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"Net-Zero" Debunked

A field guide for Board and C-suite executives to respond effectively to the climate emergency

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Authors
Victor Caritte (Deloitte), Alfred Cummins (Deloitte), Antoine Gonthier (Earth on Board), Olivier Jan (Deloitte), Philippe Joubert (Earth on Board), Julien Paulou (Deloitte), Joel Neave (Deloitte), Heloïse Tschora (Deloitte). Design and infographics by: Guylaine Defail (Deloitte), Elodie Fyda (Deloitte), Yves Levezier (Deloitte)

Correspondence
For further information, please contact Olivier Jan, Partner Deloitte Sustainability at ojan@deloitte.fr or Earth on Board at contact@earthonboard.org

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Foreword

The time for negotiations is behind us. From 1992 (one could contend earlier), with the creation of the UNFCCC and the first COPs, the primary issue was what needed to be done. In the next two decades, with successive IPCC reports, scientific consensus grew ever clearer: profound societal changes were needed if humankind wanted to avoid the ever clearer, ever greater and closer, threat of climate change. Such clarity came in the form of a politically agreed global warming limit beyond which the risks were too high that ecological balances would be disrupted, weakening and perhaps destroying our current socio-economic system. At COP21 in 2015, the historic Paris agreement was reached to hold *the increase in the global average temperature to well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5°C*, recognising that this would significantly reduce the risks and impacts of climate change. States have committed to limiting global warming and set their respective courses through nationally determined contributions (NDCs). And yet, emissions on the whole have continued to increase.

2020 has been an unusual year. With Covid-19 lockdown measures pausing the global economy, and particularly transport, emissions are estimated to have dropped by 6 to 8% compared to 2019. To stay on a trajectory compatible with the Paris Agreement's +1.5°C target, emissions should decrease at the same rate year-on-year until 2030[1]. This is the magnitude of change we are committed to.

In the last 12 months, more have set or are committed to achieving Net-Zero emissions. This acceleration may be the long-awaited shift to finally addressing climate change boldly. Current state pledges, if respected, may still lead to global warming of between +2.9°C and +3.4°C[2]. November 2021's COP26 will be a milestone moment to measure progress in relation to the Paris Agreement. If pledges cannot align with the objectives agreed upon in Paris, the credibility of the non-binding, self-defined NDCs and the overall UNFCCC mechanism of negociations will be significantly undermined.

Now is the time for both long-term planning and immediate action for companies. 2050 is the horizon by which global climate neutrality must be reached. Thirty years is, for some sectors, beyond the time frame of their established strategies. For others, it is the near future: merely one or two investment cycles away before their activities and business model must be ready for a Net-Zero world. For many sectors, this transformation will be radical. Long-term planning is critical to limit economic and social costs. Also, without significant emission reduction efforts, the window of opportunity to stay within a +1.5°C trajectory will have closed around 2030. Swift, short-term action is of the essence and it must go hand in hand with long-term planning.

However, this journey needs to be one of humility and collaboration. We must develop solutions by working together with our clients, suppliers, partners, and employees, harnessing collective intelligence for technological and non-technological innovation, working to improve and adapt to enhance our resilience to build this new world. We believe that new partnerships are essential.

While we don't have all the answers, we certainly have some ideas. When reflecting on the most relevant questions businesses should ask themselves when addressing Net-Zero, four questions and observations emerged:

1) As climate neutrality is a concept scientifically defined at a global level, how is Net-Zero defined at the company level?
2) What is the role of business in helping to build a Net-Zero economy? And in this role, what makes an ambitious contribution to climate neutrality?
3) There are general principles to be followed to establish relevant climate neutrality strategies, but there are no general formulas or roadmaps to be applied; each company's meaningful contribution must be tailor-made.
4) Net-Zero goals are an important step consistent with the evolution of the role of the company within society as more stakeholder-oriented and purpose-driven. It is a logical consequence of a company's willingness to respect the interests of society at large.

We have written this guide to provide our answers to these questions and to take another step beyond the prevalent limitations C-suite and Boards face in tackling climate change. We hope these answers will allow you and your company to grasp the Net-Zero concept more firmly and to define more ambitious, impactful, transformative and value-generating climate strategies. Achieving global climate neutrality is complex, and this report is one more step in its understanding and actual implementation. Both our organisations would be very keen to exchange with your company and boards on these aspects.

Olivier Jan
Partner, Deloitte

Philippe Joubert
Founder and CEO, Earth on Board

Executive summary

Executive summary

Global alignment to Net-Zero greenhouse gases (GHG) emissions is imperative. Climate change science cannot be clearer: environmental conditions in a world with a global warming beyond +2°C would seriously reduce our living standards. Radical change is needed to meet the more ambitious +1.5°C that many governments are aiming for. Governments, companies, and individuals face the choice of preparing and building a Net-Zero world or facing the increasingly significant consequences of climate change. Neither is easy, but the economic cost of the former is disproportionate.

Radical change is needed to meet the more ambitious +1.5°C that many governments are aiming for.

Net-Zero is flourishing for companies striving for leadership.

Our research shows a great increase in companies' announcements of Net-Zero objectives over various time horizons, recognising their responsibility and showing positivity about the role they can play to accomplish the goals of the Paris Agreement. Looking into the details of these announcements, we acknowledge that **the concept is not yet stabilised**, with corporations differing in their scopes, time horizons, transformative pathways and emission reduction efforts, thus showing that this apparently simple concept drives a lot of questions and implications.

Net-Zero debunked.

The concept was first scientifically defined at the global level and calls for a global transformation of our economies. **However, it has no scientific reality at the company level.** Companies are confronted with the following issues: they don't know at which scale to apply the Net-Zero formula, nor to what extent they can rely on compensation for their efforts. This situation has negative consequences: corporate announcements of their goals lack clarity or are even misleading. They don't accurately portray how companies may be best suited to a Net-Zero global economy, which is the question that really matters for the company. It is also possible that these claims do not maximise climate action and certainly do not answer climate urgency.

Companies need to look beyond Net-Zero to the climate-change horizon.

The economic and social environment upon which they depend will change radically. Understanding the implications of climate change and what a Net-Zero world means for the existence of your sector and company is the only starting point. **Compensating the emissions of a business's activities and ecosystem is a laudable residual action but can in no way justify deterring or deferring bold contributions to the collective global Net-Zero journey.** An ambitious climate strategy is possible when the company is preparing, across its value chain and stakeholders, for a Net-Zero world, has taken full stock of what this means, and has assessed which activities in its portfolio must be expanded, ceased or transformed.

We help businesses to think about their climate strategies.

We propose a conceptual framework that will be broken down between a practical summary for Boards written by Earth on Board and an operational checklist illustrated by Deloitte with existing best practices. We hope that this tailored field guide will help clarify what Net-Zero is and help your business to capture opportunities and thrive in a Net-Zero world.

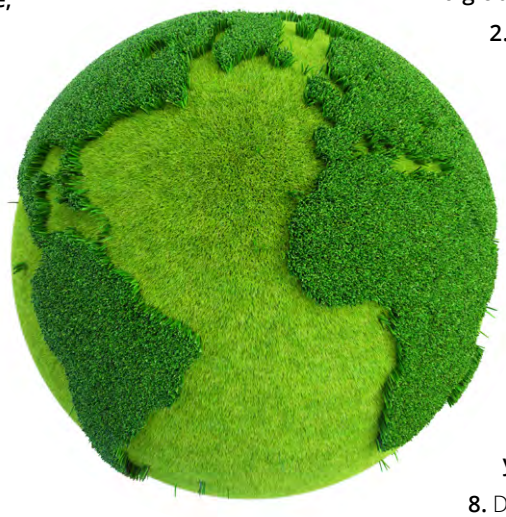
Key recommendations for Boards

Boards' main priority should be ensuring their companies' purpose are fit for the 21st century and responding to societies' biggest challenges. Our recommendations are as follows:

- **Understand the urgency of climate change;** what it means both at the global level and for the company.
- **Review your company's purpose;** to align it with the goal of climate neutrality at the global level.
- Require executives to conduct an **analysis of current activities** and products/services sold, and design a complete portfolio of activities fit for a Net-Zero world.
- Ensure **your company collaborates with all stakeholders** to develop activities consistent with a global Net-Zero economy with a holistic approach.
- Check that your Net-Zero plans achieve **measurable and meaningful emissions reductions** in your value chain, **are timebound and with intermediate targets regularly checked.**
- As guardians of the **long-term reputation** of the company, make sure your reduction actions are scientifically sustained and your claimed sequestered carbon **is reliable and permanent.**

Key recommendations for C-suites

Our society will undergo deep transformations in a +1.5°C world. To ensure businesses can align with and facilitate these transitions, we have compiled the following checklist:



1. Is your climate strategy **compatible with delivering a global climate neutral economy by 2050?**
2. Is your **strategy applied on a relevant scope?**
3. Is your strategy delivering **absolute GHG reduction** without offsetting?
4. Did you craft a **credible roadmap** to achieve this target?
5. Does it include **milestones and intermediate targets?**
6. Do you **avoid referring to operations as "neutral"** because of the purchase of carbon credits?
7. Is the c**limate strategy at the core of your business?**
8. Did you define a **global Net-Zero compatible purpose?**
9. Are your **staff trained on climate change?**
10. Are your **R&D efforts** aligned with your strategy?
11. Did you align your **marketing and lobbying practices?**
12. Are your employees (management & staff) **incentivised to reach your targets?**
13. Did you implement an **internal price on carbon?**

Net-Zero commitments are increasingly scrutinised by the media, investors, peers and civil society. **We insist that honesty and fairness are necessary to avoid a backlash.**

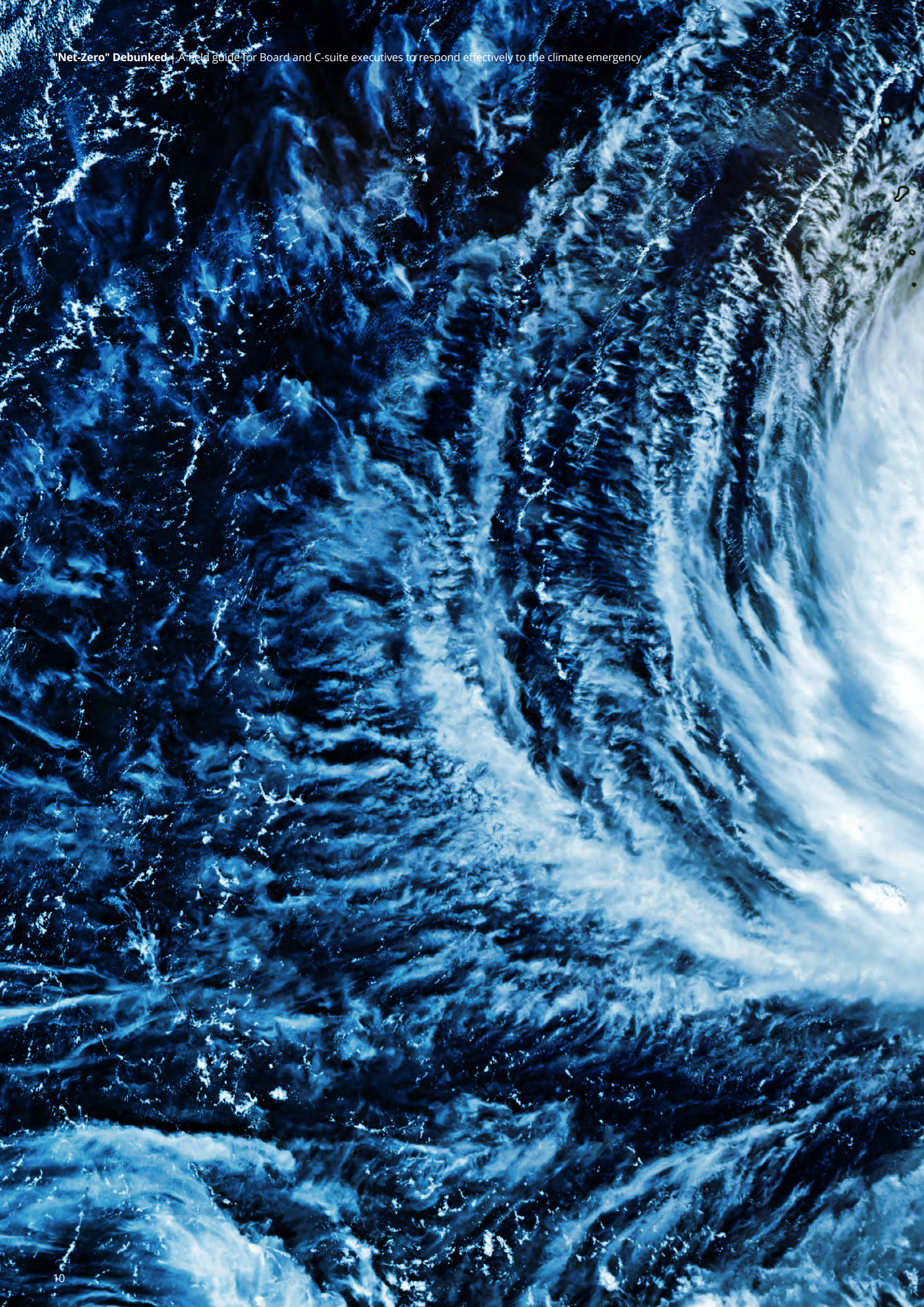
Ambition is another keyword that should be rooted in all Net-Zero strategies. Our world will have to undergo deep and rapid transformations if we are to reach global neutrality in 2050. This calls for a drastic reduction of emissions – by a factor of 5.5 in less than 30 years[3]– and for abrupt changes in business models.

After all sectors have decarbonised at maximum, the remaining emissions will need to be absorbed by carbon sinks. **How access to this limited resource will be allocated is a matter of political choice. A choice based on the capacity of sectors to provide critical economic and social value and not only on their climate impacts.**

Net-Zero targets should never be auto-centred and static, but always embedded into meaningful and ambitious climate strategies consistent with climate neutrality at a global level. While we do not wish to undermine Net-Zero either as a concept or as an objective, we consider it is not the right horizon for an independent action for companies. **Companies must start planning for how they will operate in a Net-Zero world and how they may contribute to building this world in the best way they can**.

A note on vocabulary

Currently, companies use a variety of terms to qualify their climate strategies' overarching objective, such as carbon neutrality, Net-Zero CO_2 emissions, Net-Zero emissions, climate neutrality, carbon negative, climate positive... sometimes used interchangeably and sometimes presented with different meanings by actors. Throughout this document, the authors use the notions of "**climate neutrality**" and "**Net-Zero**" interchangeably to mean a global balance between anthropogenic GHG emissions and captured and sequestered GHG emissions.



Climate action is not negotiable

Climate action is not negotiable

A sense that tackling climate change is an emergency is building across society. Signals from stakeholders are placing growing pressure on businesses to change. Ambitious business climate action is no longer a choice.

We are heading to +1.5°C before the middle of this century and will significantly exceed this by the end of the century.

Leading global experts unanimously stress the urgency of the fight against climate change...

The **scientific community** is increasingly alarmed, as the worst predictions are currently materialising. The IPCC latest contribution to the Sixth Assessment Report (AR6) released in August 2021 points out that mean global temperatures have already risen by 1.1°C compared to pre-industrial levels. It also states that, on our current emissions trajectory, in all likelihood we will have overshot the carbon budget associated with a +1.5°C scenario within the next 20 years. We are heading to +1.5°C before the middle of this century and will significantly exceed this by the end of the century. This is particularly concerning as climate models predict important increases in the frequency and intensity of extreme weather events such as heavy precipitation, large storms, heat waves and sustained drought as global mean temperatures continue to rise. In a world where global warming has increased beyond +2°C, this could have severe impacts on human activities and lead to the destruction of entire ecosystems (sea ice, coral reefs...). The IPCC points out that a temperature rise of +2°C will tremendously increase damaging impacts than a rise of +1.5°C. As stated by the UNFCCC Secretary General *"A half of degree of warming makes a world of difference"* [4]. Urgent and radical decarbonisation is needed to limit temperature rise. Urgent and radical decarbonisation is needed to limit temperature rise.

...and compounded drivers mean the case for climate action has never been clearer nor more pressing.

- **Political statements and commitments are multiplying but so far are insufficient.** Under the Paris Agreement, signatory countries agreed to keep global warming this century to well below 2°C and to pursue efforts to limit it to 1.5°C. The Agreement aims to achieve *"a balance between anthropogenic emissions by sources and removals by sinks of greenhouse gases in the second half of this century"*, which is sometimes referred to as "Net-Zero emissions", "carbon neutrality" or "climate neutrality" (UNFCCC). However, to date, countries have endorsed national reduction targets and developed Nationally Determined Contributions (NDCs) that fall far short of the 2°C target.

- **Regulatory climate measures and legal cases will inevitably strengthen in the next decade.** Climate-related law is being established at all levels, from international treaties to local legislation. A strong example of such policy responses is the European Union's commitment to reach climate neutrality by 2050 under the first continental-scale program: the European Green Deal[5]. Beyond governmental policy making, citizens and NGOs are resorting to the judicial system, whether against states because their climate objectives are insufficiently ambitious or not implemented (Netherlands[6]), but also against companies (e.g. seeking compensation for climate change damages linked to past emissions)[7].

