United Nations
Global Compact

CORPORATE NET ZERO PATHWAY

DELIVERING THE PARIS AGREEMENT AND THE SUSTAINABLE DEVELOPMENT GOALS

A PUBLICAITON BY "SUSTAINABLE INFRASTRUCTURE FOR THE BELT AND ROAD INITIATIVE TO ACCELERATE THE SDGS" ACTION PLATFORM OF THE UN GLOBAL COMPACT, WITH KNOWLEDGE PARTNER BOSTON CONSULTING GROUP

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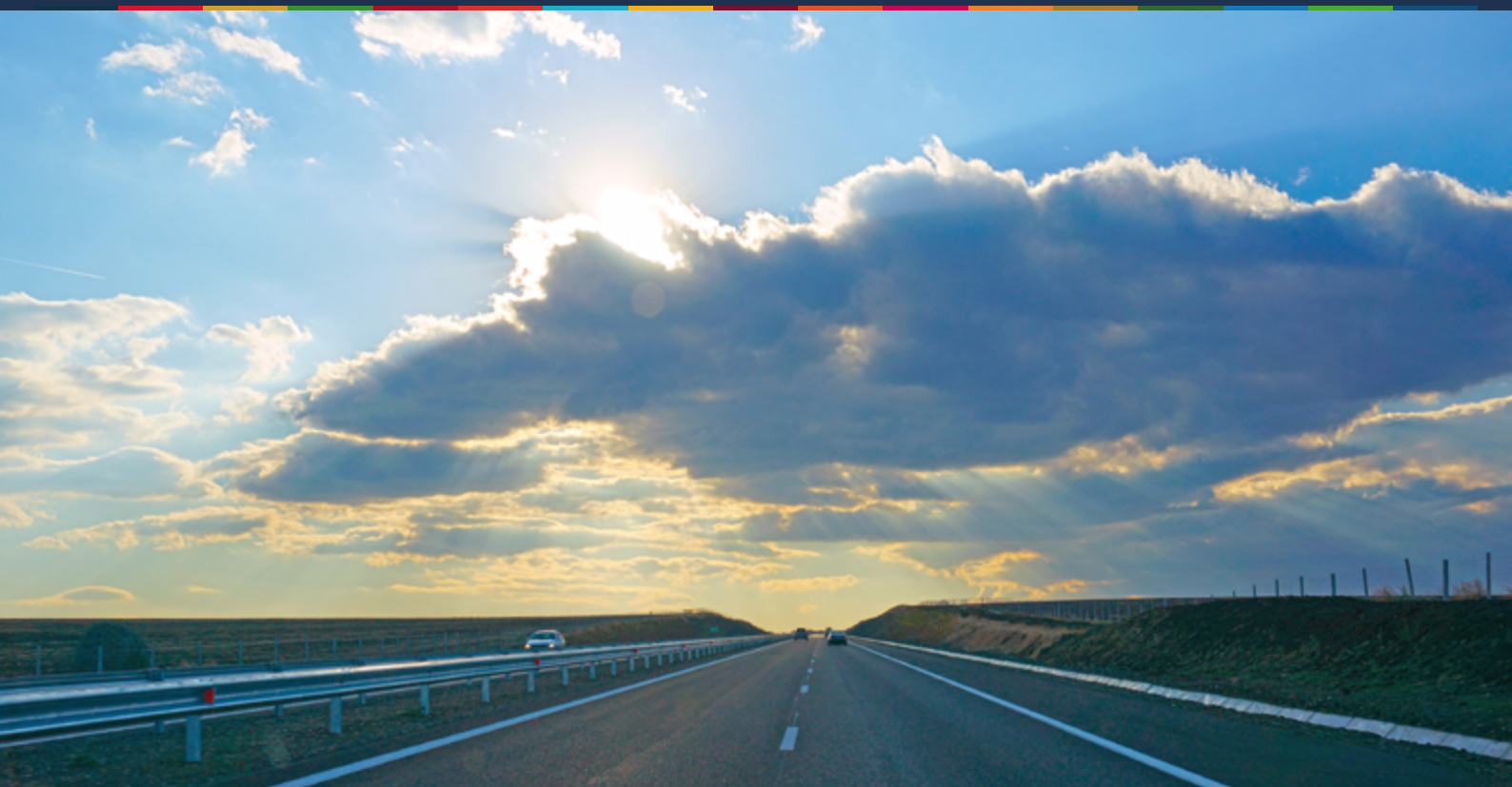

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Foreword

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The United Nations warns that on our current trajectory, levels of planet-warming greenhouse gas emissions will have barely budged by 2030, when we need to slash them by almost 50 per cent in the next decade to avoid irreversible and catastrophic climate change.

We urgently need more businesses to join the fight against climate change, and we need their pledges to be credible. Companies should not be making long-term promises without backing them up with short-term plans and actions. Yet research from the New Climate Institute shows that only 8 per cent of companies with net zero targets also have interim targets.

Science-based targets: Good for the planet, and profits

Assessing your carbon footprint and setting science-based targets is a good place to start as outlined in the report. These targets describe a company's route to reducing greenhouse gas emissions. They are considered 'science-based' if they are in line with what climate science deems necessary to meet the goals of the Paris Agreement — holding the increase in the global average temperature to well below 2 °C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5 °C above pre-industrial levels.

Science-based targets work. Collectively, 338 corporate pioneers with science-based targets have reduced their annual emissions by 25 per cent between 2015 and 2019 — equivalent to the annual emissions from 78 coal-fired power plants. But to achieve the transition to a net zero future, we need far more companies to sign on to climate-based decarbonization targets, particularly those in heavy emitting sectors.

Speaking at the World Economic Forum in January, UN Secretary-General António Guterres emphasized: "Every country, city, financial institution and company needs to adopt credible climate plans backed by intermediate goals for transitioning to net zero emissions by 2050, and to take decisive action now to put themselves on the right path. Every sector must do its part, from aviation and agriculture to transport, shipping, and industry."

Businesses must draw up decarbonization plans now, set ambitious, short-term science-based targets, and report on their progress. Together, we will activate Corporate Net Zero Pathway to deliver the Paris Agreement and the SDGs. We can and must succeed in the drive for a just transition to a Net Zero future.

Acronyms and Abbreviations

AD	Activity Data
BREEAM	Building Research Establishment Environmental Assessment Method
BRI	Belt and Road Initiative
CCUS	Carbon Capture, Utilization and Storage
CDP	Carbon Disclosure Project
CNG	Compressed Natural Gas
CO_2e	Carbon Dioxide Equivalent
EF	Emission Factors
EP	Equator Principles
ESG	Environmental, Social and Governance
EV	Electric Vehicles
GHG	Greenhouse Gases
GPF	Government Pension Fund
IFC	International Finance Corporation
IPCC	Intergovernmental Panel on Climate Change
IPMVP	The International Performance Measurement and Verification Protocol
LCA	Lifecycle Assessment
LEED	Leadership in Energy and Environmental Design
LNG	Liquefied Natural Gas
LPG	Liquefied Petroleum Gas
MSCI	Morgan Stanley Capital International
PPA	Power Purchase Agreement
PUE	Power Usage Effectiveness
PV	Photovoltaic
RNG	Renewable Natural Gas
SAF	Sustainable Aviation Fuel
SBTi	Science Based Targets initiative
SDGs	Sustainable Development Goals
TPI	Transition Pathway Initiative
WELL	The WELL Building Standard
XDC	X-Degree Compatibility
ZEV	Zero Emissions Vehicle

Photo: UN Photo/Mark Garten

Executive Summary

Global warming, which is now developing more rapidly than ever, poses a formidable challenge to the earth, driven by the ever-growing increase in greenhouse gases in the atmosphere from human activities. Achieving net zero emissions, namely reducing anthropogenic emissions and balancing the remaining GHGs with an equivalent amount of carbon removal, has therefore become an essential obligation for everyone, and actions should be taken immediately without hesitation.

A growing number of countries have committed to achieving net zero, following the call from United Nations and other multilateral organizations. Building on previous efforts, the Paris Agreement, initiated by the United Nations Framework Convention on Climate Change (UNFCCC) in 2015, is a milestone. As of March 2021, 195 parties have signed the agreement to work together to hold the increase in the global average temperature to well below 2 °C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5 °C above pre-industrial levels.

A just transition to a net zero future is an important undertaking, requiring bold actions from all parties — and effort from corporates is definitely an important one. The UN Global Compact helps businesses to align with its Ten Principles and the UN Sustainable Development Goals (SDGs) and has published this whitepaper to plot a roadmap for corporates to reach net zero, facilitating the private sector to play its role in the pathway.

Carrying out an emissions inventory audit is the starting point of the transition, which allows companies to determine their base year emissions. The whitepaper suggests a step-by-step approach, including clarifying boundaries of organizations, explicating gases, identifying relevant activities and assessing emissions on an activity level. By analysing underlying principles and recognizing different accounting and reporting standards, the WRI/WBCSD GHG Protocol (GHG protocol) has been viewed as the leading standard that lays the foundation for measuring and reporting corporates' global GHG emissions as many of the popular guidelines refer to it.

Setting emissions reduction goals is another important step in the roadmap. Companies are advised to decide on a level of ambition, a target type, the reach of the target and a timeline before making final decisions to ensure that their goals are realistic and feasible. In terms of reporting standards, the Science Based Target initiative (SBTi), launched by the UN Global Compact, Carbon Disclosure Project (CDP), World Resource Institute (WRI) and the World Wildlife Fund (WWF), has rapidly become the most recognized frameworks to set emissions reduction targets based on the latest climate science.

Designing decarbonization initiatives is also a vital component of corporates' net zero roadmap planning. Infrastructure industries require special attention since they account for

approximately 70 per cent of total global emissions and together will have a tremendous impact on other facets of human society during the net zero transition. **This whitepaper suggests specific decarbonization initiatives for six of the infrastructure industries from the consumption side — transportation, agriculture and food, industrial manufacturing, construction, digital and information and financial services — based on best practices from pioneer players** and provides deep-dive case studies for companies to understand more details on the decarbonization highlights and key lessons learned to inspire their own efforts.

The whitepaper proposes **nine key initiatives**, based on an extensive study of best practices from 48 companies in six industries. The initiatives are applicable to companies with any sectorial background, covering the whole net zero transition to help companies reach net zero in their own businesses as well as in their value chains. The initiatives are as follows:

- **Audit and set net zero goals**
- **Optimize energy efficiency during operations**
- **Increase renewable energy use in operations**
- **Use green buildings**
- **Promote green ways of working**
- **Support decarbonization of the supply chain**
- **Design sustainable products**
- **Utilize green downstream logistics**
- **Launch products to facilitate decarbonization in other industries**

Chapter 6 **outlines suggested roadmaps for companies from the six infrastructure industries**, identifying crucial industry-specific actions in accordance with the nine initiatives and, sorting them into short-term, middle-term and long-term actions based on their importance and ease of implementation.

The final chapter of the whitepaper selected **nine prospective technologies** that forward-looking corporates and investors could pay attention to generate long-term benefits for both businesses and society.

We believe a clear and scientific corporate net zero pathway, in line with the Ten Principles of the UN Global Compact, will guide the efforts of the private sector to accelerate the realization of the Sustainable Development Goals.

Photo: UN Photo/UN7128929

1. The Race to Net Zero Emissions

Global warming — which is now developing more rapidly than ever — poses a formidable challenge to the earth, driven by the ever-growing increase in greenhouse gases (GHGs) in the atmosphere from human activities (NASA, 2010). Achieving net zero emissions, namely reducing anthropogenic emissions and balancing the remaining GHGs with an equivalent amount of carbon removal (WRI, 2019), has therefore become an inevitable obligation for everyone, and actions should be taken immediately without hesitation.

The United Nations and leading multilateral organizations have proactively boosted the global transition to net zero, unifying global forces from various parties.

- **The United Nations Framework Convention on Climate Change (UNFCCC) is an entity founded to facilitate the global response to the threat of climate change** and focuses on promoting the intergovernmental climate change negotiations in its early years, supporting the implementation of the United Nations Framework Convention and the Kyoto Protocol. In 2015, grounded on previous efforts, the UNFCCC initiated the Paris Agreement, a legally binding international treaty on climate change, aiming to hold the increase in the global average temperature to well below 2 °C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5 °C above pre-industrial levels (UNFCCC, 2015). As of March 2021, 195 parties have signed and 191 had ratified the agreement. The **UNFCCC also launched the Race to Zero campaign**, rallying leadership and support from a growing number of businesses, cities, regions and investors committed to achieving net zero emissions by 2050 at the latest. As of March 2021, 85 major investors, 1,675 businesses, 22 regions, 569 universities and 471 cities had successfully qualified to join the Race to Zero (UNFCCC, 2021).

- **The UN Environment Programme (UNEP) initiated The Six Sector Solution to Climate Change,** a roadmap for six major sectors (energy, industry, agriculture & food, forests & land use, transport, buildings & cities) to boost their transition to net zero targets (UNEP, 2020).

- **The International Renewable Energy Agency (IRENA) launched the World Energy Transitions Outlook** in 2021 which outlines a nuanced vision of the transition of the world's energy landscape aligned with the Paris Agreement goals, presenting high-level insights on technology choices, investment needs and socio-economic contexts involved in setting the world on a trajectory towards a sustainable, resilient and inclusive energy future (IRENA, 2021).

Echoing global trends, Governments from different countries have committed to the carbon reduction pathway. Although 86 per cent of emissions come from the top 20 countries, the race to net zero emissions is dependent on every country. Pledging to curb carbon emissions and halt global warming, 195 parties signed the Paris Agreement (UNTC, 2021), which together account for 92 per cent of global GHG emissions. The Paris Agreement sets a long-term goal for all global citizens to hold the increase in the global average temperature to well below 2 °C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5 °C. In addition, the Belt and Road Initiative (BRI), an initiative for international economic cooperation with infrastructure development as one of the focuses, is worth further attention since it is playing an increasingly salient role in world economics thanks to huge infrastructure investments and is a major enabler in the race to net zero emissions. With aggregate investment of over $4 trillion by Q1 2020 (Refinitiv, 2020), the average BRI infrastructure investment per year is estimated to reach $0.67 trillion[1], accounting for around 20 per cent of annual global infrastructure investment, which is estimated to be around $3.7 trillion between 2016 and 2040 (Oxford Economics, 2017). More importantly, 2020 was the first half year in the BRI, when the portion of renewable energy investments reached at 58.12 per cent, approximately 40 per cent increase compared to the 2014 level (Wang, 2020). Belt and Road Cooperation partner countries make up a significant footprint in the decarbonization process.

Countries are taking varying actions through legislation and policymaking to cope with climate problems and jointly mitigate the effects of global warming. **They can be divided into five categories according to the stage of climate action they have reached** (Energy and Climate Intelligence Unit, 2021)**: 1. countries that claim to have achieved net zero emissions, 2. countries that have enacted legislation, 3. countries that have proposed legislation, 4. countries that have issued a policy document and 5. countries that are still discussing climate issues.**

1. Countries that claim to have achieved net zero emissions

Two countries, **Suriname**[B&R2] and Bhutan, have already claimed to have achieved net zero emissions mainly because of their high forest coverage and low energy demand. They will continue to have high forest coverage and a renewable energy mix in the future.

- **Suriname:** Suriname claimed to achieve net zero emissions in 2014. It has maintained over/more than per cent forest coverage for the past few decades. Its electricity, gas and water supply accounted for 2.8 per cent of its 2019 gross domestic product (GDP) at market prices. Suriname remains committed to maintaining 93 per cent forest coverage — equivalent to more than 15.2 million hectares (The Republic of Suriname, 2020).

1. Estimated monthly average based on the data disclosed in Refinitiv report, assuming the accumulative investment started from the first quarter of 2015.
2. [B&R] refers to Belt and Road Cooperation partner countries.

- **Bhutan:** Bhutan claimed to achieve net zero in 2018. It has more than 60 per cent forest coverage and aims to increase this to 70 per cent through legislation. It will also adopt a Renewable Energy Act to provide the legal, economic and institutional basis for the promotion of renewable energy sources. Bhutan has also promoted a low-carbon transport system and will develop its hydropower from run-of-the-river systems to account for almost 100 per cent of electricity generation (Bhutan, 2015).

2. Countries that have enacted legislation

Six countries, including **Hungary**[B&R], **New Zealand**[B&R], the United Kingdom, France, Denmark and Sweden have officially enacted relevant legislation.

- **The United Kingdom:** In 2008, the United Kingdom passed the "Climate Change Act 2008", which committed to an 80 per cent reduction in carbon emissions by 2050, compared to 1990 levels. In 2019, the United Kingdom passed an order to revise the Climate Change Act of 2008, changing the target for the net United Kingdom carbon account from at least 80 per cent lower than the 1990 baseline to at least 100 per cent lower by 2050 (the 2050 Target Amendment).
    - **Reduction targets for different industries:** The Act offers advice and guidance for those governed by the law and reduction targets for the consumption of energy, resulting in businesses focusing on energy efficiency and waste reduction.
    - **Power efficiency regulation:** The Act also resulted in the Gas Act, the Electricity Act and the Utilities Act, which introduced a responsibility for energy producers and suppliers to reduce waste and improve efficiency (UK, 2019).
- **New Zealand:** In 2019, the New Zealand Government adopted the "Climate Change Response (Zero Carbon) Amendment Act 2019", which aims to put the goal of achieving zero net greenhouse gas emissions by 2050 on a statutory footing. The Act mainly focuses on the decarbonization of the energy mix by speeding up the reduction of fossil energy consumption. It pledges to reduce the net accounting emissions of greenhouse gases, other than biogenic methane, to zero by 2050 and the emissions of biogenic methane to 10 per cent less than 2017 emissions by 2030, and 24-47 per cent less than 2017 emissions by 2050, while new offshore oil and gas exploration will be banned (New Zealand, 2019).

3. Countries that have proposed legislation

Six countries/regions, including **the Republic of Korea**[B&R], **Chile**[B&R], **Fiji**[B&R], Canada, the European Union and Spain have already proposed climate legislation.

- **The Republic of Korea:** In 2020, the National Assembly of the Republic of Korea declared a 'climate emergency' as part of a resolution aimed to facilitate the country's climate efforts and set out its 2050 net zero target in law. In March 2021, President Moon Jae-in declared that the country will achieve net zero emissions by 2050 and the new climate target would be introduced in the coming months, supported by the Green New Deal (BusinessGreen, 2020).

- **Canada:** In November 2020, the Canadian Government introduced **the Canadian Net Zero Emissions Accountability Act (Bill)**. The proposed Act will legally bind the Government to achieve net zero emissions by 2050 by requiring that emission-reduction targets be set for the milestone years 2030, 2035, 2040 and 2045 and that emission-reduction plans be developed for each target date (Canada, 2020).

4. Countries that have issued a policy document

Twenty-one countries and states including **China**[B&R], **Austria**[B&R], **Portugal**[B&R], **Slovenia**[B&R], **Kazakhstan**[B&R], **South Africa**[B&R], **Panama**[B&R], **Costa Rica**[B&R], **Indonesia**[B&R], the United States, Japan, Germany, Finland, Iceland, Switzerland, Norway, Ireland, Andorra, the Vatican City, Brazil and the Marshall Islands are processing policy documents.

- **China:** In March 2021, **China's 14th Five Year Plan** included actions to mitigate the climate change, developing action plans to peak carbon emissions by 2030 and taking proactive actions to reach the net zero emissions goal by 2060. The plan echoed the announcement by President Xi Jinping at the general debate of the 75th Session of the United Nations General Assembly in September 2020 that China aims to have CO_2 emissions peak before 2030 and achieve carbon neutrality before 2060. Actions will mainly focus on controlling both the amount and intensity of energy consumption, especially for combustion fuels, promoting clean energy and facilitating decarbonization in industrials, buildings and transportation areas (Xinhua, 2021).

- **The United States:** President Joe Biden passed the **Executive Order on Tackling the Climate Crisis at Home and Abroad** in January 2021 to achieve a carbon pollution-free power sector by 2035 and put the United States on an irreversible path to a net zero economy by 2050. The main focus is on refining the country's energy mix, directing federal agencies to eliminate fossil fuel subsidies as consistent with applicable law and identify new opportunities to spur innovation, commercialization and the deployment of clean energy technologies and infrastructure. It also encourages the federal Government to pause on entering into new oil and natural gas leases on public lands or offshore waters, launch a rigorous review of all existing leasing and permitting practices related to fossil fuel development on public lands and waters and identify steps that can be taken to double renewable energy production from offshore wind by 2030 (US, 2021).

