Transparency and Integrity of Companies' Emission Reduction and Net-Zero Targets'. Berlin and Cologne: NewClimate Institute, Carbon Market Watch. https://newclimate.org/resources/publications/corporate-climate-responsibility-monitor-2024.
- ———. 2024c. 'Navigating the Nuances of Corporate Renewable Electricity Procurement: Spotlight on Fashion and Tech'. Berlin and Cologne: NewClimate Institute. https://newclimate.org/sites/default/files/2024-01/NewClimate_RenewableElectricityReport_%20Jan24.pdf.
- ———. 2024d. 'The Role of Environmental Attribute Certificates for Corporate Climate Strategies'. https://newclimate.org/sites/default/files/2024-10/NewClimate_RoleOfEACs_Oct24_1.pdf.
- Niinimäki, Kirsi, Greg Peters, Helena Dahlbo, Patsy Perry, Timo Rissanen, and Alison Gwilt. 2020. 'The Environmental Price of Fast Fashion'. *Nature Reviews Earth and Environment* 1 (4): 189–200. https://doi.org/10.1038/s43017-020-0039-9.
- Nike. 2024. 'FY23 Nike, Inc. Impact Report'. Nike. https://about.nike.com/en/newsroom/releases/fy23-nike-inc-impact-report.
- PepsiCo. 2024. 'PepsiCo Europe and Yara Partner to Decarbonize Crop Production'. *PepsiCo*, 16 July 2024. https://www.pepsico.com/our-stories/press-release/pepsico-europe-and-yara-partner-to-decarbonize-crop-production.
- Perkins, Lewis, and Michael Sadowski. 2024. 'Taking Stock of Progress Against the Roadmap to Net Zero 2024'. Apparel Impact Institute (Aii). https://apparelimpact.org/wp-content/uploads/2024/05/Taking-Stock-of-Progress-Against-the-Roadmap-to-Net-Zero-2024-5.15.pdf.
- Poore, J., and T. Nemecek. 2018. 'Reducing Food's Environmental Impacts through Producers and Consumers'. *Science* 360 (6392): 987–92. https://doi.org/10.1126/science.aaq0216.
- ProVeg International. 2023. 'Evolving Appetities: An in-Depth Look at European Attitudes towards Plant-Based Eating'. Smart Protein project. https://smartproteinproject.eu/wp-content/uploads/Smart-Protein-European-Consumer-Survey_2023.pdf.
- Reisinger, Andy, Harry Clark, Annette L. Cowie, Jeremy Emmet-Booth, Carlos Gonzalez Fischer, Mario Herrero, Mark Leahy, and Sinead Howden. 2021. 'How Necessary and Feasible Are Reductions of Methane Emissions from Livestock to Support Stringent Temperature Goals?' *Phil. Trans. R. Soc. A* 379 (20200452): 1–18. https://doi.org/10.1098/rsta.2020.0452.
- Rio Tinto. 2022. 'Rio Tinto and Ford Sign MOU for Battery and Low Carbon Materials Supply to Support Net-Zero Future'. 2022. https://www.riotinto.com/en/news/releases/2022/ford-rio-tinto-sign-mou-for-battery-and-low-carbon-materials-supply-to-support-net-zero-future.
- RMI. 2024. 'Sustainable Steel Buyers Platform'. 2024. https://rmi.org/our-work/climate-aligned-industries/sustainable-steel-buyers-platform/#:~:text=RMI-led Sustainable Steel Buyers Platform is enabling corporate,near-zero emissions steel in North America this decade.
- Robiou Du Pont, Yann, Joeri Rogelj, Angel Hsu, Detlef Van Vuuren, and Andreas G. F. Hoepner. 2024. 'Corporate Emissions Targets and the Neglect of Future Innovators'. *Science* 384 (6694): 388–90. https://doi.org/10.1126/science.adl5081.