* According to the IPCC's AR6 report, staying below a +1.5-degree global warming with a 67% probability corresponds to a budget of 400 GtCO2 or 10 years of current emissions. If the probability is reduced to 50%, the global carbon budget is met within 14 years if current emission trends continue.

- **Economic drivers** to decarbonise are gaining importance as there is a growing number of policies to factor-in environmental externalities into business activities. For example, as of 1 January 2022, financial market participants in the EU will be required to disclose the alignment of their products with the EU Taxonomy in relation to the climate objectives[8]. Increasingly, companies already include a carbon price in their investment decisions and research activities. With carbon prices set to rise under all +1.5°C and +2°C scenarios[9], reducing the company's carbon intensity is a sound economic decision when factoring in the global increase of carbon prices.

- **Pressure to mitigate GHG emissions will cascade across the value chain** as companies increasingly include upstream and downstream emissions in their climate commitments. For example, a car manufacturer company aiming to be Net-Zero must ensure that the raw and semi-finished materials used as inputs are also Net-Zero and from the other side is under pressure from companies asking for their fleet of vehicles to be Net-Zero to achieve their own Net-Zero commitment.

- **Employees' expectations that their company plays its part are growing.** According to the Deloitte study *Feeling the Heat* [10], companies report pressure from clients and customers, but also from employees, regulators, civil society and investors. For instance, the *French Student Manifesto for Climate* brought together 30,000 students pledging that they will pursue their social and environmental ambitions in their professional pursuits. This organisation is also publishing companies' answers to climate questionnaires to help job applicants integrate climate criteria in their search for employment[11].

The consequences of climate change, including an increased frequency of extreme weather events affecting food security and biodiversity, are being felt.

- **The political and financial sector will also react to grassroots pressure from civil society.** Public awareness can only increase as the effects of climate change become apparent. Pressure from environmental NGOs, corporate actors through campaigns, legal action, etc., will inevitably grow.

- **The financial community's interest in and action on this issue is accelerating as it seeks to understand and reduce climate-related financial risks** and to respond to regulators' increasing scrutiny. Two initiatives illustrate this momentum. This first is the Taskforce on Climate-related Financial Disclosure (TCFD) that developed a framework for consistent climate-related financial risk disclosure. Over 1000 companies are supporting the initiative and disclosing how they address climate risks in their businesses. The second is the Climate Action 100+ investor initiative[12], which calls for the world's largest corporate greenhouse gas emitters to take action on climate change, signed by more than 450 investors with more than USD $40 trillion in assets under management.

- Finally, the most important "stakeholder" may well be **Nature itself, particularly when it reminds us that our societies and economies depend on ecosystems and on a stable, predictable environment. Both are currently disintegrating.** We are already living in a +1°C world[13]. The consequences of climate change, including an increased frequency of extreme weather events affecting food security and biodiversity, are being felt. This puts tremendous pressure on various economic actors and fuels activism throughout society. Because of inertia in the global climate system, we know that increasing weather events will impact our society regardless of the action we undertake immediately. Attribution Science*, focused on better understanding extreme weather events, is making the links with climate change increasingly clear and pointing more readily than before to the responsibility of carbon-intensive companies.

The risk and opportunity landscape is changing rapidly...

The impacts of climate change **will not be linear**, and it is very likely that society's response will not be linear either. Stakeholder reactions and expectations (from businesses, governments, civil society, investors, consumers, NGOs) are likely to grow exponentially and feed into one other, thus increasing the need for economic activities to enhance the pace of their decarbonisation (cf. Figure 1, below). In the meantime, we see an acceleration in corporate commitments through more and more structured initiatives. **The mechanism whereby several actors mutually strengthen their climate ambitions (and actions)** has been called the ***Ambition Loop*** by the UNGC, WRI and We Mean Business organisations and has inspired the broader illustration of interaction between stakeholders shown on the next page.

...and this will inevitably transform business.

These external forces build pressure on economic activities and ultimately transform business. This **transition** requires a reconceptualisation of the operational structure of the current economic system. Such changes will deeply affect lifestyles and societies and represent a **critical challenge for businesses: they will create winners and losers**.

Pressure is placed on **large companies** via the financial and organisational resources required to transform their value chains, and those **sectors responsible (or perceived as responsible) for the major share of emissions.** To summarise, companies in sectors that have a significant climate impact and have the capacity to mitigate this impact will be seen as holding **the greatest obligation.**

* A relatively new field of research largely used in climate studies. It seeks to test whether – and by how much – climate change may be responsible for certain extreme weather events, such as droughts, extreme flooding, hurricanes, excessive heat or unusual storm trajectories.

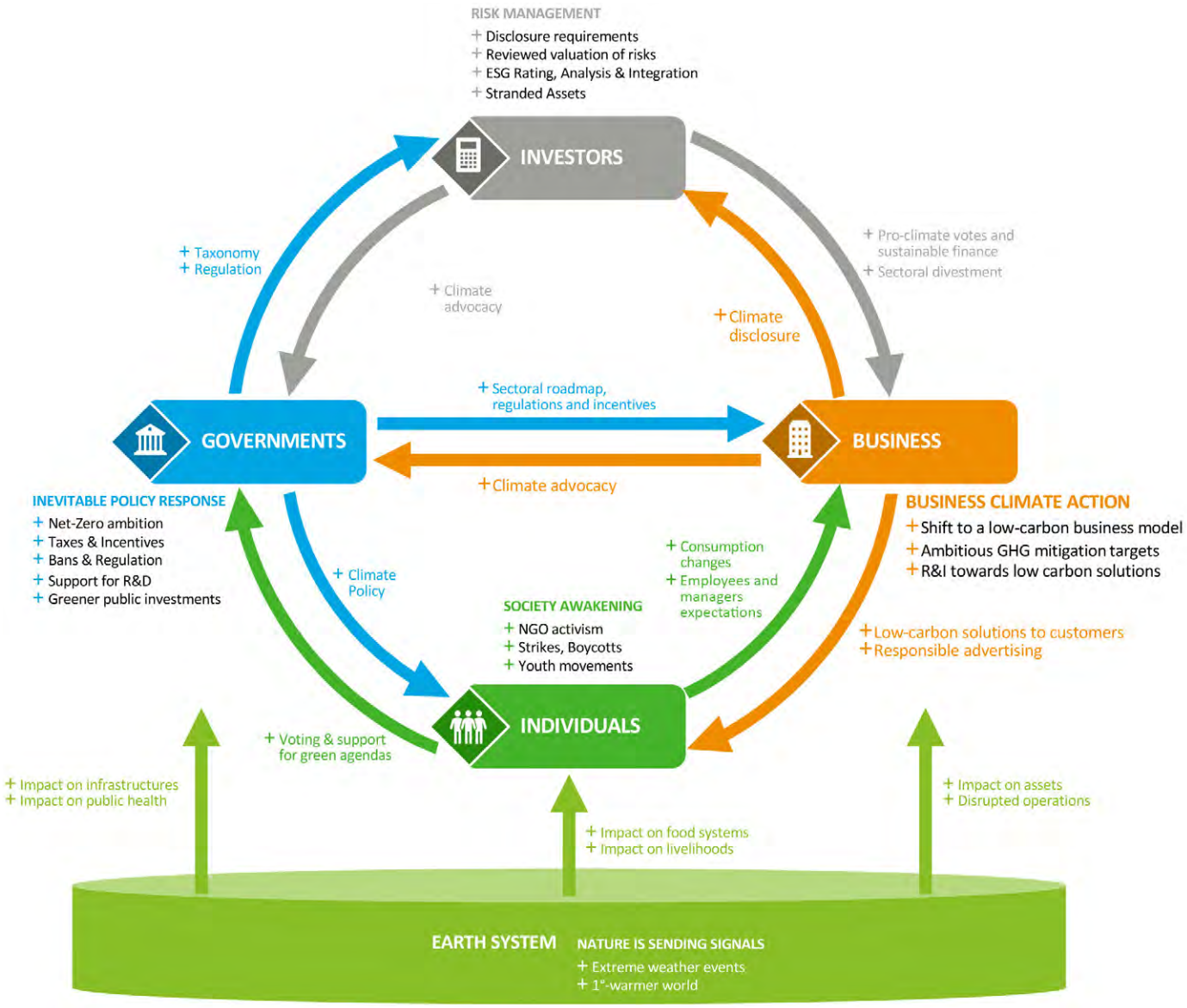


Figure 1: How external forces are driving business transformation to a low carbon future and how business can accelerate this inevitable transformation. Figure by Deloitte and EoB, inspired by the Ambition Loop concept.

Companies cannot adopt a conservative, business-as-usual approach, believing they will have time to adapt:
to make the most of present opportunities, and even to stay in business, they need to take proactive steps now.

In the next section: to respond to these pressures and demonstrate their climate leadership, many actors have chosen Net-Zero carbon announcements. Easy to communicate and to grasp, this goal is increasingly adopted by public and private actors alike. However, it also fuels discussion since although it is seemingly simple, the concept masks different realities.

Net-Zero is flourishing for companies striving for leadership

Net-Zero is flourishing in companies striving for leadership

Over a few years, the corporate discussion has shifted from "Do you have a climate strategy?" to "Do you have a Net-Zero target?"

Although climate neutrality claims and commitments are not new, the last 24 months have seen an increased rate of zero-emission pledges from both States and companies. Following the United Nations Secretary General's Climate Action Summit in September 2019, over 77 countries and States pledged to reach Net-Zero emissions by 2050[14]. **The States that have formally committed to Net-Zero emission represent 68% of the world's GDP[14b].** The European Union has the ambition to be the first major economic power to set a legally binding climate neutrality target[15].

In the private sector, the trend is just as noticeable. In January 2020, at the World Economic Forum, participants were asked to set Net-Zero targets for their companies. Our research reveals that, the total value controlled by companies currently *claiming to have achieved* or *have set* a Net-Zero target is at least **USD 10,7 trillion – 13% of the world's GDP.** The figure below represents the horizon these companies have set their Net-Zero objective, the year the claim was published and the size of the company revenue:

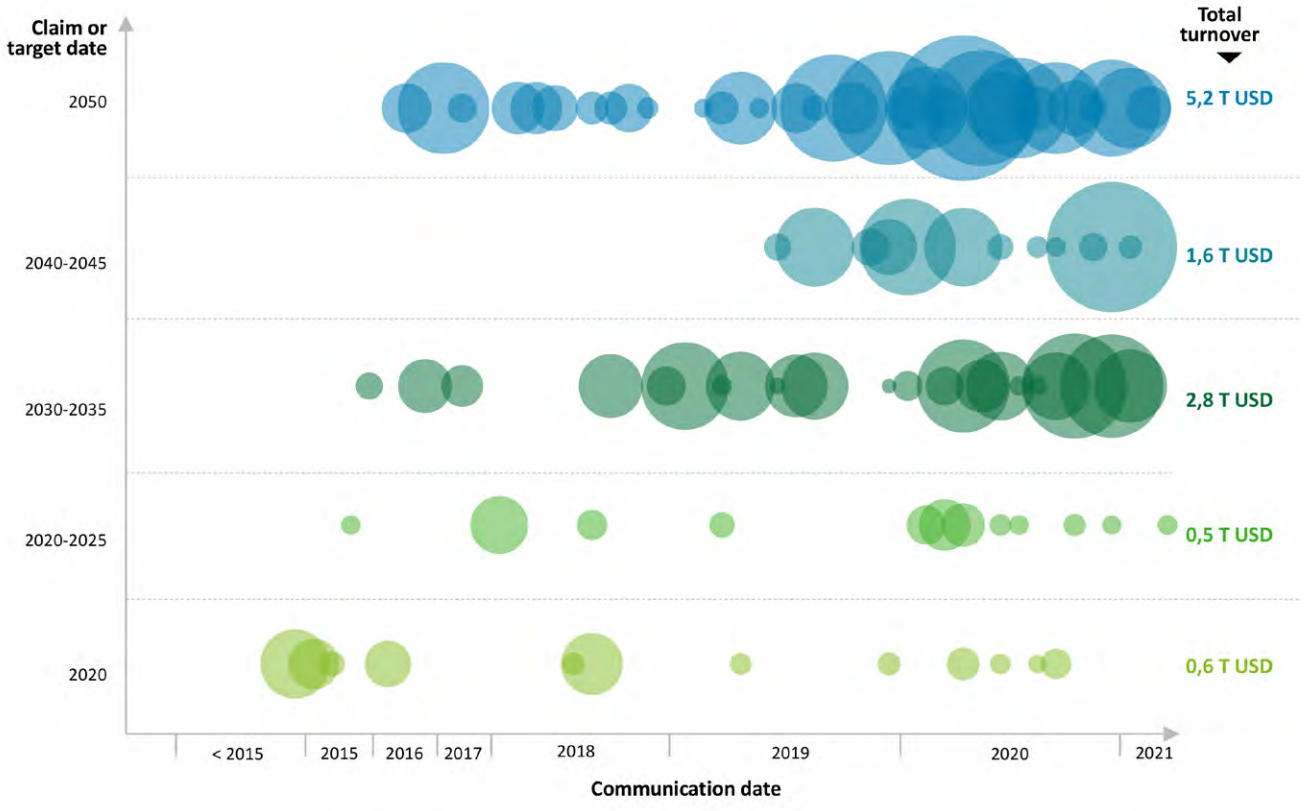


Figure 2: Value of companies committed to climate change over time (not exhaustive).

The date corresponds to the year when the company declared its Net-Zero commitment. The bubble size is proportional to company turnover. Data from ECIU – Net-Zero Tracker completed with Deloitte analysis: 419 companies in the entire dataset, 214 used for the computation and visualisation. Only announcements of the first trimester of 2021 have been included for year 2021.

This graphic confirms the acceleration of Net-Zero pledges and the rapidly growing corporate interest in the Net-Zero concept over the past two years. The concept is indeed easy to communicate, and has made its way up to the executive committees of many companies. It has undoubtedly led to positive emulation among stakeholders. **However, not all climate neutrality declarations are equal.**

Different time horizons

Commitments/pledges to a long-term Net-Zero target versus **claims** that the Net-Zero objective has been met by short-term targets that rely heavily on offsetting are very different (explained in the following chapter: *Net-Zero Debunked*). While an initial commitment to reach Net-Zero in the long term is commendable, it is not necessarily ambitious. Time horizons vary, but many recent commitments set their target for 2050. According to the IPCC, to limit global warming to 1.5°C this century, the world should reach Net-Zero by around 2050. Companies setting their climate neutrality sights on 2030 or 2040 may well show climate leadership, as long as their scope of activities is relevant and their reliance on offsetting is limited.

Different scopes

Most corporate actors wish to be climate-neutrality at the company level. Some limit their climate-neutral ambition to the goods and services they provide. For example, Air France has claimed it will achieve carbon neutrality for its domestic flights by 2020. Barclays is aiming for all of the activities it finances to be climate-neutral by 2050. Assessing the ambition of a company's claims must also take account of what it covers: its own operations (Scopes 1 and 2) and the activities within its entire value chain (Scope 3 activities, both upstream and downstream). Particular attention should be paid to what a company includes within its Scope 3 that may vary from one company to another.

Different transformation pathways

Even with the same goals, companies with a clear, milestoned, transformative roadmap demonstrate their commitment and leadership by moving from intention towards implementation. **While all may have set the destination, only a portion have chartered their course.**

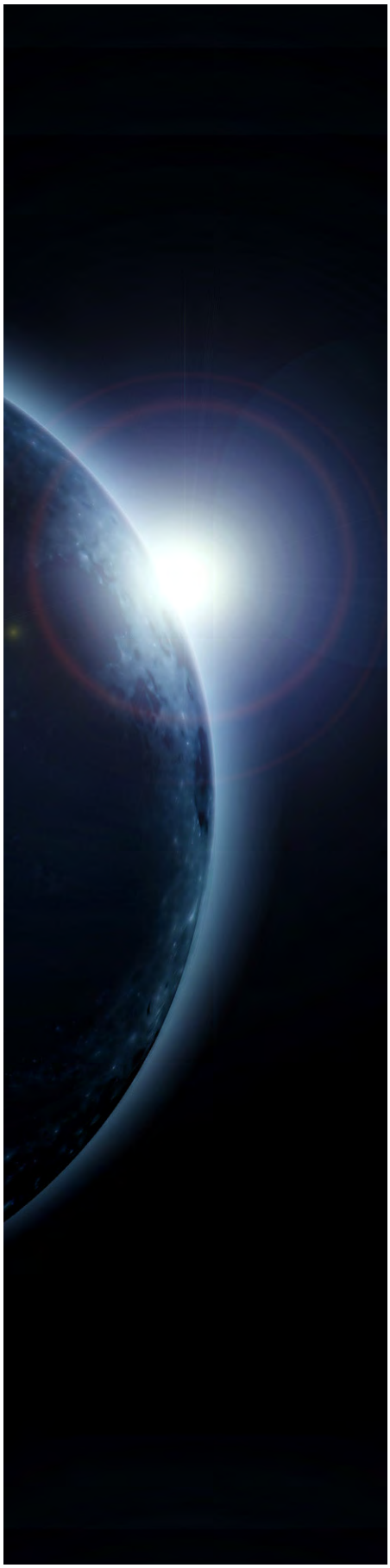
Roadmaps to carbon neutrality are diverse. They vary depending on the sector and the company's individual activities. Even for a particular company, there are many strategies to reach this end. For instance, agri-food companies may want to take over the carbon element within their value chain by improving carbon uptake on farmland. Oil and gas companies may need to diversify their portfolios and close non-decarbonisable assets if they are to achieve deep decarbonisation objectives. Service companies may invest in offsets or review their procurement, but industrial companies with high emissions usually choose to focus on improving their processes.