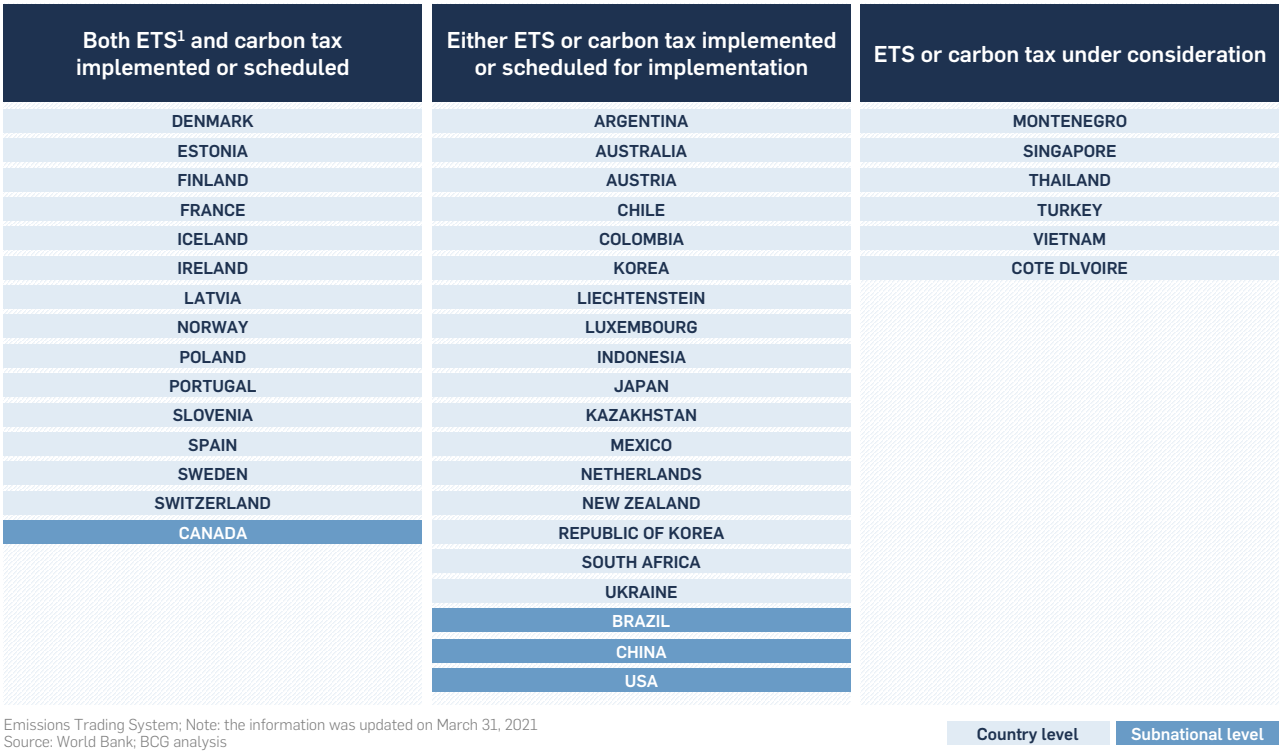
- **Indonesia:** Indonesia disclosed a 2050 Long-term Strategy on Low Carbon and Climate Resilience (LTS-LCCR) through the Ministry of Environment and Forestry in 2021 (Indonesia, 2021), and has announced in May 2021 that it will reach net zero emissions by 2060. Effective policymaking actions are followed by the target: for example, Indonesia also claimed in May 2021 that it will stop building new coal-fired power plants after 2023 and it has developed partnership with organizations like International Chamber of Commerce (ICC), The Organisation for Economic Co-operation and Development (OECD), World Bank and World Economic Forum (WEF) to develop The Tri Hita Karana (THK) Blended Finance Roadmap, taking Blended Finance as a way to catalyze private investment to facilitate the transitions. Besides, the Low Carbon Development in Indonesia (LCDI) is also explained by the Ministry of National, planning earlier net zero scenarios and its implication to Indonesian economic growth (IESR, 2021).

5. Ninety-seven countries have entered the national policy discussion stage. In particular, countries in Africa and the Middle East are expected to catch up on the net zero race and propose legislation or policy documents concerning net zero emissions in the coming years, bringing approximately 75 per cent of global emissions under strict reduction regulations.

- **Israel:** The Israeli Ministry of Environmental Protection proposed a comprehensive bill in April 2021 that seeks to slash the country's greenhouse gas emissions by 85 per cent by 2050, in comparison to its 2015 emissions, and also includes specific goals such as to reduce coal-fired power plants and expand the use of renewable energy. The new law will be the first to set national climate goals and establish an independent expert committee to advise the Government on the issue. The draft Climate Law is expected to be published in the near future for public and Government review, which marks a significant milestone in Israel's net zero pathway (Ynet, 2021).

- **Zambia:** Zambia presented an updated Nationally Determined Contribution (NDC) to the UNFCCC at the end of 2020, highlighting key ambitions on decarbonization issues, insisting on the target of at least 25 per cent and up to a 47 per cent reduction in greenhouse gas emissions compared to 2010, while broadening the range of sectors under mitigation by adding transport, liquid waste and coal (Zambia, 2020).

We have witnessed considerable progress in climate legislation. Decisive steps from more countries and a more well-rounded understanding of the laws can be expected in the next few years; 33 countries have enacted or proposed relevant legislation or have established policy documents, together accounting for 66 per cent of global emissions. As more high emitting countries accelerate their legislation/policy making process, around 75 per cent of total emissions could be governed by strict regulations by 2025 (Energy and Climate Intelligence Unit, 2021). The refinement of the energy mix remains the key initiative in multiple national laws and policies related to climate change as most countries are striving to promote the use of renewable energy and reduce fossil fuel consumption from energy use. **Meanwhile, as carbon trading becomes an increasingly popular means to achieve net zero emissions, countries have emphasized carbon market regulation:** 41 countries have set comprehensive pricing and trading systems for different types of carbon emissions and many countries, including China, have accelerated the policy making process to develop well-regulated carbon trading and pricing systems (Exhibit 1).



Emissions Trading System; Note: the information was updated on March 31, 2021
Source: World Bank; BCG analysis

Exhibit 1. 41 countries, representing around a quarter of global GHG emissions are putting a price on carbon in either national level or subnational level

While Governments and international organizations have sent out aspiring signals that the transition to a low-carbon economy is underway and inevitable in the long run, **corporates in different industries have a critical role to play in bridging the gap between the level of effort countries have pledged and the critical reality**. In October 2018, the Intergovernmental Panel on Climate Change (IPCC) published a "Special Report on Global Warming of 1.5°C", which stated the imperative of raising the Paris Agreement ambition to limiting the global temperature rise to 1.5°C above pre-industrial levels. In response, the United Nations Global Compact (UN Global Compact), Carbon Disclosure Project (CDP), the World Resources Institute (WRI) and the World Wildlife Fund (WWF) launched a new campaign in 2019: "Business Ambition for 1.5°C", calling on corporates to set targets aligned with the 1.5°C goal and reach net zero emissions by no later than 2050. The **Global Energy Interconnection Development and Cooperation Organization (GEIDCO), a non-profit international organization headquartered in China that is dedicated to promoting the sustainable development of energy worldwide, initiated the World of Energy Interconnection Platform** in March 2021, aiming to solve pain points in the power infrastructure by building a comprehensive service platform for Governments, enterprises, institutions and other users worldwide, focusing on project promotion, exchanges and cooperation, resource sharing and conferences (GEIDCO, 2021).

In the following chapters, this report will elaborate on how corporates could design their own net zero roadmap from auditing emissions inventory to setting goals and integrating initiatives.

Photo: UN Photo/UN753621

2. Emissions Inventory Auditing

As a starting point, companies need to determine their base year emissions. However, this can be a complicated process that requires companies to clarify the boundaries of their organizations, explicate gases, identify relevant activities and assess emissions on an activity level. To make things more difficult, there are dozens of competing GHG accounting and reporting standards initiated by non-governmental organizations, institutions and Governments.

The underlying principles of these GHG accounting standards, however, are consistent. There are two main approaches to measuring GHG emissions that can be used to integrate GHG emissions inventories:

- **The emission factors approach** determines emissions by calculating activity data and the corresponding emission factors. This assessment approach has been widely adopted by most standards, especially the popular WBCSD/WRI GHG protocol and ISO 14000 series.

- **The measurement-based approach** is based on continuous measurement of the concentration of relevant GHGs on an activity level, utilizing CEMS (Continuous Emissions Monitory Systems). This approach appears to be more in line with industry or sector specific reporting standards, for example the USEPA GHG Final Rule, the EU ETS Monitoring and Reporting Regulation (MRR) and China's GB/T 32150/32151 (Requirements of GHG emission accounting and reporting).

The WRI/WBCSD GHG Protocol (GHG protocol) has been viewed as the leading standard that lays the foundation for measuring and reporting corporates' global GHG emissions as many of the popular guidelines refer to it. For instance, CDP, the GHG reporting system widely recognized by investors, stakeholders and the Global 500, recommends following the GHG protocol standard. More than 9,600 companies worldwide report to CDP and most of them have adopted the GHG protocol for baselining, accounting for 50 per cent of global market capitalization. Therefore, companies need to understand the principles and process for baselining based on the GHG protocol.

1. Clarify organizational boundaries

The GHG protocol recommends three approaches to define organizational boundaries for the GHG inventory. The equity share approach accounts for emissions under operations based on share of equity, reflecting companies' economic interests. The financial control approach only includes emissions over which the company has 100 per cent control. The operational control

approach excludes emissions in which companies own an interest but are not able to direct operations (World Resource Institute). Companies can select one of these three approaches when defining the organizational boundaries and use it for the entire inventory over time for consistency.

2. Explicate relevant gases

The GHG protocol, like many other global or regional standards, suggests that companies refer to the "Kyoto basket of six", which includes carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons and sulfur hexafluoride. Yet the coverage is not mandatory, leaving companies freedom to identify the types of gases relevant to their major operating activities.

3. Identify relevant activities

Companies need to determine the type of activities that should be included in the calculation of the emissions baseline. The GHG protocol classifies emissions into three scopes, which can offer guidance to companies at this stage. (Exhibit 2)

- **Scope 1** accounts for direct GHG emissions from both fuel combustion activities and physical or chemical production processes under a company's direct control. Typical Scope 1 emissions could be generated in activities from coal-fired power generation, the use of self-owned gasoline vehicles, chemical materials processing, and fugitive gas leakage from equipment.

- **Scope 2** accounts for the indirect GHG emissions from consuming purchased or acquired power, including electricity, heat, steam, and cooling. Typical Scope 2 emissions represent the amount of GHG released from off-site power stations during the generation process. Upstream or downstream emissions associated with power generation are not included.

- **Scope 3** accounts for other indirect GHG emissions which envelope a wide range of activities. The GHG protocol suggests an indicative list of commonly used activities, however, companies preserve the autonomy to decide what to include. As a result, Scope 3 emissions could be controversial for many corporates. Before going deeper on emission assessment processes, companies need to set a line regarding the responsibility that they are willing to take from their upstream and downstream partners.

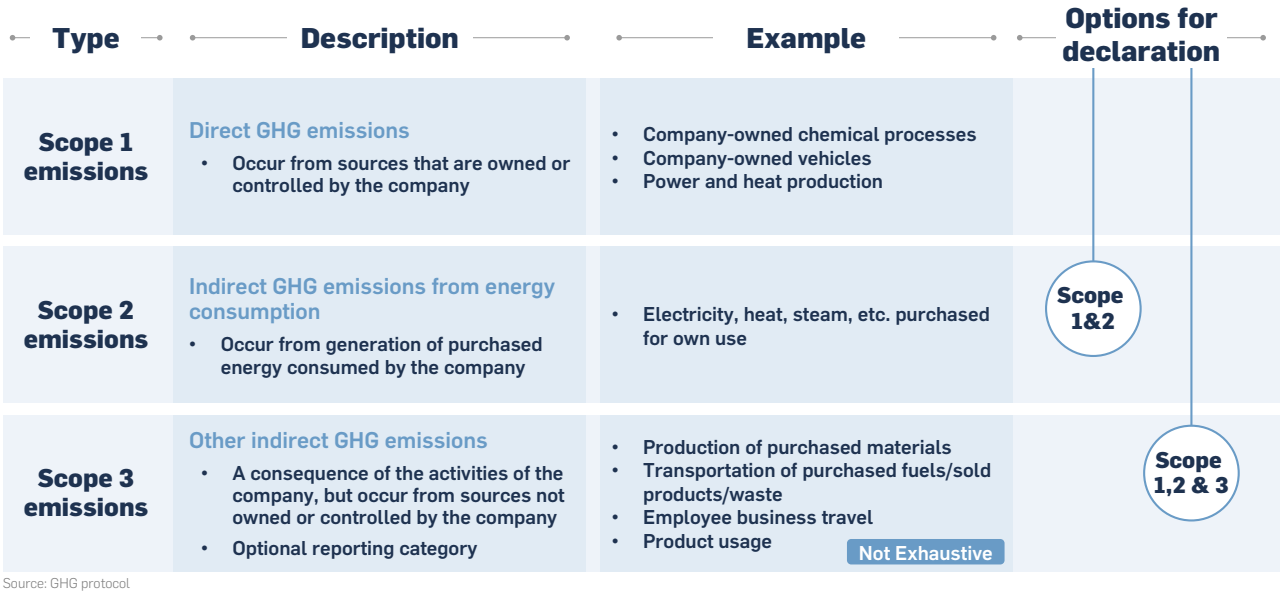


Exhibit 2. GHG protocol defines 3 scopes of emissions with indicative list of activities

In most of the reporting systems that refer to the GHG protocol (including CDP), Scope 1 and Scope 2 are often required, while Scope 3 is generally optional. The reflections on Scope 3 emissions allow companies to differentiate themselves on their environmental consciousness and social responsibilities.

4. Assess the emission level

Since the GHG protocol for corporates adopts an emission factors approach (Exhibit 3), there are three major steps that companies need to take when evaluating the level of their emissions: first, collect data from activities considered to be relevant from a business perspective, then choose the most appropriate emission factor and lastly, calculate the level of emissions.

- Step 1 **Collect activity data (AD):** Companies need to identify the source of emissions for each activity within the designated scope and collect activity data as one of the key parameters. The activity data are the information that directly relate to the energy usage, for example, kilowatt hours of electricity or tons of waste in landfill. The collection process is often time-consuming, especially for companies that do not have the necessary data infrastructure in place.

- Step 2 **Choose emission factors (EF):** Emission factors can be different or contingent on individual activities, regions or countries, technologies or the fuel mix, yet direct measurement or calculation of emission factors is not essential for most companies, especially those operating in mid-to-low emission industries. A series of standard factors has been published by non-governmental organizations and industry associations as a proxy for companies to leverage. Furthermore, country-specific emission factors

across sectors are often recognized as a better estimation, e.g., the EU ETS MRR, US EPA GHG Rule, and China's GB/T 32150/32151. IPCC default emission factors can be used as a supplement when more accurate EFs are not available. Companies could always leverage resources like the IPCC emission factor database (EFDB) to quickly obtain emission factors from multiple sources, reducing the complexity of emissions assessment.

- **Step 3 Multiply the AD by the EFs:** After gathering key parameters, AD and EFs for each activity, the calculation process becomes straightforward. Simply multiply the activity data by the emission factors and roll it up to the corporate level. Emissions data then need to be converted from different types of gases against a common basis — CO_2 equivalent (CO_2e) — according to a globally recognized standard (Global Warming Potential, GWP[3]).

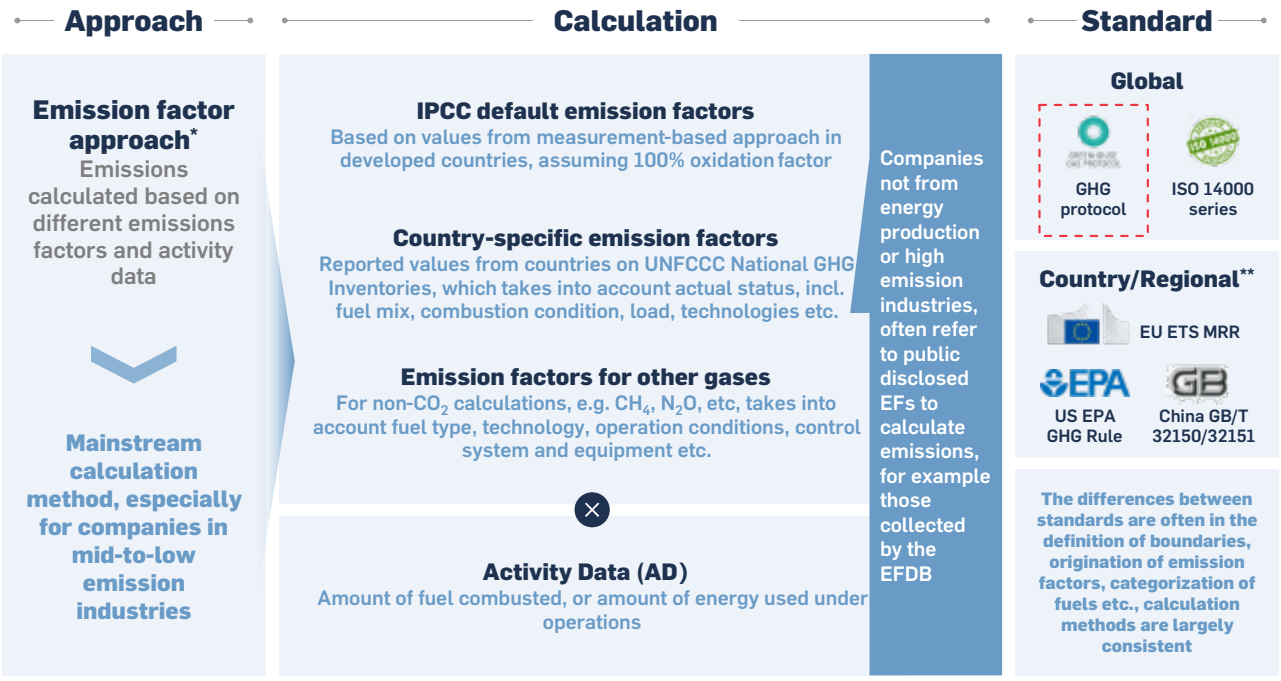


Exhibit 3. Most standards adopt the "emission factor" approach to calculate emissions

Aside from going through the steps manually, the GHG protocol also provides Excel tools[4] to facilitate the calculation of emissions in selected sectors, for example, aluminum, cement and semiconductors. Companies in these sectors could leverage the consolidated tools after identifying activities, selecting emission factors and coding the calculation process.

3. The GHG protocol does not set a reference for GWP, while most global standards refer to the IPCC second assessment report.
4. https://ghgprotocol.org/calculation-tools.

3. Setting GHG Emissions Reduction Goals

Setting sensible emissions reduction targets is critical for corporates to move forward on net zero pathways. The Paris Agreement sets the goal to hold the increase in the global average temperature to well below 2 °C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5 °C (UNFCCC, 2021) and companies are supposed to translate the goal into actionable reduction goals. There are four key dimensions for companies to consider (Exhibit 4):

- **Decide on the level of ambition.** Companies need to decide how aggressive a goal to set based on their current level of emissions, willingness to invest and the general expectation/requirement of the industry. This level of ambition could be reflected in the global temperature-rise scenario the company commits to.

- **Determine the target type.** An absolute target or an intensity target links the company's emission reduction goals with a temperature-rise scenario. Absolute targets can be applied to most industries and offer more straightforward pathways to reduce global GHG emissions. However, they are challenging for companies with growing business to achieve and it would be inefficient to measure the environmental performance of a shrinking business, therefore many companies would prefer to adopt intensity targets (emissions per unit of economic output, such as unit of production, number of employees, or added value) or set both absolute and intensity targets. Industries with well-defined activities and physical intensity data (e.g., electricity generation, iron and steel, chemicals, aluminum, cement, pulp and paper, road, rail and air transport, and commercial buildings) are best suited to intensity goals.

- **Identify the reach of the target.** Companies need to verify which scopes (Scope 1, 2 or 3) should be covered by the emission reduction target and which regions and business units should be included in the target-setting process.

- **Set the timeline.** Companies need to set goals for both the short or medium-term and long-term in order to design more feasible roadmaps.

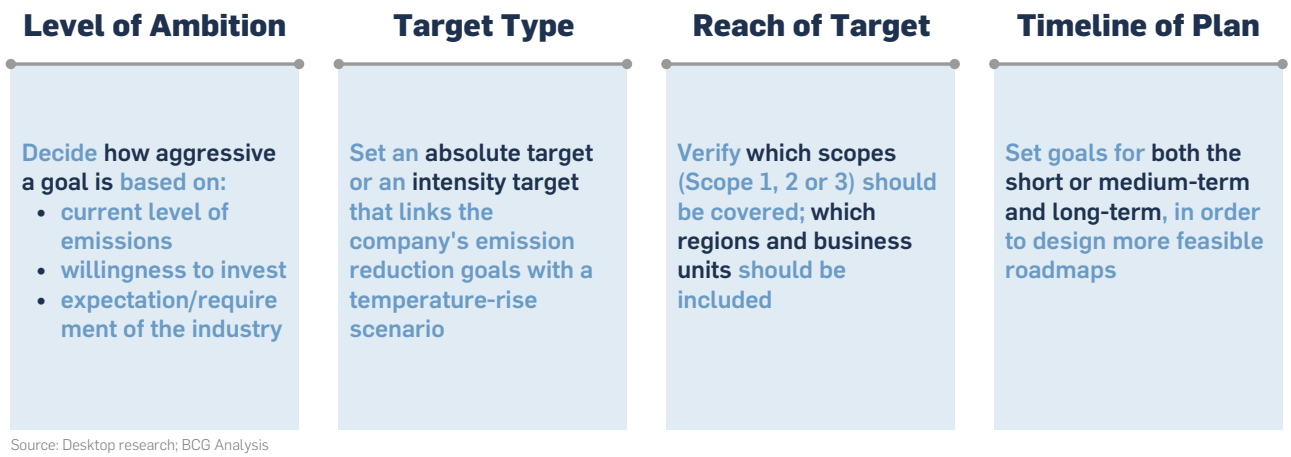


Exhibit 4. Four key dimensions should be considered before setting emissions reduction targets

Several standards allow companies to determine their emission reduction targets based on the latest climate science and **four of them have been widely adopted globally, including the Science Based Targets initiative (SBTi), Transition Pathway Initiative (TPI), X-Degree Compatibility (XDC) and the SME Climate Hub.**

- **SBTi** is a partnership between the UN Global Compact, CDP, WRI and WWF, supporting companies to set emission reduction targets required to hold the increase in the global average temperature to well below 2 °C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5 °C. SBTi currently offers a target setting methodology for short and medium-term emission reduction targets (5 to 15 years) and building on the well-established target setting methods, the SBTi is broadening the timeframe and will soon be able to provide methods for science-based net zero targets for the long-term, which is expected to be launched at the end of 2021 (SBTi, 2021).

