GSMA™

# Achieving Climate Targets

A step-by-step guide for mobile network operators to achieve near-term science-based targets

The GSMA is a global organisation unifying the mobile ecosystem to discover, develop and deliver innovation foundational to positive business environments and societal change. Our vision is to unlock the full power of connectivity so that people, industry and society thrive. Representing mobile operators and organisations across the mobile ecosystem and adjacent industries, the GSMA delivers for its members across three broad pillars: Connectivity for Good, Industry Services and Solutions, and Outreach. This activity includes advancing policy, tackling today's biggest societal challenges, underpinning the technology and interoperability that make mobile work, and providing the world's largest platform to convene the mobile ecosystem at the MWC and M360 series of events.

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The Carbon Trust is a global climate consultancy driven by the mission to accelerate the move to a decarbonised future. We have been climate pioneers for more than 20 years, partnering with businesses, governments and financial institutions to drive positive climate action. From strategic planning and target setting to activation and communication, we turn ambition into impact. To date, our 400 experts have helped set 200+ science-based targets and guided 3,000+ organisations and cities across five continents on their route to Net Zero.

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# Acknowledgements

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**GSMA**
**Carbon Trust**
**BT**
**Epi Consulting** (Secretariat for the Joint Audit Cooperation Initiative)
**Ericsson**
**Vodafone**
**The members of the GSMA Climate Action Taskforce**

# Contents

# Using this guide

Since the development of the ICT sector target-setting approach, jointly developed by the Global Enabling Sustainability Initiative (GeSI), the GSM Association (GSMA), the International Telecommunications Union (ITU) and the Science Based Targets initiative (SBTi), many mobile network operators have set or updated their science-based targets and are now turning their focus towards achieving them.

This guide provides practical step-by-step instructions for mobile network operators to achieve their near-term science-based targets, building on the Setting Climate Targets[1] guide published in 2020. It is framed by the ICT sectoral target-setting approach, but companies with targets that pre-date the publication of the ICT sectoral target-setting approach can still use this guide to achieve their own emissions reductions targets. The steps and emission reduction opportunities presented in this guide will be equally relevant.

Readers who are familiar with specific steps of the process may skip these to focus directly on the most relevant sections of the guide.

**Key actions and important considerations for operators are signalled with this radio icon throughout the guide.**

## This guide is divided into two sections and an appendix:

**The first section** is an overview of setting science-based targets and current climate action across the ICT sector.

**The second section** presents a three-step process for mobile network operators to achieve science-based targets, including an overview of carbon reduction opportunities across Scopes 1, 2 and 3.

**The appendix** documents the key model characteristics and assumptions used to generate the modelling results and analysis presented within the Scope 3 chapter of this guide.

1 gsma.com/betterfuture/setting-climate-targets

# Overview of Science-Based Targets (SBTs)

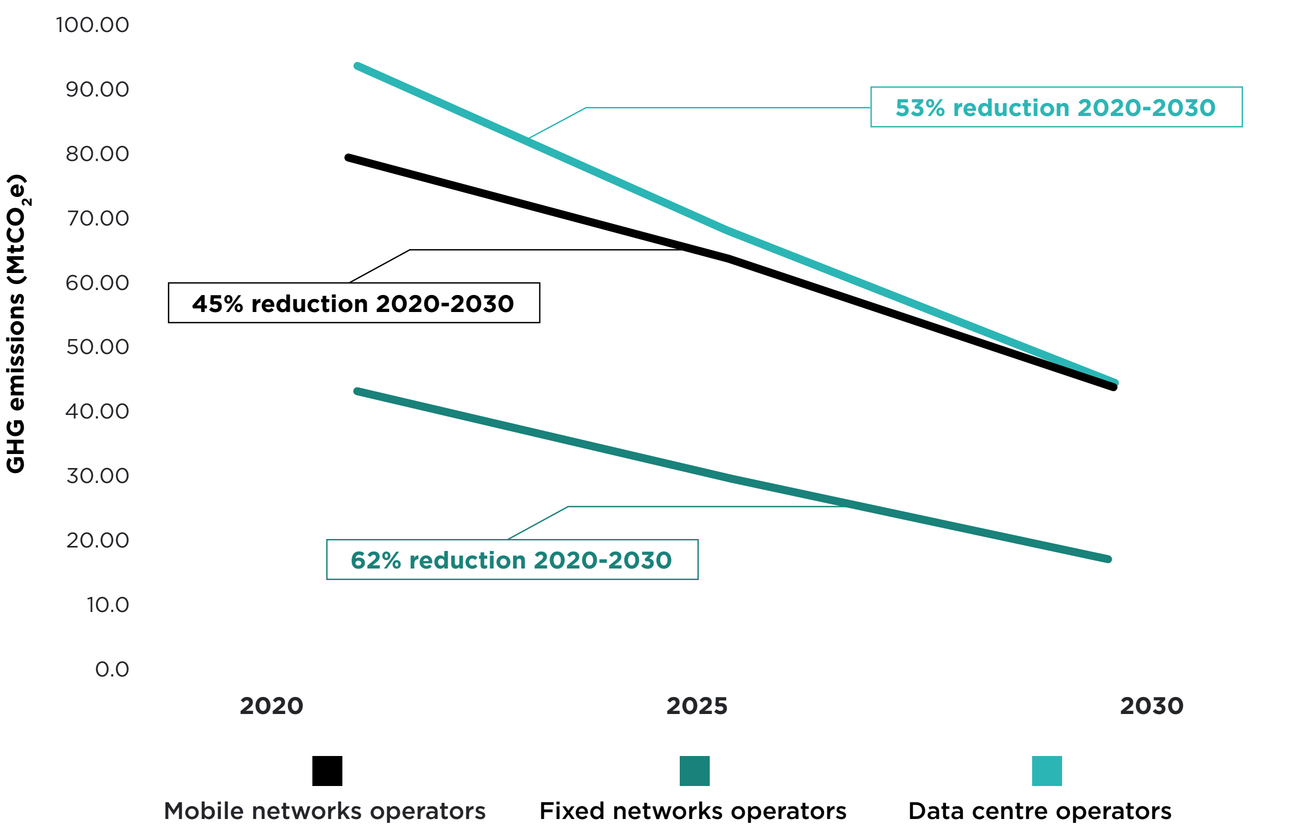
## ICT sector net zero pathway

This guides builds upon the 'Setting Climate Targets' guide published by the GSMA and the Carbon Trust[2]. 'Setting Climate Targets' provided a detailed breakdown of target-setting requirements for SBTi validation and specific considerations for mobile network operators in their target-setting approaches. This guide forms the next step in the process for MNOs on their decarbonisation journey.

**The Science Based Targets Initiative (SBTi), launched in 2014:**

- Supports companies in their efforts to decarbonise by providing guidance and validation of carbon reduction targets;
- Aligns the private sector to the best current science; and
- Ensures that companies are setting targets to decarbonise at the necessary rate to achieve worldwide climate goals.

**Figure 1** | Sub-sector trajectories for ICT operators' Scope 1 and 2 emission reductions




Source: GSMA Setting Climate Targets Guide, adapted from the SBTi's Guidance for ICT Companies Setting Science Based Targets

2 gsma.com/betterfuture/setting-climate-targets

# A three-step process

Companies seeking to develop a strategy to achieve their science-based targets should follow these three key steps:

1. **Assess emission hotspots**
2. **Identify emission reduction opportunities**
3. **Develop implementation plans**

### Assess GHG inventory to determine emission hotspots

**Operators should use their base year GHG inventories to assess the emission hotspots within their operations and value chain.**

Hotspots should be assessed within Scopes 1 and 2 and Scope 3 inventories separately. Breaking down GHG inventories by scope and category (for Scope 3 emissions), emission source, region and operation will aid in identifying the largest emissions contributors and allocating responsibility within the organisation.

**Operators should consider the potential effect of business growth and sector trends on projections of future emissions.**

Without implementation of emission reduction opportunities, it is possible for GHG inventories to increase over time.

### Identify opportunities for emission reductions across Scopes 1, 2 and 3

In order for MNOs to decarbonise in line with science-based targets, opportunities for emission reductions should be identified across Scopes 1, 2 and 3.

Potential reduction opportunities are discussed in the detailed steps of this guide and are broadly categorised:

- **Scope 1:** Electrification of base stations, offices and fleet, energy efficiency and low global warming potential (GWP) refrigerants.
- **Scope 2:** Continuous improvement of network base station energy efficiency and procurement of renewable electricity.
- **Scope 3:** Improved environmental performance in procurement of goods and services, business model innovation to enable implementation of circular principles and engagement in energy policy.

**Develop an implementation plan to achieve targets within the defined timeframe**

The final step is developing an actionable implementation plan and gaining the necessary buy-in within the organisation to achieve SBTs.

**Operators should map out the specific opportunities and implementation phasing, then perform a feasibility analysis to determine if the opportunities are likely to achieve emission reduction targets in the target timeframe.**

This process may be iterative, as new opportunities are identified and incorporated into the plan over time.

Enabling success within the business is an essential part of achieving targets.

**Successful organisations should embed sustainability in the business by assigning responsibility for climate action to executive leadership and being transparent and vocal in climate policy advocacy.**

# The SBTi Corporate Net-Zero Standard

As the climate crisis develops and our understanding of climate science grows, the ambition required to combat the worst impacts of climate change is constantly reviewed and guidance is being updated alongside this.

Since the predecessor to this guide (the GSMA's 'Setting Climate Targets')[3] was published, the SBTi have published the Corporate Net-Zero Standard (October 2021). The Standard provides an updated guidance document and validation framework for private sector target-setting. The Corporate Net-Zero Standard provides a framework for setting long-term (i.e. net zero) science-based targets with a central focus on rapid and deep cuts in emissions[4]. It also established the concept of near-term SBTs.

At COP27 in November 2022, the International Organization for Standardization (ISO) launched its Net Zero Guidelines[4] to provide a common reference document towards collective efforts to net zero at the state, regional, city and organisational levels. The guidelines set a common path for the definition of net zero and actionable guidance on achieving net zero by 2050 or earlier. The guidelines establish a definition of net zero which is consistent with the SBTI's Corporate Net-Zero Standard, where Scope 1, 2 and 3 emissions are reduced in line with the 1.5°C pathway and balanced by removals.

In the same month, the UN's High Level Expert Group on Net-Zero Commitments of Non-State Entities also published 10 recommendations[5], which aim to address greenwashing and establish a consistent definition of net zero and general alignment with the SBTI's Corporate Net-Zero Standard.

3 gsma.com/betterfuture/setting-climate-targets
4 sciencebasedtargets.org/resources/files/Net-Zero-Standard.pdf
5 iso.org/netzero

## Implications for ICT near-term targets

Near-term SBTs are place markers on a longer 1.5°C-aligned pathway to net zero and provide the function of legislating short-term decarbonisation action within organisations. Due to the timing of the Corporate Net-Zero Standard publication, many ICT companies had set SBTs that predate this and were aligned to previous iterations of the SBTi criteria or ICT sector-specific guidance. However, the ICT sector guidance does generally align with the near-term target requirements of the Corporate Net-Zero Standard, so updates to targets would only be necessary for companies that have targets aligned purely to previous non-sector specific SBTi guidelines.

**ICT companies setting new targets should therefore continue to follow the relevant sub-sector guidance that aligns to their operations when setting near-term targets...**

...generally setting a target for all three emissions scopes.

## Implications for ICT long-term targets

A Corporate Net-Zero Standard target includes a near-term and a long-term target, where the long-term target includes all emissions scopes by default and reduces emissions to a residual level (<10% of total footprint) by no later than 2050. Neutralising residual emissions must be done entirely through greenhouse gas (GHG) removals offsets, permanently removing and storing the carbon from the atmosphere. While this guide focuses on strategies to achieve short-term SBT targets, it is important to recognise the extended trajectory to net zero that companies are undertaking and how short-term efforts fit within this longer-term context.

### SBTi's ongoing work

Updates to SBTi criteria are generally made annually, so it is expected that further developments to the SBTi framework will be released within the coming year. The specifics of these are not yet known and there are currently no known plans to update the ICT sectoral target-setting approach.

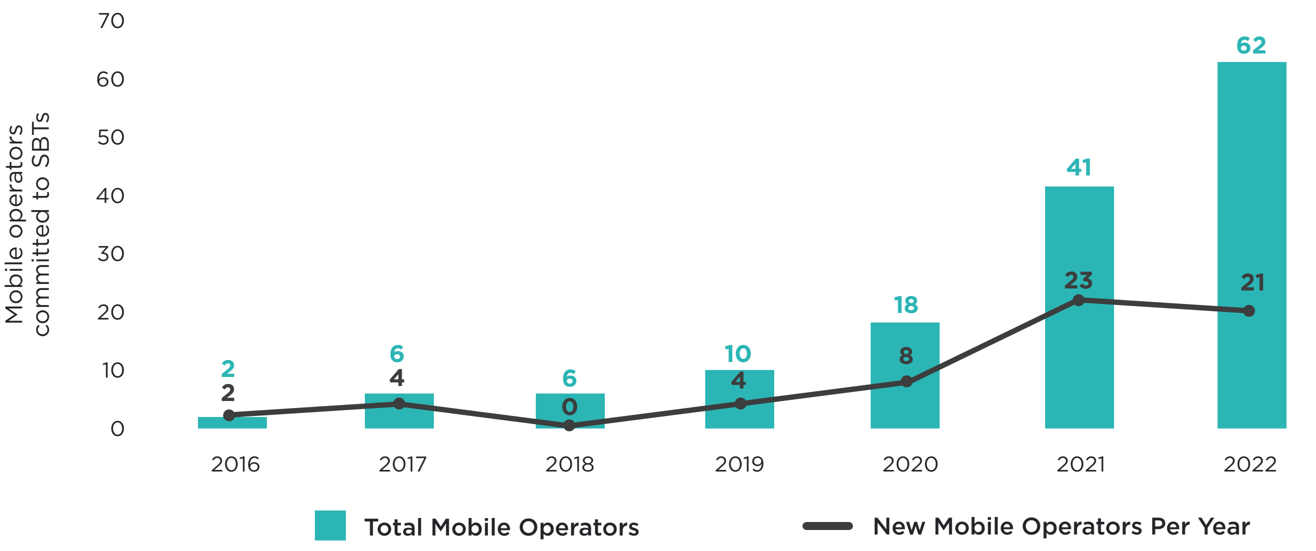
Ongoing workstreams within the SBTi are in place to review Scope 3 target-setting methods, address Beyond Value Chain Mitigation, develop a progress framework to advance work on measurement, reporting and verification (MRV)[6] and ongoing reporting tools for companies to reliably update their progress against targets[7].