The target of climate neutrality is sometimes backed by a GHG emission reduction target. In this case, it is taken for granted that remaining emissions between the two targets will be offset. Reduction targets enable assessment of the extent to which a climate neutrality strategy relies on carbon credits.

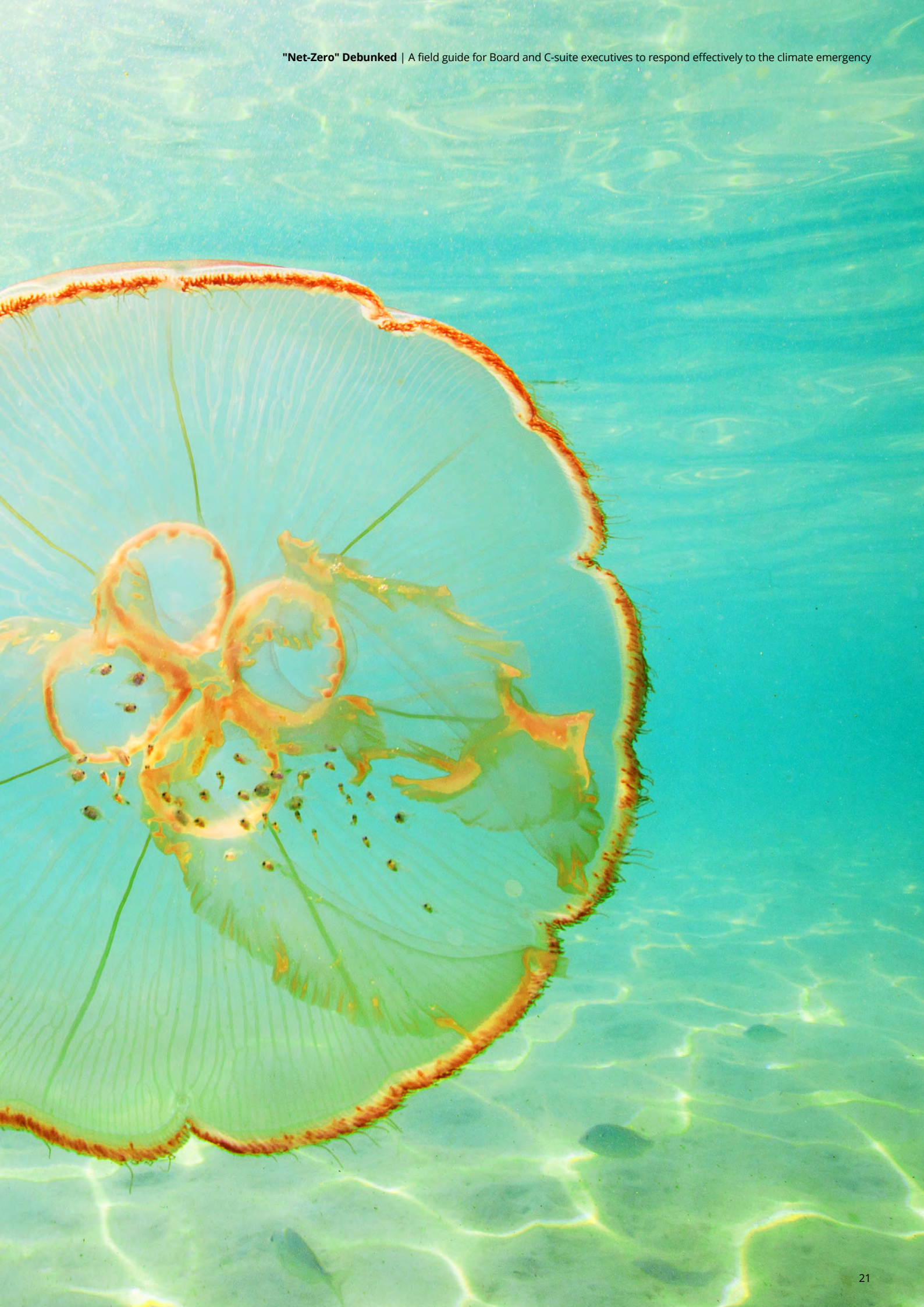
Declarations, not actions

The very positive trend shown in the figure above should be tempered with other facts. **Many players who have set a climate-neutrality objective are not currently aligned with a +1.5°C or a +2°C target.** According to Climate Action Tracker[16], the European Union's Nationally Determined Contribution set during the Paris Agreement in 2015 is one such example. Likewise, the emissions of many companies with Net-Zero emissions targets still rise year-to-year. **This leads to the first caveat to Net-Zero goals: they do not necessarily mean that the climate action undertaken is enough.**

In light of the various implication of this seemingly simple concept, claims will be put in perspective with the science behind Net-Zero in the next section.



Net-Zero debunked



Net-Zero debunked

First defined by the scientific community at the global level, what is the science behind Net-Zero?

By burning fossil fuels and releasing their carbon content into the atmosphere, humans added the lithosphere to the natural carbon cycle, creating an anthropogenic disruption of the carbon cycle.

On a global scale, according to the IPCC, *"Net-Zero emissions are achieved when anthropogenic emissions of greenhouse gases to the atmosphere are balanced by anthropogenic removals over a specified period."* The figure on the following page portrays the Net-Zero concept in terms of a simplified representation of the Earth's carbon cycle. It indicates possible levers that can be collectively used to achieve Net-Zero. A more complete description of the carbon cycle and other factors influencing the climate can be retrieved from the IPCC[17].

During the Holocene Era (11,700 BC), before human influence, the natural carbon cycle involved three carbon reservoirs, or sinks: the biosphere, the ocean and the atmosphere. Each exchanged carbon through biological or geological processes. These processes balanced each other out so that the CO_2 concentration in the atmosphere was relatively stable, between 260 and 280 ppm, for the last 11,000 years. Carbon's fourth reservoir, the ground (or lithosphere) was not involved in the carbon cycle on a human timescale. Indeed, the exchange fluxes between geological carbon stocks (fossil fuels, rocks, sediments) and the other three reservoirs are very slow. It takes a million years for petroleum to be derived from fossilised organic matter. Therefore, prior to the Industrial Revolution, the lithosphere was disconnected from the carbon cycle.

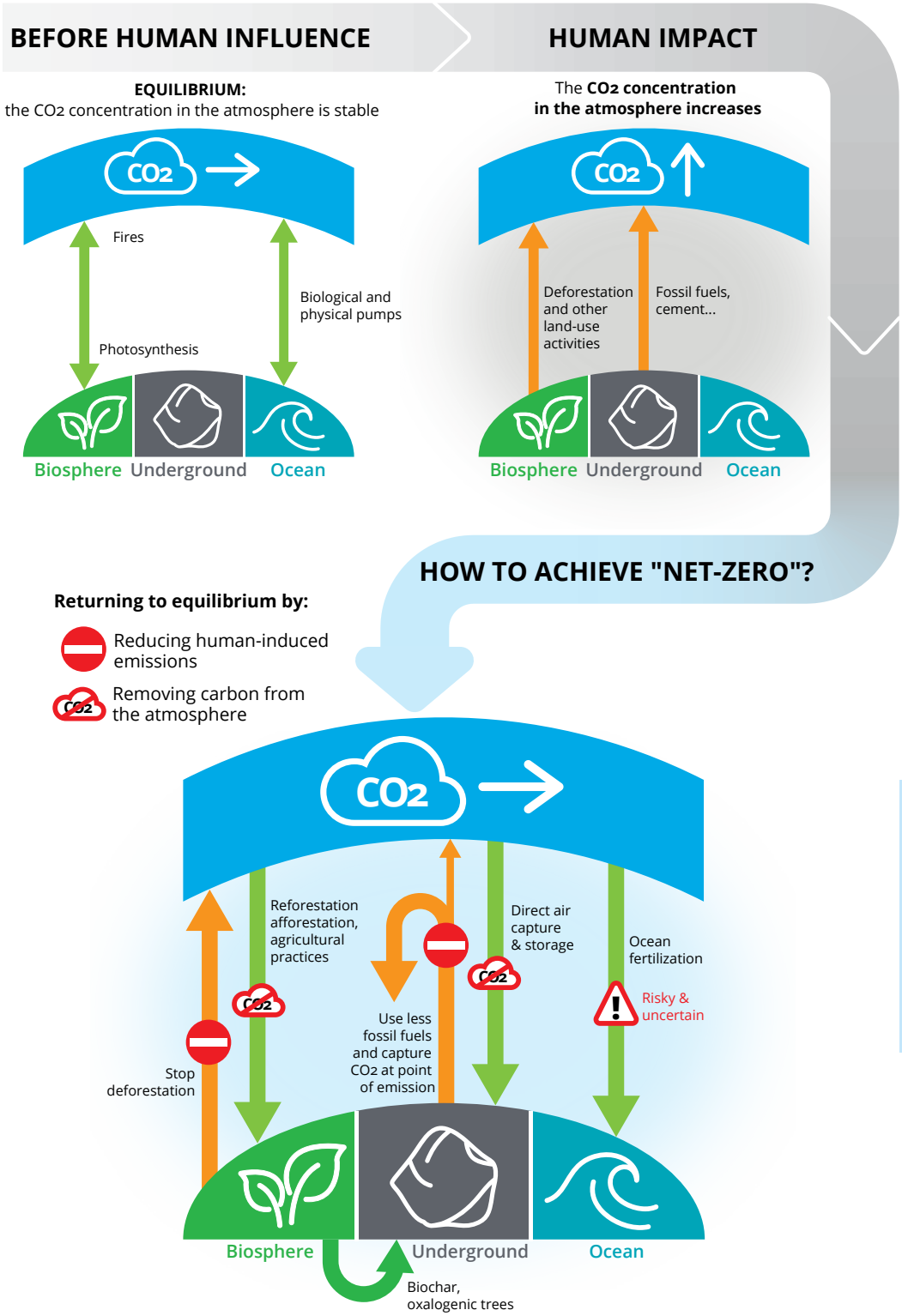
Anthropogenic land-use change can be dated back to **early agriculture (9,500 BC).** Human activity decreased the biosphere carbon stocks by deforestation and other forms of land disturbance, with no noticeable impact on global climate.

Human influence on climate systems became major with the first **industrial revolution.** By burning fossil fuels and releasing their carbon content into the atmosphere, humans added the lithosphere to the natural carbon cycle, creating an *anthropogenic disruption of the carbon cycle*. CO_2 molecules don't react spontaneously with other molecules in the atmosphere, so they persist. Therefore, CO_2 concentration in the atmosphere is rising proportionally to **cumulative emissions not absorbed by oceans and the biosphere**, increasing the magnitude of the greenhouse effect and thus leading to global warming and climate change. Currently, the level of CO_2 in the atmosphere is above 410 ppm, more than a 40% increase compared with pre-industrial levels.

To mitigate climate change, the CO_2 concentration in the atmosphere must be stabilised. Netting out CO_2 emissions is possible thanks to two paths of action: either **reducing the emissions** from the ground and biosphere ( ), **or enhancing carbon uptake** in the ocean, biosphere and in the ground ( ). As a result, a new point of attainable equilibrium (around 450 ppm, to limit global warming to below +2°C with a high degree of confidence[18]) has been put forward.

According to the IPCC SR15 report, global net GHG emissions need to reach zero by around 2050 to meet the +1.5°C target*. This target is backed by setting a midway point of cutting emissions in half by 2030 as compared to 2010 levels.

* Reasonably = have a 66% probability of meeting the temperature target according to climate models

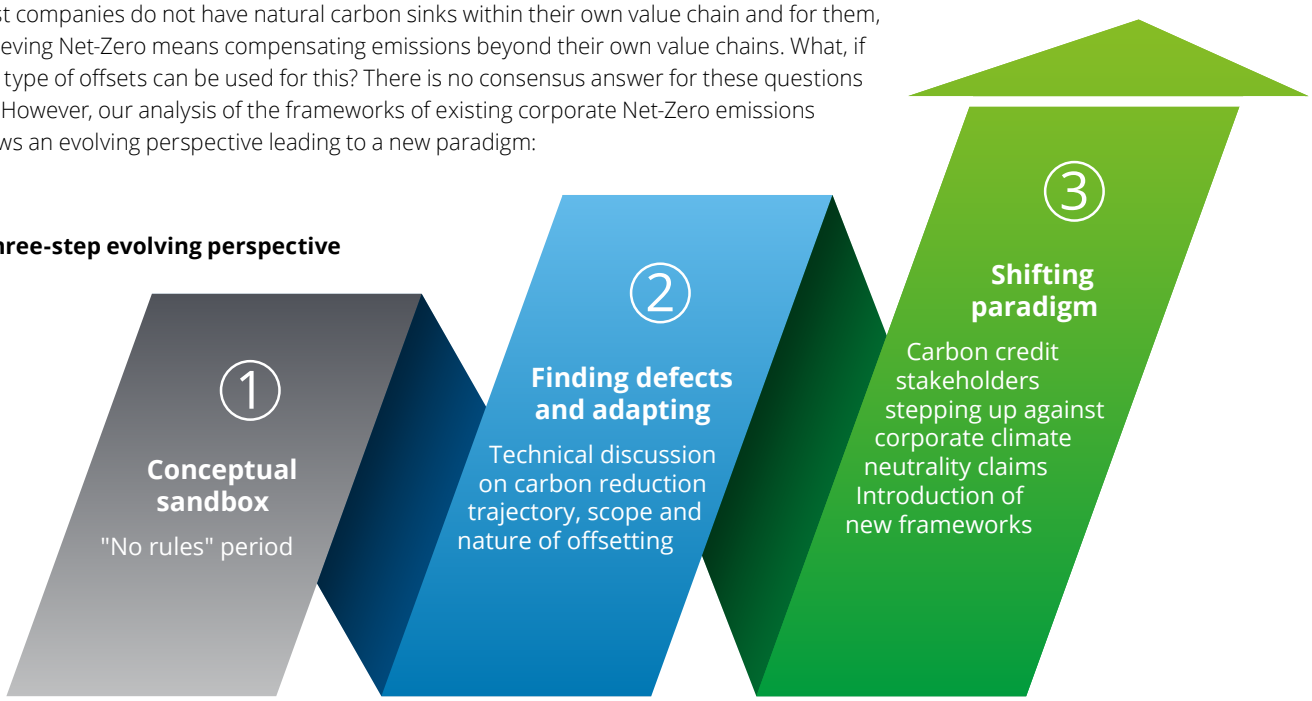


The concept of Net-Zero emissions is therefore useful and unambiguous on a planetary scale. However, can the concept be applied at the company level? What would it mean for a company to be at Net-Zero emissions from a practical point of view?

Applying the concept of Net-Zero at the company level: an evolving exercise to be closely scrutinised if credibility and transparency are to be achieved

Although Net-Zero is easily understandable at an Earth system level, whether climate neutrality is transposable to a company level is subject to debate. What greenhouse gas emission sources should be included? Should indirect emissions (such as the carbon footprint of raw materials, their extractive processes or those associated with the use of the product) be considered? Most companies do not have natural carbon sinks within their own value chain and for them, achieving Net-Zero means compensating emissions beyond their own value chains. What, if any, type of offsets can be used for this? There is no consensus answer for these questions yet. However, our analysis of the frameworks of existing corporate Net-Zero emissions shows an evolving perspective leading to a new paradigm:

A three-step evolving perspective



1) Conceptual sandbox

In the 2010s, when the "carbon neutral" concept arose, there were no rules nor definition of what it means to be carbon neutral. Companies could claim achieving climate neutrality for their products or operations **relying solely on offsetting or with very weak decarbonisation criteria.** Examples of such criteria include "contributing to Sustainable Development Goals", "following the transition to a low-carbon economy" or "implementing a Carbon Management Plan".

2) Finding defects in, and trying to adapt, the concept

One of the first actors to set up criteria for GHG emission-reduction goals within Net-Zero emission strategies was the Science-Based Target (SBT) initiative in 2019[19]. Backed by the CDP, the UN Global Compact, the WRI, the WWF and the Carbon Trust, the initiative called for a **decarbonisation in line with an SBT +1.5° trajectory** or through "highly aggressive" emissions cuts, as a preliminary to leveraging offsets to net out the remaining emissions to zero. This restriction was introduced to ensure that Net-Zero emissions targets would position companies on a path to a +1.5°C world.