- **TPI** is a global initiative led by the Environment Agency Pension Fund in the United Kingdom, associated with many asset owners and supported by asset managers. Using publicly disclosed data, TPI assesses the progress that companies are making on the transition to a low-carbon economy, supporting efforts to mitigate climate change and thus provide companies with guidelines to set or adjust emission reduction targets (TPI, 2020).

- **XDC** is a scientific climate metric initiated by right. based on science, a Germany-based climate advisory agency. XDC is designed to quantify a company's contribution to global warming by expressing how many celsius degrees the Earth would warm up by 2050 if all companies were as emission-intensive as the company under consideration, assuming the same economic output. Companies could take their output as a sensible benchmark to set or adjust their emission reduction targets (right. based on science, 2020).

- **The SME Climate Hub** is an pioneering initiative of the International Chamber of Commerce, the Exponential Roadmap Initiative, the We Mean Business coalition and the United Nations Race to Zero campaign, aiming to support small and medium-sized enterprises (SMEs) as they commit to halve greenhouse gas emissions before 2030, and race to net zero emissions before 2050 by guiding them to set down commitments and empowering them with toolkits to decarbonize their own businesses as well as their value chains (SME Climate Hub, 2020).

All four standards share the same basic methodology for setting emission reduction targets. They all link a company's level of ambition with different temperature-rise scenarios. SBTi offers two scenarios, well below 2°C and 1.5°C (SBTi, 2020). TPI offers five scenarios including two scenarios (upper and lower case) for both 2.0°C and 1.75°C and one scenario for "Paris Pledges", namely 1.5°C (TPI, 2021). XDC offers two scenarios (2°C and 1.5°C) (right.based on science, 2020) and the SME Climate Hub offers one scenario (1.5°C). Although companies are encouraged to make more dedicated ambitions, they have the flexibility to set goals based on their ambition levels.

Over the past several years, SBTi has rapidly become the most recognized way for companies to align their corporate goals with the Paris Agreement due to its compatibility and coverage. By March 2021, 1,323 companies had joined SBTi, compared to 340 for TCI and 30 for XDC, and around 800 SMEs with no more than 500 employees for the SME Climate Hub.

Compatibility: **SBTi offers the most customized target types and guidance for companies from different industries.**

- **SBTi offers companies two types of targets, absolute contraction and the sectoral approach, including both physical intensity and economic intensity**. It allows companies to express their targets either in absolute terms (tCO_2e) or intensity terms (e.g. tCO_2e/t product) and offers other methods for Scope 3 target setting (SBTi, 2020). By contrast, the other three standards offer only one type of target. Using SBTi to set the emission reduction target, each company can utilize its tools to compare the target using various approaches and choose the most appropriate type for its industry and status since the performance of the two types of targets varies when applied to different industries.

- **SBTi offers the most detailed manuals for companies to follow.** SBTi provides manuals and guidance that take companies step by step, from getting internal buy-in to selecting a base year, target year, scopes, boundaries and target-setting methods in line with best practices. It also provides a set of criteria and validation

protocols that ensure transparency and comparability of targets within a given industry and across industries. It even provides manuals for individual industries, including aluminum, forest, land and agriculture (FLAG), power, chemicals, apparel and footwear as well as information and communication technology (ICT), and is developing manuals for other major industries. By following industry-specific manuals, companies will find the goal setting process much easier and more sensible to follow (SBTi, 2020).

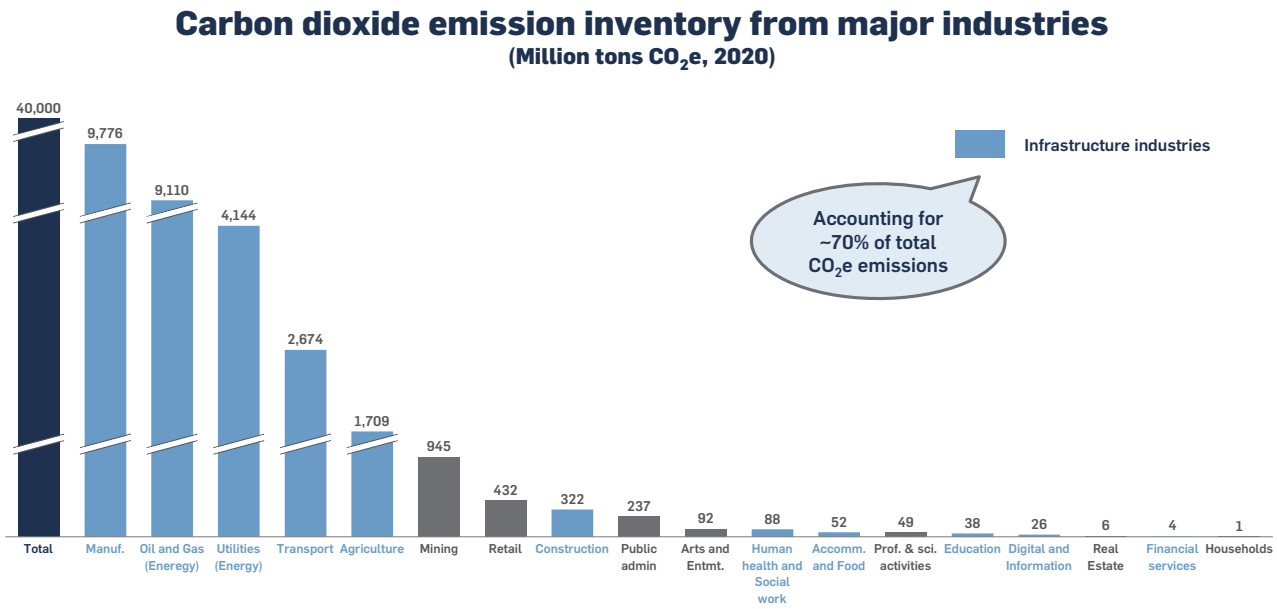
Coverage: SBTi covers more industries than the other three standards.

- SBTi covers 15 major industries and provides industry-specific guidelines on target setting. It is still developing industry-specific guidelines for other major industries including oil and gas, transport, chemicals and financial services (SBTi, 2020). TCI (TPI, 2020) and XDC (right.based on science, 2020) cover approximately 10 major industries each. For the SME Climate Hub, participants are suggested to refer to details from the 1.5°C Business Playbook, another detailed guidance by The Exponential Roadmap Initiative on GHG emissions reductions which outlines how seven major industries can set targets aligned with the 1.5°C ambition (SME Climate Hub, 2020).

Photo: UN Photo/Loey Felipe

4. Initiatives to Achieve Net Zero Goals in Six Industries

GHG emissions come from various industries, among which industries related to infrastructure deserve particular attention. Infrastructure, by its narrow definition, refers to structures that provide essential services to society, and construction, manufacturing and utilities are the most closely-related industries; the definition could be even broadened to include social infrastructure, including IT systems, finance and insurance systems, educational systems, transport, agriculture and food and health-care systems. (Nature Sustainability, 2019). **These infrastructure industries not only provide fundamental services to people but also account for around 70 per cent of total emissions** (Exhibit 5)**.**



Note: Emission inventory is calculated based on emission intensity per value from UK Environmental Accounts and real GDP of different industries from Oxford Economics. Total human cased CO_2e emissions data from Global Carbon Project (GCP)
Source: Global Carbon Project; UK Environmental Accounts; Oxford Economics; BCG analysis

Exhibit 5. Infrastructure industries account for ~70 per cent of total emissions, demanding special attention

The energy industry, including both oil and gas and utilities (electricity, gas, steam and air conditioning supply), is the biggest emitter and has the highest carbon intensity. **Net zero initiatives in this industry have been straight forward since efforts should primarily concentrate on the transition to clean energy.** Iconic companies such as **PetroChina**[M][5], **SINOPEC**[M], **CNOOC**[M], **Total**[M] and **Shell**[M] have made major efforts to develop and adopt clean energy sources like geothermal energy, biodiesel and hydrogen. Outdated production capacity has been gradually phased out to improve the companies' overall energy efficiency. Energy firms are also developing rigorous auditing systems to build a clear picture of their products' carbon footprints. The commercialization of carbon capture, utilization and storage (CCUS) has been a hot topic among all these companies and has been used in enhanced oil recovery. Meanwhile, renewable energy companies like Power Electronics, **Orsted**[M], First Solar and **LONGi Solar**[M SBTi][6] are striving to facilitate the uptake of renewable energy including solar power, wind power and hydropower along value chains, accelerating the decarbonization process by reducing fuel combustion. **In addition, there is a trend towards enhanced cooperation between oil and renewable energy companies.** SINOPEC and LONGi Solar announced a strategic partnership in April 2021, collaborating closely on areas including a distributed photovoltaic (PV) system, hydrogen and chemical materials to meet the net zero emission goal (LONGi Solar, 2021).

In this report, we will include manufacturing, transport, agriculture and food and construction — the other four highest emitting infrastructure industries — and will also include digital and information and financial services, as these two industries play a fundamental role in human life as well as, furnishing and enabling other industries in their transitions to net zero. Therefore, as our aim is to help corporates design their own net zero roadmaps, we will concentrate **on six major industries — transport, agriculture and food, industrial manufacturing, construction, digital and information and financial services**[7] — offering detailed best practices and an emissions reduction roadmap for each.

5. [M] stands for UN Global Compact members as of May, 2021.

6. [SBTi] stands for companies which joined SBTi, including both of those that committed and already set targets as of May 2021.

7. The Marrakech Partnership is an initiative by the UN Global Compact, supporting the implementation of the Paris Agreement by strengthening collaboration between Governments and key stakeholders to immediately lower emissions. The six industries also cover most of the sectors that the Marrakech Partnership includes and provides with an Industry Pathway. Specifically, aluminum, apparel, plastics and steel are included in manufacturing in the membership; cement and concrete are included in construction; ICT and mobile are included in digital and information; FMCG is included in food and agriculture. Chemicals, mining and retail will not be included in this report.

4.1. Transportation

The decarbonization of transportation is one of the areas where the needle could be moved the most on the pathway to net zero. As well as being one of the highest-emitting sectors in modern life, the transportation sector also has an incredible reach and influence on other facets of human life, providing fundamental support; therefore, it is expected to play a positive role in encouraging people to transition to more sustainable lifestyles. Transportation companies, referring to those that own or operate vehicles, aircrafts and cargo ships for people and goods, are expected to fully commit to reducing greenhouse gas emissions and develop greener methods of transformation to enable a sustainable future.

In terms of heavy emitting activities, transportation companies should mainly focus on shipping using owned vehicles, operating facilities and packaging. Transportation usually has high Scope 1 emissions (40 – 80 per cent of total reported emissions), mainly arising from fuel combustion in self-owned vehicles. Scope 2 emissions primarily include emissions from electricity purchased, power hubs, ground stations and other storage or service facilities, accounting for around 20 per cent of total reported emissions. Transportation companies' Scope 3 emissions vary based on their business models. Companies that work with a lot of contractors tend to have considerable Scope 3 emissions as emissions from vehicles or aircraft they do not own fall under Scope 3. Further, Scope 3 emissions come from purchased goods and services, especially packaging materials, which account for around 10 per cent of total reported emissions.

Accordingly, transportation companies should concentrate primarily on the heavy-emitting activities mentioned above to decarbonize the shipping process, develop more sustainable facilities for storage or service and utilize greener package materials.

Photo: UN Photo/UN7111295

Decarbonizing the shipping process

Decarbonizing the shipping process is a strategic imperative for all transportation companies due to the immense emissions inventory of shipping. Leading transportation companies have made impressive efforts by investing in and changing the energy sources of vehicles, namely promoting electronic power and alternative fuels, upgrading their vehicles to make them more energy efficient and optimizing their fleet sizes and shipping routes to reduce greenhouse emissions from shipping.

- **Adopting cleaner energy vehicles:** Many companies have replaced traditional fuel combustion vehicles with more environmentally friendly vehicles to meet their environmental commitment. Making impressive investments in purchasing alternative fuels and promoting the use of electronic and hybrid models in vehicles, transportation companies could make use of variance of sustainable materials and technologies including all-electric, hybrid electric, hydraulic hybrid, ethanol, compressed natural gas (CNG), liquefied natural gas (LNG), RNG, biodiesel and propane vehicles. UPS, a leading global logistics company, purchased 135 million gallons of alternative fuels for its ground fleet in 2019, representing 24 per cent of its total ground fuel usage. It has invested heavily in promoting the use of electronic ground vehicles, transitioning 10,300 of its fleet vehicles to alternative fuels and advanced technologies (UPS, 2019). Nippon Express also identified the use of alternative fuels as a critical factor in achieving its reduction goal, actively introducing environmentally friendly vehicles, principally low-emission diesel trucks complying with the post-new long-term regulations as well as CNG, hybrid and LPG trucks (Nippon Express, 2020). **JD.com**[SBTi] has been gradually replacing traditional fuel-combustion trucks with new energy vehicles since 2017 and has adopted these new energy vehicles in more than 50 cities across China, reducing at least 120,000 tons of carbon dioxide emissions per year. In addition, JD has built and introduced more than 1,600 charging stations nationwide to better support the operations of the vehicles. **Maersk**[M SBTi] believes the use of renewable and carbon-neutral fuels is critical to achieving emission reduction goals in the industry. It has launched initiatives to collaborate with other players and stakeholders along its value chain. Maersk is engaged in several fuel manufacturing projects for both methanol and ammonia as its participation in the LEO coalition continues where it is working with partners, including customers and researchers, on the lignin fuel option to promote the availability of sustainable fuels at scale. Maersk also launched an ECO Delivery product in 2019, a form of carbon-neutral emissions shipping using externally certified biodiesel in the form of used cooking oil to power vessels in its network (Maersk, 2020).

- **Improving vehicle efficiency:** Companies could also reduce their greenhouse gas emissions from shipping by improving the efficiency of their cars, aircrafts and cargo ships. Multiple measures could be taken to elevate vehicle efficiency, including reducing fuel use in flight operations through a monitoring and optimization system dedicated to identifying operational efficiencies across aviation operations; modernizing vehicles or replacing them with more efficient models; and revolutionizing operations by exploring and employing advanced technologies. FedEx cut its aircraft emissions

intensity by 24 per cent in 2019 compared with 2005 and has increased its ground transportation vehicle fuel efficiency by almost 41 per cent since 2005 by cutting fuel use and emissions thanks to fleet upgrades, efficient intermodal rail, and advocating for regulations that support emissions reductions (FedEx, 2019). As one of the most important drivers for reducing CO_2 emissions from flight operations. **Lufthansa**[M] has also invested in modern, fuel-efficient aircraft and engine technologies. In 2019, its passenger fleet aircraft only needed 3.67 litres of kerosene on average to transport one passenger over a distance of 100 kilometres (Lufthansa, 2020).

- **Optimizing fleet size and shipping routes:** Transportation companies could also reduce their GHG emissions through fleet management optimization, applying energy-saving measures such as optimizing flying altitudes, refining workloads, dynamically deploying models based on predicted workloads, secondary release, straightening bends and shutting down auxiliary power devices. For example, SF Express obtained RNP AR operation approval for B757s at Lhasa Airport to shorten flight distances and save fuel. It also coordinated the positions of aircraft at Shenzhen and worked with air traffic control to land on the closest runway and therefore reduce time taxiing on the ground (SF Express, 2020).

Developing sustainable facilities

Powering facilities including air and ground hubs, local stations, freight service centres, and retail locations is another major activity transportation companies should concentrate on to explore the possibilities of reducing their greenhouse emissions. Implementing or purchasing renewable electricity and improving the operating efficiency of facilities are initiatives that have been widely adopted by different companies.

- **Using green electricity:** Companies could deploy renewable energy systems like solar cells and purchase green electricity to power their facilities, reducing the share of electricity generated from fossil fuel combustion. In 2019, UPS deployed 10 megawatts of rooftop solar arrays on its United States-based facilities and began procuring renewable electricity for more than 30 sites in Europe. It is now approaching near-zero emissions through the use of renewable electricity, with 3.9 percent of electricity now being generated from renewable sources (UPS, 2019). JD.com has also made efforts to strengthen the use of renewable energy in its facilities. It built and installed a photovoltaic power generation system on the roof of its Shanghai Asia No. 1 logistics park, which has significantly reduced CO_2 emissions since it entered operations in June 2018. JD plans to team up with global partners to create the world's largest ecosystem of rooftop photovoltaic power generation by 2030, creating a photovoltaic power generation area of more than 200 million square meters (JD, 2020).

- **Boosting operating efficiency:** Improving energy efficiency in facility operations is another important component of transportation companies' approach to developing more sustainable facilities. FedEx deployed retrofitted lighting at 1,112 facilities, including upgrading interior and exterior lights to LEDs and installing motion sensors and lighting control systems, which saved it more than 1.2 billion kilowatt-hour of electricity by 2019. It also promoted centralized energy management systems in different facilities, set temperature controls to account for occupied and vacant building times, controlled lighting, and identified the most energy-intensive buildings and potential energy-saving opportunities (FedEx, 2019). Nippon Express developed standards for the installation of equipment that are applicable to the construction of its logistics facilities and offices, mandating the use of renewable energy, and reducing greenhouse gases by promoting the use of LEDs (Nippon Express, 2020).

Creating green packaging

Transportation companies could reduce emissions further by reducing the total amount of packaging materials used and selecting environmental friendly and recyclable raw materials in the production of packaging materials, which is one of the highest-emitting activities along the value chain. JD.com launched several initiatives to minimize the use of packaging and increase the use of recycled materials. As of the end of 2020, JD.com has accumulated 16 million uses of reusable boxes, achieving a total reduction of 180 million disposable foam boxes. By innovating in package design with thinner tape and adopting electronic express sheets, JD Logistics saves 400 million meters of tape and 13,219 tons of paper each year (JD Logistics, 2021). It has worked with partners such as P&G to ship items to customers in their original packaging, reducing the need for additional layers of packaging material and minimizing touchpoints required to reach the customer. JD.com has also leveraged its platform advantage and an omnipresent system of To-B and C touchpoints to join efforts from other stakeholders along the value chain and formed several alliances, including the green packaging alliance, China E-commerce Logistics Industry Packaging Standard Alliance, JD Cloud Package Global Alliance and more to co-develop green packaging initiatives. Through these alliances, JD Logistics collaborated with consumer goods companies like Coca-Cola, P&G and Unilever to develop a used plastic recycling system in which plastic is picked up from JD consumers and then sent to respective recycling locations by JD logistics to reduce emissions caused by plastic production (JD, 2021). SF Express has also initiated related projects — including developing a packaging material optimization and management system, designing a full range of recyclable containers and inventing ink-free cartons which uses laser engraving technology to replace traditional ink printing — thereby avoiding excessive use of packaging materials. As a result, SF saved over 26,000 tons of paper and 8,000 tons of plastics, equivalent to a 70,000-ton CO_2e emissions saving in 2020 (SF Express, 2020).

4.2. Agriculture & Food

As a fundamental human need, the food industry is essential for the health and well-being of humanity. Before being brought to our table, food goes through R&D, farming, harvesting, processing, distributing, retailing and storage processes. All these stages generate greenhouse emissions that harm the climate. The agricultural steps in this chain set the foundation for the whole industry. Forest and land use is a large source of emissions and global food consumption is expected to grow by up to 70 per cent in the next few decades due to the growing population and changes in dietary structure in favor of high meat (European Environment Agency, 2015); therefore, it may be challenging for the industry to reduce carbon emissions while fulfilling fundamental human needs.

Photo: UN Photo/UN7295123

Where companies produce the majority of emissions depends on their coverage of the value chain. **While value chain integrators produce heavy emissions in both Scope 1 and Scope 3, food manufacturers produce more Scope 3 emissions.**

- **Value chain integrators:** Many agriculture and food corporates are vertically integrated — they do not only process and sell products but also operate or own farms (e.g. raising cattle, growing crops). Therefore, much of their emissions are from farming activities (>60 per cent of total emissions), which are usually categorized as Scope 1 emissions. Scope 3 emissions come from areas such as packaging and logistics, among other high-emissions activities. Depending on the energy sources and operators, emissions occurring during product manufacturing could be allocated to Scope 1, Scope 2 and Scpoe 3.

