CHAPTER 8

Net Zero

The concept of **net-zero emissions** emerged from scientific discussions on the link between anthropogenic emissions and global temperature changes. A linear relationship exists between **cumulative net emissions of greenhouse gases and changes in global surface temperatures**, which implies that halting anthropogenic climate change requires a balance between greenhouse gases entering the atmosphere and those removed via sinks.

Stabilizing global temperatures at any level requires global greenhouse gas emissions to reach net zero, meaning all emissions are balanced by corresponding removals. **The Paris Agreement** established a common aspiration **to limit global warming to well below 2°C above pre-industrial levels and pursue efforts to limit the increase to 1.5°C.**

The Special Report on the impacts of global warming of 1.5°C highlighted the substantial effects of an extra 0.5°C of warming and provided evidence for the challenge of reaching the 1.5°C target. While the 1.5°C target has become the standard for assessing climate ambitions, reaching it requires a sharp reversal in emission trends, with global net emissions needing to peak before 2025, decline by 43% by the 2030s, and reach net zero in the early 2050s.

The 2018 report and subsequent analyses by **the IPCC** sharply underline that reaching the 1.5°C target is a major challenge that requires a sharp reversal in emission trends. In its most recent report, the IPCC estimates that to limit global warming to 1.5°C, global net emissions would need to peak before 2025, decline by 43% by the 2030s, and reach net zero in the early 2050s (IPCC, 2022).

The difference between a global temperature rise of 1.5°C and 2°C can have significant implications for the environment and human societies. According to the 2018 IPCC Special Report on 1.5°C, a 0.5°C increase in warming would lead to a rise in severe heat exposure for 37% of the global population, compared to 14% under a 1.5°C scenario. Additionally, while 1.5°C of warming would still result in a 70-90% reduction in average coral cover, it would prevent the total loss of coral reefs projected with 2°C of warming. The probability of extreme drought and water stress, particularly in the Mediterranean region and southern Africa, is substantially higher under a 2°C scenario compared with a 1.5°C scenario. Finally, an additional 10 million people are estimated to be at risk of flooding under a 2°C scenario, compared to a scenario where warming is limited to 1.5°C by 2100.

The 2022 IPCC Report on Impacts, Adaptation and Vulnerability reiterated many of these findings, highlighting that a 1.5°C temperature rise would cause unavoidable increases in various climate hazards and present multiple risks to humans and ecosystems. The report also stresses that limiting global warming to 1.5°C would significantly reduce projected loss and damages compared to higher warming scenarios.

The global goal of achieving net-zero carbon emissions by 2050 has gained traction among governments and non-state actors worldwide**. As of November 2021, 135 countries, representing 88% of global emissions and 90% of global GDP, had committed to net-zero targets, while 7,500 entities had joined the UN Race to Zero campaign.** However, the commitment levels vary significantly across entities and countries, with different targets, scopes, and degrees of legal commitment. Some entities have well-defined implementation plans with clear strategies and interim targets, while others have made vague public statements. To distinguish between credible and non-credible commitments, there is a need for developing tools and frameworks that can effectively navigate the transition towards net-zero emissions.