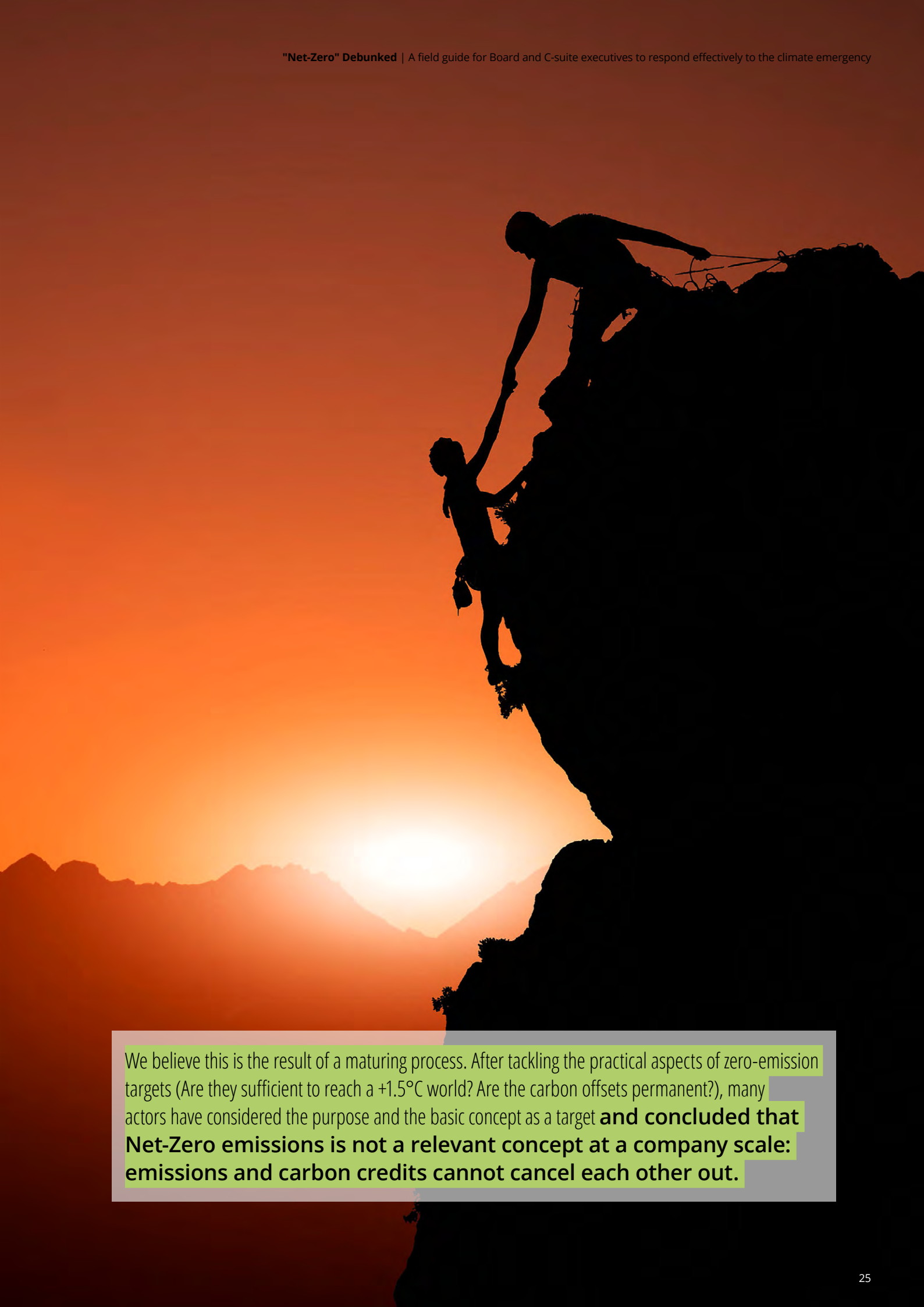
Another area of discussion was the emissions considered in the neutrality scope. For example, some oil and gas companies received numerous criticisms for not including their Scope 3 downstream emissions in their targets – such as emissions coming from the use of the petroleum products they sell.

In a position paper released in early 2020[20], BCG points out that **not all offsets are equal.** Depending on whether they are credited through avoided-emissions projects or short-term carbon sequestration projects, certain carbon offsets do not offer a reasonable guarantee that CO_2 will be permanently removed from the atmosphere. The firm Puro.earth offers companies the opportunity to offset their unavoidable emissions solely **with permanent removals such as geologically stored carbon.**

3) A shifting paradigm

In the meantime, actors began to take a stance against the very principle of achieving Net-Zero emissions, with leading certification organisations[21] and the WWF stating that using "climate neutral" to describe a company's climate impact was misleading.

In the framework published in May 2020[22], the Net-Zero Initiative contended that there is no such thing as a climate-neutral business, pinpointing the necessity for companies to **keep separate accounts of their carbon emissions and sequestration.** In March 2021, The French agency ADEME also stated that actors may only claim a **contribution to global climate neutrality**, as opposed to neutrality at the individual scale[22b].



We believe this is the result of a maturing process. After tackling the practical aspects of zero-emission targets (Are they sufficient to reach a +1.5°C world? Are the carbon offsets permanent?), many actors have considered the purpose and the basic concept as a target **and concluded that Net-Zero emissions is not a relevant concept at a company scale: emissions and carbon credits cannot cancel each other out.**

A business discussion of Net-Zero for companies

Deloitte and EoB share the view that climate neutrality, if misused, can be counterproductive at the company level. In the next section, our arguments are developed through an imagined dialogue between an employee at a company that aims to reach climate neutrality by compensating emissions and our own responses.

Company employee

My CEO is considering emission offsets to achieve climate neutrality. It is a subject of heated and sometimes polarizing debate. Could you help me to see through this?

I'm glad your CEO wants to tackle climate change and that you came to me for help. I believe offsets cannot be the cornerstone to your, or any, corporate climate strategy.

Our stance

Company employee

I know there are critics of carbon offsets. But my company would buy only top quality, verified carbon credits.

That's very good. As you know there are a lot of projects on the market that have low robustness*. You should be looking for standards to prove the additionality and durability of your investments. It's great that your company invests in these projects, but that's not enough for your company to be able to claim that it's climate neutral. This claim lacks clarity, the notion of neutrality can be misleading and it does not mean that your climate action is sufficient.

Our stance

Company employee

Lacks clarity, misleading, insufficient... These are big words! Could you elaborate?

Lack of clarity

As highlighted by the number of initiatives proposing their framework, the concept of Net-Zero emissions at the company level is imprecise. This could backfire on your company. Beyond the risk of being accused of greenwashing, the straightforward "zero" does not properly account for the decarbonisation efforts undertaken by the company. Comparison across companies is difficult if not outright impossible. Different companies may claim climate neutral or Net-Zero status while holding very different definitions of it. As regards emission scopes in particular, most actors agree that being climate neutral on their own operation alone (scope 1 and 2 emissions) is insufficient, as it does not reflect the company's responsibility for the accumulation of GHG in the atmosphere. But covering all of a company's emission (full Scope 3) remains a technically challenging issue even when companies wish to be responsible for these emissions.

Misleading

The words "neutrality", "cancelling", "offset" or "compensation" introduce a semantic bias. "Neutrality" implies that by adding a company's emissions to negative emissions or carbon offsets, it ceases to contribute to climate change. Unfortunately, this is physically not the case. Purchasing carbon credits is not equivalent to a reduction of emissions at their source, as emissions are not perfectly reversible. Even if certified projects must demonstrate their additionality as well as safeguard measures to ensure that carbon will be stored for long periods, there is no absolute guarantee that the sequestrated emission volume will indeed be stored over a long period (e.g. in cases of massive wildfires). Carbon stored in biomass or in soils is generally shorter-lived than carbon stored in the lithosphere as fossil fuels, hence they cannot be considered "equivalent". However, for the company and the public persuaded by their marketing, these emissions will appear to have been balanced out.

In addition, the capacity of natural carbon sinks is finite and well below current global GHG emissions level (see the Appendix for a full analysis)[23]. The remaining carbon would need to be captured via Direct Air Capture or other immature technologies not involving biomass.

Insufficient

If a company relies on offsetting for its claim to have achieved Net-Zero operations, such a claim says nothing about the company's ability to fit within a Net-Zero global economy – which, at the end of the day, is the only question that really matters. A company can be climate neutral even though its emissions may rise annually because of its purchase of an equally growing volume of offsets. It is a sheer contradiction to think of that a company with activities entirely misaligned with a climate neutral world can be called "climate neutral" or "Net-Zero".

* An analysis validated in March 2016 by an in-depth study on the carbon offset of the CDM of the Oko-Institut, a German environmental research institute. Of 5,655 projects studied (covering three-quarters of the total), 85% of them had a "low probability" of ensuring the promised emission reductions and the project's additionality. Only 2% of the projects – representing 7% of the credits – met the required quality criteria.

Company employee

OK, maybe the concept is not well framed for companies... but if it's driving action, don't you think we should keep encouraging these commitments?

Our stance

That's a good point: driving effective climate action is the only question that really matters. However, we have good reasons to believe that "climate neutrality" claims can actually defer the real and broader transformation needed.

Company employee

OK, so can my company be climate neutral?

Our stance

In short, it cannot on a relevant scope*. However, companies should not be dispirited. A new paradigm for corporate action and leadership is emerging. It is built around a superior standard/concept: your company's genuine contribution to the transition to a Net-Zero world.

Company employee

That is?

Our stance

Innovating and adapting to develop global activities that fit within a Net-Zero society: prioritize your financial resources, lead your employees towards radical climate action, reflect on how you could support your value chain, include customers to embrace low carbon lifestyles... and much more. It will lead your company on a purposeful and engaging journey for everyone involved in your business!

Not maximising action

We recognise that the concept is easy to communicate, has made its way up to the executive committees of many companies and has undoubtedly created a lot of positive emulation among stakeholders. However, with misleading Net-Zero claims, the pressure from external stakeholders (regulatory, consumers, etc.) on the company to implement transformational change may abate. As a consequence, such change may be delayed, itself slowing the transformation to a Net-Zero global economy while our window of opportunity to achieve the Paris Agreement objectives is closing rapidly. **Why would a company choose tough transformational change to decarbonise if carbon credits can be purchased relatively cheaply and easily?** Why would a business undertake a deep decarbonisation program if the problem is seen as already taken care of by the general public? How can employees, suppliers and customers feel empowered when they believe that the climate challenge has already been overcome? Why would I engage on a challenging decarbonisation journey in a relevant scope if my competitors are misleading the public opinion with neutrality claims on a marginal scope of their activity? Offsetting ought not to be a way to temporarily buy off stakeholder pressure by counterfeiting goodwill while overall mitigation goals are callously ignored or overlooked. In other words, only ambitious and adequate mitigation actions, not the amount of carbon credit you can buy, truly legitimate a company's social license to operate.

The phrases "climate neutrality" or "Net-Zero" refer to the **global objective** to balance emissions and absorptions. They do not apply to a company, a product or a service. As suggested by a growing number of forward looking companies[23b] , **"a business is not neutral; it can contribute to global climate neutrality"** Companies ought not to ask themselves if they are "climate neutral". They should rather think at a systemic level: to what extent is my company enabling and contributing to a climate transition at a global level? How can my company lead this transformation?

Companies should shift their focus **from individual to global targets, from compensation to contribution,** and leverage strategies having a genuine material impact. This is how they can establish true climate leadership.

For business strategy and corporate reporting, this change of paradigm has multiple ramifications. These will be presented in the next section.

* "In short, it cannot on a relevant scope", i.e. it could in some particular cases on scope 1 & 2 emissions, but that would never be sufficient given the company's responsibility for its scope 3 emissions.

A new compass for business climate leadership

Looking through the lenses of global goals rather than targeting neutrality at the company level is a tremendous accelerator to foster stakeholder engagement, enhance credibility and build meaningful business strategies.

The evolving perspective we have been seeing in recent months – and depicted in the previous chapter – leads to a shifting paradigm which can be summarised as follows:

Drafting meaningful corporate climate strategies supporting global neutrality is a challenging endeavour. We believe that the **effective execution of an ambitious decarbonisation strategy** is now a key differentiator for companies. We have therefore drafted a **dedicated checklist** (see chapter *Checklist for C-suite*) to help companies to integrate the strategy in the roadmap of each and every relevant business area. Boards have also an essential and complementary role to play to ensure their company's purpose is fit for the 21st century (see chapter *Recommendations for Boards*).

Recommendations for Boards

Earth on Board's purpose is to support Boards of Directors to fulfil their duties in aligning their company's business model with the preservation of ecosystems and the achievement of societal needs. In writing this document in collaboration with Deloitte, Earth on Board has considered the issue of climate neutrality from a Board's perspective and responsibilities and synthetised the following recommendations.

Achieving global carbon neutrality is necessary. The looming consequences of climate change are too destructive and destabilising for our modern societies to risk and to persist in accumulating carbon in the atmosphere. This fundamental need is already clearly set down and is the stated long-term goal of the 2015 Paris Agreement. The goal of climate neutrality is even in the process of being legislated in some countries (cf. Climate Action is not negotiable). **The business contribution to this overarching goal is essential and called for by society at large. Leadership is expected to drive the systemic change needed.** However, as previous chapters have demonstrated, current Net-Zero commitments at a company level are different from a company's meaningful contribution to achieving a Net-Zero emission world; and even the hypothetical achievement of these commitments will not be sufficient to lead to a climate neutral world. Two main hurdles to the concept of climate neutrality at a company's level are the definition of the scope to account for emissions and the so-called "compensation" of emissions going into the atmosphere with generally uncertain carbon offsets:

- First, a company's contribution to decarbonisation is expected on all relevant aspects of its value chain – from raw materials extraction to the products' end-life – but defining the proper reporting scope is challenging. When an employee uses a rental car to get to work, should the employer, the oil company, the car manufacturer, the automotive component manufacturer, the rental company, or the city mayor account for and deal with the related emissions? And can any of them claim to achieve climate neutrality if the production and use of this rental car is still associated with GHG emissions?

- Secondly, if actions to preserve and enhance carbon sinks are welcomed, the use of associated carbon sequestration credits to offset emissions raises serious issues. The reality of additional carbon sequestration through projects is often controversial and the permanence of sequestered carbon doubtful (particularly for forestry projects subject to fires, illegal cutting or insect infestations linked to climate change). Therefore, those offsets should be accounted for separately and not used to "cancel" or "subtract" generated emissions.

Consequently, individual claims of achievement of climate neutrality for a specific product, service or self-determined reporting scope could well be misleading as to their alignment with a Net-Zero world. They can even be counter-productive by leading consumers to think that their acquisition or usage is "neutral" – having no impact on climate change – and shouldn't be limited, while they still emit GHG emissions during their production or use.

The business contribution to this overarching goal is essential and called for by society at large. Leadership is expected to drive the systemic change needed.

The main duty of Boards of Directors is to act in the best interest of the company they serve, arbitrating between stakeholders' conflicting expectations. Since the purpose of business is meaningful only if it helps broader social achievement forwards, **Boards, if they are true to their responsibilities, need to engage in this path of global climate neutrality.** Achieving global climate neutrality is fundamental to preserving the balance of our world.

Not anticipating these evolutions toward global climate neutrality considering the number of emerging pressures and evidence could be viewed as negligence from Board members.

As the situation intensifies and becomes more severe, it is likely that society in general will implement a framework of a global climate neutrality economy and impose it on laggard companies. Companies that stand aside from taking appropriate action until their consumers, employees, political representatives and investors leave them no other choice play a dangerous game. **Not anticipating these evolutions toward global climate neutrality considering the number of emerging pressures and evidence could be viewed as negligence from Board members.**

Another duty of Boards is to protect their company's social license to operate and reputation. Ensuring their company puts its best efforts into contributing to global climate neutrality and does not face the risk of being criticised for greenwashing is part of that responsibility. To avoid backlash, Boards should give specific attention to Net-Zero claims and commitments relying heavily on compensation, because society expects businesses to provide their specific expertise and capacity for innovation to develop low-carbon solutions, not to compensate approximately by planting trees. In the same spirit, Boards should be attentive to the fairness of reporting and disclosure related to climate neutrality, which is a Board's responsibility. The creation of a Climate and ESG Task force in the Division of Enforcement of the SEC in March 2021[24] is a sign of increased accountability in this domain.

For a Board to genuinely fulfil its duties and play the role that we have just detailed, we think that an era of Earth Competent Boards* is needed, where Boards members are proficient in sustainability with the right governance and organisation and asking management the right questions. But what can Boards of Directors do specifically to **help their companies contribute to the Net-Zero world, from commitment to effective achievements?** Situations and room for manoeuvre vary from one company to another. Nonetheless, we at *Earth on Boar*d put the following recommendations forward to every firm.