- **Food manufacturers:** Manufacturing players source ingredients from suppliers or use contractors for farms. For them, ingredient sourcing is the top source of emissions and is usually categorized under Scope 3. Around 90 per cent of the total emissions from food manufacturers come from Scope 3 activities, including ingredient sourcing, packaging and logistics. Energy consumption in the product manufacturing process is the major contributor for these companies' Scope 1 & 2 emissions.

In this section, we will focus on net zero initiatives in **farming activities, product manufacturing, packaging and logistics.** Ingredient sourcing is categorized with farming activities because the emissions in food manufacturers' ingredient sourcing process is equivalent to the emissions in the farming activities of ingredient suppliers.

Decarbonizing farming activities

Methane naturally produced by livestock is the major source of GHG emissions in agriculture followed by indirect and direct emissions from feed production, and methane and nitrous oxide emissions from manure. Improving the unit output of crops and livestock while reducing the methane produced should be the key focus for farming companies.

- **Improve herd management and animal health interventions:** Controlling reproductive diseases like bovine trichomoniasis, defining mating and breeding seasons as well as strategic supplementation of growing and fattened livestock are key interventions adopted by the Argentinean Beef System to enhance animal productivity and reduce CH_4 per kilogram of live-weight (FAO, 2017).

- **Capture and reuse methane from manure:** Starting from the 2010s, **Cargill**[M SBTi] has captured and utilized biogas in its facilities around the world. Its beef processing plants in Canada and the United States reclaim methane from wastewater lagoons, using the biogas to fuel the plants and displacing about 20-25 per cent of natural gas demand at the facilities (Cargill, 2016). In the same way, **Tyson Foods**[M SBTi] burned approximately 666 million cubicfeet of biogas in its boilers, reducing its GHG emissions by more than

23,000 metric tons of CO_2e in FY19 (Tyson Foods, 2019). **China Shengmu**[M] fed dairy cows from organic pastures and returned the manure to the land (China Shengmu, 2021).

- **Use fertilizers scientifically and efficiently:** China Shengmu upgraded its composting yards with an I-steel structure design and transparent rooftop to prevent rain but allow light to shine in (China Shengmu, 2021). The company transported liquid fertilizers to oxidation ponds via tankers or pipelines. After oxidative fermentation, they are harmlessly returned to the fields. Precise use of fertilizers with advanced technologies is another way of using fertilizers efficiently. In addition, the Polish company SatAgro uses satellite data to help farmers make decisions about how much fertilizer to use on their fields and how to distribute it (Global Center on Adaption, 2021).

- **Boost soil health and prevent deforestation:** No-tillage farming, cover cropping, crop rotation and switching to organic fertilizers are typical practices to boost soil health. Many companies are actively collaborating with Governments to make contributions. **Syngenta**[M SBTi] commits to enhance biodiversity and soil health on 3 million hectares of farmland every year (Syngenta, 2013). In December 2020, Syngenta China supported the United Nations Development Programme (UNDP) in its project "Promoting Straw Incorporation and Soil Health in the Huang-Huai-Hai & Northeast Region" (UNDP, 2020). Since 2009, China Shengmu has invested RMB 7.5 billion in the Ulan Buh Desert, turning more than 200 square kilometres of desert into an oasis and introducing 150 square kilometres of high-quality meadow. The 97 million trees planted are expected to capture 1,086 tons of carbon in the coming three decades based on an estimate by the Experimental Center of Desert Forest of the Chinese Academy of Forestry (China Shengmu, 2021).

Decarbonizing food processing and manufacturing

Agriculture and food companies can **deploy on-site PV panels or sign power purchase agreements** (PPAs) with renewable energy providers to step up their decarbonization efforts. As this is a universal initiative across all industries, please refer to Sections 4.3 and 4.5 for detailed discussion. For example, **Louis Dreyfus**[M] Company installed PV panels on more than 18,000 square metres of unused rooftops in its oilseed processing facility in Tianjin, China, supplying 3 per cent of the site's electricity (LDC, 2019). More importantly, companies need to **improve the energy efficiency of their plants**. Key initiatives include converting coal fired boilers to natural gas and deploying waste heat recovery systems. Since 2014, **Yili Group**[M] has invested RMB 90 million to replace its coal-fired boilers. As a result, it reduced its 2020 carbon emissions by 550,000 tons compared to the 2014 level (Yili, 2021). In 2020, China Shengmu started to upgrade the heat pumps in its farms to air source pumps. Over 50 per cent of its farms will use air source heat pumps by the end of 2021 (China Shengmu, 2021). **Chaudhary Group**[M] (CG), a leading conglomerate in Nepal, promotes renewable energy in its food processing system, deploying power plants based on biomass fuel to supply 2.2 megavolts of electricity and 24 tons of steam, reaching 950 cubic metres per hour of ETP capacity (Chaudhary, 2020).

Reducing packaging complexity and switching to recyclable materials

Nestle[M SBTi]'s Institute of Packaging Sciences in Switzerland is working on safe packaging solutions and so far, 87 per cent of Nestle's total packaging and 66 per cent of its plastic packaging is recyclable or reusable (Nestle, 2021). Danone[M SBTi] has implemented eco-design principles for packaging, such as Evian's pilot programme to eliminate non-recyclable shrink film using specially designed adhesive and tape handles to keep water bottles together (Danone, 2017).

Decarbonizing ingredients and product transportation and distribution

This initiative requires companies to work closely with their logistics suppliers. For example, in 2019, Syngenta extended its long-term collaboration with A.P. Moeller-Maersk to focus on sustainable logistics, eliminating fossil fuels in container shipping and supply chains to reduce CO_2 emissions (Syngenta, 2020). For more details on how to reduce the carbon footprint and assess partners in logistics, please refer to Section 4.1.

Photo: UN Photo/Evan Schneider

4.3. Industrial Manufacturing

Industrial manufacturing, as the highest-polluting industry, is a major contributor of global GHG emissions. Manufacturing mountains of materials, the direct emission-producing activity of manufacturing companies, creates a heavy burden of greenhouse gases. In addition, industrial manufacturing is an infrastructure industry with a momentous influence on many facets of upstream and downstream industries. Manufacturing companies have a high demand for raw materials and products that manufacturing companies produce and sell are omnipresent in our everyday lives, from primary materials like iron and steel to end-user products like domestic equipment and cars. Therefore, manufacturers must realize that every action they take to counter carbon emissions is critical, and they must adopt measures to improve climate sustainability.

Product manufacturing, raw material supply (selection, transportation and storage) and the process and use of finished sold products are the three highest-polluting activities in industrial manufacturing. Scope 1 and Scope 2 account for the majority of emissions for manufacturing companies, which mainly refers to emissions from product manufacturing processes, including direct emissions from fossil fuel combustion and the use of refrigerants on site, and from purchased electricity. Emissions related to product manufacturing account for roughly 40-60 per cent of the total reported emissions. In terms of Scope 3, manufacturing companies incorporate indirect emissions related to their value chain. Emissions related to raw materials companies purchase and the associated logistics account for around 10-20 per cent of total reported emissions; downstream emissions (resulting from the processing and/or use of sold products) account for another 10-20 per cent, both of which should be viewed as major emission activities of manufacturing companies.

In light of these conditions, industrial manufacturing companies are encouraged to primarily focus on decarbonizing product manufacturing and raw material supply, and producing green products.

Decarbonizing product manufacturing

Companies could markedly reduce the volume of their emissions from product manufacturing by replacing fuel combustion with renewable energy, ameliorating their energy efficiency and recovering waste resources.

- **Adopt renewable energy:** Manufacturing companies could adopt renewable energy through multiple initiatives. Purchasing green electricity via power purchase agreements (PPAs) and renewable energy certificates and investing in constructing renewable energy systems are the preferred approaches of pioneering firms. **Philips**[M SBTi] has been steadily increasing the portion of electricity coming from renewable sources, and lowered its carbon emissions by 40 per cent from 2007 to 2015. To date, Philips has sourced 3,353 gigawatt-hours of low carbon electricity since 2007 and using low carbon electricity has led to reductions of 1,452,347 metric tons of CO_2e since 2007 (Philips, 2020). **KSTAR**[M] has implemented distributed rooftop and ground photovoltaic systems in factories on several sites. In its Huizhou branch, KSTAR has installed rooftop PV systems of around 730 kilowatts, delivering around 720,000 kWh of electricity per year, and a ground PV system of around 400 kilowatts, delivering around 400,000 kilowatt-hours of electricity per year. They also implemented additional rooftop PV systems in their Guangming Branch in Shenzhen, contributing to another 600,000 kilowatt-hours of green electricity, which both bring about sizable GHG emission reductions (KSTAR, 2021).

- **Improve energy efficiency:** Applying new manufacturing technology is one of the many effective ways that manufacturing companies can improve energy efficiency. **Baowu Group**[M], at its Bayi plant, is piloting oxygen-enriched BF & COREX furnaces and has introduced hydrogen-enriched technology in its Zhanjiang & Shaoguan plants. In addition, it is exploring the application of "ultra-rich" oxygen blowing technology in blast furnaces as well as H_2-based steel production technologies (NBD, 2021). **Esquel**[M] invested in a thermal power plant which is carefully managed to minimize emissions, utilizing low-sulfur coal, desulfurizing waste lye onsite, and electrostatic precipitation to reduce air pollutants (Esquel, 2020). Manufacturing companies could also strengthen energy monitoring and management. KSTAR produces and sells uninterruptible power supply (UPS) and PV inverters as its main business, which both require aging tests during manufacturing process. Aging tests, mainly applying resistor load, consume a large amount of power and therefore create considerable greenhouse gas emissions. To tackle this problem, KSTAR has introduced an electronic load with energy feedback as a replacement, through which energy consumption can be lowered by 85 per cent and recycled electricity from the DC power supply can be inverted and fed back to the grid. KSTAR estimates that the system can save around 31,715 milliwatt-hours of electricity annually, resulting in a significant GHG emissions reduction (KSTAR, 2020).

- **Recover energy from waste:** Recovering energy from production waste is another effective lever that manufacturing companies could pull in their emission reduction efforts. By the end of 2019, **Rusal**[M] had introduced 660 energy-saving electrolysis cells across the company (2,657 in total since the start of the initiative), which allowed it to save around 183 million kilowatt-hours of energy (Rusal, 2019).

Decarbonizing raw material supply

Raw material supply is another main cause of emissions for manufacturing companies. They could effectively mitigate its impact by selecting suppliers and logistics partners with sustainability advantages.

- **Raw material selection:** Companies could prioritize sustainable raw materials in their supply chain by setting selection standards and assessment tools. BYD insists on green procurement and has released documents spelling out requirements and operations guidelines for suppliers' environmental material management. As a result, all its production materials suppliers passed the quality system certification in 2018, of which 70 per cent passed the environmental and occupational health and safety management certification (BYD, 2018). Baowu has also been striving to build a green procurement management system, giving priority to green products and materials during the procurement process, and guiding suppliers to gain environmental management system certification. In 2019, the percent of green parts procurement reached 6.2 per cent in Baoshan, Dongshan and Meishan, three of Baowu's main factories (Baowu, 2019).

- **Raw material logistics:** Manufacturing companies could also decarbonize their raw material logistics processes, for which selecting the right partners to work with is the most important issue. For example, Philips partners with Maersk to lower the carbon footprint of its supply chain (Maersk, 2017). In the same way, many manufacturing companies have started to consider if a proper sustainability programme is in place when deciding which supplier to work with. For more details on how to reduce carbon footprint and assess partners in logistics, please refer to Section 4.1.

Producing green products

Companies need to advocate for the production of sustainable products, which result in fewer carbon emissions when they are processed and used downstream in the value chain, accounting for a substantial portion of companies' Scope 3 emissions. **NIO**[M] promotes both battery swapping and charging to NIO users, bringing less greenhouse gas emissions owing to smaller total amount of batteries lifecycle needed and higher energy efficiency due to concentrated battery energy storage at power swap stations. Carrying out 2 million times of EV battery swaps by March 2021 (NIO, 2021), NIO unveiled partnership with Sinopec to leverage its gas station network nationwide. NIO will be launching NIO Power Swap Station version 2.0, and expected to deploy in total 500 power swap stations by end of 2021 (NIO, 2021). Baowu Group applied the BPEI

(Baosteel Product Environmental Index) based on a life cycle assessment to evaluate the sustainability of sold products and developed lower weight and higher intensity non-oriented electrical steels to sell to EV OEMs. Non-oriented electrical steels have already been used in 1.2 million cars, reducing CO_2 emissions by 5.5 million tons based on average assumptions (Baowu, 2019).

Photo: UN Photo/JC McIlwaine

4.4. Construction

The construction industry is a critical bedrock in the lives of human beings, producing not only the buildings where people live and the infrastructure we use, but also playing an important role in tackling the climate crisis. Construction itself is a carbon-intensive industry which typically involves the extraction, manufacture and transport of large quantities of materials as well as construction activities. Through buildings, the main product of construction, the industry exerts an even bigger impact on the earth's climate, given that buildings contribute 17.5 per cent of the world's total GHG emissions — one of the largest emission sources. By taking into account the entire lifecycle of buildings, construction can create more sustainable spaces for people to work and live, mitigating the impact of GHG emissions.

Construction companies need to focus on three main high-emissions activities: the use of sold products (buildings and infrastructure), raw material supply and worksite construction processes. For construction companies, Scope 1 and 2 emissions, primarily from worksite construction processes, are generally smaller than Scope 3 emissions. The worksite construction process normally accounts for 10-20 per cent of the total reported GHG emissions of construction companies. In terms of Scope 3, use of sold products (i.e. buildings and infrastructure) is a huge source of emissions, responsible for 40-50 per cent of total reported emissions. As a result, the way companies design and deliver buildings and infrastructure projects can have a significant effect on the amount of greenhouse gases emitted. Another major emission source under Scope 3 is the supply of raw materials. Extraction of raw materials for large volume products such as concrete (cement, sand and gravel) and ferrous/non-ferrous metals for reinforcement and other structural components can have a significant negative impact on sustainability at sites of extraction and production (Skanska, 2020). This activity accounts for a further 30-50 per cent of construction companies' total reported emissions.

Photo: UN Photo/UN7628975

In view of this, the emissions mitigation efforts of construction companies, could chiefly focus on the activities mentioned above, namely the use of sold products (buildings and infrastructure), the supply of raw materials and worksite construction processes to address the bulk of GHG emissions.

Producing green buildings and infrastructure

The way buildings are designed and built could make a considerable difference in GHG reduction efforts. **Hochtief**[M] has completed more than 800 certified green buildings and infrastructure projects, characterized by its resource-saving construction methods and efficient operations. Integrating certifications such as DGNB or LEED (Leadership in Energy and Environmental Design) into the early planning stages of projects, the Wilshire Grand Center skyscraper was built to meet the high standards of the LEED Gold certification, with features including innovative lighting and climate systems that significantly reduce overall energy consumption (Hochtief, 2020). **Ayala Land**[M], the real estate development and construction company of Ayala group, a leading conglomerate company in the Philippines, implemented passive cooling and sustainable architecture design, and use natural light and ventilation in common spaces at the planning and construction level to minimize carbon emissions and has avoided about 121,951 tons of CO_2e by shifting to renewable energy use in its property projects. As of the end of 2020, Ayala Land has shifted 57 buildings to sourcing renewable energy, representing 63 per cent of total malls and offices' gross leasable area. As a result, net emissions decreased by 154,403 t-CO_2e. The share of renewable energy in the commercial properties' total energy mix is also now at 47 per cent (Ayala, 2020). **Julius Berger**[M], an African construction company, is a pioneer in construction based on environmental protection standards. Developing green construction capabilities to comply with LEED and other green building certificates. Julius Berger designed and built the parliament office buildings of the National Assembly in Abuja, incorporating designs that lower energy use and improve efficiency (Julius Berger, 2020).

Selecting sustainable material suppliers

For construction companies, significant opportunities exist to improve the sourcing and use of virgin materials and replace them with other suitable, more sustainable alternatives, such as reused or recycled material. Prefabrication has also been widely adopted by numerous construction companies, which refers to the technique of ordering customized materials built in a factory on demand rather than on the work site, preventing energy waste from producing redundant materials and saving energy consumption from work sites by reducing project time. Katerra is one of the pioneers in the global uptake of prefabricated housing. It has completed prefab projects in India and many other countries, including the GKNM Hospital and Infosys commercial space, using more sustainable materials such as prefabricated wood and prefinished PC — which can be finished 50 per cent faster than conventional constructions, leading to considerable energy savings (Katerra, 2020).

Decarbonizing work site construction processes

In addition to improving the use of buildings and infrastructure and adopting green design, companies can also moderate direct emissions from work sites by various means.

- **Adopting renewable energy:** Several construction companies have adopted renewable energy to power the construction process. Vinci[M] increased its use of renewable energies — especially thanks to the installation of photovoltaic power plants for construction use — replacing some work site machines with hybrid models and conducting experiments using hydrogen, biogas and other alternative fuels to power utility vehicles. After adopting these measures, 17 per cent of the electricity consumed by Vinci in 2020 is now from renewable sources and it expects to grow its renewable energy use in the future (Vinci, 2021).

- **Improving power efficiency:** Work sites can also be decarbonized by optimizing working processes and applying appropriate technologies to boost the efficiency of power consumption. Limak[M] utilizes technologies to increase the efficiency of heating, cooling, air conditioning and heat transfer to minimize heat losses with proper thermal insulation and prevent losses in electricity consumption. It also optimized its working process to minimize the unnecessary use of lighting systems, shut down unused vehicles and engines and calibrate meters regularly. At the same time, it promoted energy-efficient lighting and sensor lighting systems in its work sites. As a result, Limak reduced year-on-year growth in unit energy consumption per working hour from 2018 to 2019 by 3 per cent (from 0.109 gigajoule per hour to 0.106 gigajoule per hour), compared to double digit growth in previous years (Limak, 2019).

Photo: UN Photo/Mark Garten

4.5. Digital & Information

The digital and information industry, specifically Internet and technology companies, have revolutionized the world, from the ways people communicate and do business to every aspect of life. An immense quantity of information is transmitting through the Internet every day, assisted by advanced technologies, and this electronic leviathan has already formed an indispensable infrastructure for today's world. Though the industry itself would appear to have only a mild emission intensity (if only Scope 1 and Scope 2 are counted), the fact that the Internet and technology enables various companies has prompted the industry to assume part of the responsibility for upstream and downstream emissions (Scope 3). Moreover, the skyrocketing usage of Internet and mobile-phone traffic will increase energy use from networks, the production of ICT and consumer devices and data centres by 2 to 3 times in 2030 (Jones, 2018).

In terms of emission activities, companies in the digital and information industry are not heavy Scope 1 emitters — such emissions mainly come from the gasoline or diesel combustion in vehicles. The largest source of emissions depends on the company's area of business. **Internet service providers have heavy Scope 2 emissions, whereas technology companies produce more Scope 3 emissions.**

- **Internet companies** produce the heaviest volume of emissions in their data centers (Scope 2[8]) — around 80 per cent of total reported emissions in the case of Baidu. The huge amount of data transmitted from data centers all over the world passes these companies' electricity-powered servers, adding up to around 1 per cent of global electricity consumption (Jones, 2018).

- **Technology companies**, such as Alphabet, Microsoft, and Apple, have more significant Scope 3 emissions, primarily due to the carbon footprint associated with products and devices. The sweeping definition of product-related emissions could span activities from raw materials, manufacturing processes, in-bound and out-bound transportation, retail processes to end-customer usage and disposal. Of these, raw materials, manufacturing processes and end-customer usage are the largest and most measurable emissions sources for companies.

8. Most leading Internet companies pay the electricity bills for the data centres they own or share (not counting those that rely heavily on third-party IDC vendors) for which the emissions could be included in Scope 3 depending on the definition of the organizational boundary.

Accordingly, prevalent industry emissions reduction initiatives focus on the activities mentioned above: electricity consumption from **data centres**, the carbon footprint generated along **product life cycles**, and the climate impact of **supply chains**. And aside from these areas, many companies in the industry are actively addressing emissions from **business travel**, **employee commuting** and **power consumption in office buildings**, as the lowest-hanging fruit.

Leading Internet companies can take multiple measures to reduce their carbon emissions from **data centers**. Improving efficiency through technological upgrades will be the most important lever while companies can also look into the potential of using renewable energy.

- **Improve power efficiency** : Many companies have reduced the energy consumption of their data centres, lowering their power usage effectiveness (PUE). One of the most widely accepted approaches is switching to hyperscale data centres as they can achieve significant power savings through sharing systems (i.e. cooling and back-up systems) with more servers, while other companies have installed advanced technologies, such as uniform computing infrastructure, customized blade servers, consolidated storage and advanced power supply units. **Baidu**[M] whittled its average PUE of data centres down to 1.14 and the energy consumption of its infrastructure is 76 per cent lower than the industry average, mainly by building hyperscale data centres equipped with technologies, including GPU accelerated heterogeneous computing, mains supply+ UPS/HVDC, ARM64 architecture servers, LED lights and updated heating systems (Baidu, 2021). Likewise, **Facebook**[SBTi] started to build its own hyperscale data centres in 2011 and has embedded decarbonization technologies across them, including its Open Compute Project servers. The Open Compute Project servers can operate at higher temperatures and have adopted an AI model to optimize real-time efficiency, resulting in 1.1 PUE and lower for most data centres (Facebook, 2021).