# Current climate action in ICT companies

Despite it being early in the decarbonisation journey for the ICT sector, there are encouraging signs that climate action is taking place. The number of SBTi targets being set is increasing year on year[8]. Both the ICT sector and mobile sector were earmarked as 'breakthrough sectors' by the UN's Race to Zero campaign, with 40% of the ICT sector by revenue being represented in the Race to Zero scheme[9] and 42% of the mobile sector by revenue.

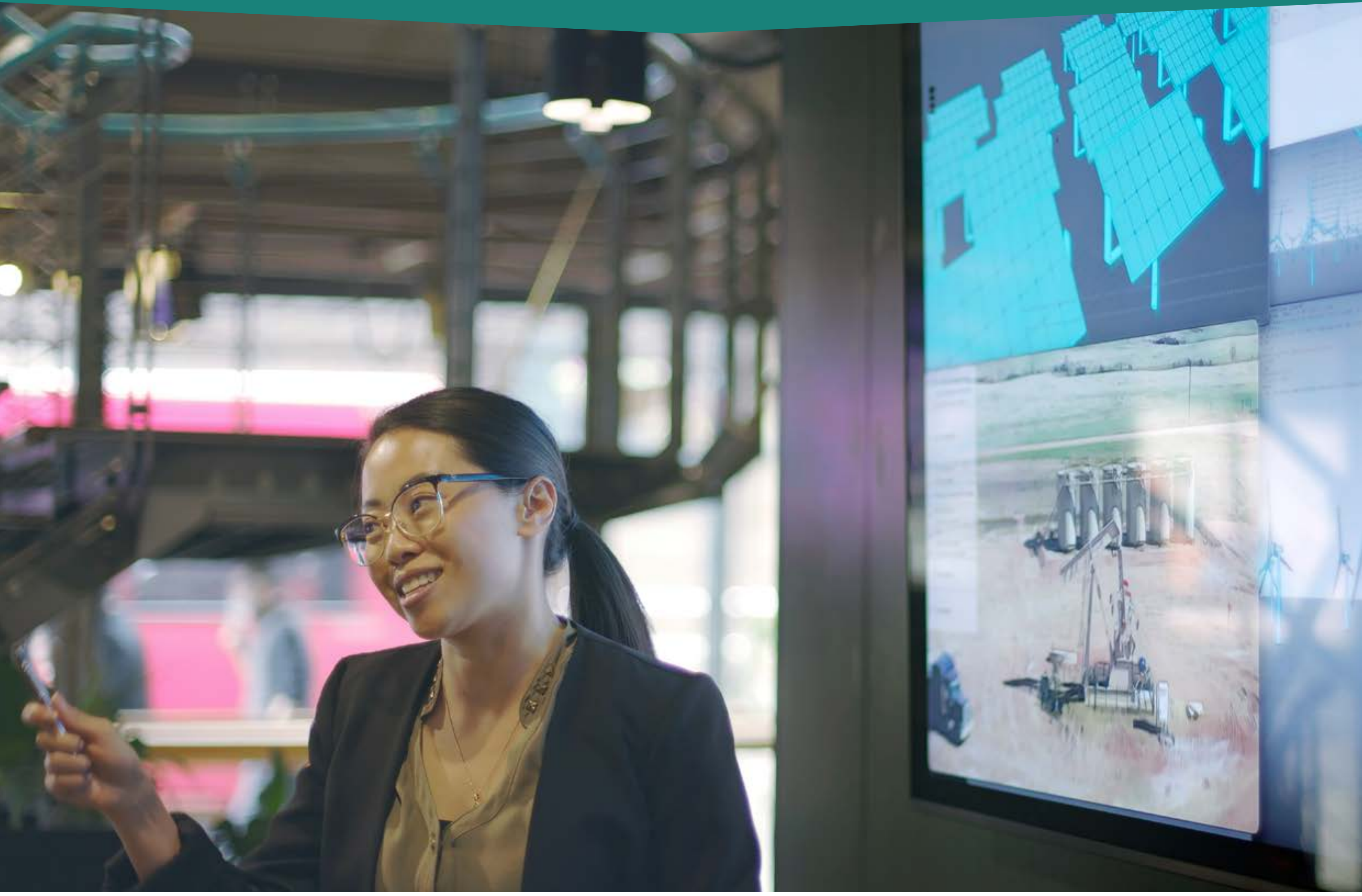
Within the telecommunications sub-sector, 62 mobile network operators have committed to a near-term SBT as of February 2023[10] (Figure 2). A significant proportion of these operators have also committed to a longer-term net zero target of 2050 or earlier; accounting for 34% of global mobile connections and 44% of global revenue[11].

**Figure 2** | Number of mobile operators that have set SBTs[12]




Source: sciencebasedtargets.org/companies-taking-action

6 sciencebasedtargets.org/measurement-reporting-and-verification-mrv
7 sciencebasedtargets.org/resources/files/SBTiProgressReport2021.pdf
8 sciencebasedtargets.org/resources/files/SBTiProgressReport2021.pdf
9 climatechampions.unfccc.int/15-sectors-of-global-economy-shift-the-dial-on-climate
10 sciencebasedtargets.org/companies-taking-action
11 gsma.com/betterfuture/resources/mobile-net-zero-state-of-the-industry-on-climate-action-2022-report
12 As of the end of February 2023



As mobile networks are expanding throughout the world, infrastructure improvements and related efficiency gains mean the relationship between higher data traffic and associated emissions has become decoupled. Data traffic increases of **31%** last year were met with associated electricity increases of just **5%** and carbon emissions increases of **2%**. There is also an increased uptake of directly purchased renewable electricity throughout the industry, up from **14%** in 2020 to **18%** in 2021 and **24%** in 2022[13].

Co-ordinated by the GSMA, the mobile industry became one of the first sectors in the world to commit to the UN Sustainable Development Goals (SDGs) in 2016. These 17 goals call for significant action to reduce carbon emissions and promote developments within the renewable energy sector.

On top of the commitment that MNOs have made in setting ambitious emissions targets aligning with the SBTi, there has been further work to develop a deeper understanding of upstream supply chains in the sector. Work in the GSMA's Climate Action Taskforce and supplier associations, such as Joint Audit Cooperation, has been done to increase the number of suppliers that disclose their environmental impacts to the CDP and set science-based targets[14].

The momentum of decarbonisation in the industry has already been evident, with many companies cutting their emissions over recent years despite also seeing growth in their data traffic and upgrading to 5G networks. While MNOs have shown ambition to achieve carbon emissions reductions and made significant initial progress with reducing emissions throughout their operations, the ambition of SBTi targets demands wider action and deeper emissions cuts throughout the sector.

13 gsma.com/betterfuture/resources/mobile-net-zero-state-of-the-industry-on-climate-action-2022-report
14 gsma.com/betterfuture/resources/mobile-net-zero-state-of-the-industry-on-climate-action-2022-report

# Embedding climate action in the business

## Telefónica[15]

Telefónica demonstrates a strong, integrated focus on climate action across the business. Their climate change and energy strategy forms part of the Responsible Business plan, which is led by the Board of Directors, and the Board's Sustainability and Quality Committee is responsible for implementation of the strategy. SBTi validated science-based targets set the mark for carbon reduction ambitions and a percentage of variable remuneration is also linked to fulfilment of carbon reduction targets. Critically, Telefónica's strategy extends beyond their own operations and into the supply chain, where they have implemented their own Supplier Engagement Programme and work closely with industry working groups through organisations such as JAC (Joint Audit Cooperation).

## SK Telecom[16]

SK Telecom has strengthened their ESG management through establishment of the ESG Committee with oversight from the Board of Directors. The ESG Committee is responsible for supervision and final decision-making for climate change risks and opportunities. By linking climate change risk to the corporate risk management process, SK Telecom ensures that corporate risk management covers climate change response. As part of its strategy to meet its science-based targets, SK Telecom has implemented an internal carbon price and has joined RE100, where the organisation is increasing its use of renewable energy, with contracts in place to purchase power from renewable sources covering 44.6GWh in 2021 and 120.1GWh in 2022 (approximately 5% of their total estimated energy usage for 2022).

15 telefonica.com/en/wp-content/uploads/sites/5/2022/03/consolidated-management-report-2021.pdf
16 sktelecom.com/img/eng/persist_report/20220721/SKTelecomAnnualReport2021English.pdf

# Steps for achieving SBTs

The following section provides detailed steps for operators to follow to establish a comprehensive strategy to achieve near-term science-based targets. While the principles are also applicable to achievement of long-term net zero targets, this guide will not focus on the role of GHG removals in a net zero strategy.


## 1. Assess GHG inventory for base year to determine emission hotspots

The hotspots identified in the assessment process will guide efforts to identify emission reduction opportunities in the next step of this guide.

**Operators should use their base year GHG inventories to assess the emission hotspots within their operations and value chain.**

Scope 1 and 2 inventories should be assessed separately from Scope 3 inventories due to the variation in emission sources and strategies required to reduce emissions within an organisation's own operations and its value chain.

**MNOs should break down their GHG inventories into regions, operation and/or business units to aid in the analysis and assign responsibility for action within the organisation.**

This process will also help organisations to determine which of their markets are the largest contributors to GHG emissions and will play an important role in the decarbonisation strategy.

**Operators should also consider the potential effect of business growth and sector trends on projections of future emissions, which may cause GHG inventories to increase over time.**

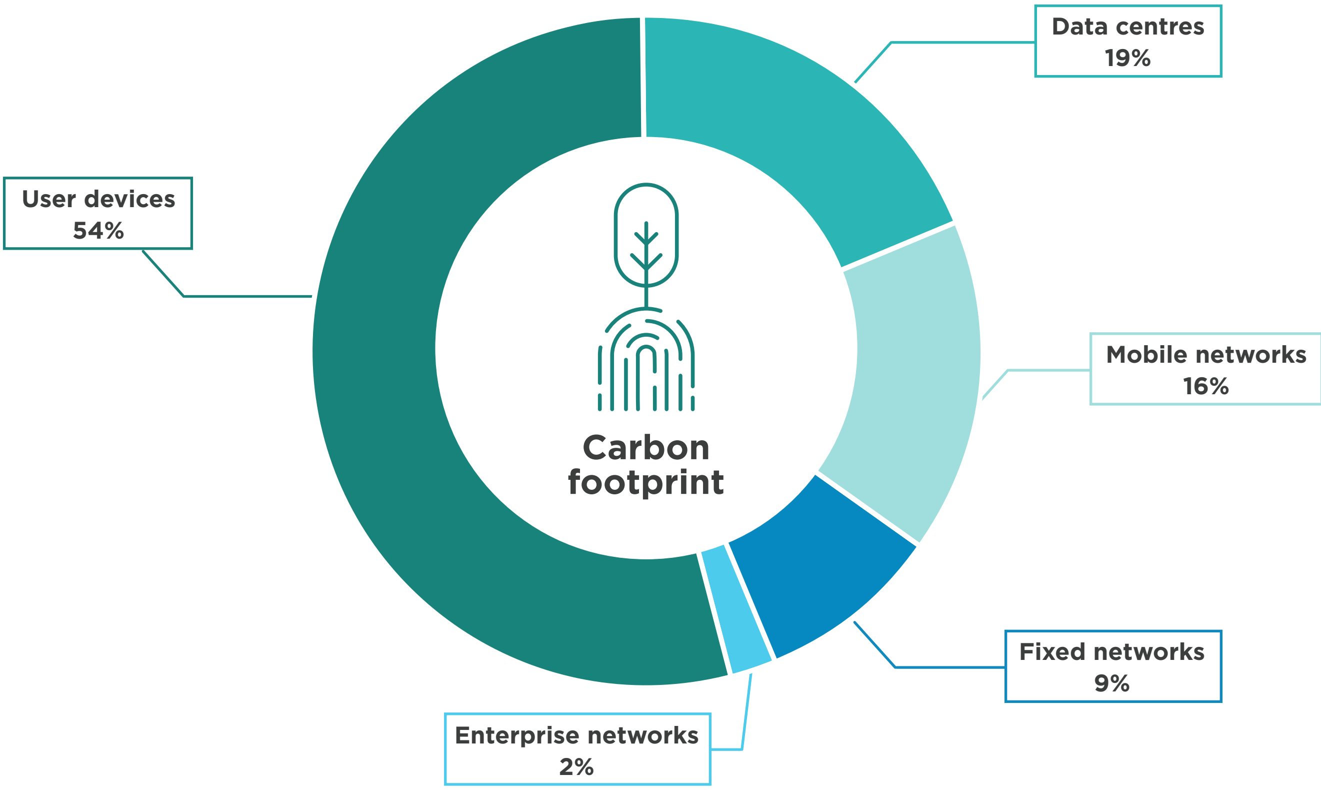
### 1.1. The carbon footprint of the ICT sector

It is helpful to understand the high-level make-up of the ICT sector's carbon footprint, as these data are useful indicators of where MNOs should focus in their assessment of their own GHG inventories. The ICT Sector's carbon footprint totals 740 Mt$CO_2$e (as estimated by ITU Telecommunication Standardization Sector (ITU-T)), including embodied emissions from end user hardware.

A breakdown of this footprint into different emissions sources can be found in Figure 3. The majority (54%) of this footprint (401 Mt$CO_2$e) is associated with user devices, with mobile networks (198 Mt$CO_2$e) and data centres (141 Mt$CO_2$e) also making up significant proportions of the footprint[17].