- **Fully grasp the urgency of climate change – what it means both at the global level and for your company.** Be aware of risks to your activities and assets, of drivers of change in your value chains and the dynamic changes both in political incentives and regulatory environments, capacity to attract talent, as well as access to financial resources (*see Figure 1 on page 15*). Both the effect of climate change and the need to cut back carbon emissions will impact your business model. As your firm's Board, you should have a clear understanding of the GHG emissions your activities generate in addition to your own direct emissions and how they are distributed upstream along your firm's supply chain and downstream through the use of your products/ services.

- **Review your company's purpose to bring it consistently into line with the global goal of climate neutrality.** The first question to ask is "are our activities compatible with a Net-Zero world"? The risk today is not only of stranded assets, but of stranded activities – activities that will be unfit for a climate neutral economy. Boards could even explicitly claim that their company's purpose ensures that its activities should be conducted in keeping with global climate neutrality.

- **Ensure your company collaborates with all stakeholders to develop activities fit for a Net-Zero world, for the simple reason that these developments will emerge with a holistic approach.** At the top, Boards should set the tone by regularly and directly engaging with stakeholders on climate neutrality plans. For this to be effective, the Board must ensure that mutual trust and respect is secured, starting by overseeing both fairness and quality of information made available to all stakeholders on climate issues, claims and achievements.

- **Require executives to analyse current activities, products and services sold, and in that light draw up what a portfolio of activities consistent with a Net-Zero economy may look like.** Plan to change or to replace those activities that do not correspond with a carbon neutral society and do that before your balance sheet is overwhelmed with stranded assets. The societal value of the products and services the company produces, their relevance and utility to overall societal needs, should be reviewed as criteria for decisions to be made. In the rush to separate from heavily polluting activities, one should be alert to the

* More information available at : https://www.earthonboard.org/post/2017/03/22/the-dawning-age-of-the-earth-competent-board

fact that selling those activities to outside bidders does not cut down global emissions if these activities continue.

- **Check that your Net-Zero plans reach measurable and meaningful reductions in your value chain, are timebound and with intermediate targets regularly checked. Top priority in reducing emissions should be given where the company's expertise and capacity for impact is greater. Initiatives should cover your whole value chain and focus on your core business.** If you are a bank, aligning your financial activities with Net-Zero scenarios is more important than the way you power or heat your buildings. If you are a food manufacturer, switching from meat-based to plant-based products is more important than the switch to electric vehicles for your fleet. Should your company's impact on consumers' lifestyles be significant, it should be aligned with deep-ranging decarbonisation too. Finally, ensure the integrity of claimed reductions, based on actual and regular assessment of emissions generated. Boards should adopt a critical stance towards avoided emissions – accounting for reduction in emissions as compared to fictitious baselines rather than in absolute terms is no longer acceptable.

- **As guardians of the firm's long-term reputation, make sure the claimed sequestered carbon from your contribution to the preservation and enhancement of carbon sinks, is reliable and permanent**. And that it will remain unchallenged in the years that lie before us. To assist him in assessing both of reduction activities and sequestered carbon, the Board should look for direct external and independent expertise as well as stakeholders' perceptions of company activities.

For this change to take place effectively, **Boards of Directors must secure and encourage management on the one hand by taking responsibility for explicitly supporting them in this direction, and, on the other, by controlling the integration of climate neutrality goals in decision-making processes. They should incorporate GHG reduction goals in the remuneration and advancement opportunities of top management. The Board should challenge them on progress in key activities, processes and incentives that need to evolve.** At *Earth on Board* we use a tool called "11 Questions to the Management", a framework of questions designed to help the Board engage with management on specific sustainability-related issues, essential to achieve the purpose of the company. A few examples of questions that Boards should ask management related to contribution to Net-Zero might be:

- **Have we assessed the risks of stranded assets in our current balance sheet?**
- **Are we revisiting our portfolio of activities to make it consistent with a Net-Zero economy?**
- **How is our internal carbon price helping us to move forward? And how could it be improved?**
- **In what way are GHG reduction goals incorporated within management remuneration and career growth? Is it effective?**
- **Is our lobbying budget spending aligned with our climate goals? Do we support global multilateral agreements and government climate action towards Net-Zero?**

Today, Boards of Directors' main priority should be to ensure their company's purpose is fit for the 21st century, in response to our societies' greatest challenges. Given the urgency and the absolute necessity of tackling climate change, we at *Earth on Board* are convinced that **no Board meeting should take place without assessing the coherence of decisions with a global climate neutral society.**

A checklist for the C-suite


JOHN
SAM
LISA
10.8%
7.8%
GLOBAL SHARE

A checklist for the C-suite

Deloitte is supporting the design and implementation of numerous corporate climate strategies around the world. In this collaboration with Earth on Board, Deloitte has designed the following recommendations to help organisations progress on this journey.

Either your company has just started thinking about Net-Zero or it has already gone a long way towards it, the following checklist has been drawn up to help C-suites start or adapt their strategy. The first part of the checklist is intended for both design and external communication of this strategy. We believe that the race for claims and the statement of ambition and intent now make less of a difference between companies. The effective execution of an ambitious decarbonisation strategy is increasingly a key differentiator between companies. Hence, we have also designed a second part of the checklist for the successful deployment of that strategy.

CHECK-LIST FOR THE DESIGN AND COMMUNICATION OF YOUR CLIMATE STRATEGY

- ☐ **#01** Is your strategy compatible with delivering a global climate neutral economy by 2050?
- ☐ **#02** Is your strategy applied on a relevant scope?
- ☐ **#03** Is your strategy delivering absolute GHG reduction without any offsetting?
- ☐ **#04** Did you craft a credible roadmap to achieve this target?
- ☐ **#05** Did you include milestones and intermediate targets?
- ☐ **#06** Do I prevent myself from calling my operations "neutral" because I purchase carbon credits?

CHECK-LIST FOR THE SUCCESSFUL ROLL OUT OF YOUR CLIMATE STRATEGY

- ☐ **#07** Is the climate strategy at the core your business?
- ☐ **#08** Did you define a global Net-Zero compatible purpose?
- ☐ **#09** Are your staff trained on climate change?
- ☐ **#10** Are your R&D efforts aligned with your strategy?
- ☐ **#11** Did you align your marketing and lobbying practices?
- ☐ **#12** Are your employees (management & staff) incentivized to reach your targets?
- ☐ **#13** Did you implement an internal price on carbon?

Answering the checklist questions: guidance and inspiring examples

#01

Is your strategy compatible with delivering a global climate neutral economy by 2050?

The climate emergency calls for the transformation of every company and every economy. Such change is a challenge to the imagination. The global and all-encompassing scale of transformation over such a short timeframe is difficult to fathom. On the side, the graph illustrates how disruptive this transformation is likely to be if we are to reach Net-Zero emissions on a global scale.

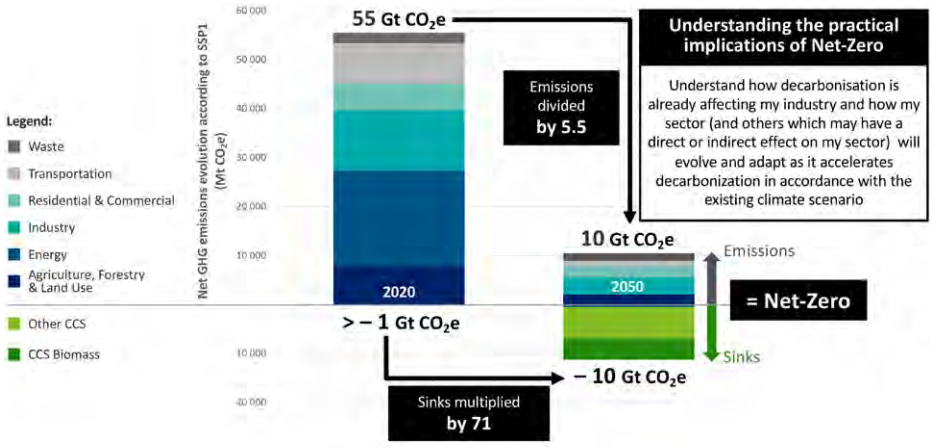


Figure 4: Current GHG emission budget by use (estimated for 2020 excluding the impact of Covid) and emission budget to meet Net-Zero emissions based upon the IPCC's SSP1 scenario.

Transport is a striking example: logistics chains are, and have always been, reliant on fossil fuels. Despite technological progress, at scale they are very difficult to decarbonise. It seems likely that transportation needs will have to be cut back if we are to achieve these carbon reduction targets in such a short timeframe. Consequently, in all probability companies dependent on transport will be obliged to take this downturn into account. **The hard truth is that it is very unlikely that all economic activities can be sustained given our carbon budget.** Deciding which activity can or cannot exist is a combination of economic, scientific and political choice (see focus box – System transformation). **Still, companies may choose what role they want to play and what value they want to bring to society.** With this in mind, we designed the strategic questions presented in the figure is on the side rather than below and laid down the following key recommendations for business leaders:

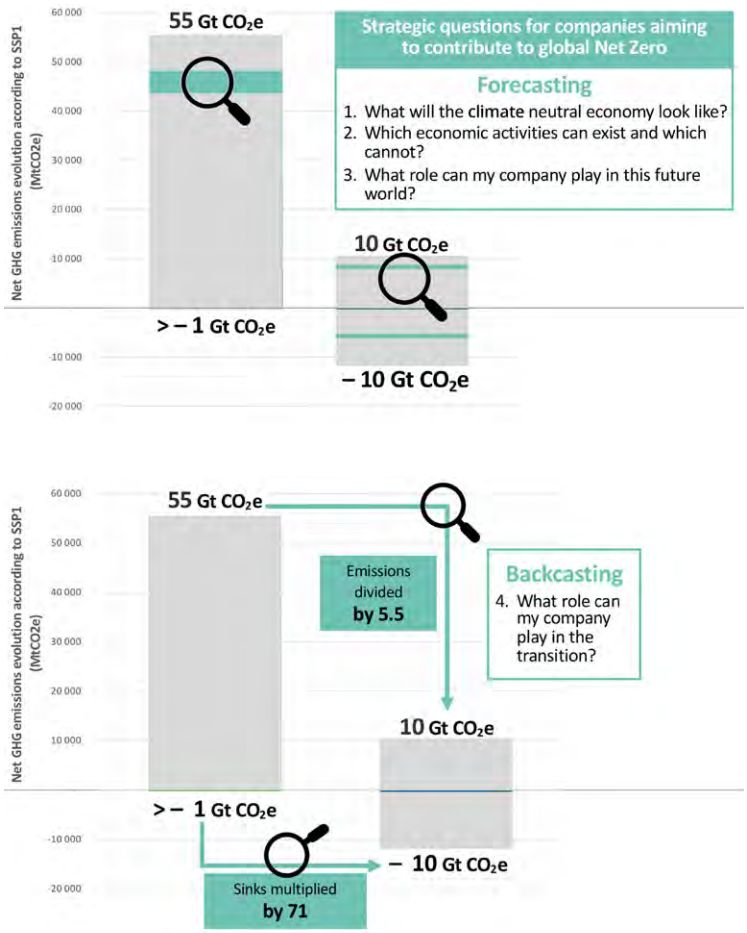


Figure 5: Net-Zero World strategic questions for companies.
Data source: SSP database hosted by the IIASA Energy Program. Deloitte analysis.

Focus box – System transformation

The speed and scale of decarbonisation will increasingly place doubt on the value of existing economic activities. Also, stakeholders will increasingly challenge companies' social license to operate. Companies shall seek to maximise their value to society and the biosphere if they are to be left untouched (and possibly flourish) by the transformative forces mentioned in the first section of this report. Assessing your contribution to the biosphere and the society is a daunting task. The use of the SDGs as laid out by the Stockholm Resilience Centre is a good place to start.

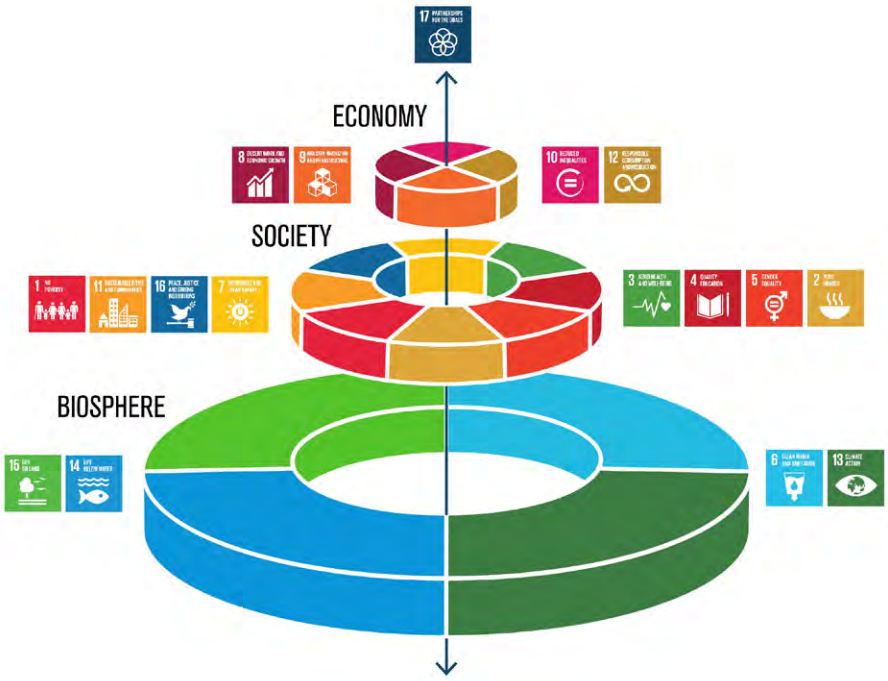


Figure 6: Integration of the 17 SDGs across the biosphere, society and the economy.
Source: Stockholm Resilience Centre

All companies are encouraged to address the 4 questions suggested in the above figure:

What will the climate-neutral economy look like? Which activities can/cannot exist? What role can my company play in this future world? Which role can my company play in the transition?

Companies that fail to answer these questions are likely to face a tough time.

By definition, the future is uncertain, and increasingly so due to climate change. To implement risk mitigating strategies and seize opportunities, climate scenarios provide a key conceptual tool. **Climate scenarios provide a way for an organisation to consider what the future might look given certain trends and conditions.** They allow organisations to ask "what if" in relation to what budget will be made available to sectors and regions, the impacts on global cost structures (internalising cost of carbon), etc.

One robust approach consists in basing oneself on the IPCC's own scenarios. From each of the representative carbon pathways (RCPs), the IPCC has developed Shared Socio-Economic Pathways (SSPs), which give insight on the potential social and economic impacts of climate change. As part of the IPCC's special report, new +1.5°C scenarios were developed that also take into account the UN's 2030 development goals. Based upon these scenarios, business can **define the speed of the transition and how much carbon budget they will have to play with,** their implications on end-client demand, physical and transition risks and where opportunities to reshape business model lie.

The International Energy Agency now also provides an interesting roadmap to understand which **"global milestones"** for policies, infrastructure and technology deployment are to be met in the Net-Zero scenario[25] : no new oil and gas fields approved for development starting from 2021, phase-out of unabated coal in advanced economies (2030) then worlwide (2040), no new diesel and gasoline cars sales from 2035...

Decision-making must also account for the fact that climate change is just one of the many facets of the ecological breakdown. As stated by the High-Level Panel of the European Decarbonisation Pathways Initiative, "the economy, as we know it, operates in a materially expansive, socially divisive and environmentally hostile way"[26]. Businesses must understand that their transformation has to be part of a larger, system-level change of the structure and operation of the current economic system whilst addressing all aspects of the ecological breakdown we collectively face in the Anthropocene. In short, resource exhaustion, the 6th mass extinction, deforestation and other changes in land use, ocean acidification and plastic contamination.

#02

Is your strategy applied on a relevant scope?

Shifting attention from an individual to a collective neutrality goal opens new opportunities.

Companies cannot focus solely on their own operations. They must reach out as far as possible to their value chain: Upstream, this means acting in partnership with suppliers and contractors to reduce emissions together.

A robust full GHG inventory on Scopes 1, 2 and 3 is a prerequisite for your decarbonisation journey since it usually reveals that the largest part of GHG emissions are Scope 3 (indirect) emissions. Companies may choose not to address these indirect emissions as not being their responsibility. Conversely, they can build upon the influence they have – **recognise that carbon emissions up and down the value chains are a significant risk for their company and therefore their responsibility to address.** For example, for companies relying on agricultural and forestry raw materials, dealing with deforestation is a powerful tool to reduce their carbon footprint, despite its difficulty [27]. Since this is beyond their direct scope of action, companies can act through supplier selection. Value redistribution across the supply-chain needs to change in some cases to allow the most relevant actors to engage with deep decarbonisation programs. Finally, supply chain design to reduce transportation needs can also drastically reduce the carbon footprint for some companies.

Another example: as part of its Regenerative Agriculture program, Danone works with its suppliers to develop and promote regenerative models of agriculture that protect soils and help sequester more carbon[28].