- Roe, Stephanie, Charlotte Streck, Michael Obersteiner, Stefan Frank, Bronson Griscom, Laurent Drouet, Oliver Fricko, *et al.* 2019. 'Contribution of the Land Sector to a 1.5 °C World'. *Nature Climate Change* 9 (11): 817–28. https://doi.org/10.1038/s41558-019-0591-9.
- Sadowski, Michael. 2023. 'Taking Stock of Progress Against the Roadmap to Net Zero'. June. Apparel Impact Institute. https://apparelimpact.org/wp-content/uploads/2023/06/Aii_RoadmapReport-615-1.pdf.
- Sadowski, Michael, Lewis Perkins, and Emily McGarvey. 2021. 'Roadmap to Net Zero: Delivering Science-Based Targets in the Apparel Sector'. *World Resources Institute*. Washington D.C., United States of America: World Resources Institute (WRI) and Apparel Impact Institute (Aii). https://doi.org/10.46830/wriwp.20.00004.
- Samsung. 2024. 'Samsung Electronics Vietnam Accelerates Its Climate Action by Expanding Renewable Energy Procurement'. *Samsung Newsroom*, 9 July 2024. https://news.samsung.com/global/samsung-electronics-vietnam-accelerates-its-climate-action-by-expanding-renewable-energy-procurement.
- SBTi. 2023a. 'Forest, Land and Agriculture Science Based Target-Setting Guidance | Version 1.1 | December 2023'. Science Based Targets initiative (SBTi). https://sciencebasedtargets.org/resources/files/SBTiFLAGGuidance.pdf.
- ———. 2023b. 'Steel Science-Based Target-Setting Guidance'. Science Based Targets initiative (SBTi). https://sciencebasedtargets.org/resources/files/SBTi-Steel-Guidance.pdf.
- ———. 2024a. 'Aligning Corporate Value Chains to Global Climate Goals: Scope 3 Discussion Paper'. Science Based Targets initiative. https://sciencebasedtargets.org/resources/files/Aligning-corporate-value-chains-to-global-climate-goals-SBTi-Research-Scope-3-Discussion-Paper.pdf.
- ———. 2024b. 'Land Transport Science-Based Target-Setting Guidance (Version 1.0, March 2024)'. Science Based Targets initiative (SBTi). https://sciencebasedtargets.org/resources/files/Land-Transport-Guidance.pdf.
- Searchinger, Tim, Richard Waite, Craig Hanson, and Janet Ranganathan. 2019. 'Creating a Sustainable Food Future'. July. Washington D.C: World Resources Institute. https://www.wri.org/research/creating-sustainable-food-future.
- Shukla, P.R., J. Skea, R. Slade, A. Al Khourdajie, R. van Diemen, D. McCollum, M. Pathak, *et al.* 2022. 'Climate Change 2022: Mitigation of Climate Change. Working Group III Contribution of the Sixth Assessment Report of the Intergovernmental Panel on Climate Change'. Cambridge, UK and New York, NY, USA: Cambridge University Press. https://www.ipcc.ch/report/ar6/wg3/downloads/report/IPCC_AR6_WGIII_FullReport.pdf.
- Simon Dietz, Cristóbal Budnevich Portales, Ali Amin, Valentin Jahn, and Antonina Scheer. 2024. 'Carbon Performance Assessment of Electricity Utilities: Note on Methodology'. London, United Kingdom: Transition Pathway Initiative Centre, London School of Economics and Political Science. https://www.transitionpathwayinitiative.org/publications/uploads/2024-carbon-performance-assessment-of-electricity-utilities-note-on-methodology.pdf.
- Springmann, Marco, Michael Clark, Daniel Mason-D'Croz, Keith Wiebe, Benjamin Leon Bodirsky, Luis Lassaletta, Wim de Vries, *et al.* 2018. 'Options for Keeping the Food System within Environmental Limits'. *Nature* 562 (7728): 519–25. https://doi.org/10.1038/s41586-018-0594-0.