- **Adopting renewable energy** : Of the various approaches to use renewable energy, power purchase agreements (PPAs) and renewable energy certificates remain the most popular. According to statistics, digital and information companies appear to be the major off-takers for PPAs globally, with 2.7 gigawatts from Google, 1.1 gigawatts from Facebook, 0.9 gigawatts from Amazon and 0.8 gigawatts from Microsoft. The four giants accounted for 28 per cent of the global clean energy PPA volume in 2019 (Petrova, 2020). However, the availability of PPA is highly subject to local policies. For example in China, only selected provinces or cities allow users to engage in PPA. Alternatively, digital and information companies can purchase renewable energy certificates to make up the gap. With such a strategy, companies can reduce their climate impact substantially under Scope 2.

As for Internet companies that do not plan to build their own data centers, the prevalent initiative is to make better use of public cloud service from external providers that run low-carbon emitting data centres. Another alternative could be renting from hyperscale data centres. For example, according to Equinix, a leading digital infrastructure provider, its data center customers could claim net zero emissions from data centres under Scope 2, as Equinix offers 100 per cent renewable energy[9] (Equinix, 2021).

The impact of **product life cycles** on the climate could be mitigated by leveraging environmentally friendly materials, decarbonizing manufacturing technology and energy-efficient product design.

- **Environmentally friendly materials:** Recyclable or low carbon materials could be sourced and used more in electronic devices. The majority of metal parts in devices translate into tons of GHG emissions caused during the mining, refining, smelting and casting processes. Using low-carbon materials, on the other hand, could be difficult but hugely beneficial to the environment. **Apple**[M SBTi], which is devoted to using recyclable materials, chose custom aluminum alloy over virgin tin and effectively reduced its carbon footprint by 4.3 million tons in 2019 (Apple Inc., 2021) .

- **Manufacturing process decarbonization:** Companies could also mitigate the impact on climate by applying technologies to decarbonize the manufacturing process. **Lenovo**[M SBTi] implemented a low-temperature solder (LTS) manufacturing technology in its PC manufacturing operations, reducing the power consumption and carbon emissions of the printed circuit board assembly process by 35 per cent. This innovation has been shared with other players via technical papers and consortia and as of April 2021, Lenovo had shipped over 37 million notebooks manufactured on LTS lines and transitioned over 90 per cent of ThinkPad and over 20 per cent of IdeaPad notebooks to these processes (Lenovo, 2021).

- **Energy-saving design:** Extra efforts to reduce product energy consumption could be made in product design or even after product launches with subsequent upgrades. **Microsoft**[M SBTi]'s engineering team reduced the standby power usage of its Xbox 360 after the product launched, leading to a 60 per cent energy saving. Its next-generation product, Xbox 360 One, was launched with a design that saved 30 per cent more energy than its processor (Microsoft, 2021). Lenovo's manufacturing plant in Hefei, China implemented chilled water storage and direct power supply projects to reduce energy consumption and improve energy utilization. In 2020, these projects saved 4,125,000 kilowatt-hours of electricity. Lenovo also implemented an APSA nitrogen station in Wuhan, China, replacing the PSA (Pressure Swing Adsorption) gas supply. The APSA unit power consumption is around 0.05 kilowatt-hours per cubic metre less than the PSA unit for the mass nitrogen demand manufacturing plant, which plays a significant role

9. Refers to most of the datacentres.

in saving energy and supports green manufacturing (Lenovo, 2021). Baidu's Tiangong Platform based on an AI cloud leverages the Internet of Things (IoT) and machine learning to help create energy-saving buildings and promote an online intelligent control system. By implementing the Tiangong Platform with equipment portrait technology in facilities, Baidu's offering could help enable overall mode control of buildings and switch modes in advance to reduce energy consumption by analysing and measuring peak and valley electricity prices, regional personnel distribution, weather and temperature and other environmental data. Compared with the original operation mode, the energy consumption of the new system has been reduced by more than 20 per cent and the power saving has exceeded 1.5 million kilowatt-hours (Baidu, 2021).

The **manufacturing supply chain** is another major source of Scope 3 emissions. As key decision makers along the value chain, digital and information companies could leverage their influential power and resources to suggest, support or enforce climate-friendly industrial processes.

- **Monitoring supply chain emissions:** Companies could set specific standards or goals for suppliers to follow. For example, Microsoft started tackling supply chain emissions with a Supplier Code of Conduct, requiring mandatory emission reports from every supplier on their three scopes while also extending the internal carbon tax to Scope 3 emitters for further monitoring (Joppa, 2020). Similarly, Lenovo requires its Tier 1 suppliers to report emissions under global selective standards while around 90 per cent of Lenovo's direct suppliers by spend set public GHG reduction goals under the company's influence (Lenovo, 2020).

- **Supporting suppliers to reduce climate impact:** Aside from monitoring supply chain emissions, companies could also provide additional resources and support to guide suppliers on the path to carbon neutrality. Google, in response to its suppliers' lack of expertise in energy optimization, launched a Technical Pilot Program to help Chinese suppliers better track and manage their energy performance in factories, with significant results — the manufacturer Flex has saved 6 million kilowatt-hours per year since 2017 after Google introduced experts to diagnose and coach Flex on how to implement energy management programmes (Google, 2019). Lenovo has a dedicated resource assigned on the Global Supply Chain Sustainability team with suppliers. In 2021, Lenovo sent out different surveys to understand its suppliers' challenges and concerns regarding SBTi and hosted training sessions in response to suppliers' needs. As a result, as of April 2021 Lenovo has motivated key suppliers with a procurement spend of up to $360 million to commit to SBTi now or in the near future (Lenovo, 2021).

Emissions from **business travel and employee commutes** may not be as notable as the activities mentioned above, yet frequent travel habits and the booming numbers of employees in the digital and information industries make the absolute emissions from these companies more prominent than those from other industries.

- **Business travel:** Companies could adopt myriad initiatives to diminish their carbon footprints, prioritizing virtual meetings, reducing air travel and limiting business class trips. To ensure these governance schemes are effective, companies should set corresponding rules and offer back-office support.

- **Employee commute:** Simply encouraging employees to choose greener methods of transport in their commutes would go a long way, and supportive mechanisms would be far more persuasive and effective in achieving this than relying purely on internal publicity. Facebook not only encourages 'green commuting' but also offers support such as showers for cyclists, and resources for ridesharing, successfully encouraging 50 per cent of its employees in the main campus to choose alternative commuting options (Facebook, 2021). Climate-progressive companies could adopt many other mechanisms to reduce their footprints, such as providing EV shuttle buses, deploy EV stations at campus and promoting work-from-home policies.

The **power consumption of office buildings** is also a key source of Scope 2 emissions for tech companies. Companies could accelerate the decarbonization of their office power consumption by using renewable energy and building materials as well as improving energy efficiency.

- **Refine the energy mix:** Companies could refine the energy mix for their office power by purchasing and/or investing in renewable energy. Facebook uses 100 per cent renewable energy in its Menlo Park headquarters, which includes a 3-megawatt on-site rooftop solar project (Facebook, 2020).

- **Utilize sustainable building materials:** Tech players could decarbonize office buildings by using sustainable building materials. JD's three-star certified green headquarters' #2 building utilizes Low-e laminated glass on its glass curtain walls to lower the reflectance of visible lights to below 0.2 and therefore keep heat inside the building, thereby lowering power demand (Green Building, 2019).

- **Improve energy efficiency:** Companies could also make use of intelligent building management systems, efficient lighting and heating/cooling systems and encourage employees to improve energy efficiency. Facebook has installed highly efficient heating and cooling systems, uses efficient office equipment and monitors building performance through sophisticated building management systems to improve energy efficiency (Facebook, 2020).

Photo: UN Photo/Loey Felipe

4.6. Financial Services

The financial industry plays an essential role in the decarbonization of the economy with its wide coverage and deep influence on other industries. Even though the emissions intensity of the financial industry is relatively small, the capital it manages is critical to every sector. The mechanisms to finance projects that are facilitating the decarbonization process (i.e. renewable energy programmes), utility efficiency improvement programmes and financing restrictions for projects that are not aligned with required emission standards or the Paris Agreement could have a major impact on the transition to a net zero world.

Power use in data centres and office buildings are the top emitting activities in financial services. The industry's Scope 1 emissions are relatively minor — they include fuel combustion for self-owned vehicles and other equipment. Scope 2 mainly covers purchased electricity for self-owned office buildings and data centres and Scope 3 emissions mainly include outsourced data centres, employee commuting, business travel and other emission activities related to the financial supply chain and products. Power use in data centers (~30 – 40 per cent), power use in office buildings (~10 – 20 per cent) and employee commuting and business travel (~10 – 20 per cent) are the highest-emitting activities. **Besides emissions from their own operations, financial institutions should also focus on activities they finance.** Even though measuring financed emissions across a range of asset classes remains an industry-wide challenge (Standard Chartered, 2020), institutions will need to pay increasing attention to their impact on the environment and climate change through their funded business activities.

Financial institutions should identify levers to decarbonize their highest emitting activities and mitigate the even greater climate impact of the business activities they finance.

Decarbonize the use of power in data centres

Financial institutions could decarbonize their data centres via various means and audit the carbon footprint of external suppliers for outsourced data centres. For details, please refer to Section 4.5.

Decarbonize power for office buildings

Financial institutions could decarbonize their office buildings by refining the energy mix, utilizing sustainable building materials and improving energy efficiency. For details, please refer to Section 4.5.

Mitigate the emission impact of financed activities

Financial institutions, including policy lenders, could set or raise carbon emission-related standards to assess the climate and social risks of financed businesses and review decisions on whether to continue or cease financing in the future. They could also develop financial tools to encourage and facilitate clients with decarbonization and actively participate in carbon trading to help mobilize the financial system around a functioning carbon offset market.

Three universal initiatives could help financial institutions to decarbonize their financed activities.

- **Develop a low-carbon assessment framework that could be applied to different products.** When developing their own framework, financial institutions could refer to several industry-wide benchmarks, for example the Equator Principles (EP) and International Finance Corporation (IFC) Performance Standards. Many leading financial institutions have developed a series of detailed policy frameworks and embedded them into their credit or investment approval process to evaluate clients' performances against environmental and climate criteria before providing any financial services. For those clients who fail to meet all standards, financial institutions could agree with clients on action plans to improve their performance within a clear timeline. **Standard Chartered**[M SBTi] developed industry-specific assessment criteria for sensitive industries with high emissions like utilities, oil and gas, etc., and applies a more detailed and stricter review process to specific activities (Standard Chartered, 2020). **Credit Agricole Group**[M SBTi] integrated environmental, social and governance (ESG) criteria into its investment decisions and has promoted responsible finance to its clients, applying ESG principles to its asset management and assurance business (Credit Agricole, 2020). Asset management firm **Arabesque**[M SBTi] utilized their proprietary platform, Arabesque S-Ray, as the foundation for all investment products, applying a quantitative approach to ESG information and measures for the sustainability of publicly listed global equities (Arabesque, 2020). **The Public Investment Corporation**[M], an African asset management firm, identifies risks and opportunities that may impact investee companies by leveraging an internally developed risk-based ESG tool that incorporates analysis of ESG factors (PIC, 2021).

- **Develop green finance products/green funds to encourage institutional clients to switch to more sustainable ways of doing business.** Financial institutions could develop green finance solutions to enable heavy-emitting sectors to progressively decarbonize and facilitate innovations in renewable energy, clean technology and other nature-based climate solutions. Financial institutions could develop a portfolio of solutions, including green bonds, green loans, green assurance, project finance, financial leasing, ABS, commercial papers and equity investment funds for decarbonization to help companies purchase cleantech instruments, carry out power efficiency projects or invest in renewable energy and any other carbon-cutting projects. Standard Chartered has helped clients issue $18.3 billion in green, social and sustainable bonds and saw a nine-fold increase year on year in green and sustainable loans to clients, taking the total loan amount from $3.2 billion in 2018 to $29.1 billion in 2019 (Standard Chartered, 2020).

- **Participate in carbon trading.** Industrial Bank (China) has contributed to seven carbon trading pilots in China to provide depository, liquidation and settlement services. It also acts as a broker for companies that are willing to buy and sell carbon credit (CIB, 2021). Financial institutions could also work with the Government and asset management companies to develop carbon-related derivatives, including options, swaps, futures, index products and ABS.

Development banks could take on more green financing obligations and explore sovereign and/or multilateral financing products.

- **Take on more green financing obligations.** Due to their sovereign, non-profit background, development banks enjoy lower funding costs and mainly finance projects that benefit human development and serve positive social purposes. Indeed, climate and the environment is one of the areas that they concentrate on. Development banks could offer capital at a lower interest rate to companies/projects that meet the green finance standard, at ~90 basis points lower than other institutions (CIB Research, 2018). They can also tolerate lower financial returns and longer investment periods, which meets the demand of green projects that require long construction periods. The energy sector is essential for achieving carbon emissions peak and carbon neutrality. **China Development Bank**[M] actively supports low-carbon, clean energy development, and is steadily driving the restructuring and upgrading of carbon-related energy industries. It is also promoting the carbon sink economy, as part of its efforts to achieve China's strategic climate goals (CDB, 2021).

- **Develop sovereign/multilateral green finance products to contribute to global climate action.** The African Development Bank (AfDB) developed partnerships with overseas investors, including Government Pension Investment Funds (GPIF) from other continents to collectively cope with the financing problem in Africa's sustainable development. AfDB established a partnership with a GPIF in Japan based on a green bond framework, providing unique investment opportunities to the GPIF's external asset managers to finance climate mitigation and adaptation projects in Africa (AfDB, 2020).

- **Act as trusted advisors in policy and regional development plan-making.** CDB has proactively participated in several green finance development plans with regional governments, including the Beijing government, Xiamen government and Qinghai government, focusing on how to facilitate financing for clean energy and environmental protection projects (CDB, 2019).

Institutions with enterprise-facing businesses, such as commercial banks, insurance companies and microfinance institutions, could launch more innovative products to guide individual customers.

Industrial Bank provides special-purpose mortgage products, housing loans and personal loans with lower interest rates to encourage individual customers to purchase buildings that meet green building standards and electronic vehicles (CIB, 2021).

Institutions with direct equity investment arms could mitigate the climate impact of their portfolio companies.

By requiring portfolio companies to regularly report their decarbonization processes, setting specific emissions reduction goals and providing technical or expert support based on their resource network, investment firms such as private equity funds could also mitigate their climate impact via portfolio management. KKR, a leading private equity firm, launched its Green Solution Platform (GSP) in 2008, by which heavy-emitting portfolio companies can track their emission status, connect with energy or climate experts and leverage best practices for transition to more sustainable business models (KKR, 2020).

5. Representative Corporate Deep Dive

Photo: UN Global Compact/Elma Okic

Human Rights

1. Businesses should support and respect the protection of internationally proclaimed human rights; and
2. make sure that they are not complicit in human rights abuses.

Labour

3. Businesses should uphold the freedom of association and the effective recognition of the right to collective bargaining;
4. the elimination of all forms of forced and compulsory labour;
5. the effective abolition of child labour; and
6. the elimination of discrimination in respect of employment and occupation.

Environment

7. Businesses should support a precautionary approach to environmental challenges;
8. undertake initiatives to promote greater environmental responsibility; and
9. encourage the development and diffusion of environmentally friendly technologies.

Anti-Corruption

10. Businesses should work against corruption in all its forms, including extortion and bribery.

5.1. DHL M SBTi — Transportation

1.
Company background

Deutsche Post DHL Group is the world's leading logistics company with business in over 220 countries and territories. In 2020, DHL reported 33 million tons of CO_2e. DHL makes a positive contribution to the planet and society through sustainable business practices and has announced that by 2030, the Group will reduce GHG emissions to below 29 million tons CO_2e and aims to achieve net zero emissions from logistics by 2050.

2.
Emissions reduction action highlights

- **Develop sustainable aviation:** As aviation accounts for the biggest proportion of greenhouse gas emissions in DHL's business, the company has taken multiple measures in this area. It is trying to decarbonize its aviation activities by improving energy efficiency, continuing to invest in modernizing aircrafts to make them more energy-efficient and therefore reduce GHG emissions. To date, 22 Boeing 777 freighters have been brought into operation, which will generate a reduction of 18 per cent CO_2 emissions due to their fuel efficient technology to the aircrafts replaced. DHL also devotes to develop technologies that help optimize the operation, including identifying ideal weight balance, optimizing its network design and choosing efficient carriers to improve operating efficiency further. In addition, it is also actively engaged in the development of Sustainable Aviation Fuel (SAF) to increase the use of renewable energy in powering aircraft. It has collaborated with various stakeholders on pioneering scientific work, promoting the use of sustainable biofuel-based synthetic kerosene scalable for a transitional period. In the long term DHL counts on synthetic kerosene from the power to liquid process (PtL) (DHL, 2021).

- **Green last-mile delivery and line haul:** DHL also strives to provide green last-mile delivery and line haul services. Electrification and the use of sustainable fuels are two of the main measures it has taken for transition to renewable power sources. In 2020, around 17 per cent of DHL ground vehicles were equipped with alternative drive systems, of which 15 per cent had e-drive systems, and the company is continuing to invest in upgrading its vehicles with conventional power in accordance with its latest emission standards. As a result, in 2020 80 per cent of DHL's vehicles were compliant with Euro 5 or Euro 6 standards or were entirely emissions-free (i.e., Zero-Emission Vehicle, ZEV). The company also sees improving power efficiency as an important lever in order to decarbonize ground delivery. By optimizing its route network and the location of its hubs, DHL aims to reduce fuel consumption through permanent network improvement. It has also provided systematic training programmes to drivers, encouraging eco-friendly driving behaviors and fostering green transport to their subcontractors through standards, education and incentives to invest in green transport solutions (DHL, 2021).

- **Build sustainable facilities:** With a considerable number of physical assets such as warehouses, sorting centres, hubs and office buildings, DHL is leveraging the latest green technologies to develop green buildings or convert existing buildings across its operations in over 220 countries and territories. It has mainly converted its facilities to greener ones by supplying green electricity mainly from directly purchased green energy from sustainable sources and from on-site production with photovoltaic systems. In the near future, DHL will also ensure the supply of green electricity through Power Purchase Agreements (PPA). By 2020, around 80 per cent of the electricity consumed at DHL facilities came from sustainable sources and by 2030 this share is expected to increase to over 90 per cent globally by 2030 (DHL, 2021). In addition, DHL is mitigating facility emissions by introducing sustainable energy source for heating systems and deploying automation systems using digitalization/intelligent building management systems to further reduce energy consumption in daily operations. Moreover, the Group announced with its Roadmap to decarburization that all new buildings are being constructed will be climate-neutral.

3.
Key actions in the future

- **Embed sustainability strategy into internal systems and processes:** DHL will further embed its net zero emissions roadmap into internal operating systems to enable a more systematic approach, from auditing and monitoring to assigning feasible actions to various stakeholders in different business units and geographic areas, supported by stringent internal reporting, training measures and policies (DHL, 2021).

- **The most important goals and measures up to 2030.** DHL has intensive discussions with their fuel suppliers to continuously increase the proportion of sustainable aviation fuel in their aircrafts in order to have a blending rate of at least 30 per cent by 2030. As the e-mobility pioneer and the largest e-fleet operator in Europe, DHL will expand its e-van fleet from 15,000 street scooters today to 21,500 by 2022. In 2025 the delivery fleet will then comprise 37,000 e-vehicles, including e-commercial vehicles from established vehicle manufacturers. By the end of the decade, the company plans to electrify 60 per cent of the last mile delivery vehicles. Within the area of buildings, DHL is targeting to use carbon neutral design for all new DHL buildings starting from 2021. As one example, the company plans to build up to 280 carbon-neutral delivery bases throughout Germany by 2025. DHL will also continue to expand its portfolio of green solutions further. This includes offering a green alternative for every one of the core products. For example, from 2022, carbon emissions will be offsetted to all shipments of national and international letter mail items for both private and business customers with no surcharge

- **Promote further collaboration with other stakeholders:** As a major player in the logistics industry, DHL will further promote open and constructive dialogue with key stakeholders based on Stakeholder Engagement Guidelines (AA1000 Standard) — especially with suppliers and sub-contractors — to work together on designing a pathway towards net zero emissions and develop innovative solutions, mainly through industry-wide programmes such as the United States Environmental Protection Agency's SmartWay programme. DHL will keep playing an active role in founding other initiatives (DHL, 2021).

4.
Lessons and learnings for other corporates

- **Carry out a comprehensive analysis to aid goal setting:** Companies should conduct comprehensive analyses to set meaningful and feasible emissions reduction goals. A combined bottom-up and top-down analytical approach would be optimal, in order to make key decisions based not only on what the obligations from aligning with the Paris Agreement require the company to achieve but also, realistically, by how much emissions could be reduced in the company's different business units and locations, depending on different scenarios (DHL, 2021).