Downstream, the **use-phase related emissions of products and services** must henceforth be fully embedded within the company's strategy. Putting low-carbon products and services on the market to decrease emissions beyond the company's operations will help other stakeholders on their journey towards decarbonisation. The new paradigm we propose is an opportunity for businesses willing to go this route both to be recognised by policymakers and by other stakeholders. It will undoubtedly be an area for growth.

#03

Is your strategy delivering absolute GHG reductions?

Not all climate actions have the same effective potential to reduce emissions. **Experience shows that acting as close as possible to the source of the problem usually yields best results.** For example, electrifying a fleet of vehicles will reduce a company's direct CO_2 emissions, but bring about higher upstream emissions linked to battery production. Overall, the environmental benefits of this specific action are far less significant than implementing car-sharing or an operation redesigned at reducing the need for transportation in the first place. For companies opting to use renewable energy, arranging on-site production or entering into Power Purchase Agreements (long-term agreement between an energy producer and consumer) generates higher incentives for producers to develop renewable energy potential on the territory scale than straightforward purchase of Guarantees of Origin (Renewable Energy Certificates). More than ever, companies should look for cost-effective and rapid climate actions using a scrupulous **hierarchy of action** to design decarbonisation pathways that have impact.

Announced in 2016, Walmart Project Gigaton aims at reducing CO_2 emissions from upstream and downstream Scope 3 sources by one billion tons (a gigaton) between 2015 and 2030. It focuses on areas such as manufacturing, materials and use of products by 2030[29]. Such programs are proof that there is no need to call a plan "carbon neutral" or "Net-Zero" to bring about and deliver relevant and sizeable carbon reduction projects.

Sufficiency before efficiency

The current focus on technological responses demonstrates declining **relative** (per-product) emissions. Empirically, however, it shows an absolute increase of GHG emissions globally. This can be explained by the so-called *rebound effect**. Improving the energy efficiency of residential buildings is a typical example. Energy efficiency gains are lower than expected because the resident increases their level of comfort, for example by turning the heating higher than previously. Companies should focus their efforts on reduction in **absolute** terms. If reductions are impossible within the next decade or so, focus on the size of the carbon-intensive activity. In other words, the amount or product or services must decline to drive absolute emissions down, mathematically. As such, **sufficiency is an underestimated lever**, probably having the largest potential for deep emission cuts[30]. In certain sectors, there are no technologies commercially available at scale within the next decade or so to ensure decarbonisation levels compatible with a +1.5° trajectory. Such is the case in the aviation sector. A sectoral emissions trajectory aligned with a +1.5° trajectory implies sufficiency; i.e. that we fly less. While such a perspective may appear initially unattractive to the aviation sector, it opens the question of whether there is an irreducible need for international flights and how an aviation company may adapt to these dramatic market shifts. **Sufficiency-driven consumer demand and business models are key to moderate greenhouse gas emissions.**

* Also known as the Jevons paradox: In economics, the Jevons paradox occurs when technological progress or government policy increases the efficiency with which a resource is used (reducing the amount necessary for any one use), but the rate of consumption of that resource rises due to increasing demand.

#04

Did you craft a credible roadmap to achieve this target?

In transforming operations towards a low-carbon world, companies are tasked with evaluating which investments could be reoriented and which activities developed or abandoned. **The transformation route will depend on the company's activity portfolio,** because several levers can be used, such as external growth through clean asset acquisition or the improved management of supply chains. The shipping industry for example, has to anticipate the 20-year-plus operational lifetime of its ships. As for **portfolio management,** selling an emission-intensive asset to another firm does not change the carbon balance at the global level. Responsible companies are well advised to save sufficient resources to close or discontinue operations rather than selling the asset to companies with a weaker ethical compass. Financial institutions are increasingly setting a premium on this approach. Credit Agricole Climate Policy, for example, calls upon companies in which it owns shares to close, and not to sell, assets linked to coal[31].

Plan and prioritise your actions based on their impact.

Companies that cannot "offset" their emissions will experience greater pressure to cut greenhouse gas emissions together with ambitious short-term targets that minimise cumulative emissions along the way. Allocation of financial resources and employee skills should reflect that sense of prioritisation. Relevance and effectiveness of these corporate resources dedicated to climate change will rise as business faces further pressure from stakeholders for transformation, particularly from large and diversified groups, more flexible in allocating their resources than smaller actors. The former should be better able to provide more financial resources and talents to new business models and processes.

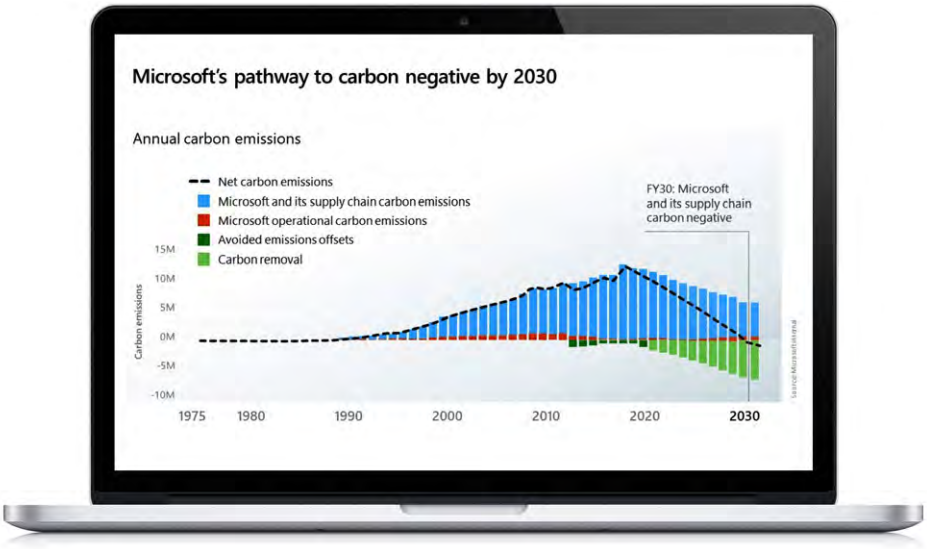


Figure 7 - Source: Microsoft

Microsoft recently received considerable press coverage of its declaration to be "carbon negative" by 2030. Regardless of what the reader might think of the idea of "netting" emissions at the company level, Microsoft's approach is interesting and transparent. **It outlines a trajectory that shows how they are expecting to get there:** for instance, which emissions it will reduce in the supply chain and how much carbon it is planning to remove from the atmosphere. Microsoft's approach is interesting because it goes publicly against their previous offset approach, which was to focus only on carbon removal projects, showing that it's never too late to change opinion on this matter.

#05

Milestones and intermediate targets. Are they included?

In early 2020, **BP** announced the goal of becoming a Net-Zero company by 2050 or sooner and help the world towards Net-Zero. Among its other commitments, **BP plans to reduce oil production by 40% by 2030** from the present 2.6 million barrels a day to 1.5 million in 10 years[32]. This shows that BP understands the physical implications a Net-Zero world poses.

Avoid lock-in effects and stranded assets.

More than ever, strategists should consider the temporality of their plan to **avoid lock-ins**, as today's technological investments might lock companies or society as a whole into carbon-intensive trajectories. For example, infrastructures such as airports and roads need to take into account future traffic and associated emissions related to their use.

Just like accountants use different accounting books to drive operations and track the financial performance of an organisation, so a company can keep track of its efforts using these three rigorously separated areas.

Figure 8 - Source: Decathlon

#06

Do I refrain from calling my operations "neutral" because I purchase carbon credits?

We acknowledge that carbon sequestration should still be part of companies' climate strategies. It should also be part of Corporate Social Responsibility so long as companies do not use it as a pretext for calling its operations "neutral". Businesses can choose to develop and sell products capable of removing carbon, such as carbon-negative construction materials for instance. Businesses should favour carbon sinks located within the value chain (agricultural soils, forests and, where relevant, Carbon Capture and Storage at point of emissions). When they choose to purchase carbon credits, companies should be aware of the quality of these credits and opt for joint-constructed projects or certified projects. A review of the various options to capture, sequester or remove carbon is detailed in the Appendix.

Actions aimed at reducing third party emissions follow a hierarchy driven by both the credibility and effectiveness of corporate action. Indeed, to put matters clearly and simply, buying carbon credits from avoided emissions has less impact (for climate, and for company) than joint-constructing the projects, investing in local territories to create long-term benefits and supporting larger-scale actions.

In terms of communication, we believe that the wording should reflect the approach taken by the new paradigm depicted in the previous chapter. We welcome claims such as Decathlon's that emphasise that the true goal is not Net-Zero within the bounds of the organisation and its activities, but at the planetary scale.

Prepare separate accounts for emissions and sequestration.

Businesses should keep track of their **real GHG emissions** calculated in the company inventory as per the GHG Protocol: direct emissions (Scope 1), purchased electricity and steam (Scope 2), inputs of products and services (upstream Scope 3), use of sold products (downstream Scope 3) emissions.

Emissions removed from the atmosphere via financing projects inside or outside a company value chain can also be tracked separately to demonstrate the company's commitment to an active role in balancing global carbon emissions and thus collectively meet the objectives of the Paris Agreement.

Avoided emissions – the difference between measured emissions and baseline emissions via the sales of products and services or, alternatively, the financing of projects – can neither be added to the previous GHG inventory nor to removals, as they physically do not lead to the reduction of airborne CO_2. They can still be calculated and communicated to demonstrate the possible downstream (via products and services) carbon benefits of a company.

Just like accountants use different accounting books to drive operations and track the financial performance of an organisation, so a company can keep track of its efforts using these three rigorously **separated areas**. Because each accounting area measures different physical metrics, they cannot be summed up or condensed into a single metric.

Continue investing in Carbon Capture and Storage (CCS) and removal.

Private actors should **continue investing in CCS and carbon removals,** thus supporting and driving public investments forward. Global climate neutrality cannot be met without large-scale carbon removals and sequestration both on the ground and underground. Investing in CCS is still an appropriate way for a business to cut back its carbon emissions and associated risks. Investing in carbon sinks is a good way to improve your company's reputation and to generate co-benefits for communities.

Ensure transparent, balanced reporting and communication.

As pointed out by the European Financial Reporting Advisory Group (**EFRAG**) Lab in February 2020, there is still a need to improve the appropriateness of climate disclosure since "various sections of companies" reports are not always clearly articulated or well-connected, making it difficult for users to get a complete picture of companies' approaches to assessing and managing climate-related risks and opportunities'[33].

t is our belief that accounting frameworks used for external disclosure should align with the **TCFD recommendations** related to Metrics and Targets. They call on companies to "disclose the metrics and targets used to assess and manage relevant climate-related risks and opportunities where such information is material"[34].

We recommend all businesses cease using the "Net-Zero" or "neutrality" terminology to characterise their activities, products or individual targets as well as the parallel concepts of "offsetting" and "cancelling", for their **internal** or **external** communications. Businesses can, however, continue to use these concepts when referring to the global-level neutrality objective and to their **contribution** to make it happen.

Reverting to our earlier discussion **for companies that already declare themselves climate neutral or with climate neutrality targets:**

To companies already claiming to be climate neutral, we recommend recognising collective progress made in the understanding of the climate neutrality concept (see the previous section "Net-Zero Debunked") and pursuing ambitious decarbonisation pathways instead, while maintaining investment in well-reputed carbon sequestration projects. Companies cannot avoid transparency: in the framework of its Race to Zero campaign, the UN calls for companies to disclose interim targets and planned use of offsets[35]. Various companies have already shown the progress they have made in their understanding of this concept. They have adjusted their strategy accordingly. Shifting the message from an individual to a collective goal means accepting the interdependence of our actions with the world we operate in. Even so, this is a more ambitious target. It has the potential to truly engage employees, suppliers, customers and other stakeholders, as well as to prepare the ground for climate leadership.

Company employee

What about the many actors that have been claiming climate neutrality? Have they all been wrong?

Our stance

What climate neutrality means has evolved a lot in recent years. These companies must stop using carbon offsetting as a short-term mitigation strategy to maintain a social license to operate for activities which are incompatible with a low carbon economy. They should instead reallocate resources to decarbonization. They should shift from seeking individual neutrality to aiming at a broader, transformative goal hand-in-hand with the global community. They should shift from seeking individual neutrality to aiming at a broader, transformative goal hand-in-hand with the global community, starting with their sector, and their ecosystem of supply chain partners.

#07

Is the climate strategy at the core of your business?

Climate strategy should not be left aside from the core business strategy: **climate strategy is the business strategy of a climate-conscious company.** This implies that the Board regularly follows up on progress on tackling climate change, for example by using a number of KPIs amongst which to monitor the evolution of emission reduction across scopes. It also implies commitment from Management to drive this issue as well as a clear understanding of how climate change affects your company.

Tesla supplies an interesting example of a company that strategically positioned itself on a technology (electric vehicles) aligned with the challenge of global decarbonisation. On the contrary, by hanging on its fossil-fuel based business, Exxon's market value has plummeted since 2007 and was recently overtaken by Tesla.

#08

Did you define a global Net-Zero compatible purpose?

Very few large corporations publicly disclose the purposes and clearly state the global Net-Zero objective. However, corporations are now increasingly taking on board purposes which are aligned with this aspiration. The energy industry provides many and relevant examples:

Orsted provides an inspiring example of a company initially in the oil and gas business and which is now rapidly moving away from fossil fuels to renewables. Their purpose statement "Let's create a world that runs entirely on green energy" seems well aligned with a global Net-Zero objective.

At its 26 February 2020 meeting, **Engie Group's** Board of Directors approved the following statement: *Engie's purpose is to act to* ***accelerate the transition towards a climate-neutral economy****, through reduced energy consumption and more environmentally friendly solutions*[36] *(see recommendations for Boards in the previous section). This example also illustrate a ommitment to a global goal.*

#09

Are your staff trained on climate change?

Make sure everyone in your business feels empowered with this transformative agenda and that **no one is left behind**. Be sure, too, that everyone participates in the journey, even symbolically. Climate is a complex and contentious topic and faces cognitive and emotional barriers. **All staff must be trained** in climate change, each according to their respective role to understand how it affects climate change. Many high impact training courses are now available on the market. This will raise the level of awareness which, in turn, will lead to climate action. Furthermore, a company whose purpose is closely aligned with a vision of a climate-neutral world is more likely to **attract and retain talent**.

Amongst the largest French companies, some have recently announced publicly that they will train all staff using **the "Climate Fresk"** - a serious game about climate change. Based on collective intelligence and creativity, it enables employees to discuss the consequences, challenges and changes that stand in the offing as well as that are already with us[37].

#10

Are your R&D efforts aligned with your strategy?

Enhancing Research and Development capacities is key to accelerating the transition. **Setting aside resources for the transformation rather than relying on carbon credits will have a long-lasting impact.** A larger share of innovation steering is possible for large companies with more central capacities than small companies. Moreover, companies should seek to explore those fields in which they already possess knowledge and legitimacy. Take, for instance, those active in the pulp and paper industry: they will be expected to investigate better methods of forest management.

Likewise, large chemical corporations could focus on carbon capture technologies, alongside with other initiatives around process electrification, alternative feedstock... while the oil and gas sector has enough resources to play a significant role in researching advanced carbon transportation and storage options.

#11

Did you align your marketing and lobbying practices?

You should ensure that your company's communication, whether direct through marketing or indirect via lobbying, are thoroughly in keeping with your climate ambitions.

In-depth verification of lobbying and marketing activities is essential both for the company's contribution to tackling climate change and in reducing reputational risk. **Ambitious climate declarations can be damagingly discredited with even limited funding or support for organisations working against these interests.**

Lobbying practices.

Aligning your lobbying practices with your climate practices implies a series of actions. First, you should identify all of the climate change lobbying undertaken by your company across all regions. You should list all organisations you are a member of, fund or support. Second, you should define the alignment between their climate position and your own. When there is no or limited alignment, you must decide whether you continue, condition or withdraw support. Conditioning support is the riskiest but can also be the most impactful strategy. It comes with a reputational risk, as you may be attacked for supporting an organisation that is misaligned with your own climate goals. To mitigate this risk, you should define what your objectives are and by when you expect to meet them. You should also draw red lines which, if crossed, imply you will withdraw all your support from this organisation. As far as possible, this information should be made public. This evaluation should be undertaken at least annually, when your climate ambition changes and in the case of substantial changes in the climate policy of organisations you support. In 2019, after undertaking such a review, TOTAL decided to withdraw support from one sector association and monitor the position of several others that were not entirely aligned with their own objectives[38].

Marketing strategy.

The underlying principle in reviewing your marketing strategy is that as a **company should take responsibility for its climate impact whilst encouraging their customers in purchasing practices that are compatible with a low-carbon world.** Marketing can and must be used as a tool to encourage sustainability goals by encouraging consumers to recycle, reuse, buy less, save energy, etc. In 2011, the outdoor sport clothing brand Patagonia ran an ad in the New York Times on Black Friday with the tag line: *don't buy this jacket*. The objective of this ad was to encourage consumers to reduce their consumption habits and to consider reusing, recycling or repairing products before buying something new and to give greater consideration to the environmental footprint of their purchases.

Embrace behavioural and lifestyle changes.