- Stand.earth. 2023. 'How Does the IT Industry's Supply Chain Stack up on a 1.5C Pathway?' 27 November 2023. https://stand.earth/resources/how-does-the-it-industrys-supply-chain-stack-up-on-a-1-5c-pathway/.

- Stellantis. 2024. ‘Carbon Net Zero Strategy - Vehicles’. 2024. https://www.stellantis.com/en/responsibility/carbon-net-zero-strategy/vehicles.
- Superdry. 2023. ‘Superdry - Climate Change Questionaire 2023’. Superdry, CDP. https://www.cdp.net/en/responses/31463/Superdry?back_to=https%3A%2F%2Fwww.cdp.net%2Fen%2Fresponses%3Fqueries%255Bname%255D%3Dsuperdry&queries%5Bname%5D=superdry.
- ———. 2024. ‘Superdry Sustainability Report 2023’. https://corporate.superdry.com/media/cw4fl0vv/sustainability-report-2023.pdf.
- Synergy Research Group. 2023. ‘On-Premise Data Center Capacity Being Increasingly Dwarfed by Hyperscalers and Colocation Companies’. 13 July 2023. https://www.prnewswire.com/news-releases/on-premise-data-center-capacity-being-increasingly-dwarfed-by-hyperscalers-and-colocation-companies-301876428.html.
- Tankou, Alexander, Georg Bieker, and Dale Hall. 2023. ‘Scaling up Reuse and Recycling of Electric Vehicle Batteries: Assessing Challenges and Policy Approaches’. ICCT. https://theicct.org/wp-content/uploads/2023/02/recycling-electric-vehicle-batteries-feb-23.pdf.
- Teske, Sven. 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: Springer. https://link.springer.com/content/pdf/10.1007/978-3-030-99177-7.pdf.
- Teske, Sven, Stefan Bratzel, Ralf Tellermann, Benjamin Stephan, and Mauricio Vargas. 2022. ‘The Internal Combustion Engine Bubble’. Hamburg, Germany: Greenpeace. https://www.greenpeace.de/publikationen/ICE-Bubble_2.pdf.
- Textile Exchange. 2023a. ‘In-Conversion to Organic Cotton: The Basics’. Textile Exchange. https://textileexchange.org/app/uploads/2023/03/In-Conversion-to-Organic-Basics-Updated-013123.pdf.
- ———. 2023b. ‘Material Pathways: Accelerating Action towards Climate+ Goals’. Textile Exchange. https://textileexchange.org/app/uploads/2023/03/Material-Pathways_March-2023.pdf.
- ———. 2023c. ‘Preferred Fibers and Materials: Definitions - Initial Guidance’. Textile Exchange. https://textileexchange.org/app/uploads/2023/02/Preferred-Fibers-and-Materials-Definitions-Guidance-Jan-2023.pdf.
- ———. n.d. ‘Preferred Fiber & Materials Matrix’. Accessed 13 November 2024. https://textileexchange.org/pfmm/.
- The Or Foundation. 2023. ‘Stop Waste Colonialism: Leveraging Extended Producer Responsibility to Catalyze a Justice-Led Circular Textiles Economy’. The Or Foundation. https://stopwastecolonialism.org/stopwastecolonialism.pdf.
- TSMC. 2023. ‘TSMC Pioneers Joint Procurement of Renewable Energy to Strengthen Suppliers’ Carbon Reduction Capabilities’. *TSMC ESG*, 25 May 2023. https://esg.tsmc.com/en/update/greenManufacturing/caseStudy/69/index.html.
- UNEP. 2022. *Emissions Gap Emissions Gap Report 2022: The Closing Window - Climate Crisis Calls for Rapid Transformation of Societies*. Nairobi. https://www.unep.org/emissions-gap-report-2022.
- UNFCCC. 2021a. ‘Race To Zero Campaign’. https://unfccc.int/climate-action/race-to-zero-campaign.