17 Carbon impact of video streaming, The Carbon Trust, 2021

**Figure 3** | Carbon footprint of ICT as at 2020 (Adapted from ITU-T L.1470)



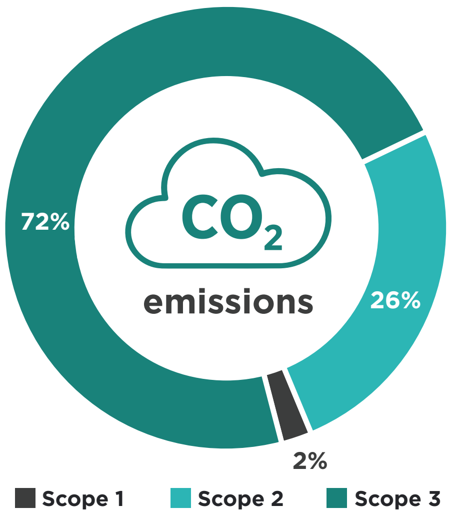

Source: Adapted from ITU-T L.1470

## 1.2. Scope 1 and 2 emission hotspots

**MNOs may choose to start their GHG inventory assessment by reviewing their operational emissions in Scopes 1 and 2.**

Typically, emissions from electricity consumption (reported in Scope 2) are a significant portion of an operator's footprint, as depicted in Figure 4. Electricity is required to run equipment in towers and data centres, core network infrastructure and cooling systems (HVAC), and as a result Scope 2 emissions are significantly higher than Scope 1 emissions for most MNOs.

**Figure 4** | Operator $CO_2$ emissions in 2021




Source: GSMA Mobile Net Zero State of the Industry on Climate Action 2022

## Vodafone

In their latest Sustainability report, **Vodafone** (who spend €700 million a year on energy) say that base station sites account for 66% of its global energy consumption, while its technology (data and switching) centres account for a further 29%. For other operators, network emissions could account for more than 80% of Scope 1 and 2 emissions, based on analysis from the Carbon Trust.

Source: The Carbon Trust

Telecom operators are significant consumers of electricity, accounting for over 1% of global electricity demand[18]. This consumption is primarily driven by the operation of network infrastructure and data centres. GSMA data[19] for MNO carbon footprints shows that when full value chain emissions are included, Scope 1 and 2 emissions account for 25-30% of the overall footprint for a typical MNO, with Scope 2 emissions from electricity being roughly 10 times greater than Scope 1 emissions.

**MNOs should further break down their Scope 1 and 2 inventories into emission sources, regions and business units to identify the specific hotspots within their operations and assign responsibility for identifying and implementing emission reduction opportunities.**

## 1.3. Scope 3 emission hotspots

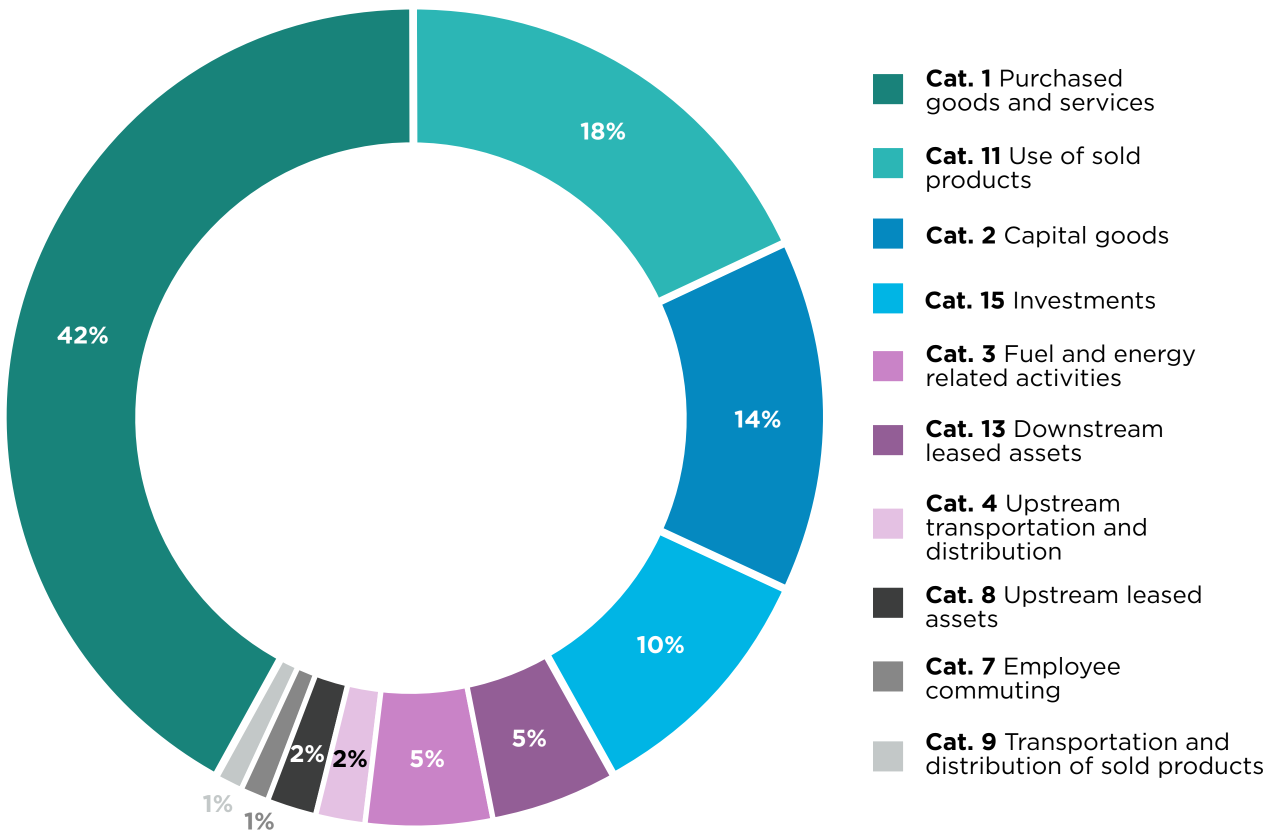
In common with many other sectors, the most significant element of operators' GHG inventories is the indirect (Scope 3) emissions in their value chains.

**When assessing Scope 3 emission hotspots, MNOs should begin with evaluating their Scope 3 GHG inventory by category to determine the largest contributors.**

A representative make-up of a Scope 3 GHG inventory for MNOs is presented in Figure 5[20].

Typically, the largest emissions sources for MNOs within Scope 3 are the embodied carbon related to the manufacture and procurement of network equipment and user devices (such as handsets, routers

**Figure 5** | Representative make-up of a Scope 3 GHG inventory for MNOs




Source: GSMA intelligence adapted by the Carbon Trust

18 gsma.com/futurenetworks/wiki/energy-efficiency-2
19 gsma.com/betterfuture/resources/mobile-net-zero-state-of-the-industry-on-climate-action-2022-report
20 Labels for categories with less than 1% of emissions have been omitted for clarity

and modems), emissions related to the use of devices by consumers and investments in joint ventures (JVs). These correspond to categories 1 and 2, category 11 and category 15 respectively.

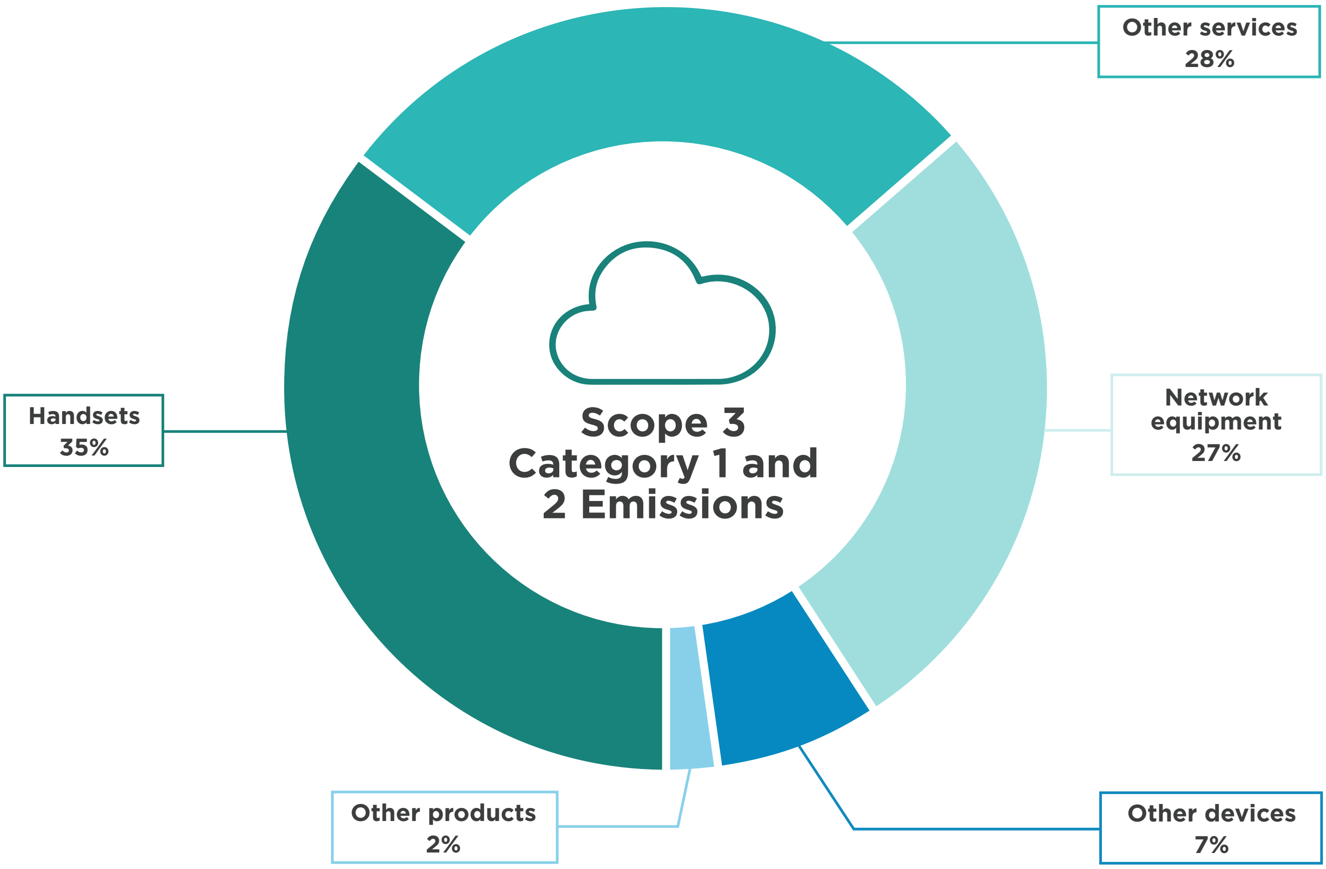
**Once the hotspot categories have been identified, MNOs should further assess the emission sources within the largest categories.**

This will be a particularly useful exercise for categories 1, 2 and 11, so that operators have a clear picture of which goods and services they procure and sell make the greatest contribution to their GHG inventory.

**MNOs should also evaluate their suppliers to identify those that make the largest contribution to their Scope 3 footprint and to determine where existing relationships can be leveraged to collaborate on reducing supply chain emissions.**

A representative distribution of emissions within categories 1 and 2 is shown in Figure 6, based on a GSMA operator's Scope 3 footprint, to provide perspective on the scale of emissions contributions from network equipment, devices and services. To better understand how to calculate Scope 3 emissions, please refer to the guidance for telecommunication operators[21].

**Figure 6** | Representative emissions distribution within categories 1 and 2 based on a GSMA operator's Scope 3 footprint




Source: Vodafone Scope 3 2021

21 gsma.com/betterfuture/resources/scope-3-guidance

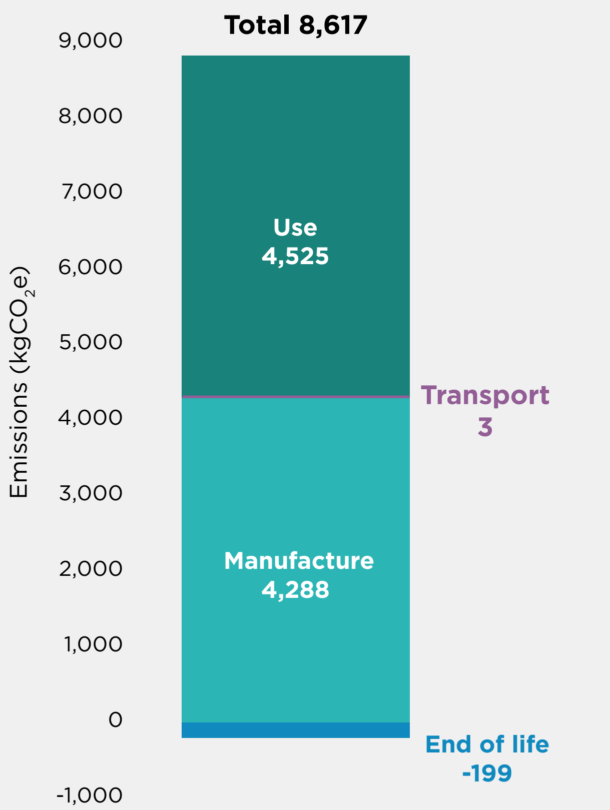
# Understanding the emission hotspots of telecommunications products

## Data centre server and smartphone

Using a Dell PowerEdge R440 server[22] and a Fairphone 3 smartphone[23] LCA as an example to demonstrate the emissions breakdown of telecommunications equipment and a proxy for other pieces of network equipment, we can get a sense of where the emissions hotspots reside which helps to focus emission reduction efforts.

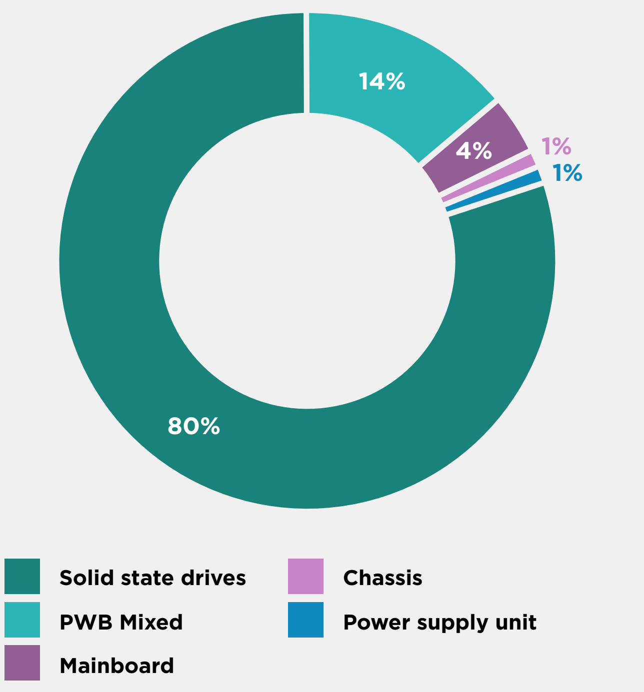
Semiconductors, integrated circuits (such as processors and flash memory) and printed wiring boards which connect the integrated circuits are the core components of modern telecommunications products and are responsible for increasing functionality. These components have complex and energy-intensive manufacturing processes to create the computational power they pack into a small size.