KEY ALLIANCES IN THE RACE TO ZERO		
Name	**Actors**	**Description**
PUBLIC SECTOR ALLIANCES		
Cities Race to Zero	Cities	Coalition of cities that have publicly joined the Race to Zero and committed to achieving net-zero emissions by 2050.
Under 2° Coalition	**Under 2° Coalition**	Coalition of sub-national governments committed to reaching net zero by 2050 or earlier.
FINANCIAL SECTOR ALLIANCES		
Glasgow Financial Alliance for Net Zero (GFANZ)	Financial sector	An umbrella group of various finance subsector alliances that are part of Race to Zero, with more than 450 member firms from across the global financial sector.
UN Environment Programme Finance Initiative (UNEP FI)	Financial sector	Initiative that works with over 400 financial-sector institutions (including banks, insurers, investors) with the goal of ensuring that financial systems support both people and planet.
Commercial banks		
Net Zero Banking Alliance (member of GFANZ)	Banks	An alliance of global banks that have committed to reaching net zero by 2050.
REAL ECONOMY (NON-SECTOR SPECIFIC)		
Business ambition for 1.5°C	Corporates	A collaboration by the Science-Based Targets Initiative, the UN Global Compact, and the We Mean Business Coalition, which seeks to encourage private businesses to develop science-based emissions-reduction targets in line with the 1.5°C target.
The Climate Pledge	Corporates	A campaign co-founded by Global Optimism and Amazon which seeks to call businesses and other organizations to action on climate. Its signatories have pledged to reach net zero by 2040.
Certified B Corporation	Corporates	B Lab is both a non-profit network and certification scheme. It certifies companies, known as B-Corps, who adhere to particularly high standards regarding their social and environmental impact, transparency, and accountability.
SME Climate Hub	Small and medium-sized companies	A hub that provides the tools, resources, and frameworks that allow businesses with fewer than 500 employees to commit to reaching net zero by 2050 or sooner.
Business Declares	Corporates	Non-profit organization that seeks to raise awareness for climate emergency in the private sector, accelerate private-sector action, and amplify the voices in the business community that are calling for regulatory action.

Name	Actors	Description
CBN Expert Community	Corporates	Community of organizations that have pledged to achieve net-zero emissions via CBN Expert, a firm that supports companies seeking to calculate, measure, and track their carbon footprint.
Planet Mark	Corporates	Sustainability certification scheme through which organizations can certify their net-zero pledge.
REAL ECONOMY (SECTOR SPECIFIC)		
Tech Zero	Tech sector	Collection of technology companies that have committed to measure and disclose Scope 1, 2, and 3 emissions and set ambitious net-zero targets.
Pledge to Net Zero	Environmental sector	A pledge through which organizations from the environmental sector are committing to reduce their own emissions in line with at least a 2°C target, and actively contribute to the conversations on how targets can be achieved (e.g., by publishing thought pieces).
Race to Zero for Universities & Colleges	Higher education	Collaboration by UNEP, the alliance for sustainability leadership in education (EAUC), and second nature, which are mobilizing universities and colleges to commit to Paris-align their operations.
Fashion Industry for Climate Action	Fashion industry	Pledge by stakeholders in the fashion industry to reduce emissions by at least 30% before 2030 and reach net zero by 2050.
Healthcare Without Harm	Healthcare sector	Alliance that focuses on mobilizing the healthcare industry to move toward a net-zero future.

Name	Actors	Description
Asset managers		
Net Zero Asset Managers Initiative (member of GFANZ)	Asset managers	An initiative designed to mobilize climate ambition among international asset managers. All members have committed to reaching net zero by 2050 and are using the forum to develop and share best-practices.
Asset owners		
Paris Aligned Investment Initiative (member of GFANZ)	Asset owners	A collaborative, investor-led forum of 118 institutional investors that are seeking to align their operations with the goals of the Paris Agreement.
Net Zero Asset Owner Alliance (member of GFANZ)	Asset owners	A coalition of 71 pension funds and insurers that are collaborating to Paris-align their investment activities.
Insurers		
Net Zero Insurance Alliance (member of GFANZ)	Insurers	A group of 20 leading insurers that have committed to aligning their insuring and reinsurance underwriting portfolio with the 1.5°C target enshrined in the Paris Agreement.
Other financial services		
Net Zero Financial Service Provider Alliance (member of GFANZ)	Financial service providers	An alliance of investment advisors, auditors, rating agencies, index providers, ESG research and data providers, and exchanges. All members have committed to achieving net-zero greenhouse gas emissions by 2050 or sooner.
Net Zero Investment Consultants Initiatives (member of GFANZ)	Investment consultants	A coalition that sets actions that investment consultants will take in the context of their legal and fiduciary duties, as well as specific client mandates, to support reaching the global net-zero target by 2050 or sooner.