Businesses should not neglect the field of **behavioural and lifestyle changes**. These are recognised by the scientific community as a missing piece of the puzzle. Businesses have been very successful at pushing new consumption patterns to consumers: they can now use this expertise to push and bring about lower carbon lifestyles[39]. Business-to-Consumer companies with high sales volumes, visibility and advertising capacities should be the first to have recourse to this technique.

Collectively push for a greener agenda.

Businesses should look for new alliances to collectively push for a greener agenda. We win or fall together in tackling the climate emergency. It is time for businesses to recognise that they should become more politically active and **support a collective push for a greener agenda.** There will be no business to be done on a +5°C planet, but this is where the business-as-usual trajectory leads.

#12

Are your employees (management & staff) incentivised to reach your targets?

Incentives for employees to reach your climate targets can go a long way to reducing your corporate (scope 1 and 2 emissions) and also to change your corporate culture toward sustainability.

These incentives come in 2 forms: monetary (e.g. cash bonuses) and non-monetary (e.g. awards). While research indicates that the use of non-monetary measures has a greater effect on reducing emissions than monetary ones[40], both will be addressed here.

Monetary incentives.

According to the CDP [41] (Carbon Disclosure Project), in 2019, half of Europe's largest firms link executive pay to climate change, with 1 in 4 tying incentives to climate targets. Many carbon-intensive companies condition executive bonuses to short-term emission reductions. This approach need not be limited to executive and top management. In 2019, in response to pressure from Climate Action 100+, BP pledged that the bonuses of half of its employees (36,000) would be linked to GHG emission reductions.

Non-monetary incentives.

Non-monetary incentives consist of providing rewards, preferably public rewards, for dedicated time achieving or contributing to an emission reduction target in a competitive context.

An initial starting point may be to refer to the carbon prices used in the IEA's sustainable development scenario and the We Mean Business Coalition and CDP Carbon Pricing Corridors for methodological insights and data for given sectors.

#13

Did you implement an internal price on carbon?

Implementing an internal carbon price is a critical piece in any serious climate strategy. According to CDP, in 2017, 1,400 companies worldwide were factoring an internal carbon price into their business plans – an 8-fold leap over four years. An internal carbon price is a value that companies set for themselves to internalise the economic cost of their GHG. It can serve to manage risk and to steer the company's decarbonisation strategy. The Institue for Climate Economics (I4CE) indicates there are three main types of internal carbon prices[42]:

1. **A shadow price**, which represents a carbon value (determined by the company) that is incorporated into investment decisions and applied to the greenhouse gas emissions generated by projects;
2. **An internal carbon tax**, a levy that companies voluntarily apply to their operations and that increases operating costs depending on the resulting greenhouse gas emissions: the company then uses the proceeds of this tax as it sees fit. Recycling the proceeds toward further emission reduction is a good practice.
3. To this one can add an implicit price[43], which is based on how much a company spends to reduce GHG emission and/ or cost of complying with government regulations. For example, it can be the amount a company spends on renewable purchases or compliances with fuel economy standards. For some companies, an implicit carbon price can be a benchmark prior to developing an internal carbon pricing program.

The key question is the price.

The carbon price may be set based on many different parameters. A full discussion of the merits of each approach is beyond the scope of this paper. However, we echo the UN Global Compact's Business Leadership Criteria on Carbon Pricing recommendation that the carbon price must be high enough to materially affect investment decisions to drive down greenhouse gas emissions. A second criterion is that the price is coherent with at least a +2°C, if not +1.5°C, preferably sectoral, or national or international, trajectory. An initial starting point may be to refer to the carbon prices used in the IEA's sustainable development scenario[44] and the We Mean Business Coalition and CDP Carbon Pricing Corridors for methodological insights and data for given sectors.

BASF SE uses two variants of internal carbon pricing: a regionally differentiated carbon shadow price and a social cost of carbon principle. BASF uses the shadow carbon price as a KPI when evaluating the economic efficiency of existing facilities and investment project. It is set by an internal group of experts up to 2035 and reviewed annually.

Appendix

Appendix

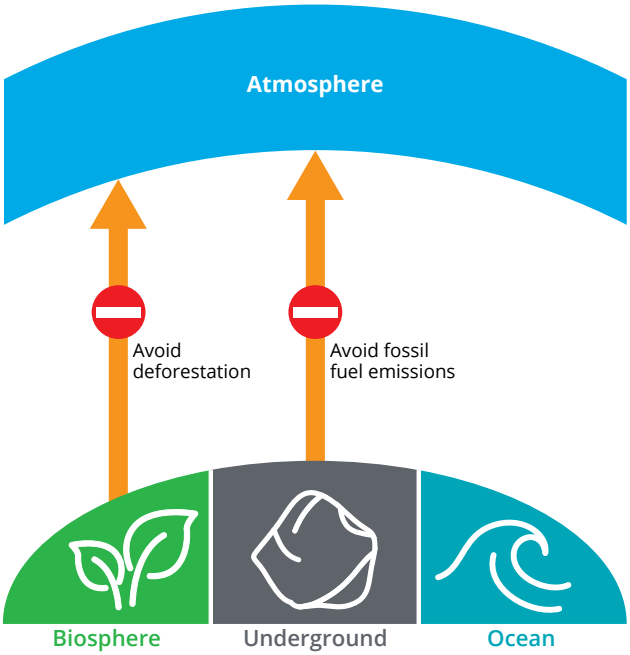
An overview of carbon capture, sequestration and carbon removal.

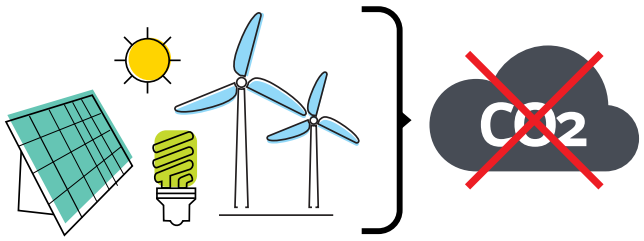
Offsetting is not a magic wand that will exorcise the climate challenge. However, the discussion on sequestration is important both because climate sinks will have to be scaled up at global levels and because companies may choose to support carbon sequestration projects. There are many different carbon capture, sequestration and removal technologies, including Carbon Capture and Storage, Bioenergy with Carbon Capture and Storage, Direct Air Capture and nature-based solutions. Their current technological and commercial maturities differ, as well as the scale at which they can be deployed, their carbon capacity and their benefits and drawbacks. However, they all face uncertainties linked to the potential of carbon storage and to the issue of scaling up processes.

Reducing anthropogenic emissions

Carbon markets allow one to buy carbon credits from sources as diverse as reforestation or avoided emissions projects (renewable energy production, solar oven deployment...).

Avoided emissions

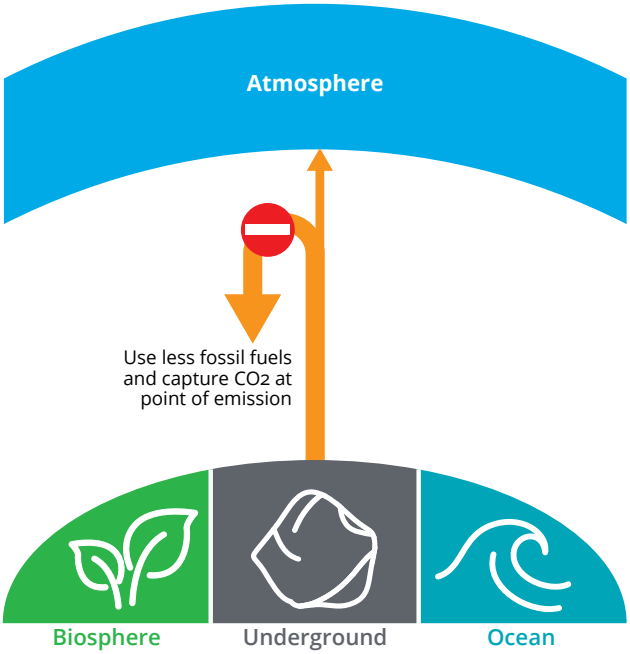


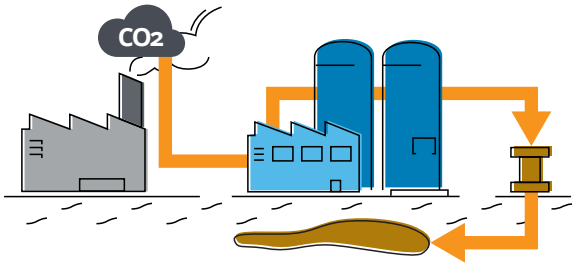


Avoided emissions projects are actions that allow for reduction of GHG emissions added to the atmosphere. For example, a solar oven can replace charcoal for home cooking. Wind turbines can be installed in countries with a carbon-intensive electricity mix. Forests can be protected to ensure carbon is not released from the biomass. Such initiatives help reduce carbon emissions against a theoretical baseline. However, when this mechanism is used to compensate a company's carbon emissions (e.g. avoided emissions traded against company emissions), it leads to a net carbon emission. **Hence, offsetting CO_2 emissions with avoided emission projects will not stabilise the amount of CO_2 in the atmosphere. It will not enable Net-Zero emissions** – it can only decrease the current rate of emissions.

However, avoided emission projects are important for sustainable development. They can have joint benefits for health and local development. They can improve livelihoods of low-income communities. For this reason, they may still be part of companies' strategies as acts of corporate philanthropy.

Carbon Capture and Storage (CCS)





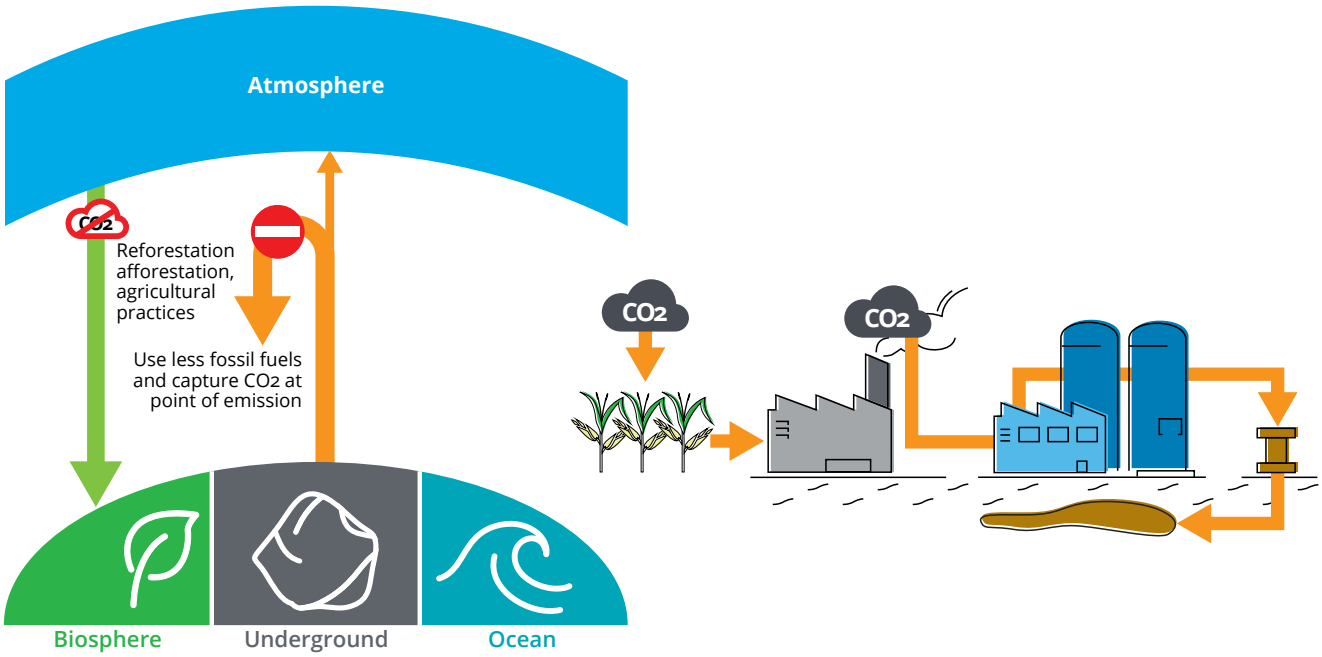
CCS at point of emission means the chemical capture of CO_2 from flue gas in large industrial facilities. The carbon captured can be used in processes (Carbon Capture and Utilisation) or stored in geological formations (Carbon Capture and Storage). This practice does not sequester carbon from the atmosphere, however. It prevents carbon from reaching the atmosphere and therefore reduces emissions. CCS has been demonstrated in many projects, although scaling up is limited by technological feasibility, price and liability attribution.

- Carbon capture from flue gas is a technological challenge. Installing CCS facilities in existing plants can be complex and economically unviable. Nevertheless, this technology is easier to integrate in new projects.
- Carbon storage in geological sinks requires building dedicated infrastructure (pipelines) and to have safe underground storage points available. Compressed carbon gas is typically stored in rock formations at a depth of over a thousand meters. There are uncertainties around the timescale of geological carbon storage and the possibility of accidental release, so that the issue of the responsibility for carbon storage underground can be a stumbling block for companies wishing to leverage this technology.
- The price of carbon can be an economic incentive to the deployment of CCS. The price of carbon storage thanks to CCS can range from $20 to $100 per ton*.
- Carbon Capture and Utilisation (CCU) refers to the subsequent use of captured carbon, which can be either converted to produce synthetic fuels, chemicals (plastic), concrete, or directly used as a fertiliser, solvent for enhanced oil recovery, or heat transfer fluid. This practice raises the issue of the attribution of avoided emissions: the actor whose flue gas is captured and the actor using the captured flue gas may lay equal claim to it.

* https://www.globalccsinstitute.com/archive/hub/publications/201688/global-ccs-cost-updatev4.pdf

Removing carbon from the atmosphere

Bioenergy with Carbon Capture and Storage



Bioenergy with Carbon Capture and Storage (BECCS) is a carbon sequestration option in which carbon is stored in an energetic crop that is converted to biofuels. Then, emissions from the biofuel's combustion are captured and stored back in the ground. This practice leads to a net carbon removal from the atmosphere to the ground (negative emissions).

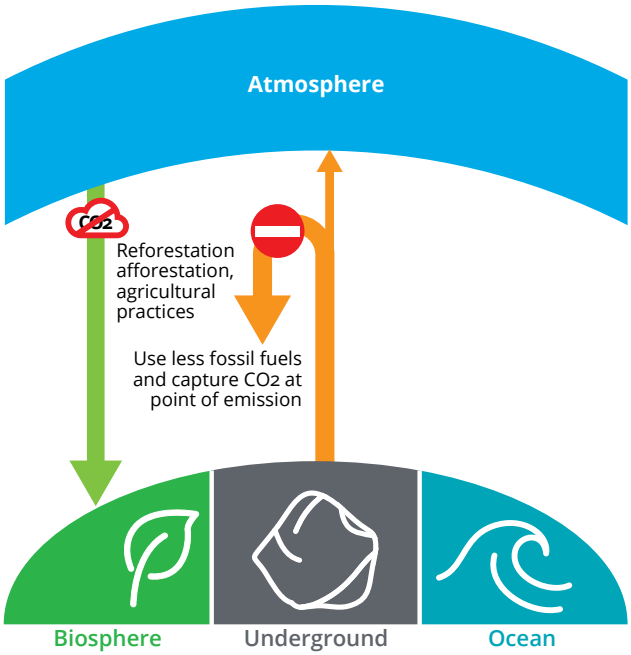
There are several generations of biofuel crops. First-generation crops such as sugarcane, oil palm or maize trigger important environmental impacts, including land and water footprints, pesticide use or biodiversity loss. Fuel crops are mainly blamed for constraining land availability for food production and natural ecosystem conservation and are not unanimously socially accepted.

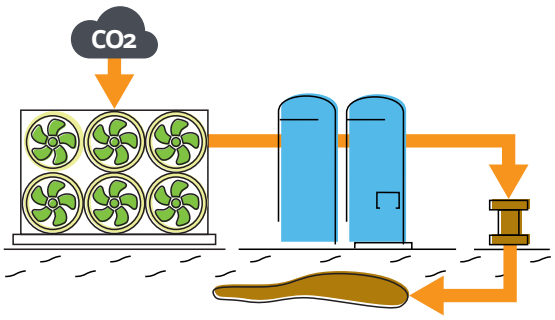
Second and third generation crops (non-food crops such as grass, crop by-products, forestry waste, algae) are more accepted since they do not compete with food production. However, they also trigger adverse environmental impacts linked to land-use change, soil carbon depletion, water stress and energy consumption.