**Figure 7** | Dell R740 server estimated lifetime emissions




Source: Adapted from Lifecycle Assessment of Dell R740

**Figure 8** | Emissions from production for server components




Source: Adapted from Lifecycle Assessment of Dell R740

22 delltechnologies.com/asset/en-us/products/servers/technical-support/Full_LCA_Dell_R740.pdf
23 fairphone.com/wp-content/uploads/2020/07/Fairphone_3_LCA.pdf

## Fairphone

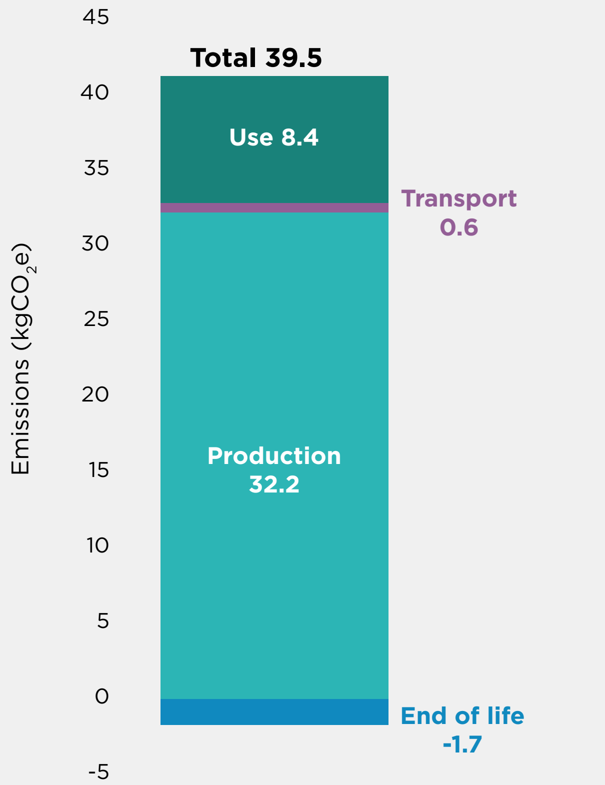
In the Fairphone 3 LCA example, production accounts for the majority of the lifecycle emissions (assuming a three-year lifetime and use in Europe) and use phase is comparatively small, relative to the server LCA.

The core module (including CPU, RAM and flash storage) causes more than half of the total production impact.

**Operators should work with their telecommunications product suppliers in these key areas:**

- **Developing a better and more accurate understanding of production-related emissions to identify reduction opportunities and improve GHG reporting.** Due to the quickly evolving nature of semiconductor technology, the estimation of the emissions of integrated circuits has a large range of uncertainty and LCA methods struggle to keep pace.
- **Incorporating a focus on emission reductions into product development.** Operators must engage with suppliers to communicate that emission reduction is a necessary feature of new products and must be balanced with improvements in computational power.
- **Reusability and refurbishment.** Reuse and refurbishment of telecommunications products and their components can offer a solution to extend equipment and device lifetime and therefore help reduce emissions.

**Figure 9** | Fairphone 3 estimated lifetime emissions




Source: Adapted from Lifecycle Assessment of the Fairphone 3

## 1.4. Evaluating the effect of growth and industry trends on GHG inventory

When assessing GHG inventories and planning for emission reductions on a pathway to achieving SBTs,

**MNOs should also evaluate the effect of growth and industry trends on their projected GHG inventory.**

This will help to understand the scale of emission reduction opportunities required to not only address today's emissions, but also the changes to emission sources throughout the target timeframe.

**A useful starting point in this process is to evaluate a business-as -usual emissions pathway...**

...where MNOs' activities and corresponding supply chain needs grow broadly in line with projections of future network subscribers or business plan, while assuming there is no direct focus on improving sources of emissions in operation and within the supply chain. More detail on this approach can be found in Section 2.5.1 – Incorporate opportunities into an implementation plan.

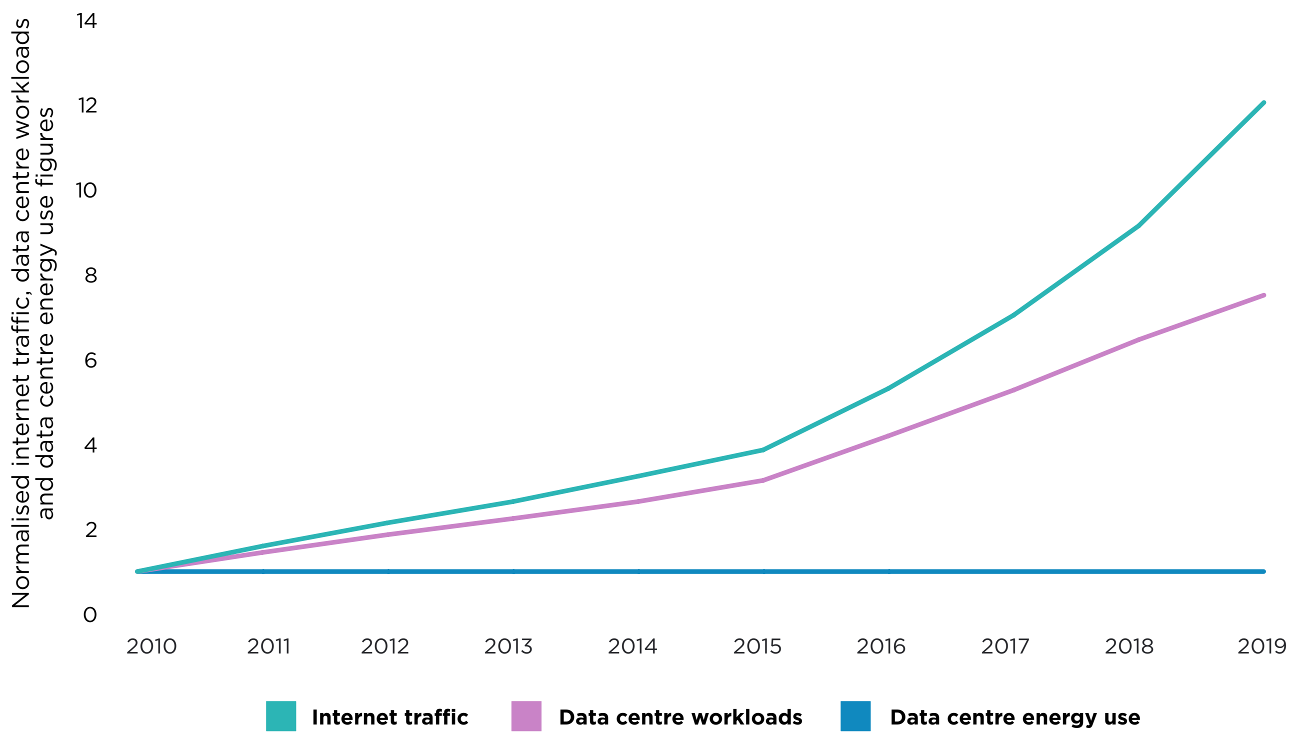
**Sector trends that affect energy and carbon should be considered as well when evaluating potential future emissions trajectories.**

Some key trends for consideration are presented below.

***Data traffic and energy efficiency***

Data traffic has grown significantly over recent years, but energy usage and emissions have remained reasonably constant throughout this period, as demonstrated in Figure 10 below. This trend is expected to increase due to the improved efficiency of data transfers in newer networks (such as 5G networks)

**Figure 10** | Global trends in internet data traffic, data centre workloads and energy use 2010-2019




Source: IEA, 2020a

as well as MNOs investing in renewable energy to power their networks (both with on-site generation and through renewable electricity imports). Further opportunities for MNOs to build on energy efficiency improvements and expand the rollout of renewable energy use within their infrastructure are explored in the following sections of this guide.

Global access to the internet is expected to continue the current trend, with projections of 66% of the world's population having access to the internet by 2023 and 70% having mobile network access. Additionally, the average number of connected devices per person could reach 3.6 by 2023 (compared to 2.4 in 2018) and connections of the Internet of Things (IoT) are projected to reach 4.4 billion by 2023 (representing a four-fold annual increase from 2018) and grow exponentially to 2026[24].

Emerging trends in the ICT industry are exacerbating the uncertainties of predicting future ICT emissions, including increases related to machine learning, cryptocurrencies, Internet of Things (IoT) and 5G networks. While these are characterised by substantial increases in data traffic and data centre workloads, they do offer some potential opportunities for further technological efficiency increases[25].

*5G expansion*

Today, 5G networks are growing throughout the world and will continue to expand into the future, which presents a significant opportunity for increased efficiency in mobile networks. Significantly, 5G is the first wireless technology where energy-efficiency has been considered during standardisation, such as through sleep/shutdown functions in transceivers and low-energy scheduler solutions. The equipment used in 5G networks also offers improved energy efficiency, which promises to reduce energy consumption in telecoms networks across a range of industries. Although 5G technology offers energy-efficiency improvements (per gigabyte) compared to legacy networks, the wavelengths used and specific use-cases of 5G will require more sites and antennae. This poses a risk that a more efficient network could paradoxically come with higher emissions unless there are active interventions.

*Renewable electricity uptake*

MNOs are continuing to increase renewable energy uptake throughout their operations, with on-site generation, direct power purchase agreements and use of electricity backed by renewable energy certificates increasing across the sector. Directly purchased or generated renewable electricity formed 24% of total MNO electricity use in 2022, up from 18% in 2021 and 14% in 2020[26], with additional renewable electricity being used through electrical grids.

Much of this trend is due to European organisations. Operators within Europe sourced around 83% of their electricity from renewable sources, compared with 24% globally. European operators have also been able to set more ambitious goals, with several already benefitting from network operations which are 100% powered by renewable sources[27]. This is primarily down to the maturity of the electricity market in Europe compared to the rest of the world, as renewable energy is less expensive and more accessible.

Renewable electricity also depends on other factors which are often outside of MNOs' control, such as local climates and country-level regulations. Despite these regional differences, the shift away from fossil fuels is still underway in all regions globally.

The GSMA has collaborated with members to understand current challenges to accessing renewables and created policy recommendations for relevant stakeholders to advocate with national governments to further accelerate the deployment of renewable electricity throughout the sector[28].

24 gsma.com/betterfuture/wp-content/uploads/2019/10/GSMA_Climate-Change-Handbook_2019_WEB-SINGLE.pdf
25 Climate Action Handbook, GSMA, 2019
26 gsma.com/betterfuture/resources/mobile-net-zero-state-of-the-industry-on-climate-action-2023
27 vodafone.co.uk/newscentre/press-release/vodafones-european-network-100-powered-by-electricity-from-renewable-sources/
28 gsma.com/betterfuture/resources/mobile-industry-position-paper-access-to-renewable-energy

# 2. Identify opportunities for emission reductions across Scopes 1, 2 and 3


In order for MNOs to decarbonise in line with science-based targets, opportunities for emission reductions should be identified across Scopes 1, 2 and 3.

Equipped with an understanding of the emission hotspots within their GHG inventories, specific opportunities related to addressing the hotspots should be explored. During this process...

**MNOs should consider the scale of reduction potential, the investment required, the implementation timeframe and the technological readiness of the solution.**

The next sections will explore some opportunities to reduce Scope 1 and 2 emissions that comprise a strategy to achieve near-term science-based targets and present them in a matrix to summarise the opportunity, its potential for carbon emission reduction and an indication of the scale of capital expenditure required for implementation.

The guidance will then look at the opportunities to address Scope 3 emissions. This requires a different approach to Scope 1 and 2 emissions because Scope 3 emissions are generally outside of MNO control. There are a number of options available, though, and their effectiveness will depend on the level of engagement with supply chain partners.

# 2.1. Scope 1 emission reduction opportunities

Scope 1 emissions for MNOs are generally composed of burning fossil fuels on-site for heating, direct combustion in fleet vehicles, local generation of electricity and fugitive emissions from cooling equipment in data centres and network base stations. These emissions usually comprise a small proportion of an MNO's overall footprint but, because they are the most direct emissions sources associated with an MNO, reducing Scope 1 emissions is critical to mobile operators achieving their net zero goals.

There are a wide range of technological solutions available for tackling MNO Scope 1 emissions, offering theoretical potential for rapid decarbonisation, particularly in the most developed geographies.

**Financing the implementation of solutions will require careful planning, with MNOs needing to prioritise actions, considering both quick-win/lower carbon impact projects, and larger transformational projects that will bring material decarbonisation but with significant upfront investment.**

**In areas where electrical grids are absent or unreliable, reducing reliance on diesel generators for network infrastructure can be the most impactful decarbonisation lever.**

However, key network assets in these areas are often remotely located, which presents a significant logistical challenge for MNOs looking to decarbonise this emission source.

Figure 11 below presents a selection of opportunities for decarbonisation of Scope 1 emissions in MNO operations and variables for consideration when planning implementation.