REAL ECONOMY (NON-SECTOR SPECIFIC)		
Business ambition for 1.5°C	Corporates	A collaboration by the Science-Based Targets Initiative, the UN Global Compact, and the We Mean Business Coalition, which seeks to encourage private businesses to develop science-based emissions-reduction targets in line with the 1.5°C target.
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Source: SCR Certificate (2023)

The Implications of Net Zero

Country level:

The emission accounting **standards for countries** typically use a territorial or production-based method, which means that a country's emissions are based on the emissions that occur within its geographic borders. **To achieve a net-zero target, a country must significantly reduce its greenhouse gas emissions and remove any remaining emissions through carbon sinks.** However, this approach has been criticized for not considering the consumption patterns that drive emission-intensive production elsewhere. **An alternative approach is to use consumption-based accounting methods**, which measure the cumulative emissions resulting from the production of goods and services consumed within a country, regardless of where the production took place. **High-income countries usually have higher consumption-based emissions than production-based emissions,** while **low- and middle-income countries often have emissions-intensive industries catering to foreign demand.** Despite concerns, production-based accounting is the dominant standard for attributing emissions at the country level. Achieving net-zero at the national level requires a system-level understanding of the economy and energy system, and policy decisions will depend on various factors, including economic and technological means, voter preferences, and political will.

Sub-national governments:

Sub-national climate policies are becoming increasingly important, but there is currently no universally accepted standard for measuring emissions at the sub-national level. Therefore, cities and regions face a challenge in creating greenhouse gas inventories, determining baseline emissions, and defining their targets. The GHG Protocol's Protocol for Community-Scale Greenhouse Gas Emissions Inventories is a widely recognized best practice standard that distinguishes between Scope 1, 2, and 3 emissions. **The GHG Protocol has developed two reporting standards, BASIC and BASIC+, for cities and regions based on this distinction. BASIC** inventories cover scope 1 and 2 emissions from energy and transport, as well as scope 1 and 3 emissions from waste. **BASIC+** inventories are more comprehensive and cover scope 3 emissions from transboundary transport and scope 1 emissions from

agriculture, forestry, and land use. The emissions inventories define the target for reaching "net zero," so it is important for cities and regions to use consistent standards. Generally, cities and regions must decarbonize urban transport systems and reduce emissions from buildings to achieve their targets.

Private Sector:

Non-Financial Sectors:

The impact of the net-zero transition on firms in the real economy varies depending on the sector. **Energy-intensive industries** with high Scope 1 emissions will need to develop alternatives to current production processes through technological innovation and deploying less emissions-intensive solutions at scale. **High-emitting sectors** may require increased investment to decarbonize and retire high-emitting assets early. For example, steel producers need to find energy carriers to replace fossil fuels for producing steel. Other sectors, like many supermarket chains, have small Scope 1 emissions compared to emissions across the value chain of their products. In these sectors, the challenge is to understand Scope 3 emissions embedded in products and work with partners across the value chain to minimize these, as well as customers' and consumers' use and disposal of products.

Financial Sectors:

The net-zero transition presents unique challenges for the financial sector, as the climate impact of financial institutions mainly **comes from the activities they finance rather than their own operations**. While there is little regulation in this area, industry-led alliances and voluntary standards have emerged to help financial institutions establish the climate impact of their portfolios and develop strategies for reducing their financed emissions over time. Financial services use different tools and methodologies, such **as implied temperature ratings and sectoral pathways, to support their net-zero strategies and targets**, but it is important to understand their assumptions, models, and limitations when using them.

Transition Plans:

Transition plans are becoming increasingly important in the private sector as a way to implement climate action and demonstrate the credibility of commitments. These plans are defined as time-bound strategies that outline how an organization will shift their assets, operations, and business model to align with the latest climate science recommendations, ultimately reaching a net-zero-carbon economy. Although this concept is relatively new, the **TCFD** has released high-level guidance outlining the necessary components for effective transition plans. These plans should align with overall **corporate strategy, have measurable targets, be subject to effective governance, be full of actionable initiatives, be credible, reviewed and updated regularly, and reported annually to stakeholders.** The content of the plans should reflect how the organization will adapt its **governance structure and strategy** to deliver the transition, manage and mitigate transition risks, and what **metrics and targets** will monitor and track progress.