Bio-based feedstock for durable goods

Another alternative to the previous example is to use the carbon from bio-based feedstock for goods production. **If carbon is kept in these goods for relative long period of time, then this process helps to store carbon away from the atmosphere. This alternative is possibly interesting for companies in the chemical sector aiming to reduce the use of fossil fuels feedstock.**

Direct Air Carbon Capture and Storage (DACCS)



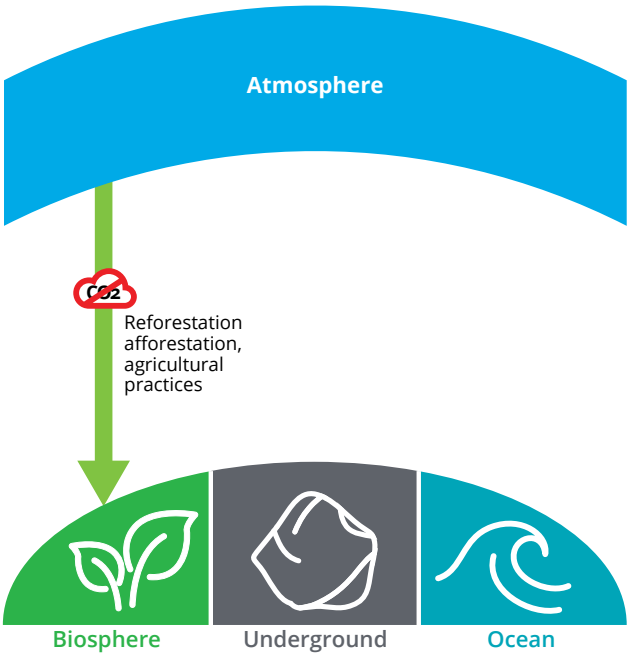


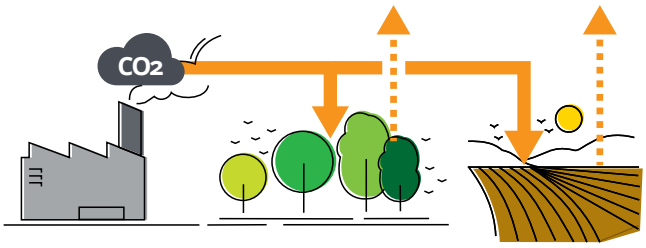
Direct Air Carbon Capture and Storage (DACCS) refers to chemical capture and storage of atmospheric CO_2 in geological sinks. CO_2 is captured from the air through chemical bonding with a separating agent that is then later regenerated with heat, water or both, releasing the CO_2 in a high purity stream. This technology would allow net removals but is not mature.

- Two key challenges in DACCS are the large flows of air required for a relatively small amount of CO_2 captured and the resources required for regeneration of the separating agent. Due to the significant dilution of CO_2 in ambient air compared to flue gas (where it is over 100 times more concentrated), these processes have high energy or heat requirements.

- DACCS is costly compared to other carbon sequestration methods: forecasts evaluate that current technology costs could approach $150 per ton of CO_2 at best[45].

Nature-based solutions





Nature-based solutions are land management practices that aim at removing carbon from the atmosphere to store it in biomass or soils. Natural climate solutions could represent a consequent sink of carbon while bringing co-benefits for ecosystems and local livelihoods. However, contrarily to carbon storage in the ground, carbon storage in biosphere is not permanent. On timescales ranging from years to decades, the stored carbon will be released to the atmosphere. A notable exception is biochar, which could hold organic carbon for over a century.

An example of practices termed as nature-based solutions are presented below:

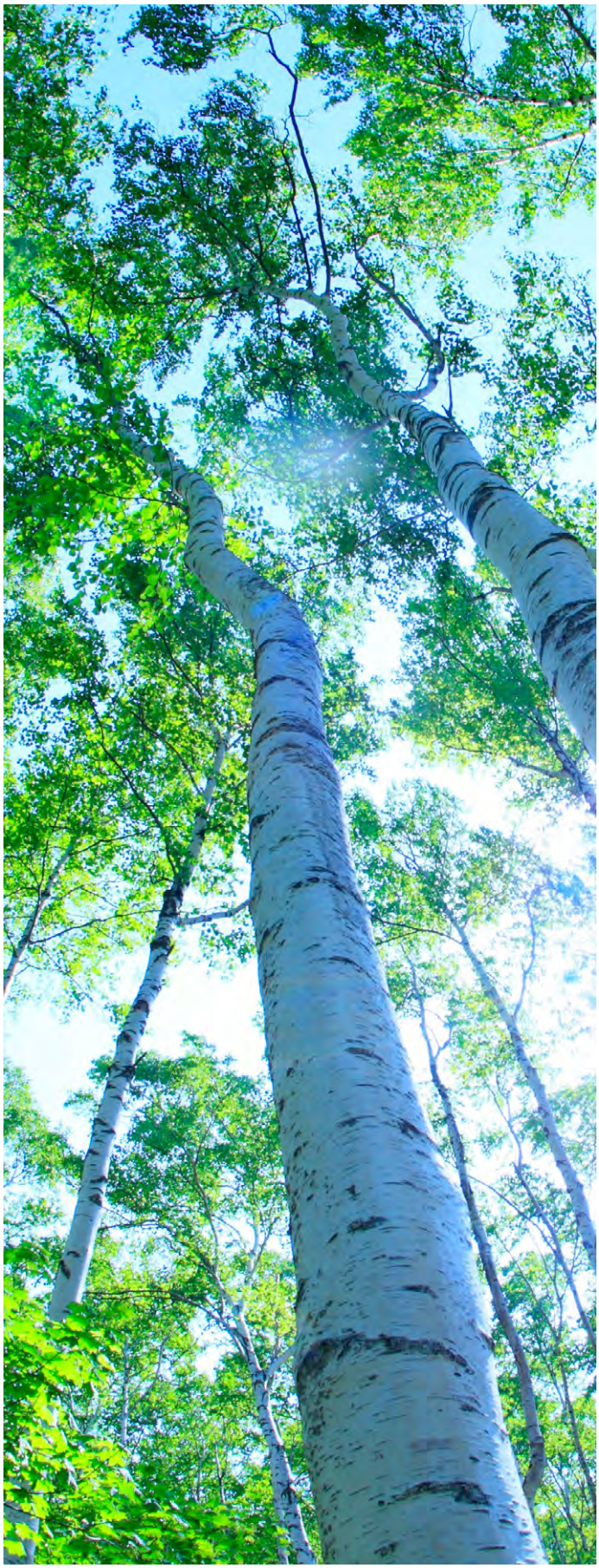
Practices enhancing biomass carbon	Practices enhancing soil carbon
· **Reforestation** · **Afforestation** (planting trees on a land that was primarily not forested) · **Land rehabilitation** (restoration of a land's ecological abilities after desertification, erosion or salinisation), such as peatland or mangrove restoration (also called *blue carbon*) · **Agroforestry** (the management of trees on pasture or cropland)	· **Improved agricultural management** (no-till, legume crops in pasture, cover crops or other practices linked to regenerative agriculture) · **Improved forest management** (residue removal...) · **Biochar** (stable form of organic carbon which is the solid residue of biomass combustion at high temperatures, applied as fertiliser).

Besides their carbon sequestration potential being short-lived, nature-based solutions have the following limitations:

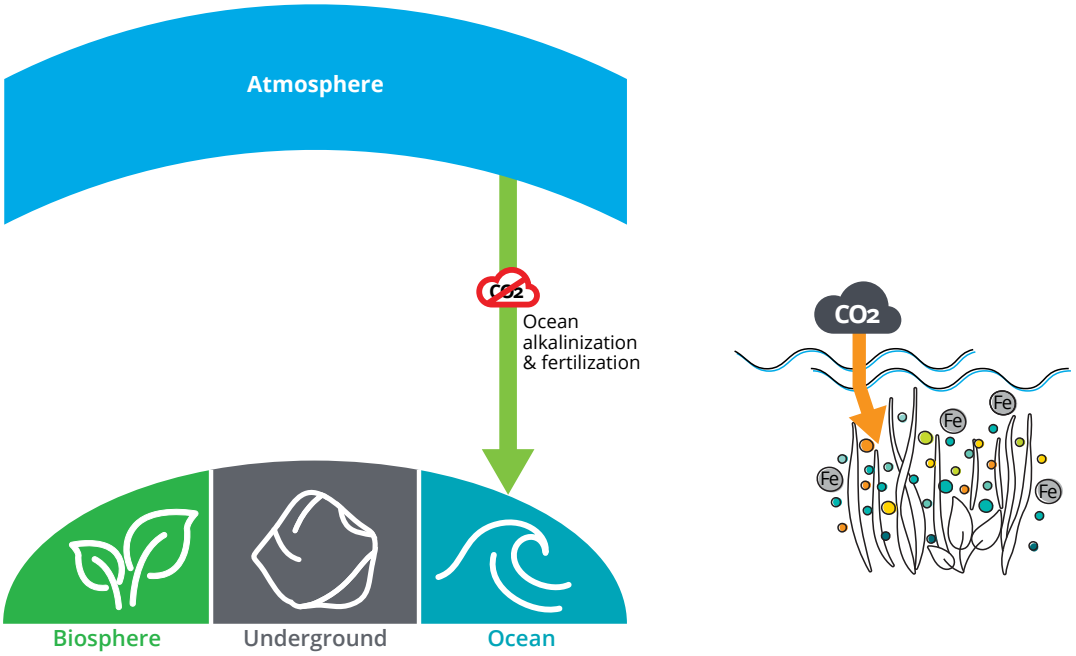
- Carbon sequestration in biomass and soils is limited in amount and time. Ecosystems eventually reach saturation: the amount of carbon in a hectare of forest cannot grow above a few hundred tons. Disturbance such as pest or forest fire triggers quick carbon release, and climate change will increase the risk of such disturbances.
- There are concerns about social and environmental impacts of such practices: infringe on human rights, conflict with local policies, trade-off with other goals such as ecosystem preservation.
- Operationally, accounting for the removals triggers questions about the baseline to consider, the possibility of double-counting and the risk of emission displacement. Nature-based solutions yield carbon credits or offsets only when they allow additional carbon sequestration, i.e. sequestration that would not have occurred without the project. In order to establish additionality, a baseline must be defined, which is not always straightforward.

Consequently, compensation projects should be selected based on strict criteria (such as selection of Verified Gold Standard or Verified Carbon Standard certified projects) to ensure a proper accounting of carbon sequestration and no adverse externalities.

On the other hand, solutions that present less detrimental effects – soil carbon sequestration, coastal carbon sequestration (blue carbon), biochar – have been demonstrated mostly at a local scale and it is unclear whether they can be efficiently scaled up. For instance, the data on carbon in soils lacks representativeness. Companies are currently making assumptions and massive extrapolations based on the little academic research available.

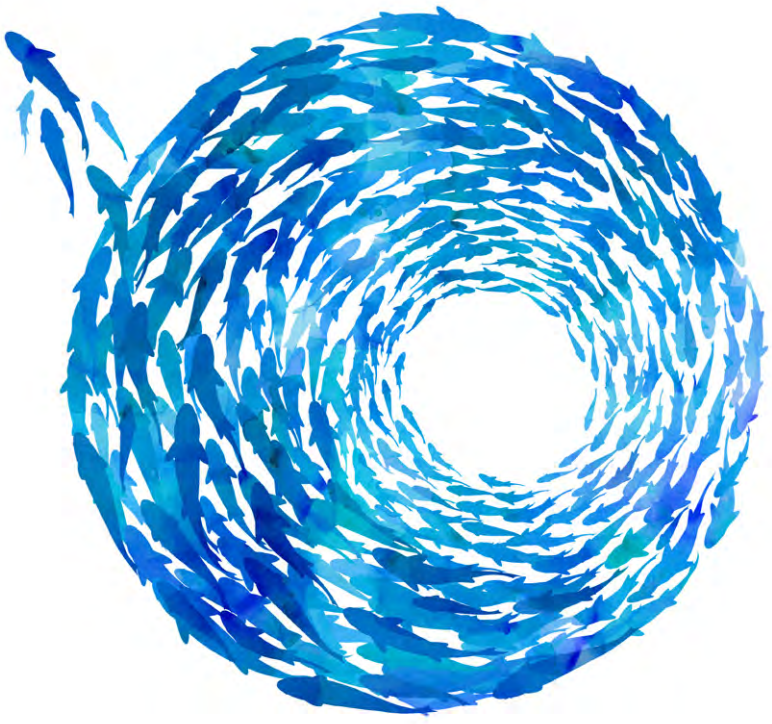


Ocean alkalinisation and fertilisation



Ocean alkalinisation and enhanced weathering mean CO_2 capture by chemical processes in rocks and sediments, leading to a higher alkalinity. This technology has not been demonstrated at a larger scale and may have detrimental effects on ecosystems.

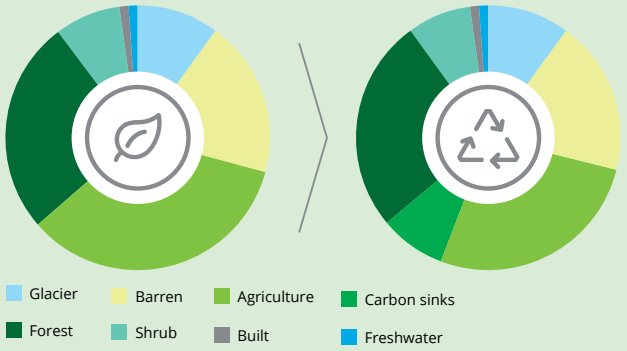
Ocean fertilisation is a geo-engineering practice where nutrients such as iron, nitrogen and phosphorus are added to the ocean in order to enhance organic CO_2 uptake. Such technology presents a high potential of adverse effects on biodiversity and uncertain GHG reductions[46].



Negative emission technologies: are they scalable?

Nature Based Solutions

The extent to which nature-based solutions are able to solve the climate challenge can be questioned. Carbon uptake primarily relying on biomass is the most commonly leveraged option to offset emissions, but to what extent is it scalable to the whole economy? We can try to answer this question with a quick back-of-the-envelope calculation.



This graph shows the distribution of land surface on Earth, sourced from *Our World in Data*[47]. Among these surfaces, only current agricultural areas (including fields and pastures) are suitable for afforestation or reforestation. Indeed, shrublands and forests already have high carbon stocks and a rich biodiversity, whereas other habitats such as barren (desert) are not suitable for growing biomass.

Global GHG emissions in 2019 amount to about 43 billion tons (Gt) of CO_2eq. According to the 2019 refinement to the 2006 IPCC guidelines on national greenhouse gas inventories[48], most forest plantations store no more than 200 t of carbon (C) per hectare. Its takes about 20 years for a tropical forest to grow and store this amount of carbon, so the carbon sequestration rate is approximately 10 t C/ha/year which equals 36.7 t CO_2/ha/year. If we wanted to sequester our yearly emissions for the next two decades, we would therefore need 43 billion/36.7 = 12 million km², or almost 25% of current agricultural land. This surface would need to be locked up without any removal that might trigger carbon emissions. This is assuming global CO_2 emissions stay constant during the two decades.

In practice, it is not possible to dedicate such a large amount of land to carbon sequestration without jeopardising global food, feed and fibre production as well as existing ecosystems. Besides, carbon sequestration rates in most ecosystems are not those of forest plantations, and carbon could even be released due to unfavourable climatic conditions, pests, fires and natural and anthropogenic disturbances.

The IPCC's fourth assessment (2007)[49] estimated that soil carbon sequestration potential on cropland amounted to 3 billion tons of CO_2 per year, or 6% of global yearly emissions. The implementation would reduce the land required for afforestation according to our back-of-the-envelope calculation by that much. Having said this, the IPCC's AR4 figures are considered to be largely overestimated[50].

Consequently, offsetting can play a role in curbing emissions but is clearly not a silver bullet solution. The land available for natural carbon sinks should be considered by companies as a scarce resource to be shared among many and not as an easily scalable solution limited only by the financial means allocated to it.

Carbon Capture and Storage

Today, only about 26 large-scale CCS facilities are operational, of which only two are in Europe[51]. Worldwide, CCS facilities sequester 40 Mt CO_2eq/year or about 0.07% of global annual emissions[52].

However, the theoretical potential of this carbon sequestration, defined by the storage capacities of geological formations, is actually much higher. The IPCC's Special Report on CCS, released in 2005, evaluates the storage potential to range from 1,700 to several thousand Gt CO_2, mainly within abandoned oil and gas fields and deep saline aquifers[53]. This means that CCS could potentially sequester the entirety of our annual emissions at least for the next 35 years, assuming constant emissions. This is of course theoretical, since CCS facilities would need a huge scale-up, and cannot capture mobile emissions sources.

Regarding the prioritisation of these techniques, our recommendations are as follows:

- **When it is possible to deploy it at a facility level, at point of emission CCS can effectively cut emissions from combustion or processes. However, this might only be available for large plants with important volumes of emissions.**
- **Nature-based solutions do not only include reforestation, but also such as Coastal Blue Carbon, Soil Carbon Sequestration and Biochar, which can bring interesting co-benefits. On the other hand, afforestation or bioenergy with purpose-grown first-generation crops (oil palm, sugar cane) may bring significant trade-offs.**
- **Due to low technology maturity and uncertainties around their side effects, DACCS, ocean alkalinisation and ocean fertilisation technologies should not be considered in medium-term strategies.**

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6, place de la Pyramide – 92908 Paris-La Défense Cedex