**MNOs should review and select the opportunities that are most appropriate and likely to have the biggest impact on their operations.**

**Figure 11** | Summary of decarbonisation opportunities for Scope 1 emissions

| **Ease of implementation/ key barriers** | **Timeframe for commencing implementation** | **Scale of additional investment required relative to typical budgeted CAPEX**<br>$ = <1%<br>$$ = 1-5%<br>$$$ = <5% | **Return on investment**<br>(near/long-term or strategic)<br>▪ = <5 years<br>▪▪ = 5-10 years<br>▪▪▪ = Strategic, Limited ROI | **Magnitude of carbon reduction potential**<br>(relative to Scope 1 and 2 total)<br>☁ = <1%<br>☁☁ = 1-10%<br>☁☁☁ = >10% |
|---|---|---|---|---|
| **Electric heat pumps (buildings)**<br>Transition gas-fired heating systems in buildings to electric heat pumps (air, ground or water-sourced). | | | | |
| Well-established technology, but site-specific challenges often require bespoke design<br><br>Will increase electricity consumption | Pre-2025<br><br>(Technology readily available) | $$$<br>High relative to individual building CAPEX, but low compared to overall network | ▪▪<br>Can be dependent on operating conditions and incentives[29] | ☁<br>Potential to remove 100% of gas from sites, but low overall impact |

29 johnsoncontrols.com/en_gb/-/media/jci/be/united-kingdom/iref/jci_iref_district_energy_white_paper.pdf

| Ease of implementation/ key barriers | Timeframe for commencing implementation | Scale of additional investment required relative to typical budgeted CAPEX | Return on investment | Magnitude of carbon reduction potential |
|---|---|---|---|---|
| | | $ = <1%<br>$$ = 1-5%<br>$$$ = <5% | (near/long-term or strategic)<br>▂ = <5 years<br>▂▄ = 5-10 years<br>▂▄█ = Strategic, Limited ROI | (relative to Scope 1 and 2 total)<br>☁ = <1%<br>☁☁ = 1-10%<br>☁☁☁ = >10% |

## Refrigerant leak detection (data centres and network base stations)

Installing fixed point refrigerant leak detection systems to minimise fugitive emissions.

| Ease of implementation/ key barriers | Timeframe for commencing implementation | Scale of additional investment | Return on investment | Magnitude of carbon reduction potential |
|---|---|---|---|---|
| Well-established technology, easy to install | Pre-2025 | $ | ▂▄█<br>Could save expenditure if prevents catastrophic leakage | ☁ |

## Low GWP refrigerants and free cooling (data centres)

Switching data centre cooling systems to deliver a high percentage of free cooling and using low GWP refrigerants (e.g. R1234ze, R744 etc).

| Ease of implementation/ key barriers | Timeframe for commencing implementation | Scale of additional investment | Return on investment | Magnitude of carbon reduction potential |
|---|---|---|---|---|
| Increasing availability of solutions<br><br>Could require complete replacement of data centre cooling system[30] | Pre-2025 | $$$<br>High relative to data centre CAPEX, but low compared to overall network | ▂▄<br>Likely reduced electricity demand/ costs, see Scope 2 measure | ☁<br>Potentially significant impact on source emissions, but low in overall terms |

## Low GWP refrigerants and passive cooling (network base station sites)

Use of passive cooling can remove the need for fluorinated gas-based cooling systems altogether. In warmer climates, low GWP electrically powered refrigerant systems would minimise fugitive emissions.

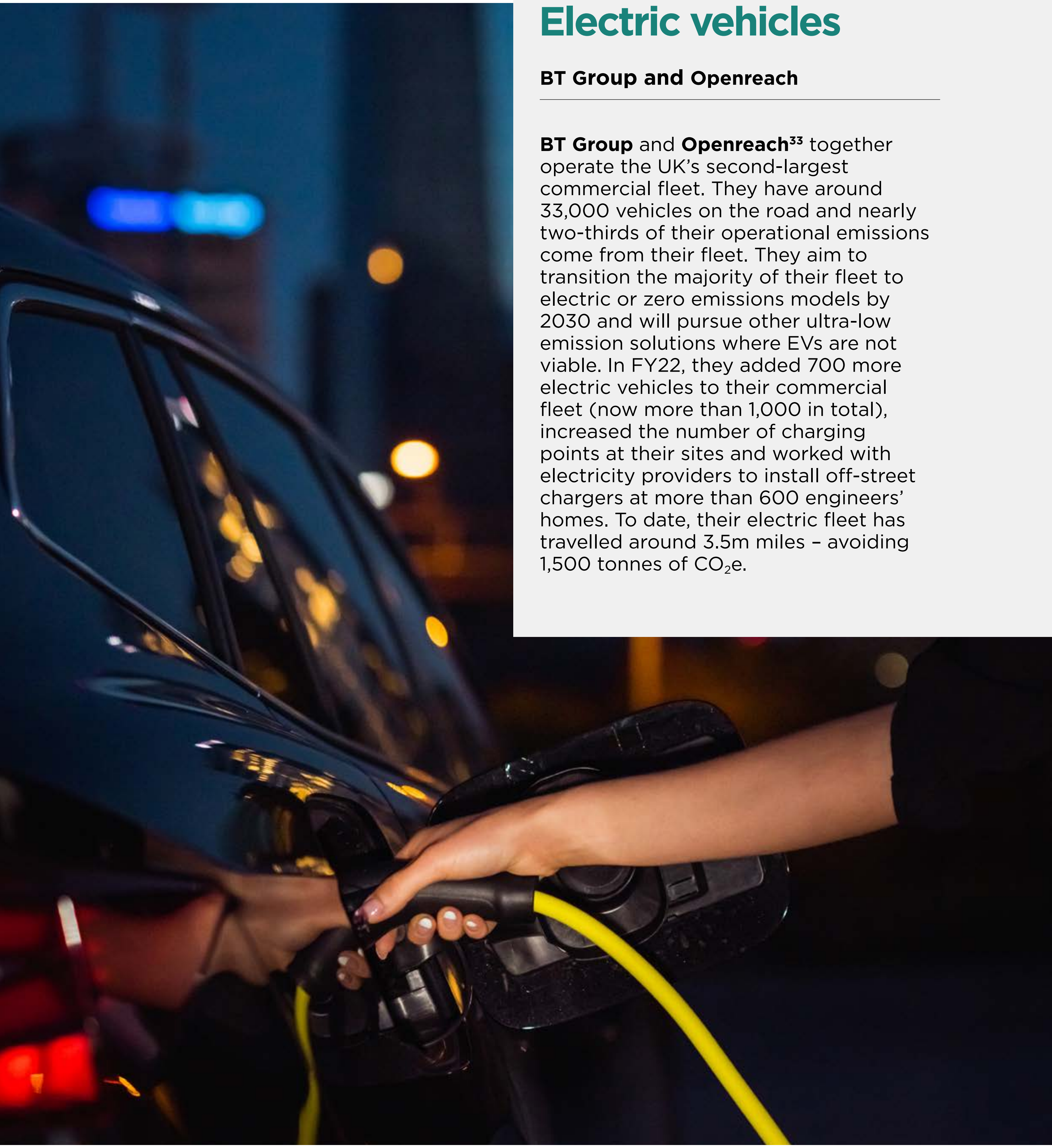
| Ease of implementation/ key barriers | Timeframe for commencing implementation | Scale of additional investment | Return on investment | Magnitude of carbon reduction potential |
|---|---|---|---|---|
| Challenge to upgrade large number of remote sites as currently limited options for direct drop in low GWP replacements<br><br>Passive coolers typically have a large footprint and high initial cost. Low GWP refrigerant-based cooling systems have slightly lower costs associated but require more energy to operate than passive systems<br><br>Tower sharing and TowerCo interaction can present challenges | Pre-2025, continue to 2030 | $$ - $$$<br>Moderate to high if base stations owned by operator, will require upgrades to significant number remote sites each with specific restrictions and limitations. May have reduced burden if tower ownership Is shared or outsourced to TowerCos | ▂▄<br>Likely reduced electricity demand/ costs, see Scope 2 measures | ☁<br>Low for Scope 1, potentially greater impact for Scope 2 |

30 Bell Canada have been transitioning to natural refrigerant-based (R744/$CO_2$) cooling systems for their datacentres that can operate for ~90% of the year in free-cooling mode (www.carnotrefrigeration.com/en/case-studies/data-center-cooling).

| Ease of implementation/ key barriers | Timeframe for commencing implementation | Scale of additional investment required relative to typical budgeted CAPEX<br>$ = <1%<br>$$ = 1-5%<br>$$$ = <5% | Return on investment (near/long-term or strategic)<br>▄ = <5 years<br>▄█ = 5-10 years<br>▄▆█ = Strategic, Limited ROI | Magnitude of carbon reduction potential (relative to Scope 1 and 2 total)<br>☁ = <1%<br>☁☁ = 1-10%<br>☁☁☁ = >10% |
|---|---|---|---|---|
| **Renewable generation, coupled with battery storage (network base stations)**<br>Self-generation of electricity combined with storage to reduce the need for diesel-powered generators. | | | | |
| Lots of remote legacy systems to convert. Increasing grid availability provides alternative solution with lower CAPEX requirement[30]. Tower sharing and TowerCo interaction can present challenges | Pre-2025, continue to 2030 | $$$<br>High if base stations owned by operator<br><br>Relatively high CAPEX burdens can be eased for individual mobile operators by tower sharing mechanisms or by leveraging carbon targets to influence TowerCos | ▄█<br>Likely reduced electricity demand/ costs, see Scope 2 measures | ☁☁<br>Potential to remove 100% of fossil fuel use for generators if widely adopted, potential to benefit Scope 2 |
| **Electric vehicles**<br>Transitioning internal combustion engine (ICE) fleets to battery electric vehicles (BEV). | | | | |
| Readily available alternatives to all vehicles (cars and small vans) that typically form Mobile Operators' vehicle fleets. Collaborating with utilities, vehicle manufacturers and others can help ensure charging infrastructure and supply chain is in place (see BTs participation in cross industry EV Fleet Accelerator in UK[31])<br><br>Will increase electricity consumption | Pre-2025 | $$<br>Moderate if fleet wholly owned by mobile operator, may be negligible additional capital if fleet leased | ▄▆█ | ☁☁<br>Potential to remove 100% of fossil fuel from fleets, but low overall impact |

Source: The Carbon Trust analysis

31 gsma.com/mobilefordevelopment/wp-content/uploads/2020/09/Clean_Tech_Report_R_WebSingles.2.pdf
32 bt.com/bt-plc/assets/documents/digital-impact-and-sustainability/our-approach/our-policies-and-reports/evfa-report-july-2021.pdf



# Electric vehicles

### BT Group and Openreach

**BT Group** and **Openreach**[33] together operate the UK's second-largest commercial fleet. They have around 33,000 vehicles on the road and nearly two-thirds of their operational emissions come from their fleet. They aim to transition the majority of their fleet to electric or zero emissions models by 2030 and will pursue other ultra-low emission solutions where EVs are not viable. In FY22, they added 700 more electric vehicles to their commercial fleet (now more than 1,000 in total), increased the number of charging points at their sites and worked with electricity providers to install off-street chargers at more than 600 engineers' homes. To date, their electric fleet has travelled around 3.5m miles – avoiding 1,500 tonnes of $CO_2e$.

33 BT Group carbon reduction plan

# 2.2. Scope 2 emission reduction opportunities

Decarbonisation of Scope 2 emissions is critical to achieving science-based targets because they dominate the operational footprint of MNOs.

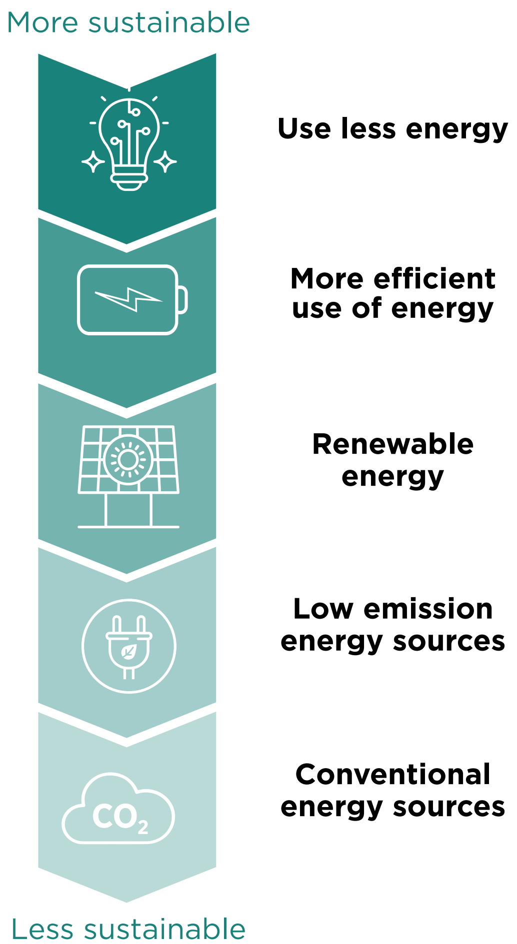
**Procurement of renewable energy can be a means to decarbonise Scope 2 emissions when using a market-based accounting approach, but best practice should always be to maximise energy efficiency to reduce electricity consumption rather than relying on the availability of clean energy.**

(The energy efficiency hierarchy, Figure 12, remains valid when planning for achieving climate targets).

Geographical variations in the availability of renewable electricity from the grid mean that many MNOs cannot rely on energy procurement as a route for decarbonising in the near term.

**Increases in the use of on-site renewable generation would help to ease the reliance on grid decarbonisation, but engagement with policy makers and local grid operators will be vital to ensure that Scope 2 emissions can be fully decarbonised in all regions.**

**Figure 12** | Emissions reduction hierarchy




Source: The Carbon Trust

The two most significant consumers of electricity within MNO operations are typically network base station sites and data centres.

Network base stations are transitioning from legacy infrastructure to newer, more efficient systems to support 5G rollouts. These 5G systems will manage higher volumes of data traffic, which will require more equipment and capacity to be added to the network. Improving equipment efficiency will likely mean that growth in data traffic will far exceed increases in energy consumption caused by the extra capacity, but careful management is required to ensure that any increases are minimised.

Data centres are energy-intensive assets (relative to other assets under the operational control of an MNO) that are managing ever-increasing data demands from expanding networks. Efficiency improvements in ICT equipment and cooling technologies will be key solutions in helping to mitigate this, but significant demand for energy will likely remain. For both challenges, the continued development of smart software and AI, when coupled with equipment upgrades and modernisation, presents an evolving opportunity to manage energy consumption and optimise the efficiency of existing and new network infrastructure in ways not previously possible.

**Network equipment and data centre efficiencies should be under constant review by MNOs to ensure they are up to speed with the latest decarbonisation opportunities available.**

Figure 13 provides an overview of key opportunities available for reducing Scope 2 emissions. The opportunities are listed at an asset level (buildings, data centres, network sites etc.), but best practice should involve a whole-network approach that will maximise efficiency across all assets. Improving network base station efficiency while upgrading network data capacity will likely provide both the biggest challenge and the greatest reduction in Scope 2 emissions for most MNOs, requiring considered planning and early action.