Following **COP26, the UN Race to Zero** campaign has shifted from simply encouraging entities to commit to net-zero targets to developing more rigorous standards and supporting members in implementing their targets. The UN Secretary General has announced that a High-Level Expert Group will be established in 2022 to propose standards for assessing targets published by non-state actors. Climate initiatives have also developed overarching or sector-specific benchmarks to assess the

ambition behind individual pledges. Fankhauser et al. (2022) have summarized the debate and identified seven attributes that net-zero targets should fulfill to provide a meaningful framework for action. These include **front-loaded emission reductions (***to meet Paris Agreement targets, entities must reduce emissions as soon as possible, as global temperature change is determined by cumulative emissions, not just emissions in any given year***)**, **a comprehensive approach to emission reductions (***reaching net-zero requires tackling all emissions, including hard-to-abate sectors. Governments and private corporations should reduce emissions across all scopes and engage with all stakeholders along the value chain***), cautious use of carbon dioxide removal (***prioritize deep emissions reductions as there are unresolved issues with most forms of carbon dioxide removal***), effective regulation of carbon offsets (***mechanisms to balance global sources and sinks should meaningfully address concerns and allow for monitoring, reporting, and verification of removed carbon***), an equitable transition to net-zero (***recognize that developing countries will need more time, financial and technological support to transition, and that certain actors will need to decarbonize at different speeds***), alignment with broader socio-ecological objectives (***a narrow focus on mitigation may overlook negative repercussions in other dimensions, such as economic inequality or the marginalization of indigenous communities***), and pursuit of economic opportunities (***effective net-zero planning should consider economic opportunities arising from the transition***).** Transition plans offer organizations the chance to demonstrate how their net-zero targets align with these attributes and benefit local populations.

The Science-Based Targets initiative (SBTi) has developed a framework to provide guidance on how financial firms can set science-based, Paris-aligned net-zero targets. The SBTi recommends three different approaches, including **setting physical intensity targets for investments and loans in emission-intensive sectors, working to ensure increasing proportions of investees in portfolios have committed to their own respective science-based targets, and aligning portfolios with long-term temperature targets by engaging with portfolio companies.** The SBTi also emphasizes the importance of engaging with investees and financing their transition to achieve effective emission reductions, while adjusting portfolio holdings and divesting from companies with low ambition are complementary strategies.

Carbon offsetting involves balancing greenhouse gas emissions by sequestering carbon or other gases elsewhere, but there are challenges in determining what activities should be eligible and ensuring social and environmental integrity. While carbon markets allow entities to balance emissions with carbon credits, there are concerns about non-additional projects, leakage, permanence, and accurate measurement. Certification bodies have developed standards, but these are not universally applied, and organizations must carefully tread when relying on offsets to reach decarbonization targets. The Oxford Principles for Net Zero Aligned Carbon Offsetting and the Science-Based Targets initiative stress the need to prioritize deep emissions reductions and shift to high-quality, long-lived carbon removal offsetting while being cautious about using carbon credits to measure progress on net-zero targets.

Interim Targets and Pathways Detailed

The key to achieving credible and attainable net-zero targets is through detailed net-zero pathways and interim targets. For countries, **Climate Action Tracker** has identified ten key elements of national net-zero target setting, including comprehensive planning, stakeholder management, review processes, and transparency. Comprehensive emission reduction pathways with adequate interim targets are essential for governments to limit global warming to 1.5° or 2°C above pre-industrial averages, as yearly emissions alone are insufficient. While some countries have recently updated their

Nationally Determined Contributions to reflect more ambitious interim targets, no country currently has a credible and attainable pathway to reach net-zero emissions by 2050.