- **Establish a dedicated team with complementary areas of expertise:** Companies could organize a dedicated team to support the decarbonization process. The concrete responsibility for implementing the decarbonization measures lies with the operating units. Within the dedicated team, talents with both technical backgrounds and project management backgrounds should be included as the tech staff could mainly focus on solving scientific problems, making sure that the goal setting and decarbonization

initiatives are scientific and feasible, while project management talents could help to negotiate with key managers and stakeholders in different positions, overseeing the PMO process (DHL, 2021).

- **Optimize management of subcontractors:** Managing subcontractors could be an important issue for many logistics companies as they decarbonize their ground delivery and line haul, therefore companies should build a comprehensive subcontractor management system to collect relevant data, adopt reduction tools and provide support as needed. Companies could also include environmental performance in their subcontractor selection criteria (DHL, 2021).

Photo: UN Photo/UN7107793

5.2. Yili[M] — Agriculture & Food

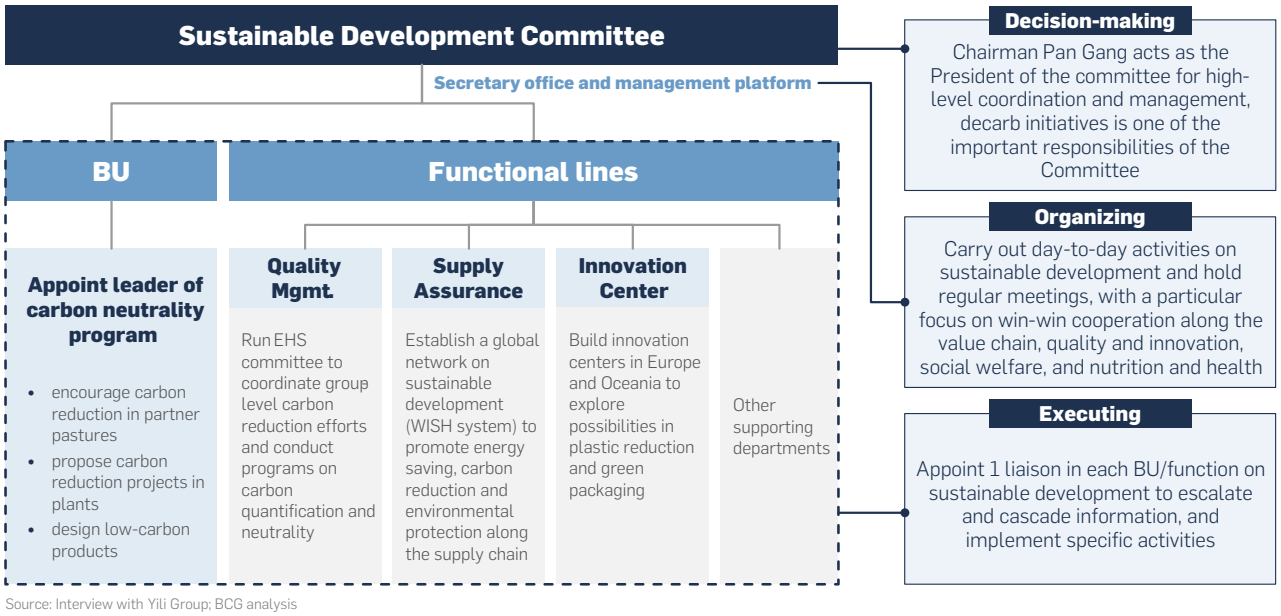
1.
Company background

Yili ranks among the top five in the global dairy industry and is the No.1 player in Asia. In 2019, it reported 1.9 million tons of greenhouse gas emissions (Scope 1 and 2), and reduced its emissions intensity from 377 kg CO_2e/ton of end-product in 2012 to 214 kg CO_2e/ton in 2019. It is committed to reaching carbon neutrality in 2060 and is developing a detailed implementation roadmap.

2.
Emissions reduction action highlights

- **Clear view of the company's carbon inventory:** Yili started to audit its Scope 1 and 2 carbon emissions by following the ISO14064 standard and IPCC GHG Emission Guidelines in 2010. A decade later, the company is very familiar with global and China-specific guidelines and has standardized its auditing process. It has a dedicated team of 100 people to collect emissions data and propose energy conservation initiatives on an annual basis. In 2019, it added emissions from upstream pastures to the audit scope (Yili, 2021).

- **Comprehensive organization structure and guiding principles for carbon emissions** (Exhibit 6): The company's sustainability committee is led directly by Chairman Pan Gang. Guided by the committee, the management, business departments and factories cooperate closely on four sustainability-related action areas: win-win results across the industrial chain, quality and innovation, social welfare, and nutrition and health. Clear roles and responsibilities have been assigned to its quality management department, factories and other participants (Yili, 2021).



Source: Interview with Yili Group; BCG analysis

Exhibit 6. Yili has set up a comprehensive organization structure for decarbonization initiatives

- **Low-carbon food processing and manufacturing:** Yili has invested RMB 90 million since 2014 to convert coal-fired boilers to natural gas. By the end of 2020, all of its factories were using natural gas, except for three due to lack of local supply, translating to an annual emissions reduction of 550,000 tons of CO_2e. Yili also introduced a series of green technologies to improve the energy efficiency of its factories, such as waste heat recovery and heat pump recycling. As of 31 December 2020, 24 of its factories had passed the ISO50001 certification and 19 factories had been named National Green Factories in China. Through these decarbonization actions in 2020, Yili reduced its operating cost by RMB 100 million, and saved 48 million kilowatt-hours of electricity, 4 million tons of water, 4.3 million cubic metres of natural gas and 28,000 tons of coal (Yili, 2021).

3.
Key actions in the future

- **Audit Scope 3 emissions:** As mentioned in Section 4.2, around 90 per cent of the total emissions for food manufacturers such as Yili come from Scope 3 activities, such as ingredient sourcing, packaging and logistics. Yili is working on clarifying its Scope 3 activities and exploring the best approach to audit emissions (Yili, 2021).

- **Decarbonize farming activities:** Yili's innovation centres are working on using plants to absorb and degrade animal manure and are deploying low-carbon principles in pasture selection, for example, using high-latitude regions to lower carbon emissions from cows (Yili, 2021).

- **Explore the potential of purchasing green electricity:** Yili will screen the renewable energy regulations in places where its factories are located and communicate with local governments to apply for renewable energy quotas (Yili, 2021).

4.
Lessons and learnings for other corporates

- **A comprehensive organizational structure and clear definitions of roles and responsibilities are the foundation for sustainability governance.**

- **Following international standards from the very beginning can save companies a lot of effort in the long run.** For the baseline of its carbon inventory, Yili followed IPCC guidelines which include a larger scope of activities. In this way, the company's data can easily fit the CDP reporting system and MSCI rating system, and it is able to standardize its annual update process.

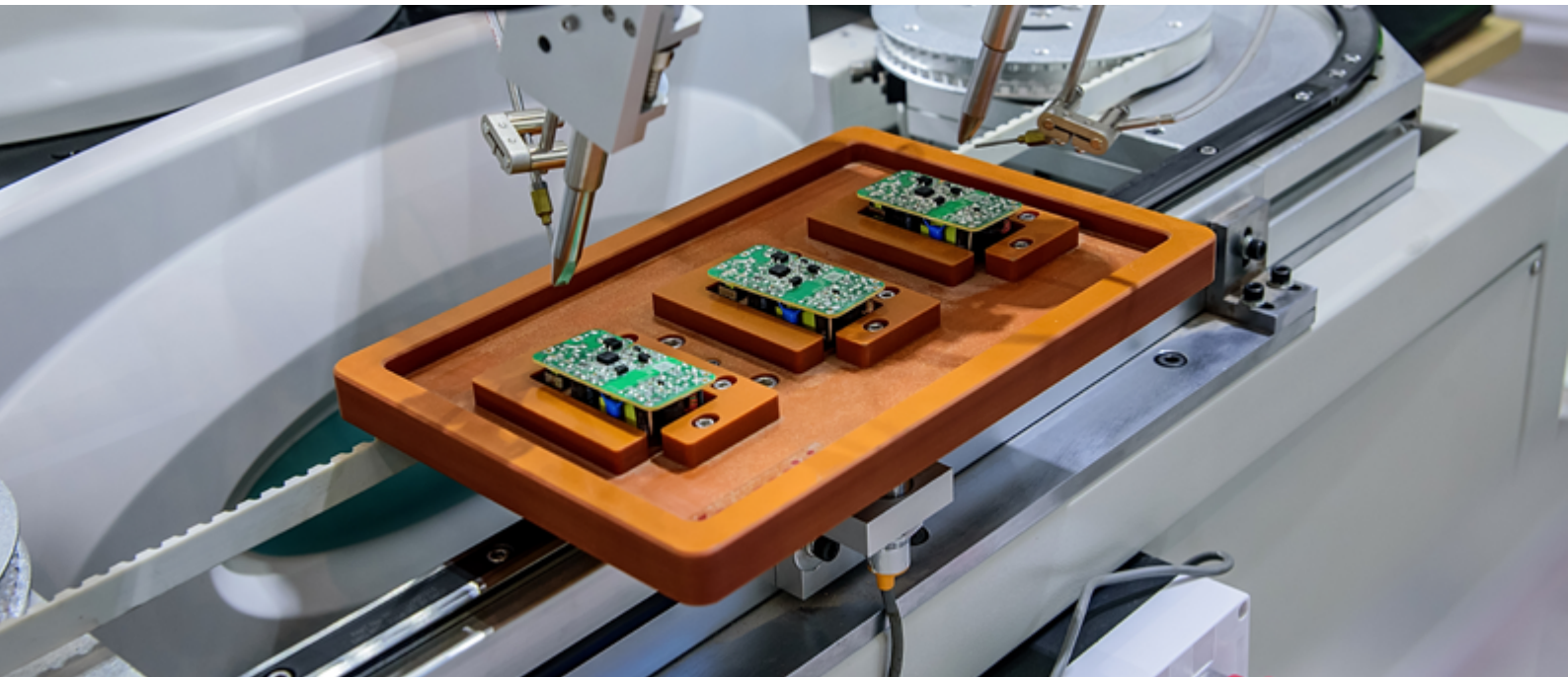
- **Primary data collection is essential for emissions auditing and monitoring, especially for Scope 3 emissions:** Carbon inventory auditing is time-consuming and requires highly granular and complete data (Yili includes small items like fire extinguishers, and switches in its carbon audit). Companies therefore need to develop IT systems to standardize and automate primary data collection, reduce the manual workload, and improve the accuracy of audits.

Photo: UN Photo/Mark Garten

5.3. Bosch[M SBTi] — Industrial Manufacturing

1.
Company background

The Bosch Group is a leading global supplier of technology and services, covering nearly every country in the world. With its more than 400 locations worldwide, the Bosch Group claimed to achieve carbon neutral since the first quarter of 2020, which was externally certified by an independent auditing company. The carbon neutrality refers to the energy the company generates by itself and the volume purchased for manufacturing, development, and administration (scopes 1 and 2). To achieve climate neutrality, Bosch systematically applies four levers: increasing energy efficiency, using renewable energies, expanding the purchase of green electricity, and — as a last resort — offsetting unavoidable CO_2 emissions with carbon credits. Having achieved carbon neutrality in scopes 1 and 2, Bosch also aims to systematically reduce upstream and downstream emissions (scope 3) by 15 percent by 2030 (Bosch, 2021) (Exhibit 7).



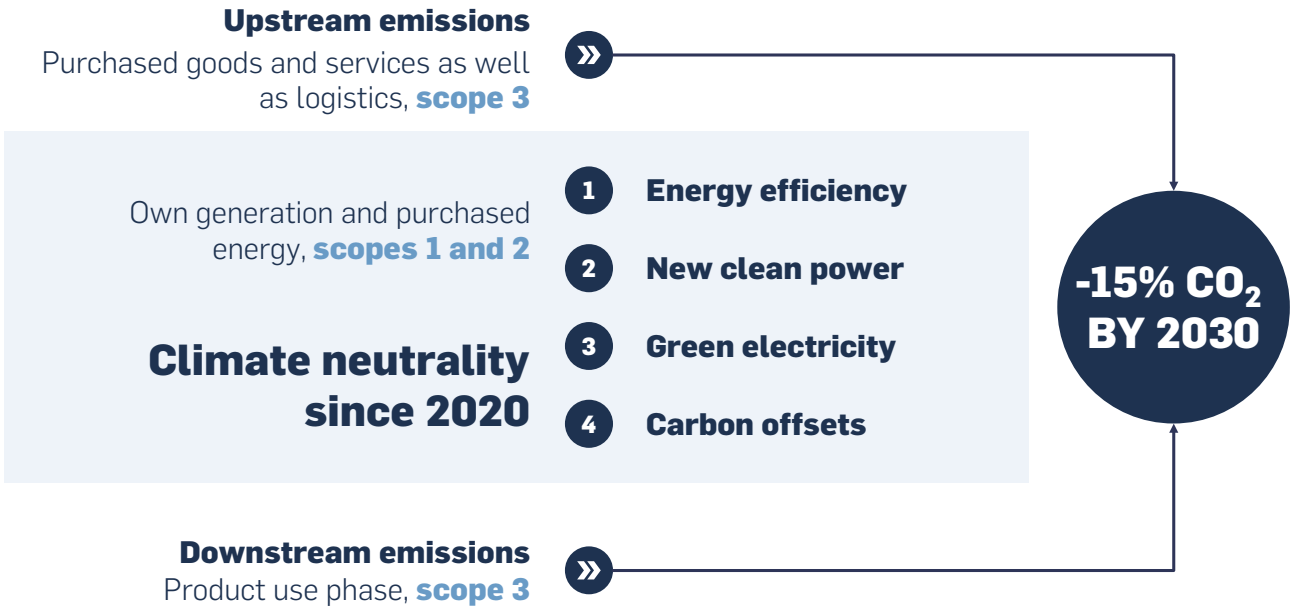


Exhibit 7. Bosch climate goals 2020

2.
Emissions reduction action highlights

- **Improve energy efficiency in manufacturing process:** By 2030, Bosch aims to save 1.7 terawatt-hours (TWh) of energy by making energy-efficiency improvements at its locations. Since 2019, the company has initiated more than 2,000 projects worldwide and captured savings potential of 0.38 TWh. More than 100 company locations are already achieving significant savings with the Bosch Energy Platform, a smart energy management system. For example, its Homburg site has slashed around 4,500 tons of CO_2 in the past two years by using connected sensors and self-programed algorithms to monitor and manage the energy use. On top of that, Bosch has implemented other impressive projects to improve energy efficiency in its worksites and factories, among them a digital solution reducing energy consumption of Surface Mounted Technology soldering machines(Bosch, 2021).

- **Deploy renewable power:** Under the banner of new clean power, Bosch aims to drive renewable energy generation — both through in-house generation at its company locations and through long-term supply contracts that will ultimately enable the construction of new photovoltaic plants and wind farms. By 2030, the aim is to generate 0.4 TWh of the energy the company needs annually in-house at its locations from renewable sources. Bosch has already been able to supply around 69 gigawatt-hours of electricity from self-owned renewable sources to meet the power demand by 2020, mainly by deploying in-house photovoltaic systems at its sites in regions with dense business coverage and favorable local conditions for PV power. In parallel, in 2020 Bosch entered into long-term supply agreements with three energy suppliers in Germany, thus enabling the construction of new renewable energy plants (Bosch, 2021).

- **Purchase green electricity:** Bosch also concentrates on the purchase of green electricity from existing plants to accelerate their decarbonization process. In 2020, Bosch was already able to cover around 83 per cent of their global power demand with green electricity, which is expected to keep increasing in the future. The current strategy Bosch applies is to initially concentrate their procurement on areas where Bosch consumes sizable energy and expand the efforts to other places in the world (Bosch, 2021).

3.
Key actions in the future

- **Improve the lever mix:** Bosch intends to continuously improve the lever mix over the coming years in order to reduce the use of carbon offsets while further increasing energy efficiency and procurement of new clean power. In 2020, carbon offset accounts for around 29 per cent of contribution to Bosch's carbon neutrality. Bosch seeks chances to minimize the portion of carbon offsets needed to stay carbon neutral to no more than 15 per cent in 2030 (relative to the 2018 baseline) (Bosch, 2021).

- **Curb emissions from both upstream and downstream (scope 3):** In the future, Bosch intends to go beyond their immediate scope of emissions (scope 1 and 2) and seek chances to curb emissions from the upstream and downstream value chain (scope 3) by 15 per cent by 2030. After systematic analysis of its scope 3 emissions, Bosch focuses on highest emitting activities including purchased goods and services, logistics and use of sold products (Bosch, 2021).

4.
Lessons and learnings for other corporates

- **Adopt a holistic approach to become carbon neutral:** Companies can start their path to carbon neutrality by adopting an approach consisting of different levers. Having identified their current CO_2 footprint and reduction potentials, different levers enable companies to become carbon neutral in scopes 1 and 2. It is recommended to create an interdisciplinary team of controllers, engineers, energy and climate experts to realize carbon neutrality.

- **Derive specific performance indicators to track contribution of measures:** Companies are suggested to design indicators to track the contribution of different identified decarbonization measures, allowing them to introduce any follow-up measures that might be needed and focus on the key levers, to ensure the best possible use of resources in the interest of sustainability as well as their ability to reach the net zero goals.

- **Focus on products to help mitigate emissions:** For manufacturing companies, bulk of emissions in scope 3 comes from the product use phase and consequently it is critical for companies to reduce the products' CO_2 emissions during use by designing energy efficient products, shaping the product portfolio and harnessing the transformation of the energy sector, facilitating their customers to mitigate greenhouse gas emissions (Bosch, 2021).

5.4. Skanska[M SBTi] — Construction

1.
Company background

Founded in 1887, Skanska is one of the world's leading construction and project development companies, focused on selected home markets in the Nordic region, Europe and the United States. In 2019, Skanska reported a total of 2.1 million tons CO_2e emissions, including 0.26 million tons from Scope 1 and Scope 2 and 1.9 million tons from scope 3, which has not included sold of products, the biggest emitting activities in Scope 3 for construction companies. Compared with base year (2012), Skanska has achieved a 28 per cent decrease in scope 1 and 2 in 2019 and claimed to become climate-neutral across its own operations and its entire value chain (Scopes 1, 2 and 3) by 2045.

2.
Emissions reduction action highlights

- **Producing green buildings and infrastructure:** Skanska designs and produces energy-positive buildings, which produce more electricity than they consume. Powerhouse Brattørkaia, one of the world's northernmost energy-positive office buildings, is designed with a roof sharply pitched at 19.7 degrees to provide the optimum angle for the photovoltaic panels to harvest the sun's energy and a big circular opening that enables sunlight to reach the interior offices. The building produces more than double the amount of electricity it consumes daily (Skanska, 2020).

- **Selecting sustainable material supply:** Skanska has engaged in finding and utilizing sustainable materials for many years. In Sweden, for example, it has developed low-carbon concrete mixes in which it replaced a portion of cement with either slag, a waste product from steel mills, or fly ash, produced by power plants. While they produce up to 50 per cent less carbon emissions, these types of concrete maintain their durability, strength and workability. In the United States, Skanska is leading a partnership that has developed an innovative new tool, the Embodied Carbon in Construction Calculator (EC3). The free, open-access EC3 tool can be implemented in both the design and procurement

phases of a construction project to look at a project's overall embodied carbon emissions and potential savings, as well as sort and evaluate material manufacturers' embodied carbon emissions in each category, enabling the specification and procurement of the lowest-carbon options. In the Czech Republic, where supplies of natural aggregates are decreasing, Skanska is bringing to market a circular concrete approach that uses 100 per cent recycled aggregate (Skanska 2020).

- **Decarbonize work site construction processes:** Skanska joined forces with the research company SINTEF, Volvo and the software company Ditio to develop intelligent construction machines, all of which know each other's location, task and how to best optimize and organize upcoming work using machine learning, route optimization and artificial intelligence, which helps machines work more efficiently and lowers emissions (Skanska, 2020).

3.
Key actions in the future

- **Explore further opportunities in innovative solution to customers:** Through market analysis, Skanska will further identify more business chances and changing market demands to deliver more sustainable solutions to end users, decarbonizing the use phase of its buildings and infrastructures via innovations. Skanska will keep pursing high standards in achieving high power and resource efficiency (Skanska, 2020).

- **Promote ACT Climate plan:** Skanska will further promote its climate plan named ACT, referring to Awareness, Customer Success and Transformation. By developing internal structures and advocating and communicating how it is measuring the targets and financial models, Skanska drives awareness of sustainable construction and development. Skanska also believes that cross-industry collaboration for sustainability innovation and success is necessary to solve the climate crisis. Low and zero carbon solutions will happen in unison with the partners and customers through the increased use of digital tools, smarter energy solutions and low-carbon offerings. Skanska participates to develop sustainability standards for buildings and infrastructure. On top of that, Skanska also plans to take further actions to keep reducing carbon emissions from the whole picture: ranging from the planning phase through construction to demolition.

4.
Lessons and learnings for other corporates

- **Measurement and follow-up are key in developing decarbonization solutions:** a comprehensive measurement of all critical emitting activities is important to all companies and an unceasing follow-up on carbon performance monitored by high-level executives will also play a crucial role (Skanska, 2020).