**Figure 13** | Summary of onsite decarbonisation opportunities for Scope 2 emissions

| **Ease of implementation/ key barriers** | **Timeframe for commencing implementation** | **Scale of additional investment required relative to typical budgeted CAPEX**<br>$ = <1%<br>$$ = 1-5%<br>$$$ = <5% | **Return on investment** (near/long-term or strategic)<br>▄ = <5 years<br>▄█ = 5-10 years<br>▄██ = Strategic, Limited ROI | **Magnitude of carbon reduction potential** (relative to Scope 1 and 2 total)<br>☁ = <1%<br>☁☁ = 1-10%<br>☁☁☁ = >10% |
|---|---|---|---|---|
| **Improved energy management (all assets)**<br>General improvements to overall energy management, based on the principles outlined in best practice standards such as ISO 50,001. | | | | |
| Leadership buy-in and dedicated resources are required to ensure success and impact | Pre-2025 | $ | ▄█ | ☁<br>In isolation, but essential to have buy-in for other measures listed to succeed |

| Ease of implementation/ key barriers | Timeframe for commencing implementation | Scale of additional investment required relative to typical budgeted CAPEX<br>$ = <1%<br>$$ = 1-5%<br>$$$ = <5% | Return on investment (near/long-term or strategic)<br>▬ = <5 years<br>▬▮ = 5-10 years<br>▬▮▮ = Strategic, Limited ROI | Magnitude of carbon reduction potential (relative to Scope 1 and 2 total)<br>☁ = <1%<br>☁☁ = 1-10%<br>☁☁☁ = >10% |
|---|---|---|---|---|
| **LED Lighting (buildings and data centres)**<br>Convert any existing non-LED luminaires to LED under automated control | | | | |
| LED lighting is now widely available and can reduce energy consumed by lighting systems by 50-70% when combined with effective automated control | Pre-2025 | $ | ▬ | ☁ |
| **Data centre configuration optimisation software**<br>AI and VR-driven data centre optimisation software can provide real-time operational visibility to help manage thermal and power risk, optimise cooling capacity and minimise energy waste | | | | |
| Established software providers can provide live modelling and analysis of data centre performance and can provide guidance on reconfiguration to maximise the efficiency of existing assets | Pre-2025 | $ | ▬ | ☁☁ |
| **Renewable energy (data centres)**<br>Solar photovoltaics for data centres to support electricity demand | | | | |
| Large open roof spaces of data centres are often the ideal location for extensive solar arrays | Pre-2025 | $$<br>Moderate if purchasing, however 'Energy-as-a-Service' type arrangements that can reduce the need for CAPEX are available | ▬▮ | ☁☁<br>e.g. Orange partnered with Engie to install solar arrays on their Cote d'Ivoire data centre site that can generate 60% of the site's daytime consumption[34] |

34 cibsejournal.com/technical/in-concert-reducing-energy-in-data-centres/

| Ease of implementation/ key barriers | Timeframe for commencing implementation | Scale of additional investment required relative to typical budgeted CAPEX<br>$ = <1%<br>$$ = 1-5%<br>$$$ = <5% | Return on investment (near/long-term or strategic)<br>▂ = <5 years<br>▂█ = 5-10 years<br>▂▄█ = Strategic, Limited ROI | Magnitude of carbon reduction potential (relative to Scope 1 and 2 total)<br>☁ = <1%<br>☁☁ = 1-10%<br>☁☁☁ = >10% |
|---|---|---|---|---|
| **Data centre cooling optimisation**<br>Efficiency improvements through effective aisle containment, increasing target temperatures, introducing free cooling using evaporative coolers or using liquid-based systems rather than air, and rack-based cooling rather than room-based | | | | |
| Established and readily available technologies can require significant investment to overhaul legacy cooling systems<br><br>Evaporative coolers can provide a good energy-saving solution for existing legacy air-based systems because systems can operate in 'free' cooling mode for most of the year in many locations[35]<br><br>Liquid-based rack cooling systems provide a means of efficiently cooling for high-density data centres[36], which can create opportunities for consolidation | Pre-2025 | $$$<br>High relative to typical annual CAPEX of data centre site, but Moderate compared to overall network | ▂█ | ☁<br>But can result in significant savings relative to data centre cooling |
| **Data centre power system and IT optimisation**<br>Efficiency improvements through server and rack improvements (e.g. variable-speed CPU fans, smart racks and idle server management), power management (using advanced rack PDUs) and high-efficiency UPS systems (with Eco-mode of eConversion bypass and low losses) | | | | |
| In the pursuit of ever-improving PUE, the efficiency of IT equipment can often get overlooked. Overall energy reductions should be targeted through equipment and power distribution optimisation. Recent sample studies have shown that ageing IT kit (older than five years), which may represent ~40% of deployed servers, could consume 66% of IT equipment energy globally energy, but contributed just 7% of the computing capacity[37]. This clearly presents significant opportunity for improvement | Pre-2025, continue to 2030 | $$<br>Can form part of general data centre OPEX and advancement | ▂█ | ☁<br>But can result in significant site energy savings |

35 edgeir.com/high-density-racks-are-straining-data-centers-liquid-cooling-may-offer-a-solution-20220411
36 uptimeinstitute.com/uptime_assets/80ae92ca9b8dfa363a077cb537f51870777499a39218906efc6d4e37e28ac3a0-beyond-pue-tackling-its-wasted-terawatts.pdf
37 datacenterdynamics.com/en/news/orange-partners-with-engie-to-install-solar-panels-at-ivory-coast-data-center/

| Ease of implementation/ key barriers | Timeframe for commencing implementation | Scale of additional investment required relative to typical budgeted CAPEX<br>$ = <1%<br>$$ = 1-5%<br>$$$ = <5% | Return on investment<br>(near/long-term or strategic)<br>▂ = <5 years<br>▂▄ = 5-10 years<br>▂▄█ = Strategic, Limited ROI | Magnitude of carbon reduction potential<br>(relative to Scope 1 and 2 total)<br>☁ = <1%<br>☁☁ = 1-10%<br>☁☁☁ = >10% |
|---|---|---|---|---|

## Network base station site efficiency

**Dynamic energy management software.** Allows live assessment data traffic to enable smart sleep state controls to reduce site consumption at periods of low demand. Can lower energy consumption multi-input, multi-output radios by up to 70% when in sleep state[38].

**Improve cooling efficiency.** Use of passive cooling can remove the need for refrigerant-based cooling systems altogether in cooler climates, resulting in significant reductions in energy consumption.

Water-based cooling systems have also been shown to provide significant energy savings (up to 30% energy and 80% of emissions) over existing refrigerant cooling systems[39], but the scope for application of water-based systems can be more limited than for passive air cooling.

Optimising site configuration based on specific equipment cooling needs can also help reduce cooling energy consumption (e.g. locating radios and basebands outside or positioning radios closer to antenna to reduce cable losses).

**Install energy efficient radio components.** These may include high-efficiency smart power amplifiers (PA) that can be optimised for the specific output power or configuration used by continuously integrating more discrete steps into a single package and multi-band PA technology allowing power to be dynamically shared between different bands[40].

**Site simplification/modernisation.** Rather than leaving old legacy systems on site, install newer, more efficient systems and move traffic to more efficient bands (5G). Consider using multi-band technology that allows combining the functionality of several radio units into a single physical unit.

| | | | | |
|---|---|---|---|---|
| These measures should form part of a holistic approach to modernising network base stations[41]. Maximising site energy efficiency needs to go hand-in-hand with upgrades to increase data traffic capacity for operators to manage both emissions and operating costs<br><br>If working with TowerCos, collaboration may be required to ensure coordination of competing needs for shared locations | Pre-2025, continue to 2030 | $$$<br>High if operator owns towers, but efficiency should form part of standard site modernisation as the network transitions to faster, more efficient data bands | ▂▄█ | ☁☁☁ |

38 ericsson.com/en/blog/2021/12/a-holistic-approach-to-address-ran-energy-efficiency
39 ericsson.com/en/blog/2021/12/a-holistic-approach-to-address-ran-energy-efficiency
40 computerweekly.com/news/252484174/Elisa-enjoys-5G-base-station-energy-emissions-reductions-from-Nokia-liquid-cooling
41 ericsson.com/en/blog/2021/12/a-holistic-approach-to-address-ran-energy-efficiency

| Ease of implementation/ key barriers | Timeframe for commencing implementation | Scale of additional investment required relative to typical budgeted CAPEX<br>$ = <1%<br>$ $ = 1-5%<br>$ $ $ = <5% | Return on investment<br>(near/long-term or strategic)<br>▄ = <5 years<br>▄█ = 5-10 years<br>▄██ = Strategic, Limited ROI | Magnitude of carbon reduction potential<br>(relative to Scope 1 and 2 total)<br>☁ = <1%<br>☁☁ = 1-10%<br>☁☁☁ = >10% |
|---|---|---|---|---|
| **Transition fixed network connections to fibre**<br>Fibre is estimated to consume much less energy than historical copper networks (though estimates vary widely: three times less to 17 times less[42]), so transitioning as much of the fixed network to fibre as possible will result in reduced consumption. | | | | |
| Fixed networks consume much less energy than mobile networks. They can also manage much greater data flows without significant increases in energy use, unlike mobile<br><br>New fixed fibre networks are much more efficient than older ones, but converting large networks and a high number of connections is a costly exercise | Pre-2025, continue to 2030 | $ $<br>Can form part of general data centre OPEX and advancement | ▄██ | ☁☁ |
| **Renewable generation, coupled with battery storage (network base stations)**<br>Self-generation of electricity combined with storage with smart control to optimise charge and discharge with local demand. | | | | |
| Tower sharing and TowerCo interaction can present challenges | Pre-2025, continue to 2030 | $ $ $<br>High if base stations owned by operator<br><br>Relatively high CAPEX burdens can be eased for individual mobile operators by tower-sharing mechanisms or by leveraging carbon targets to influence TowerCos | ▄█ | ☁☁☁<br>High if deployed widely across a network. Japan's NTT DOCOMO is reported to have reduced grid-power usage by as much as 40% at some of its base stations by using solar panels and higher-capacity batteries[43] |

Source: The Carbon Trust analysis

42 linkedin.com/pulse/which-energy-efficiency-telecom-networks-alexandre-pieyre/
43 mckinsey.com/industries/technology-media-and-telecommunications/our-insights/the-case-for-committing-to-greener-telecom-networks

# Datacentre configuration optimisation software

**O2**

**O2**[44] is overhauling its data centres and core network sites with energy-efficient cooling equipment to regulate temperatures at the sites that keep its mobile network running. The new equipment uses the natural cold air outside to help cool data equipment when it needs it. This avoids sole reliance on traditional electric-powered air conditioning and the associated polluting refrigerant gases.

O2 has also become the first major mobile network operator to roll out new management software from EkkoSense across its entire estate. The software uses smart sensors fitted to data centre equipment to monitor exactly how much cooling each site needs at any one time and report back on how to optimise cooling as demand changes. This helps make sure each site operates as efficiently as possible, identify any issues and prevent overcooling or overheating. This is expected to deliver energy savings equivalent to 1m kilogrammes of $CO_2$ year-on-year.

O2 has already upgraded around 70% of its core network sites with the new equipment and EkkoSense data centre optimisation software, delivering an energy saving of between 15% and 20% per site – equivalent to 678,000 kilograms of $CO_2$ in its first pro-rata year of use.

Source: The Carbon Trust

### 2.2.1 Renewable energy procurement

Energy efficiency and system optimisation, while critical contributors to decarbonisation, will only ever go so far towards abating MNO operational emissions and electricity will remain the main contributor to an MNOs Scope 1 and 2 footprint. Mobile operators are estimated to have a global electricity demand of 293 TWh per year in 2021, representing approximately 20% of their network operating expenditures, and currently around 24% of the electricity used by MNOs globally comes from direct renewable purchases[45]. This demand is unlikely to reduce, meaning MNOs are likely to turn to market-based accounting for Scope 2, which reflects emissions from electricity generation that companies have purposefully chosen.

44 O2 cools down data centres to save energy as 4G and 5G hot up - Virgin Media O2
45 gsma.com/betterfuture/wp-content/uploads/2022/11/Mobile_Industry_Position_Paper_Access_to_Renewable_Electricity_Nov22.pdf

***Additionality is fundamental to reducing emissions through renewable energy procurement.*** Achieving carbon emission reductions through procurement of renewable energy is a viable strategy but, to achieve a direct result on decarbonising the generation of energy, the additionality of the energy purchased must be considered. Critically, to achieve carbon emission reductions through renewable energy, additional renewable energy generation capacity must be installed. Different mechanisms exist to procure renewable energy whether it is on-site or local renewable energy generation, PPAs, green tariffs or unbundled energy attribute certificates, yet not all are the same from the perspective of additionality.

**MNOs seeking to increase procurement of renewable energy should ensure that any purchases result in additional renewable energy generation.**

GSMA members were trailblazers in embracing renewable energy. In the run-up to the Paris Agreement in 2015, BT Group, KPN and Proximus all committed to switching to 100% renewable electricity by 2020[46] through the global RE100 campaign[47]. Since then, more MNOs have made renewable energy commitments, with many already using 100% renewable electricity. Nine MNOs are currently RE100 members and several others have made commitments to increase renewable electricity usage within their operations.

While clearly a vital lever for MNOs to decarbonise the electricity they use, there has been growing concern about companies using low-impact instruments to reduce their market-based Scope 2 emissions, from an emissions accounting point-of-view, without driving real-world change. The impact of renewable energy procurement on the wider system can depend on the overall structure of the electricity market in which it operates. The market-based method does not currently specify that new renewable generation needs to occur as a result of the procurement contract. Therefore, emissions reduction will only occur if the procurement method chosen specifies new generation or if it is linked to a wider electricity market system where the procurement of renewables automatically increases renewable generation.