Similarly, it is crucial for private sector targets to be credible. While around a fifth of companies on the Forbes Global 2,000 list have committed to net zero, less than 16% have set interim targets. To address this, sectoral transition pathways are being developed by organizations such as industry tracker and the transition pathway initiative to provide coherent data on transition pathways of companies to asset managers and owners. Companies should take advantage of industry-specific benchmarks, consider local net-zero policies, determine specific short- and medium-term interim targets, and consult with key stakeholders. Initiatives like Science Based Targets can help verify that targets are science-based and realistic.

Metrics To Track Progress Towards Net Zero Net Zero

Cross-industry principles & metrics

The Task Force on Climate-related Financial Disclosures (TCFD) recommends that organizations disclose climate-related metrics to cover three main topics: **disclosing metrics used to assess climate-related risks and opportunities, Scopes 1 and 2 emissions, and targets used to manage climate-related risks and opportunities.**

Organizations should also disclose **metrics used to assess progress against their decarbonization targets, including operational and financial performance metrics, cross-industry climate-related metric categories, and industry-specific or organization-specific metrics. Historical data** should be provided to allow for trend analysis, and the metrics should be closely related to the targets set. Organizations should define metrics that appropriately cover the topics defined above and harvest low-hanging fruits while defining processes to automate and standardize the calculation of more complex quantitative measures. The usage of carbon-related metrics can go beyond reporting, and they can be used for project selection purposes and internal carbon pricing to account for emissions in net present value calculations.

Metrics for financial institutions

Financial institutions have access to various tools that help them assess whether their investments align with sustainability goals. **ESG ratings and data** are commonly used, but **they lack the depth needed to determine whether a company is on a net-zero by 2050 path or how it compares to benchmark schedules. Portfolio alignment tools** are needed to answer these questions. **The Portfolio Alignment Team** identifies three broad groups of portfolio alignment tools, each based on a core question: **binary measurement, benchmark divergence, and implied temperature rise (ITR).** However, the quality of reporting using these tools depends on the scientific robustness of the specifications and choices made in the modeling of the scores. For instance, when using binary measurement, asset managers need to determine what is classified as a net-zero target.

Each of the three portfolio alignment tools has its own strengths and weaknesses. **Binary measurement** is easy to use, applicable to any asset class and provides a simple way to check if an entity reports a net-zero target. However, it lacks insight into the degree of net-zero alignment and can be challenging to aggregate results to the portfolio level. **Benchmark divergence** generates a measurement of the degree of alignment/misalignment, allows progress evaluation towards net zero, and can be aggregated to the portfolio level. However, it is complex and requires climate-scenario

expertise, as well as potentially difficult-to-obtain data such as company-level emissions projections and benchmarks. On the other hand, **implied temperature rise (ITR)** has all the benefits of benchmark divergence, plus it measures the consequence of alignment/misalignment and provides easily understood output. However, it is also complex, requires climate-scenario expertise, and may be based on potentially difficult-to-obtain data.

Financial institutions can also use **portfolio alignment tools to set sector-specific targets and assess whether industry-specific sub-portfolios align with net-zero pathways.** They should focus on **decarbonizing sectors with the most impact, including Scope 3 emissions**. **Taxonomies, such as the EU Sustainable Finance Taxonomy**, can help categorize investments based on their contributions to high emissions or decarbonizing activities. While taxonomies provide less detail than portfolio alignment tools, they are simple to use, understand, and increasingly included in regulatory frameworks. The UK Climate Financial Risk Forum provides an exemplary taxonomy for fossil fuel producers.