- **Participate in develop sustainability certifications is important to facilitate the transition in use phase:** a large bulk of emissions of construction companies come from the use phase of buildings, and sustainability certifications are important for customers to compare and evaluate sustainability performance of buildings and facilities and therefore is a key driver to promote the sustainability development of construction industry. Actively participating in widely accepted certification schemes including LEED, WELL, BREEAM etc. is therefore a key initiative for construction and project development companies (Skanska, 2020).

5.5. Huawei[M] — Digital & Information

1.
Company background

Founded in 1987, Huawei is a leading global provider of information and communications technology (ICT) infrastructure and smart devices. Huawei reported 2.2 million tons of CO_2e emissions in Scope 1 and Scope 2 in 2019 but decreased its carbon emissions (Scope 1 and 2) per million RMB of sales revenue by an impressive 32.7 per cent compared to the base year (2012), and is devoted to reducing it by a further 16 per cent before 2025.

2.
Emissions reduction action highlights

- **Decarbonize internal operations through technology:** Huawei has always strived to conserve energy and reduce carbon emissions in all aspects of its operations, from campus facilities, R&D labs and data centers to its manufacturing plants. In 2019, it adopted the Intelligent Campus Energy Management Solution as part of its digital transformation of campus management which it rolled out across all campuses, achieving more than 15 per cent energy savings across the year. By leveraging modular uninterruptible power supply (UPS) solutions, indirect evaporative cooling technology and other advanced technologies, Huawei cut the PUE of its data centres to 1.2, avoiding a significant volume of emissions (Huawei, 2019).

- **Promote a circular economy:** Huawei also reduces its greenhouse gas emissions by promoting a circular economy, including using more eco-friendly materials, reducing the use of raw materials, making products more durable and easier to disassemble, and improving its product recycling system. The simplified design of the Huawei Blade AAU (Active Antenna Units) integrates active 5G AAU and passive 2G/3G/4G antennas into one box with a total height of around two metres, leading to significant material, space and energy savings. Huawei has also implemented the "6R1D" strategy for green packaging, an acronym which stands for "Right Packaging (the core), Reduce, Returnable, Reuse, Recycle, Recovery and Degradable." As a result, Huawei used more than 400,000 pieces of green packaging in 2019, saving more than 90,000 cubic metres of wood (Huawei, 2019). Huawei has also built e-waste management systems globally

to eco-process and reuse the raw materials in e-waste, such as copper, cobalt salt/iron, aluminum, copper sand, resin powder and plastic. In 2020, Huawei recycled over 4,500 tons of e-waste, making efforts to maximize its resource efficiency.

- **Develop green products:** Huawei systematically assesses the carbon footprints of its products by following lifecycle assessment (LCA) methodology, believing that carbon emissions from products mainly come from the use phase; therefore, it has made impressive efforts in developing energy-saving technologies to help reduce the energy use from ICT products throughout their lifecycles, mitigating emissions for clients from numerous industries. For example, the Net Engine 8000 X8 router consumes 26-50 per cent less power per bit than similar products, saving about 90,000 kilowatt-hours of electricity every year in each case (Huawei, 2019).

- **Encourage suppliers to build greener supply chains:** Huawei proactively collaborates with its suppliers to decarbonize its value chains. It also incorporates environmental protection requirements into its procurement strategy and procurement process, encouraging and guiding suppliers to develop their own energy conservation and emission reduction plans by introducing widely accepted methodologies like the International Performance Measurement and Verification Protocol (IPMVP). In 2019, 35 suppliers took part in the programme, and collectively reduced CO_2 emissions by 80,144 tons (Huawei, 2019).

3.
Key actions in the future

- **Continue to decarbonize internal operations:** Huawei will continue to make efforts in source control (clean energy), process management (technology and management energy saving) and closed-loop results (other measures). While ensuring business continuity, Huawei will save energy and improve the efficiency of its resource use to reduce operating costs and achieve efficient, high-quality and low-carbon operations on its campus.

- **Explore chances to develop sustainable products:** Combining future technological innovation and evolution, Huawei will continue to improve all aspects of network construction, such as 5G, F5G, IP networks and site energy, to achieve green and intelligent connections from end to end.

- **Develop further decarbonization plans on suppliers:** Huawei will continue to encourage its top 100 suppliers to check their carbon emissions, confirm carbon emission reduction targets, formulate emission reduction plans and implement emission reduction projects.

4.

Lessons and learnings for other corporates

- **Decarbonize the supply chain:** Tech companies should place sufficient emphasis on their supply chains when designing decarbonization initiatives as their supply chains are responsible for a sizable portion of the greenhouse gas emissions. Companies should develop systematic methods and mechanisms to guide and manage the decarbonization process of suppliers.

- **Examine and track emissions using digital tools:** the process of examining and allocating emissions to different activities is highly complicated, especially for companies operating in many regions and practice areas. Digital tools like energy management systems could help to evaluate and track such activities.

5.6. China Development Bank[M] — Financial Services

1.
Company background

Founded in 1994, China Development Bank (CDB) is a development finance institution in China. As a member of the UN Global Compact, CDB has proactively adopted responsible financing practices and fulfills its corporate social responsibilities. It offers diversified financing products and services to support China's strategic goals of reaching a carbon peak and carbon neutrality.

2.
Emissions reduction action highlights

- **Successfully issued first "carbon neutral" green bond**: In March 2021, CDB issued the first "carbon neutral" green bond to global investors in Beijing. The three-year, RMB 20 billion bond has a coupon rate of 3.07% and will be used to fund wind power, photovoltaic power and other carbon emission reduction projects. The bond was certified by the World Bank's Climate Bonds Initiative (CBI). The raised funds will be invested in a measurable, auditable and verifiable way to make a real difference in emissions reduction. Each year, it is expected to save more than 7.3 million tons of standard coal, and reduce CO_2 by about 19 million tons, SO_2 by around 4,300 tons, and nitrogen oxides by around 4,700 tons. The bond was issued simultaneously in and outside China, and was snapped up by global investors:
    - RMB 19.2 billion worth of bonds were issued in the interbank bond market to guide the allocation of financial resources to carbon neutrality;
    - RMB 800 million worth of bonds were issued in the commercial banking OTC market to guide public participation in carbon neutral actions;
    - The overseas orders of the bond exceeded RMB 10 billion, reflecting the recognition of China's green bond market by global financial institutions.

3.

Lessons and learnings for other corporates

- Achieving a peak in carbon emissions and carbon neutrality requires broad, deep and systematic changes across the economy and society. Financial institutions should follow a green development philosophy and align their business with global standards to diversify green financial offerings, increase low-cost financing for green projects, and promote green industries in the transition towards a green society and economy.

5.7. Industrial Bank — Financial Services

1.
Company background

Industrial Bank was established in 1988 as one of the first joint-stock commercial banks in China and has now grown into a mainstream commercial banking group with banking as its main business but also with a business portfolio in multiple other fields. Industrial Bank was the first bank in China to join the Equator Principles (EPs), a risk management framework adopted by financial institutions to determine, assess and manage the environmental and social risks of projects.

2.
Emissions reduction action highlights

- **Develop green financing products and services in multiple categories:** Like other financial institutions, the biggest portion of Industrial Bank's greenhouse gas emissions comes from its value chain and, specifically, its financed projects and businesses; Industrial Bank therefore regards the development of its green financing products as a major pillar in its decarbonization process. Since 2006, Industrial Bank — as China's first Equator Bank — has been the first commercial bank in China to develop a green finance business. Deeply involved in this field for 15 years, Industrial Bank has formed a financial products and service systems spanning multiple categories, including green bonds, green loans, green leasing, green trusts, green funds and green wealth management, giving it a first-mover advantage in green finance. As of the end of March 2021, the bank has provided more than RMB 3 trillion in green financing to more than 30,000 companies with a green financing balance exceeding RMB 1.2 trillion. It has the largest issuance scale and green bond balance of any commercial financial institution. Specifically, the energy-saving and emission-reduction projects supported by Industrial Bank are expected to reduce their carbon dioxide emissions by 85.87 million tons per year, which is equivalent to shutting down 196,100 megawatt thermal power plants (CIB, 2021).

- **Actively participate in carbon trading markets:** Industrial Bank is an active player in the development of a carbon trading market in China and has developed partnerships with all seven carbon trading pilot provinces and cities. Combining experience from both international and domestic carbon markets, Industrial Bank offers a full package of solutions to carbon market entities. It also offers services to trading platforms, including transaction structure and system design, carbon trading fund clearing and settlement, carbon performance tracking, carbon asset value preservation and appreciation, carbon asset pledge financing and carbon trading brokage — covering all aspects and phases of projects and transactions. Industrial Bank serves as the main clearing bank in key regions such as Shanghai, Guangdong, Tianjin, Hubei and Shenzhen, proactively participating in carbon transactions and trading system account opening and settlement. On top of its partnerships with trading platforms, Industrial Bank also provides comprehensive carbon finance service solutions to high-emitting companies and helps regulators and carbon asset management firms explore opportunities to set up guidance funds and guarantee funds. The bank also develops carbon financial derivatives, including forwards, futures, options, swaps as well as tradable structured products, such as carbon indices, carbon bonds and carbon asset-backed securities (ABS) (CIB, 2020).

- **Promote expertise as an industry pioneer:** Industrial Bank has promoted its expertise as an industry pioneer by contributing to policymaking and helping other banks to develop green finance solutions. It participated in the development of several green finance policies in China, including the "Special Statistical System for Green Loans", "Energy Efficiency Credit Guidelines" and the "Green Bank Rating Program", leveraging its expertise and experience in the roles banks can play in green finance under different standards. Industrial Bank also helps other banks in China and other developing countries develop their own green finance solutions. Industrial Bank has signed cross-industry green finance cooperation agreements with 20 Chinese banks, including Jiujiang Bank, Huzhou Bank and Anji Rural Commercial Bank, and has provided green finance development solutions for Jiangsu Bank, among other institutions. It also actively participates in promoting sustainable development practices in other emerging market countries, such as Vietnam, Thailand and Mongolia, through partnerships like the Equator Principles to help other countries fulfill their climate obligations. Industrial Bank believes that each bank can enhance its green financial services further by leveraging partnerships with complementary advantages (CIB, 2020).

3.
Key actions in the future

- **Design net zero goals and roadmaps:** Industrial Bank joined the United Nations Climate Neutral Now Campaign in April 2021 and will establish its own carbon peak, carbon neutrality goals and detailed roadmap based on the UN framework in order to facilitate its low-carbon transformation. Industrial Bank also hopes to continue to form in-depth collaborations with international organizations and financial institutions to work jointly on climate and environmental information disclosure pilots, environmental stress tests, green financial product innovation, and the alignment of various green standards (CIB, 2021).

- **Take further actions in carbon trading:** Industrial Bank will promote further innovations in carbon finance products and services to meet the rising demand in emission quota tracking and trading and carbon asset appreciation and revitalization, contributing to the evolution of the carbon trading market in China (CIB, 2021).

4.
Lessons and learnings for other corporates

- **Develop an assessment framework for current financing products:** Apart from launching green finance products, financial institutions could also develop a carbon emissions assessment framework and embed it into their current credit or investment approval process to evaluate the greenhouse gas emissions of high-emitting projects or businesses before providing financial services. They could also alter capital flows by assessing and limiting financing to high-emitting activities as well as encouraging projects that contribute to a net zero pathway (CIB, 2019).

- **Set up supporting organizations and mechanisms:** Financial institutions could develop organizations and mechanisms to enable the green transition. For example, assessments of the green financing performance of business teams could be incorporated into the current key performance indicator (KPI) system while dedicated assets, dedicated human resources and priority credit approval could be allocated to green finance projects (CIB, 2019).

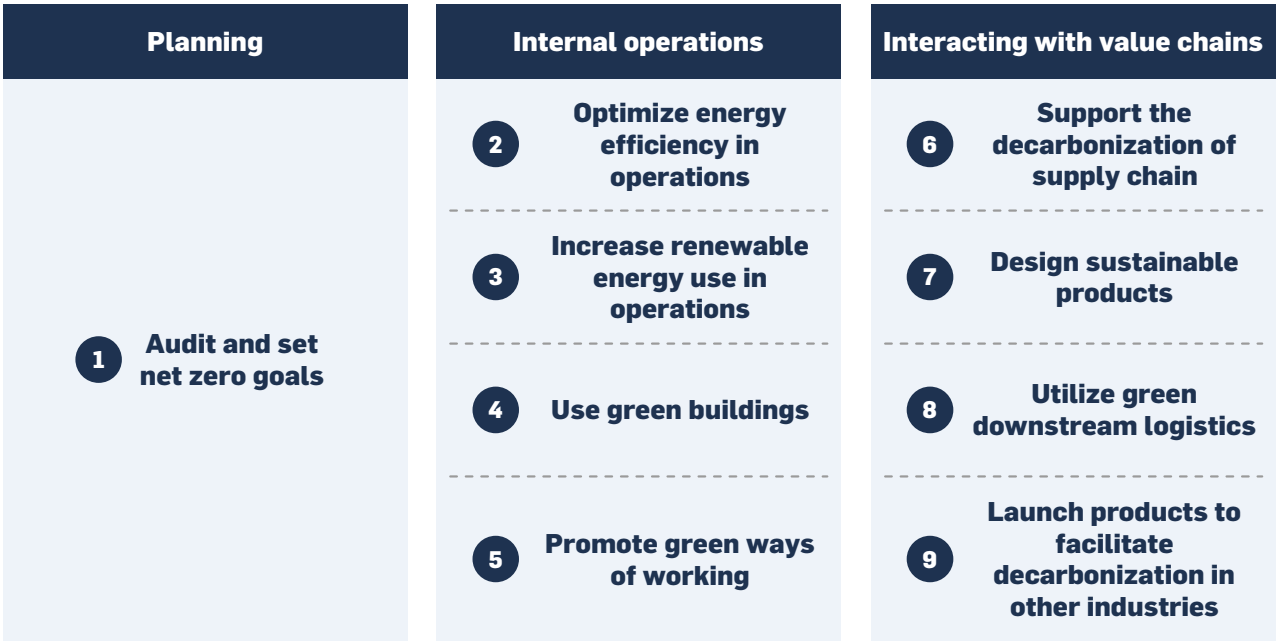
Company Name	DHL	Yili	Bosch	Skanska	Huawei	China Development Bank	Industrial Bank
Sustainable Development Goals (SDGs)							
Ten Principles of UNGC	**Environment** **Principle 7**: Businesses should support a precautionary approach to environmental challenges; **Principle 8**: undertake initiatives to promote greater environmental responsibility; and **Principle 9**: encourage the development and diffusion of environmentally friendly technologies.						

Exhibit 8. How representative corporates meet the SDGs and the Ten Principles of the UN Global Compact

Photo: UN Photo/Cia Pak

6. The Corporate Roadmap Towards Net Zero

As the danger to human beings from global warming intensifies, pioneering companies from different countries and industries have taken concrete initial steps to mitigate their climate impact. Following their lead, more companies are expected to follow the pathway and contribute to the process of decarbonization. Although the status quo varies by industry, **nine key initiatives** have formed the backbone for more customized and detailed net zero roadmaps. These initiatives cover **planning, internal operations and interacting with value chains, and companies with any industry background can consider taking them as basis to develop their detailed net zero transformation plans (see Exhibit 9).**



Source: Desktop research; BCG Analysis

Exhibit 9. Nine key initiatives covering planning, internal operations and interacting with value chains, should be considered when designing net zero roadmaps

1. Audit and set net zero goals

Carrying out a comprehensive carbon audit would be a good way to give companies an overview of their emissions performance and the opportunities where decarbonization could make a difference. It will also be critical to set both short and long-term scientific emissions reduction goals, to ensure that actions taken are both significant and feasible.

2. Optimize energy efficiency in operations

Companies could improve energy efficiency during their operations given that a large bulk of emissions come from power use. They can take measures such as modernizing tools and equipment, optimizing working process and methods, deploying power monitoring and management systems and developing waste recycling methods.

3. Increase renewable energy use in operations

Adopting renewable energy to power operations has become a widely recognized means for businesses to decarbonize their operations. Companies should be encouraged to implement their own renewable energy systems, such as photovoltaic rooftop installations, or purchase green electricity directly from existing power plants.

4. Use green buildings

Cutting emissions from the daily operations of factories, hubs, branches and office buildings will also be a key lever for emissions reduction, and applying power management systems, sensors and LED systems would be a significant first step. At the same time, companies could also apply more energy-efficient cooling and heating systems to lower the power use of buildings further.

5. Promote green ways of working

Companies could also decarbonize their businesses by encouraging green ways of working among their employees. From instructing staff to save power to avoiding unnecessary business travel, initiatives should be taken to establish greener working practices.

6. Support the decarbonization of the supply chain

On the upstream side, it is crucial for companies to realize that selecting suppliers with more sustainable offerings (i.e. those that have adopted sustainable materials) and those that use sustainable processes and logistics will be imperative in building a more sustainable value chain.

7. Design sustainable products

Companies are also encouraged to fulfill their obligations to help downstream stakeholders to meet their net zero goals. Designing more sustainable products will be an important lever in achieving this. Green design would reduce the emissions during the product use phase on top of the reduction from manufacturing process via sustainable operations.

8. Utilize green downstream logistics

Downstream logistics is another area companies should take into consideration when it comes to downstream emissions. Decarbonizing self-owned vehicles through electrification, using sustainable fuels and improving efficiency or collaborating with vendors with greener airplanes, vessels and fleets are practices that should be strongly encouraged.

9. Launch products to facilitate decarbonization in other industries

Companies should do more than simply making existing products greener. They can offer products and services specifically to help other stakeholders decarbonize their businesses. For example, making electric vehicles, producing PV inverters and providing green loans and green bonds would contribute hugely to the decarbonization of the downstream value chain.

When developing detailed net zero roadmaps, companies should prioritize actions based on their importance and ease of implementation. They should also understand each initiative from an industry-specific perspective to ensure that their roadmaps are actionable and solve real problems. **Based on the nine key initiatives outlined in Exhibit 10, we have suggested roadmaps for the six industries, including actions that should be taken in the short-term, medium-term and long-term** (see Exhibit 10[10]).

10. Numbers before each action refer to the corresponding key initiatives in Exhibit 9.

	Short-Term	Medium-Term	Long-Term
Universal actions for all industries	1 Complete carbon auditing and set net zero goals 1 Design detailed net zero roadmaps 5 Promote energy saving behaviors and reduce unnecessary travel or physical documentations 4 Upgrade buildings with energy mgmt. systems and lighting retrofit systems	3 Utilize renewable energy via implementing PV systems or purchasing green electricity 4 Apply green building standard when design and select new buildings 6/8 Develop training and incentive plans to facilitate a greener supply chain and downstream logistics	6 Develop carbon performance assessment standard for supply chain and apply to every business units 8 Develop and conduct new assessment standard for downstream logistics with emphasis on carbon performance
Transportation	9 Develop recyclable packages and increase use of sustainable packaging materials 3 Adopt accessible clean energy for self-owned vehicles 2 Develop and deploy route and shipping size optimization plans 2 Implement efficiency improvement IT systems to fleets and other vehicles 2 Complete modernizing outdated models to improve energy efficiency 2 Screen potential techniques and secure R&D and other investment dedicated to vehicle efficiency improvement		3 Promote clean energy for third party vehicles 3 Make key breakthrough in other energy source areas, like biofuels 9 Achieve significant increase in the share of low or zero emission logistic services
Agriculture and Food	2 Apply R&D on reusing methane to improve efficiency 2 Implement equipment to capture and reuse methane from manure 9 Reduce packaging complexity and switch to recyclable materials		2 Develop scientific approach to track and enhance animal productivity and reduce CH_4/kg live-weight by using fertilizers scientifically 2 Make key breakthroughs in controlling reproductive diseases to improve animal productivity
Industrial Manufacturing	7 Develop life cycle assessment on carbon performance of sold products 2 Apply systematic approach to recover energy from waste	2 Identify and apply new techniques and process mgmt. tools in manuf. steps to increase efficiency	9 Achieve significant increase in the share of related decarbonization products and renewable energy products like EVs, batteries, etc.
Construction	2 Increase use of prefabricated materials on construction projects 2 Identify and apply efficiency improvement projects on work site 7 Develop internal capabilities or external partnerships on green building design		9 Achieve significant increase in the share of renewable energy related projects, including renewable energy plants or relevant buildings and infrastructures
Digital and Information	2 Screen techniques to improve the PUE of data centers 2 Identify key techniques to improve energy efficiency in manuf. process	7 Develop life cycle assessment on carbon performance of sold products, screen and apply energy saving design	9 Enable downstream customers to decarbonize their business with advanced technology like AI, data analytics, etc.
Financial Services	7 Promote online banking services 2 Screen techniques to improve the PUE of data centers 9 Incorporate carbon impact into current financing and investment approval criteria	9 Develop a comprehensive portfolio of green finance products to facilitate net zero missions	9 Develop systematic approaches to track and assess financed projects 9 Provide technical support to improve carbon performance of financed projects if necessary

Source: Desktop research; BCG Analysis

Exhibit 10. Corporates are suggested to take key actions, according to nine key initiatives, including both universal and industry-specific ones

Photo: UN Photo/Manuel Elías

7. Looking Forward: Climate Technology Investment

In the race to reduce emissions, forward-looking corporates are investing in prospective climate technologies, with the strong belief that they will generate long-term benefits for both businesses and society. To end this whitepaper, we have selected nine prospective technologies that corporates and investors could pay attention to:

Autonomous driving

L4/L5 autonomous driving makes truly driverless operation possible. Tech companies, car manufacturers, and progressive investors strongly believe that the technology will not only change people's driving behaviors and travel patterns, but also make a major contribution to achieving net zero — big data and 5G enabled vehicle-to-vehicle and vehicle-to-infrastructure connectivity will allow authorities to improve planning for road transportation, reduce congestion, and increase the energy efficiency of vehicles.