**Figure 14** | Renewable energy procurement hierarchy

The green credentials of renewable electricity will depend on a combination of its additionality, traceability and link to the generation source. Figure 14 shows a hierarchy of options.

| 'Green' credentials | Renewable energy procurement channel |
| --- | --- |
| 🍃🍃🍃🍃 | On-site or local solutions usually using on-site solar PV installations, often coupled with battery storage technology, for direct generation and use by the MNO. These systems can either be directly owned by the MNO for self-consumption or owned by a third party with energy procured directly by the MNO (substantiated by a supply contract with the supplier to specify the project's energy attributes). The direct additionality associated with this type of system makes it one of the strongest ways for MNOs to decarbonise the electricity they use. |

46 gsma.com/betterfuture/wp-content/uploads/2021/04/Mobile-Net-Zero-State-of-the-Industry-on-Climate-Action.pdf
47 there100.org/sites/re100/files/2021-08/RE100%20Technical%20Criteria%20Aug%202021.pdf

**Power Purchase Agreements (PPAs)** are direct procurement contracts signed between MNOs and renewable electricity generators. PPAs represent a long-term commitment by a company to purchase power from a particular renewable energy project. This commitment can help with generating additional renewable energy production and real emission reductions, as the long-term power price reduces risks for new projects and allows access to project finance. PPAs can also offer a cost-effective solution for MNOs, and 92% of companies across Europe who purchased PPAs indicated that a primary driver for signing was a reduction in electricity costs[48]. There are two main types of PPAs that can be considered by MNOs:

- **Physical PPAs** are a more direct delivery of electricity supply, with renewable energy purchased directly from a generator, and the buyer takes delivery of the purchased electricity directly.

- **Virtual PPAs** allow the generator to sell their electricity into the local wholesale power market and the user (MNO) takes energy from the grid. The generator and the MNO buyer then settle the difference between the variable wholesale market price and the contract strike price, and the corporate buyer receives the certificates that are generated from the project.

**Green Tariffs** offering a lower carbon alternative to more standard energy tariffs are available from many energy suppliers. A premium is usually paid on the specific tariff (per kWh), over and above the standard tariff price (although cost parity with standard tariffs is becoming increasingly common). Green tariffs offer additional flexibility for companies because they aren't locked into long-term commitments like with PPAs or on-site solutions, and can switch suppliers/tariffs more easily.

MNOs should ensure they procure green tariffs from suppliers that are creating new renewable generation by matching the renewable demand created by their consumers with contracting new supply. Tariffs should therefore be supported by some form of certification (such as Renewable Energy Certificates in North America) to provide customers with certainty regarding the green credentials of the energy they are buying.

**Unbundled Energy Attribute Certificates (EACs).** Companies can claim the environmental benefits of renewable energy production by acquiring EACs issued to renewable electricity generators operating within the same market boundary as the claimant. Unbundled EACs can be procured separately from the generated electricity. Companies may purchase unbundled EACs like RECs North America), Guarantees of Origin (Europe) and I-RECs (some other regions) separately from electricity to match their procured electricity consumption. These mechanisms can be one of the most flexible ways of procuring renewable energy.

There is growing scrutiny regarding the transparency of EACs and the additionality they bring to wider system decarbonisation. Companies can report zero emissions for each unit of electricity consumption covered by purchased EACs, regardless of the actual emissions produced by the electrical grid at their location. There is also growing evidence that EACs may be unlikely to lead to additional renewable energy generation[49], with calls to reconsider how they are they are accounted for in Scope 2 calculations in relation to science-based targets.

48 gsma.com/betterfuture/wp-content/uploads/2021/04/Mobile-Net-Zero-State-of-the-Industry-on-Climate-Action.pdf
49 nature.com/articles/s41558-022-01379-5

# 24/7 Carbon Free Energy

Renewable energy generation is inherently intermittent and only generates energy as the energy source is available, such as when the sun is shining and the wind is blowing. As more renewable energy generation is added to the electrical grid, through mechanisms such as PPAs, the challenge of meeting instantaneous demand through renewable energy becomes greater.

Enter 24/7 carbon-free PPAs, where energy consumed each minute of the day is matched with renewable energy generated at the same time. This style of PPA promises increased effectiveness in reducing carbon emissions. These 24/7 PPAs rely on adequate energy storage solutions to balance renewable generation and aim to address problems in balancing supply and demand with the intermittency of renewable energy generation. This temporal component is missed in traditional PPAs, where energy is matched on an annual basis for reporting purposes.

Companies like Google and Microsoft are already entering into 24/7 carbon-free PPAs, with Google aiming to operate on 24/7 clean energy by 2030[50, 51].

**It is critical that MNOs take great care when procuring renewable electricity as a means of decarbonisation to ensure that growing energy demands in their operating regions are matched by increases in clean, renewable generation in the same locality.**

***Regional challenges***

Procurement of renewable energy is far more challenging in regions where renewable energy generation infrastructure is not as well established. Centralised market control, a lack of appropriate financial/legal structures to support investment, lack of access to renewable energy sources and a shortage of capital to implement solutions can all factor into a region having fewer options for renewable energy procurement for MNOs[52].

Projections from the International Energy Agency (IEA) show global renewable electricity capacity to grow by an average of around 305GW per year between 2021 and 2026 in their main case forecast. This is being driven by continuous policy support in more than 130 countries, ambitious net zero goals being announced by nations accounting for almost 90% of global GDP and improving competitiveness of renewable industries[53].

Mobile communications networks are now key components of national and regional infrastructure. Mobile communications networks and power grids are also becoming increasingly intertwined, with flexible, smart grids reliant on communications to function effectively and efficiently. The power sector will need to increase renewable energy from 33% in 2018 to 92% in 2050 according to UN research on the energy transition[54].

**Collaboration between mobile operators and power grids, supported by local/regional policy, is therefore vital in regions where renewable energy availability is scarce to ensure that efficient and reliable decarbonised electricity is available.**

50 ldescouncil.com/assets/2205_ldes-report_247-ppas.pdf
51 edie.net/google-and-microsoft-among-businesses-backing-24-7-clean-energy-tracking/
52 gsma.com/betterfuture/wp-content/uploads/2021/04/Mobile-Net-Zero-State-of-the-Industry-on-Climate-Action.pdf
53 iea.org/reports/renewables-2021/renewable-electricity?mode=market&region=World&publication=2021&product=Total
54 un.org/sites/un2.un.org/files/2021-twg_2-062321.pdf

### 2.2.2 Engagement in energy policy

Many developed countries have national policy objectives to decarbonise the generation of electricity, but various levels of grid decarbonisation have been achieved to date. Countries like the UK have successfully reduced grid carbon intensity in recent years with a shift away from coal power generation and, by 2019, carbon emissions from electricity generation were 71% lower than 1990 levels[55].

The USA has an existing target to reach 100% carbon pollution-free electricity by 2035[56]. Its Inflation Reduction Act (IRA) of 2022 is "the largest single step that Congress has ever taken to address climate change"[57] and looks set to put the USA back on track towards its climate goals.

Contemporary geopolitics have demonstrated the importance of resilient planning for decarbonisation of electricity and energy supply. Developing countries require support in a just transition towards building energy infrastructure and resilience while mitigating carbon emissions related to growing electricity demand. Fundamentally, strength in numbers is the best path forward and industry-level collaboration is required to advocate to national and regional governments for rapid decarbonisation of electricity.

The influence of companies and the corporate sector is critical for driving forward climate action through legislation.

**Making climate policy a key advocacy priority, aligning advocacy efforts across the organisation to support climate action and driving advocacy from the C-suite are necessary components of climate policy advocacy. Through initiatives like the WRI's Responsible Corporate Advocacy, business leaders can be equipped with the tools to act through policy advocacy[60].**

**Asia Clean Energy Coalition**

The recently launched **Asia Clean Energy Coalition**, which convenes the likes of Google, Meta, Samsung and others, aims to shift policy in Asia to enable more corporate procurement options for renewable energy. Within existing policy and market structures, organisations like Apple, through their China Clean Energy Fund, are driving forward on renewable energy procurement[58, 59].

Industry initiative RE100 brings together businesses committed to 100% renewable electricity to focus on international work and partnerships to drive market change and engage in policy through advocacy to support corporate sourcing of renewable electricity at the global and local level. Recent policy successes through the RE100 initiative[61], such as in South Korea where businesses are now able to purchase renewable electricity directly from providers with direct PPAs and in Japan where the government will subsidise the cost of construction for solar PPAs, demonstrates the power of collective action and policy engagement.

55 gov.uk/government/news/plans-unveiled-to-decarbonise-uk-power-system-by-2035
56 whitehouse.gov/briefing-room/statements-releases/2021/04/22/fact-sheet-president-biden-sets-2030-greenhouse-gas-pollution-reduction-target-aimed-at-creating-good-paying-union-jobs-and-securing-u-s-leadership-on-clean-energy-technologies/
57 The Inflation Reduction Act, in Short (wri.org)
58 wri.org/events/2022/11/launch-asia-clean-energy-coalition-accelerating-corporate-renewable-electricity
59 apple.com/uk/newsroom/2019/09/apple-launched-china-clean-energy-fund-invests-in-three-wind-farms/
60 wri.org/initiatives/responsible-corporate-advocacy
61 there100.org/policy-engagement

## Summary of Scopes 1 and 2 emission reduction opportunities

The opportunities explored and presented in this section have been summarised in an example roadmap in Figure 15, depicting how successful implementation of these opportunities can lead to achieving near-term SBTs by 2030.

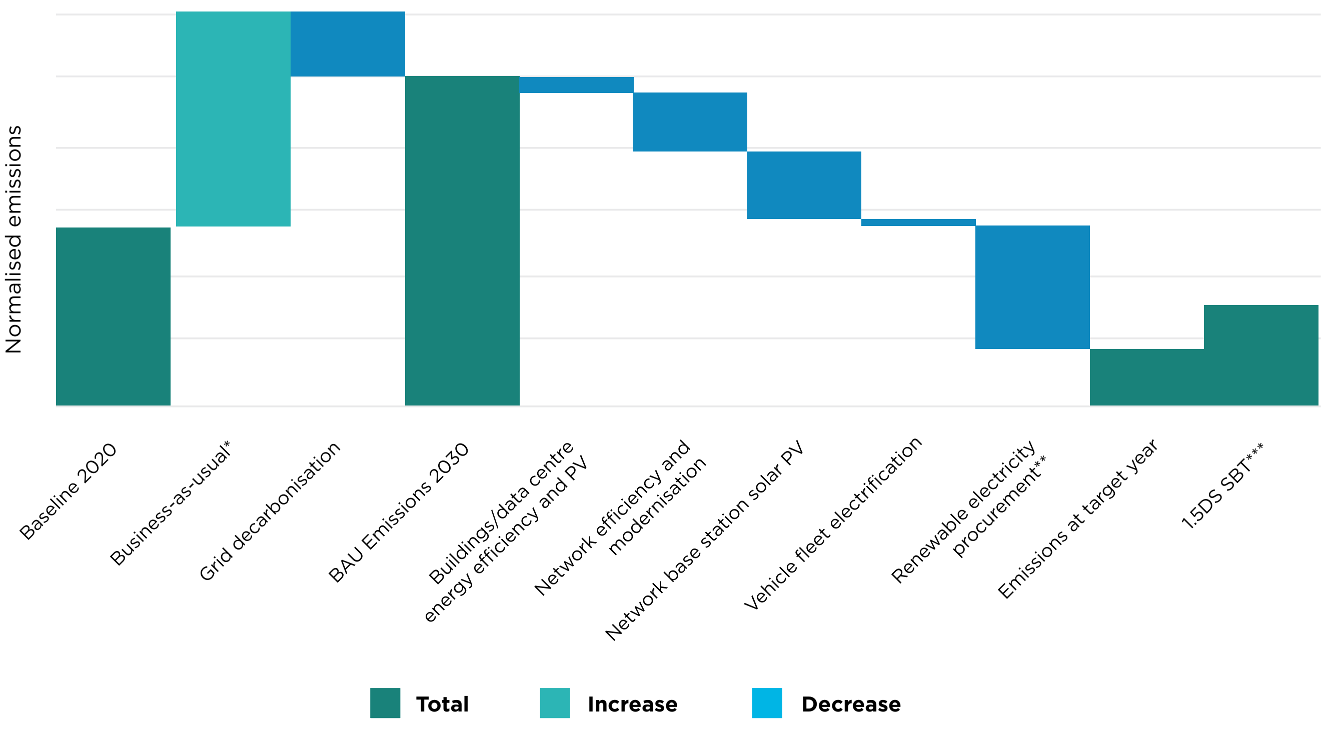
In the example roadmap, growth is applied to represent the potential increase in emissions in a business-as-usual scenario with continued growth in network capacity.

In the short-term, MNOs should focus on improving efficiency and increasing on-site renewable generation across buildings and datacentres to realise some early emissions reductions.

Also beginning in the short-term, optimising efficiency and increasing on-site renewable generation capacity across the RAN can start to bring early savings, yet continuing to implement these initiatives alongside vehicle fleet electrification will continue through to the end of the target period due to the scale of the challenge and evolving technology.

Finally, renewable electricity procurement will be essential for decarbonising residual electricity consumption.

**Figure 15** | Emissions roadmap for a MNO with implementation of Scope 1 and 2 carbon reduction opportunities




* Growth is applied to a 2020 baseline based on an estimated increase in network capacity of 200-300% to represent the potential increase in emissions in a business-as-usual scenario without a focus on improved energy efficiency and implementation of other decarbonisation initiatives.

** Example shown in graph assumes 75% of MNO electricity is provided by renewable sources.

*** Approximately 42% reduction from 2020 base year.

Source: The Carbon Trust analysis

## 2.3 Scope 3 emissions reduction opportunities

The scale of the challenge in reducing Scope 3 emissions cannot be overstated. Reducing Scope 3 emissions is inherently challenging and complex, as emission sources are spread across the value chain and require collaborative efforts to mitigate. As a result, effective coordination across the supply chain through a variety of solutions is vital to reduce Scope 3 emission sources.

**Mobile network operators should seek to identify and understand emission reduction opportunities across Scope 3.**

This section will take the reader through Scope 3 emissions reduction opportunities, with a focus on the following Scope 3 emissions categories most applicable to MNOs:

- **Categories 1 and 2 –** purchased goods and services and capital goods
- **Category 11 –** use of sold products
- **Category 15 –** investments

The aim of this section is to explore solutions to mitigate and reduce emissions in line with SBT pathways and a model has been developed to guide these concepts. The model reflects a simplified Scope 3 footprint, following the GHG Protocol Value Chain Standard methodology, where each category comprises simple modelling parameters which enable the model to reflect changes in key contributors to MNOs' Scope 3 emissions[62]. This section will evaluate and unpick the Scope 3 emission drivers and then explore solutions to address these sources.