- ———. 2021b. ‘Upgrading Our Systems Together: A Global Challenge to Accelerate Sector Breakthroughs for COP26 – and Beyond’. UNFCCC Climate Champions. https://racetozero.unfccc.int/wp-content/uploads/2021/09/2030-breakthroughs-upgrading-our-systems-together.pdf.
- ———. 2023. ‘Fashion Industry Charter for Climate Action: Aggregate Report of the Transition Plans’. UNFCCC. https://unfccc.int/sites/default/files/resource/FICCA_Aggregate_Rep_2023.pdf#page=16.
- Unilever. 2024. ‘Climate Transition Plan (2024 Update)’. Unilever PLC. https://www.unilever.com/files/92ui5egz/production/2a44a1a76f4899f09a2d745ccdd86d0b65185eb5.pdf.
- Value Change Initiative. 2024. ‘Achieving Net Zero Through Value Chain Mitigation Interventions’.
- Victoria Gill. 2019. ‘Millions of Old Gadgets “Stockpiled in Drawers”’. *BBC*, 21 August 2019. https://www.bbc.com/news/science-environment-49409055.
- Volvo Cars. 2024. ‘Volvo Cars Adjusts Electrification Ambitions, Remains Committed to Fully Electric Future’. 2024. https://www.media.volvocars.com/global/en-gb/media/pressreleases/333213/volvo-cars-adjusts-electrification-ambitions-remains-committed-to-fully-electric-future.
- Vries, Wim de, Paul Römkens, Hans Kros, Jan Cees Voogd, and Lena Schulte-Uebbing. 2022. ‘Impacts of Nutrients and Heavy Metals in European Agriculture: Current and Critical Inputs in Relation to Air, Soil and Water Quality’. ETC-DI.
- WBA. 2022. ‘Automotive - Methodology [Status: 11.10.2022]’. World Benchmarking Alliance; CDP; French Environment and Energy Management Agency (ADAME). https://www.worldbenchmarkingalliance.org/publication/automotive/methodology/.
- WEF. 2020. ‘Forging Ahead: A Materials Roadmap for the Zero-Carbon Car’. World Economic Forum (WEF); McKinsey & Company. http://www3.weforum.org/docs/WEF_Forging_Ahead_2020.pdf.
- Willett, Walter, Johan Rockström, Brent Loken, Marco Springmann, Tim Lang, Sonja Vermeulen, Tara Garnett, *et al.* 2019. ‘Food in the Anthropocene: The EAT-Lancet Commission on Healthy Diets from Sustainable Food Systems’. *The Lancet Commission* 393 (10170): 447–92. https://doi.org/10.1016/S0140-6736(18)31788-4.
- WRAP, and IGD. 2023. ‘Retail: Actions to Support Delivery of the UK Food and Waste Reduction Roadmap’. https://www.wrap.ngo/sites/default/files/2023-02/WRAP-Food-Waste-Reduction-Roadmap-Quickstart-Guide-Retail.pdf.
- Xu, Qingyu, Wilson Ricks, Aneesha Manocha, Neha Patankar, and Jesse D. Jenkins. 2023. ‘Working Paper: System-Level Impacts of Voluntary Carbon-Free Electricity Procurement Strategies’. https://zenodo.org/record/8325964.
- Zhang, Xin, Eric A. Davidson, Denise L. Mauzerall, Timothy D. Searchinger, Patrice Dumas, and Ye Shen. 2015. ‘Managing Nitrogen for Sustainable Development’. *Nature* 528 (7580): 51–59. https://doi.org/10.1038/nature15743.

NEWCLIMATE INSTITUTE

NEWCLIMATE – INSTITUTE FOR CLIMATE POLICY AND GLOBAL SUSTAINABILITY gGmbH

**Cologne Office**
Waidmarkt 11a
50676 Cologne, Germany

**Berlin Office**
Schönhauser Allee 10-11
10119 Berlin, Germany

**Phone:** +49 221 999 83 300
**Email:** info@newclimate.org
**Website:** www.newclimate.org