Cross-Industry, Climate-Related Metrics Categories, and Example Metrics	
Metric category	**Example metrics**
GHG emissions	• Absolute Scope 1, 2, and 3 emissions • Financed emissions by asset class • Emissions per MWh of electricity produced
Transition risks	• Concentration of credit-exposure to carbon-related assets • Percent of revenue from coal mining
Physical risks	• Proportion of real assets exposed to 1:200 climate-related hazards • Revenue associated with water withdrawn and consumed in regions with high baseline water stress
Climate-related opportunities	• Number of zero-emission vehicles and hybrid vehicles sold • Revenues from products or services that support the transition to a low-carbon economy
Capital deployment	• Percentage of revenue invested in R&D of low-carbon products • Investment in climate adaptation measures (e.g., flood defenses, location changes)
Internal carbon prices	• Internal carbon price (e.g., a company internal tax on emissions that is invested into sustainability projects) • Shadow carbon price (an estimated cost of carbon used for project selection purposes)
Remuneration	• Weighting of climate goals on scorecards for Executive Directors • Portion of employee's bonus linked to climate-related metrics

Adapted from TCFD, Guidance on Metrics, Targets and Transition Plans (2021)

Source: SCR Certificate (2023)

Reporting

The credibility of net-zero targets relies on how organizations disclose their targets and plans to external stakeholders. Various sustainability-related standards have been introduced by independent bodies to redefine the scope of financial disclosure. **The Task-force on Climate-related Financial Disclosure (TCFD)** is the leading force and baseline setter for climate risk disclosures, with over 2600 organizations supporting its recommendations. Some jurisdictions, including **Brazil, the EU, Hong Kong, Japan, New Zealand, Singapore, Switzerland, and the UK**, have made **TCFD-aligned reporting mandatory**, with more to follow. Net-zero transition plan disclosure standards are only beginning to emerge now, with the **TCFD**, **GFANZ**, and the **UK's Sustainability Disclosure Requirements (SDR)** encouraging and introducing transition plan disclosure requirements for

members and companies. In the UK, preparing and publishing net-zero transition plans will become mandatory for financial institutions and listed companies by 2023. **The International Sustainability Standards Board (ISSB)** aims to create comprehensive and lasting carbon-related financial disclosure standards and has published initial exposure drafts of its general sustainability and climate-related corporate disclosures, which seek to align with recommendations provided by other organizations. A key controversy in the development of net-zero disclosure standards is whether such standards should consider double materiality, which adds to the materiality concept by disclosing activities that could be material to society and the environment. The TCFD and ISSB are essential organizations for the future of net-zero financial disclosure, as well as national regulatory bodies that are increasingly looking to include net-zero disclosure requirements.

Goals of key disclosure and reporting standard setters

Organization	Main goal
TCFD	Improve and increase reporting of climate-related financial information by developing disclosure recommendations.
SASB	Identify the subset of ESG issues most relevant to financial performance in each of 77 industries and create disclosure standards around them.
ISSB	Deliver a comprehensive global baseline of sustainability-related disclosure standards.
GRI	Impact reporting; deliver the highest level of transparency for organizational impacts on the economy, the environment, and people.

Source: SCR Certificate (2023)

BULLET POINTS:

- Achieving a balance between global greenhouse gas sources and sinks (net zero emissions) is necessary to stabilize global temperatures. To limit global average temperature increases to 1.5°C, global emissions must halve by 2030 and reach net zero by 2050, according to the IPCC.
- Countries, sub-national governments, and companies are submitting net-zero pledges, but these differ in ambition and credibility. Some only apply to carbon emissions while others cover all greenhouse gases.
- National net-zero pledges cover all emissions produced within a country's boundaries, requiring the reduction of all domestic greenhouse gas emissions and the removal of any remaining net domestic flows via carbon sinks. There is no globally recognized standard for sub-national communities or corporations, but the Science-Based Target Initiative may become one.
- Transition plans can add credibility to net-zero pledges by demonstrating alignment with broader organizational strategies and a meaningful action plan.
- Net-zero targets are not enough without credible pathways and interim targets to ensure a timely transition.
- Carbon-related metrics track progress along a net-zero pathway, help select projects, and compare entities to peers. Stakeholder needs and public disclosure must also be considered.
- Portfolio alignment tools help financial institutions assess if counterparties are on a net-zero transition path, but portfolio decarbonization alone may not support economy-wide decarbonization or mitigate climate risk exposure.
- The net-zero disclosure landscape is evolving, with the TCFD and ISSB as leaders, and new government-backed initiatives trying to incorporate these standards into law.