Carbon Capture, Utilization and Storage (CCUS)

CCUS involves the capture of CO_2 from fossil fuel or biomass, or the CO_2 in the atmosphere. If the captured CO_2 is not used, it can be compressed and injected into deep geological storage. Today, the major challenge of CCUS technology is its economics: separating out CO_2 from a mixture of gases is costly; injecting CO_2 into oil wells requires high oil prices to be commercially viable, and is problematic when oil prices fall. There have also been debates about the safety of the technology, and its long-term impact on land health.

Electric vehicles

Batteries are the most critical part of electric vehicles, and the area in which the biggest technological breakthroughs take place. Manufacturers and investors are actively researching technologies like solid electrolytes to reduce battery weight and increase efficiency, and are looking for replacements for lithium to avoid the environmental impact of a potential toxic chemical leakage, while they are also exploring other technologies like wireless charging.

Energy storage

A technology that uses a storage medium, power conversion system and control software to balance out fluctuations in energy supply and demand. Energy storage is critical to ensure grid stability and safety when more and more electricity is generated from solar, wind, and other distributed energy resources. The key focus today is to develop a cost-effective solution that can be applied on a large scale.

Hydrogen and fuel cells

Producing no GHG emissions, low particulate emissions and no noise pollution, hydrogen is increasingly considered a key element in the path to decarbonization. Many of its future applications involve the transformation of hydrogen into power using fuel cells. The current focus of research and development is to overcome the combustion risk of pressurized hydrogen, increase power-to-power efficiency and eventually reduce costs.

Insulation materials

Exterior and roof insulation is the key to increase the energy efficiency of buildings. Vacuum insulated panels have been deployed in some buildings, but broader implementation is still limited by their high cost. In addition, some other innovative solutions such as nanoporous materials, phase change materials, and anti-radiation materials are also being discussed.

Materials for high-efficiency solar cells

Today, most solar panels are between 15 – 20 per cent efficient. The materials that cells are made from impact the conversion rate of light to electricity. From monocrystalline silicon and polycrystalline silicon to cadmium telluride, researchers around the world are exploring cost-effective materials to maximize efficiency.

Offshore wind

Despite its 30 years' track record in Europe, offshore wind is still new to many countries due to its high initial investment and maintenance costs. The emphasis for investors is how to balance the cost increase from deeper and/or farther shore sites and improvements in power production.

Superconducting technology

Superconducting technology provides a foundation for various applications. The high-temperature superconducting maglev train has low maintenance costs, is highly safe, and produces less environmental pollution. Metal processing companies are exploring the potential of using direct current superconducting induction heaters to achieve higher efficiency. High temperature superconducting technology enables furnaces to produce monocrystal silicon on a large scale, which ultimately benefits the photovoltaic industry.

References

AfDB. (2020). Green and Social Bond Newsletter.

Aleph. (2020). Belt and Road Initiative: the World's Largest Infrastructure Investment. Retrieved from https://www.alephas.org/2020/11/11/belt-and-road-initiative-the-worlds-largest-infrastructure-investment/.

Apple Inc. (2021). Apple Environment. Retrieved from Apple.com: https://www.apple.com/environment/.

Arabesque. (2020). Arabesque Asset Management. Retrieved from https://www.arabesque.com/asset-management/sustainable-investing/.

Australia, G. o. (2020). Carbon farming: reducing methane emissions from cattle using feed additives. Retrieved from https://www.agric.wa.gov.au/climate-change/carbon-farming-reducing-methane-emissions-cattle-using-feed-additives.

Ayala. (2020). Climate Change. Retrieved from https://ayala.com/sustainability/environmental.

Baidu. (2021). Baidu Special Report on Low Carbon Development 2020.

Baowu. (2019). sustainability report.

Bhutan, R. G. (2015). National Environment Commission.

Bosch. (2020). Four levers for climate neutrality.

Bosch. (2020). Sustainability Report Factbook.

Bosch. (2021). Sustainability Report Factbook.

BusinessGreen. (2020). South Korea national assembly declares climate emergency. Retrieved from https://www.businessgreen.com/news/4020801/south-korea-national-assembly-declares-climate-emergency.

BYD. (2018). sustainability report.

Canada. (2020). Canadian Net-Zero Emissions Accountability Act.

Cargill. (2016). Renewable energy: Good for business and the planet.

CDB. (2019). sustainability report.

CDB. (2021, June). (BCG, Interviewer)

CDP. (2020). Bosch Climate Change 2020.

Chaudhary. (2020). A Journey Towards Sustainable Social Reform.

China Shengmu. (2021). ESG Report.

CIB. (2019). Sustainability Report.

CIB. (2019). 兴业银行的绿色发展之路: 绿色金融，点绿成金 . Retrieved from https://cj.sina.com.cn/articles/view/1926909715/72da4f13019010of4?cre=wappage&mod=r&loc=3&r=9&rfunc=68&tj=none.

CIB. (2021). 兴业银行信用卡中心助力绿色汽车消费 . Retrieved from http://creditcard.cib.com.cn/minisite/20201231/ls.html.

CIB. (2021). 兴业银行陶以平：应对气候变化 贡献更大金融力量 . Retrieved from https://finance.sina.com.cn/roll/2021-04-16/doc-ikmyaawc0054155.shtml.

CIB. (2021). 提前布局“碳中和”兴业银行加速向 ESG 集团演变 . Retrieved from https://www.cib.com.cn/cn/aboutCIB/about/news/2021/20210310.html.

CIB Research. (2018). 政策性银行：以独特优势创新引领绿色金融发展 . Retrieved from https://app.cibresearch.com/shareUrl?name=00000000070bdfff50170e632523d2d0b.

Credit Agricole. (2020). ACTOR OF INFLUENCE.

Danone. (2017). Circular Economy of Packaging. Retrieved from https://www.danone.com/impact/planet/packaging-positive-circular-economy.html.

DHL. (2021). Carbon neutral buildings. Retrieved from https://www.dpdhl.com/en/sustainability/environment/carbon-neutral-buildings.html.

DHL. (2021). ESG Presentation Q1 2021: Sustainability Roadmap.

DHL. (2021). net zero emissions actions for DHL. (BCG, Interviewer)

Energy and Climate Intelligence Unit. (2021). NET ZERO TRACKER (NET ZERO EMISSIONS RACE). Retrieved from https://eciu.net/netzerotracker.

Equinix. (2021). Equinix Green Data Centers. Retrieved from Equinix: https://www.equinix.com/data-centers/design/green-data-centers/.

Esquel. (2020). climate actions. Retrieved from https://sustainability.esquel.com/planet/.

European Environment Agency. (2015, 6). Agriculture and climate change.
Facebook. (2021). Sustainable data centers.

Facebook. (2021). Sustainable workplaces. Retrieved from Facebook Sustainability: https://sustainability.fb.com/innovation-for-our-world/sustainable-workplace/#section-Employeetransit.

FAO. (2017). Low-emissions Development of the Beef Cattle Sector in Argentina - Reducing enteric methane for food security and livelihoods. Food and Agriculture Organization of the United Nations & New Zealand Agricultural Greenhouse Gas Research Centre.

FedEx. (2019). 2019 Global Citizenship Report.

GEIDCO. (2021). World of Energy Interconnection Offical Launch.

Global Center on Adaption. (2021). This is how farmers are using satellites to enhance adaptation. Retrieved from https://gca.org/this-is-how-farmers-are-using-satellites-to-enhance-adaptation-2/.

Google. (2019, October). Building an energy-efficient, low-carbon supply chain. Retrieved from Google Sustainability: https://sustainability.google/progress/projects/supply-chain-energy-emissions/.

Green Building. (2019). 看京东集团总部二期如何实现绿色建筑？ . Retrieved from https://www.sohu.com/a/329405333_775609.

Hochtief. (2020). practical sustainability.

Huawei. (2019). Sustainability Report.

IESR. (2021). https://iesr.or.id/en/indonesia-can-achieve-net-zero-emission-before-2070. **Retrieved from Indonesia Can Achieve Net Zero Emission Before 2070.**

Indonesia. (2021). 2050 Long-term Strategy on Low Carbon and Climate Resilience (LTS-LCCR).

IRENA. (2021). WORLD ENERGY TRANSITIONS OUTLOOK.

Italy. (2019). The National Energy and Climate (ENCP) Plan.

JD. (2020). GREEN SUPPLY CHAIN. Retrieved from
https://corporate.jd.com/sustainability.

JD. (2021). JDL's net zero initiatives. (BCG, Interviewer)

JD Logistics. (2020). Green Stream Initiatives. Retrieved from
https://www.jdl.cn/plan/.

Jones, N. (2018). How to stop data centres from gobbling up the world's electricity. Nature.

Joppa, L. (2020, July 21). Progress on our goal to be carbon negative by 2030. Retrieved from Microsoft:
https://blogs.microsoft.com/on-the-issues/2020/07/21/carbon-negative-transform-to-net-zero/.

Julius Berger. (2020). Design and construction of parliament office buildings. Retrieved from
https://www.julius-berger.com/references/national-assembly-abuja.

Katerra. (2020). Offsite Construction in India.

KKR. (2020). Green Solutions Platform. Retrieved from
https://kkresg.com/responsibility/green-solutions-platform#:~:text=The%20Green%20Solutions%20Platform%20(GSP,wide%20variety%20of%20focus%20areas.

KSTAR. (2020). Introduction of electronic load with energy feedback.

KSTAR. (2021). Introduction of PV systems in KSTAR.

LDC. (2019). 2019 Sustainability Report.

Lenovo. (2020). Combatting Climate Change: Supply Chain. Retrieved from
https://www.lenovo.com/fr/fr/sustainability-climate-change-supply-chain.

Lenovo. (2021). (BCG, Interviewer).

Limak. (2019). Sustainability Report.

LONGi Solar. (2021). 隆基股份与中国石化签署战略合作协议 .

Lufthansa. (2020). FUEL CONSUMPTION AND EMISSIONS. Retrieved from
https://www.lufthansagroup.com/en/responsibility/climate-environment/fuel-consumption-and-emissions.html#cid9413.

Maersk. (2017). A leading light.

Maersk. (2020). 2020 Sustainability Report.

Microsoft. (2021). Energy efficiency.

NASA. (2010). earth boservatory: global warming. Retrieved from
https://earthobservatory.nasa.gov/features/GlobalWarming.

Nature Sustainability. (2019). Infrastructure for sustainable development.

NBD. (2021). The green revolution of the biggest steel company in the world.

Nestle. (2021). Nestlé's Net Zero Roadmap.

New Zealand. (2019). Climate Change Response (Zero Carbon) Amendment Act 2019".

NIO. (2021). NIO completes 2,000,000 battery swaps. Retrieved from
https://insideevs.com/news/497166/nio-2-million-battery-swaps/.

NIO. (2021). NIO Power Swap Station 2.0 Starts Operation in Beijing. Retrieved from
https://www.nio.com/news/nio-power-swap-station-20-starts-operation-beijing.

Nippon. (2020). Japan to Write Carbon Neutrality Goal into Law.

Nippon Express. (2020). Responsibilities to the Earth's Environment.

OECD. (2016). Agriculture and Climate Change: Towards Sustainable, Productive and Climated-Friendly Agricultural Systems.

Oxford Economics. (2017). GLOBAL INFRASTRUCTURE OUTLOOK.

Petrova, V. (2020). Corporate clean energy PPA volumes hit 19.5 GW in 2019. Renewables Now.

Philips. (2020). Renewable energy. Retrieved from https://www.philips.at/a-w/ueber-philips/nachhaltigkeit/sustainable-planet/green-operations/renewable-energy.html.

Philips. (2020). Taking climate action.

PIC. (2021). Environmental, Social and Governance. Retrieved from https://www.pic.gov.za/investment-philosophy-and-approach/environmental-social-governance.

Refinitiv. (2020). BRI CONNECT: An Initiative in numbers 4th edition.

right. based on science. (2020). WHAT IS THE XDC MODEL. Retrieved from https://www.right-basedonscience.de/en/xdc-model/.

right.based on science. (2020). The Climate Metric X-Degree Compatibility ("XDC") for Companies.

Rusal. (2019). Sustainability report 2019.

SBTi. (2020). Science-Based Target Setting Manual version 4.1.

SBTi. (2021). Net zero. Retrieved from https://sciencebasedtargets.org/net-zero.

SF Express. (2020). Sustainability Report.

Skanska. (2019). Making better mixes: Low-carbon and circular concrete.

Skanska. (2020). Annual and Sustainability Report.

Skanska. (2020). On the journey toward a carbon neutral future. Retrieved from https://group.skanska.com/sustainability/a-carbon-neutral-future/.

Skanska. (2020). responsible sourcing.

SME Climate Hub. (2020). About the SME Climate Commitment.

Standard Chartered. (2020). Sustainable Finance Impact Report.

Standard Chartered. (2020). Task Force on Climate-related Financial Disclosures.

Syngenta. (2013). The Good Growth Plan: a bold new set of commitments for our future. Retrieved from https://www.syngenta.com/en/sustainability/good-growth-plan.

Syngenta. (2020). 2020 CDP Report.

Syngenta. (2020). ESG Report.

Thacker, S., Adshead, D., Fay, M., Hallegatte, S., & Harvey, M. (2020). Infrastructure for sustainable development.

The Republic of Suriname. (2020). Nationally Determined Contribution 2020.

TPI. (2020). Overview of the TPI. Retrieved from https://www.transitionpathwayinitiative.org/overview.

TPI. (2021). Management Quality and Carbon Performance of Industrials and Materials Companies: February 2021.

Tyson Foods. (2019). Our actions are focused on achieving a SBTi-approved target by 2030. Retrieved from https://www.tysonsustainability.com/environment/energy-emissions.

UK. (2019). the 2050 Target Amendment.

UNDP. (2020). Financing Agreement between the United Nations Development Programme (UNDP) and Syngenta (China) Investment Co., LTD.

UNEP. (2020). The Six Sector Solution to Climate Change. Retrieved from https://www.unep.org/interactive/six-sector-solution-climate-change/.

UNFCCC. (2015). The Paris Agreement.

UNFCCC. (2021). Race To Zero Campaign. Retrieved from https://unfccc.int/climate-action/race-to-zero-campaign.

UNFCCC. (2021). The Paris Agreement. Retrieved from https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement.

UNTC. (2021). CHAPTER XXVII Environment 7. d Paris Agreement. Retrieved from https://treaties.un.org/pages/ViewDetails.aspx?src=TREATY&mtdsg_no=XXVII-7-d&chapter=27&clang=_en.

UPS. (2019). UPS 2019 Sustainability Progress Report.

US. (2021). Executive Order on Tackling the Climate Crisis at Home and Abroad.

Vinci. (2021). Acting for the climate.

Wang, D. C. (2020). Brief: Investments in the Chinese Belt and Road Initiative (BRI) in the first half of 2020 during the Covid-19 pandemic. International Institute of Green Finance, CUFE.

World Resource Institute. (n.d.). GHG Protocol Scope 2 Guidance.

WRI. (2019). What Does "Net-Zero Emissions" Mean? 6 Common Questions, Answered. Retrieved from https://www.wri.org/insights/what-does-net-zero-emissions-mean-6-common-questions-answered.

Xinhua. (2017). 国开行发行首笔准主权国际绿色债券 凸显绿色融资成本优势 . Retrieved from http://greenfinance.xinhua08.com/a/20171110/1735056.shtml?f=arelated.

Xinhua. (2021). 中华人民共和国国民经济和社会发展第十四个五年规划和 2035 年远景目标纲要 .

Yili. (2021). Net Zero Initiatives. (BCG, Interviewer)

ynet. (2021). New bill seeks to reduce greenhouse gas emissions by 85% until 2050. Retrieved from https://www.ynetnews.com/environment/article/SkXClWoL00.

Zambia. (2020). Nationally Determined Contribution.

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About the UN Global Compact

As a special initiative of the UN Secretary-General, the **United Nations Global Compact** is a call to companies everywhere to align their operations and strategies with Ten Principles in the areas of human rights, labour, environment and anti-corruption. Our ambition is to accelerate and scale the global collective impact of business by upholding the Ten Principles and delivering the Sustainable Development Goals through accountable companies and ecosystems that enable change. With more than 12,000 companies and 3,000 non-business signatories based in over 160 countries, and 69 Local Networks, the UN Global Compact is the world's largest corporate sustainability initiative — one Global Compact uniting business for a better world.

For more information, follow **@globalcompact** on social media and visit our website at **unglobalcompact.org**.

About the UN Global Compact "Sustainable Infrastructure for the Belt and Road Initiative to Accelerate the SDGs" Action Platform

Launched on 16 June 2020 during the UN Global Compact Leaders Summit, the Action Platform is designed to be the main mechanism for engaging companies operating in alignment of the SDGs under the framework of the Belt and Road Initiative. The Action Platform takes a sectoral approach to engage private sector players across major infrastructure sectors to ensure adoption of the Ten Principles of the UN Global Compact in corporate strategy and actions to truly accelerate the SDGs.

For more information about the action platform and potential participation, please contact **bri@unglobalcompact.org**

About the UN Global Compact Climate Ambition Accelerator

The United Nations Global Compact has launched in 2021 the Climate Ambition Accelerator, a six-month learning programme to equip more companies with the knowledge and skills they need to help halve global emissions by 2030 and to reach net zero by 2050. The Accelerator aims to scale-up credible climate action across companies of all sizes, sectors and regions, to enable them to set and deliver on meaningful commitments to reduce emissions and deliver on the Paris Climate Agreement. Through the Global Compact Local Networks around the world, companies participating in the Climate Ambition Accelerator will gain access to best practices, peer-to-peer learning opportunities, capacity building sessions and on-demand training. The new programme builds on the UN Global Compact's work to develop and promote the Science Based Targets initiative and the Business Ambition for 1.5°C campaign. It also complements the Global Compact's existing environmental sustainability efforts such as the Action Platform on Climate Ambition, the Sustainable Ocean Business Action Platform and the Water Resilience Coalition, which in turn contribute to the Race to Zero and Race to Resilience campaigns in the lead up to COP26.

About the 17 Sustainable Development Goals (SDGs)

The 2030 Agenda for Sustainable Development, adopted by all United Nations Member States in 2015, provides a shared blueprint for peace and prosperity for people and the planet, now and into the future. At its heart are the 17 Sustainable Development Goals (SDGs), which are an urgent call for action by all countries — developed and developing — in a global partnership. They recognize that ending poverty and other deprivations must go hand-in-hand with strategies that improve health and education, reduce inequality, and spur economic growth — all while tackling climate change and working to preserve our oceans and forests.

1. **No Poverty**
2. **Zero Hunger**
3. **Good Health and Well-being**
4. **Quality Education**
5. **Gender Equality**
6. **Clean Water and Sanitation**
7. **Affordable and Clean Energy**
8. **Decent Work and Economic Growth**
9. **Industry, Innovation and Infrastructure**
10. **Reducing Inequality**
11. **Sustainable Cities and Communities**
12. **Responsible Consumption and Production**
13. **Climate Action**
14. **Life Below Water**
15. **Life On Land**
16. **Peace, Justice, and Strong Institutions**
17. **Partnerships for the Goals**

Visit **sdgs.un.org/goals** to learn more.

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About the Ten Principles of the UN Global Compact

Corporate sustainability starts with a company's value system and a principles-based approach to doing business. This means operating in ways that, at a minimum, meet fundamental responsibilities in the areas of human rights, labour, environment and anti-corruption. Responsible businesses enact the same values and principles wherever they have a presence, and know that good practices in one area do not offset harm in another. By incorporating the Ten Principles of the UN Global Compact into strategies, policies and procedures, and establishing a culture of integrity, companies are not only upholding their basic responsibilities to people and planet, but also setting the stage for long-term success.

Human Rights

1 Businesses should support and respect the protection of internationally proclaimed human rights; and

2 make sure that they are not complicit in human rights abuses.

Labour

3 Businesses should uphold the freedom of association and the effective recognition of the right to collective bargaining;

4 the elimination of all forms of forced and compulsory labour;

5 the effective abolition of child labour; and

6 the elimination of discrimination in respect of employment and occupation.

Environment

7 Businesses should support a precautionary approach to environmental challenges;

8 undertake initiatives to promote greater environmental responsibility; and

9 encourage the development and diffusion of environmentally friendly technologies.

Anti-corruption

10 Businesses should work against corruption in all its forms, including extortion and bribery.

Visit **unglobalcompact.org/what-is-gc/mission/principles** to learn more.

The Ten Principles of the United Nations Global Compact are derived from: the Universal Declaration of Human Rights, the International Labour Organization's Declaration on Fundamental Principles and Rights at Work, the Rio Declaration on Environment and Development, and the United Nations Convention Against Corruption.