62 Further information on the model can be found in the Appendix.

**Figure 16** | Principles of Scope 3 emissions reduction strategy


Source: The Carbon Trust

**The central theme of a Scope 3 emissions reduction strategy is collaboration between operators, suppliers, customers, industry associations and governments to realise ambitious levels of decarbonisation.**

The scale of emission reductions necessary to meet near-term science-based targets is considerable: in the range of 25% to 42% by 2030, relative to 2020 base year, to stay within reduction pathways aligned to well-below 2°C and 1.5°C futures. Furthermore, modelling of Scope 3 emissions in a business-as-usual approach projects a 16% increase in emissions in this time period, significantly overshooting the target window.

These emissions are spread throughout the value chain and therefore require a comprehensive strategy to achieve science-based targets. Each category and emission source will have unique considerations in determining a viable carbon reduction pathway and will require collaborative, ambitious and innovative solutions while leveraging existing technological know-how.

Together, the principles presented above form a comprehensive approach to reducing Scope 3 emissions in line with science-based target pathways as they touch on all the primary emissions sources throughout the value chain.

### 2.3.1. Procurement of low carbon network equipment, services and devices (categories 1 and 2)

To address emissions in categories 1 and 2...

**MNOs ultimately need to drive towards an aggregate reduction in embodied carbon used to manufacture network equipment and devices, and will require both a reduction in the volume of units produced and a reduction in carbon intensity to produce each unit.**

**MNOs must work with their suppliers to emphasise environmental performance at all stages of the procurement process.**

The key features of this approach are:

- Identify key suppliers for meaningful engagement and collaboration through analysis of Scope 3 footprint;
- Sustainability in design – product environmental performance must be a top-tier design criterion, balanced with computational performance and cost;
- Specific focus on achieving emission reductions related to the carbon hotspots in electronics manufacturing: the production of semiconductors, integrated circuits and printed circuit boards;
- Operators should encourage manufacturers to design to maximise longevity through repairability, modularity and reuse; and
- Restructuring of contractual arrangements to cascade down environmental performance targets and enable reuse and refurbishment.

***Identify key suppliers for meaningful engagement and collaboration***

**In the immediate term, MNOs should perform a hotspot analysis of their existing Scope 3 emissions data to determine key suppliers and manufacturers that contribute most to the MNO's categories 1 and 2 emissions.**

Fostering relationships with these suppliers through ongoing communication on carbon reduction strategy and collaboration during the design and road-mapping phase of their product lifecycle will lay the foundation for achieving improvements in environmental performance of the products they produce. Refer to Section 1.3 Scope 3 emission hotspots for additional guidance on a Scope 3 hotspotting approach.

*Sustainability in design*

**MNOs should clearly signal to their suppliers that environmental performance must be a top-tier design criterion.**

Since design decisions made early in the product life cycle can lock carbon in for an entire generation of product, early engagement with suppliers and manufacturers is critical to achieving sustainability in design. This should be reinforced through the procurement process and flow down of environmental performance targets related to product design and manufacturing.

*Achieving emission reductions related to the carbon hotspots in electronics manufacturing*

**MNOs should specifically target reducing the emissions related to the production of semiconductor components by working directly with tier 1 and tier 2 suppliers and engaging with industry collaboration efforts such as IMEC's Sustainable Semiconductor Technologies and Systems programme[63] to accelerate progress.**

Emissions related to the production of semiconductors, integrated circuits and printed circuit boards make up large portions of embodied carbon in the manufacture of network equipment and devices and are integral to both network equipment and user devices.

*Design to maximise longevity through repairability, modularity and reuse*

**MNOs and suppliers must work together to identify opportunities to extend the lifetime of products, moving away from an obsolescence model and towards a circular model that keeps equipment and devices in use for as long as possible.**

Manufacturers should be encouraged to design their products for longevity through repairability, modularity and reuse. Maximising the longevity and durability of network equipment and devices plays an important role in reducing emissions in the value chain.

As stated in the GSMA's Strategy Paper for Circular Economy: Network Equipment, there are existing challenges to realising the circular economy vision for network equipment…

**…so developing awareness on circular economy across the industry, creating common KPI metrics and guidelines and working to improve the regulatory ecosystem to support circular operations are among the key recommendations to progress towards a circular future[64].**

*Restructuring of contractual arrangements to flow down environmental performance targets and enable reuse and refurbishment*

**Procurement policies and strategies should be reviewed and updated to ensure alignment with science-based targets and drive environmental performance in suppliers' products. Operators should be targeting reductions in production-related emissions of network equipment, services and devices in the range of 30-40% per unit produced.**

MNOs such as BT and Vodafone have started to implement environmental requirements into the procurement qualification process[65, 66].

63 imec-int.com/en/expertise/cmos-advanced/sustainable-semiconductor-technologies-and-systems-ssts
64 gsma.com/betterfuture/wp-content/uploads/2022/11/Strategy-Paper-for-Circular-Economy-Network-Equipment.pdf
65 groupextranet.bt.com/selling2bt/articles/side/climate_change.html lan.pdf
66 vodafone.com/sustainable-business/operating-responsibly/responsible-supply-chain/how-we-manage-our-supply-chain

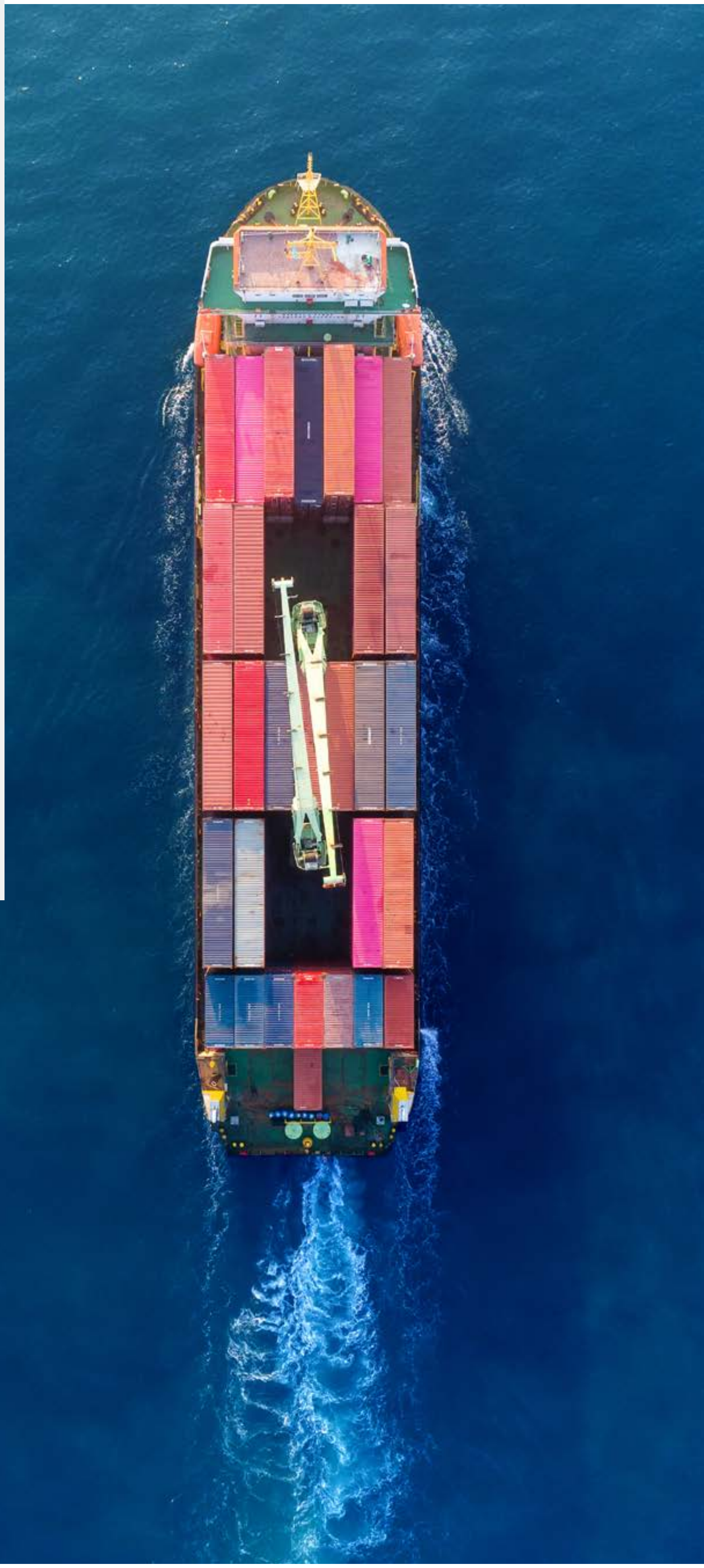
# Supply chain engagement in action

### 1.5°C Supply Chain Leaders Initiative

UK-based multinational communications company **BT Group** is a founding corporate member of the 1.5°C Supply Chain Leaders Initiative which has been leading on the launch of the SME Climate Hub.

All suppliers must meet the BT Group standard on climate change. In addition, for all new contracts worth over £25m, the company requires suppliers to have a net zero science-based target in place or commit to having one within six months.

BT Group has also introduced a climate clause which commits key suppliers to make measurable carbon savings during the life of their contract with BT. Ten active BT Group and Openreach suppliers have signed up to the clause so far[67].



67 bt.com/bt-plc/assets/documents/digital-impact-and-sustainability/our-approach/our-policies-and-reports/bt-carbon-reduction-plan.pdf

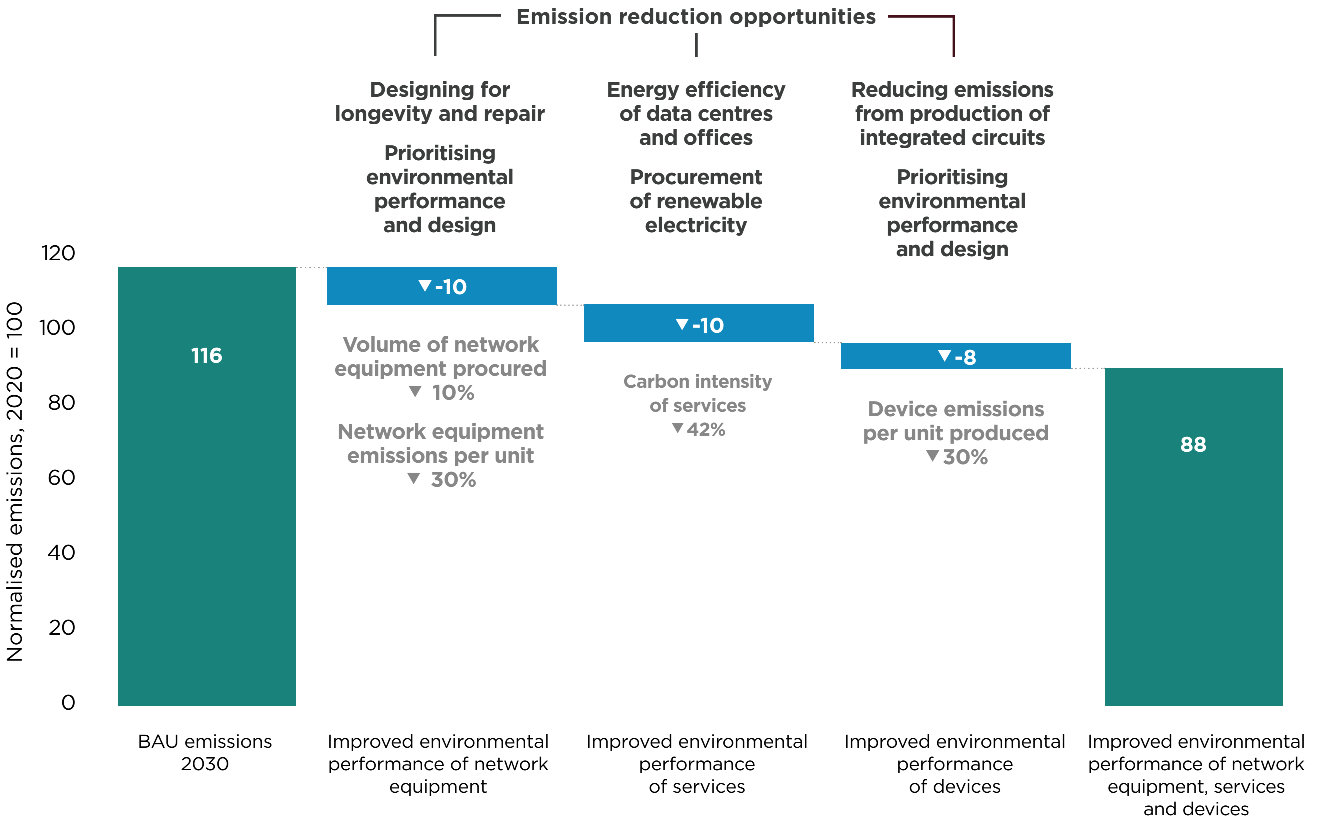
Strategically collaborating with suppliers to set and achieve ambitious environmental performance targets will drive large reductions in emissions across the supply chain. Using the model, we can illustrate the result of effectively implementing these principles, as shown in Figure 17. This will be demonstrated by 'ratcheting up' the ambition of achieving carbon reduction pathways by 2030 across network equipment, devices and services. For example, emissions related to manufacturing and production of network equipment and devices are modelled to reflect achievement of a 30% reduction in emissions per unit manufactured by 2030 relative to 2020.

Achieving reductions in the emissions to manufacture and produce these products, in the range of 30-40% per unit, is an ambitious and challenging goal. However, it is broadly aligned with carbon targets seen across the telecommunications sector. Many telcos have committed to 1.5DS targets[68] and supply chains, and the world-leading producer of semiconductors, Taiwan Semiconductor, has recently set 2030 targets to reduce emissions for 12-inch equivalent semiconductor wafer mask layers by 30% (relative to 2020 intensity[69]).

**MNOs will have to work closely with suppliers and manufacturers to ensure the importance of environmental performance is communicated, agreed and acted upon.**

Even achieving these ambitious reductions in production of goods and services is not enough to achieve Scope 3 targets.

**Figure 17** | Effect of ratcheting up environmental performance in design and manufacture of network equipment, devices and procurement of services




Source: The Carbon Trust analysis

68 sciencebasedtargets.org/companies-taking-action
69 esg.tsmc.com/download/file/2021_sustainabilityReport/english/e-all.pdf

# Achieving environmental performance in design and manufacture today

## Apple

Comparison of **Apple**'s 16th generation of iPhones based on Apple's published Product Environmental Reports[70, 71, 72] yields useful insights into the decarbonisation potential of smartphones.

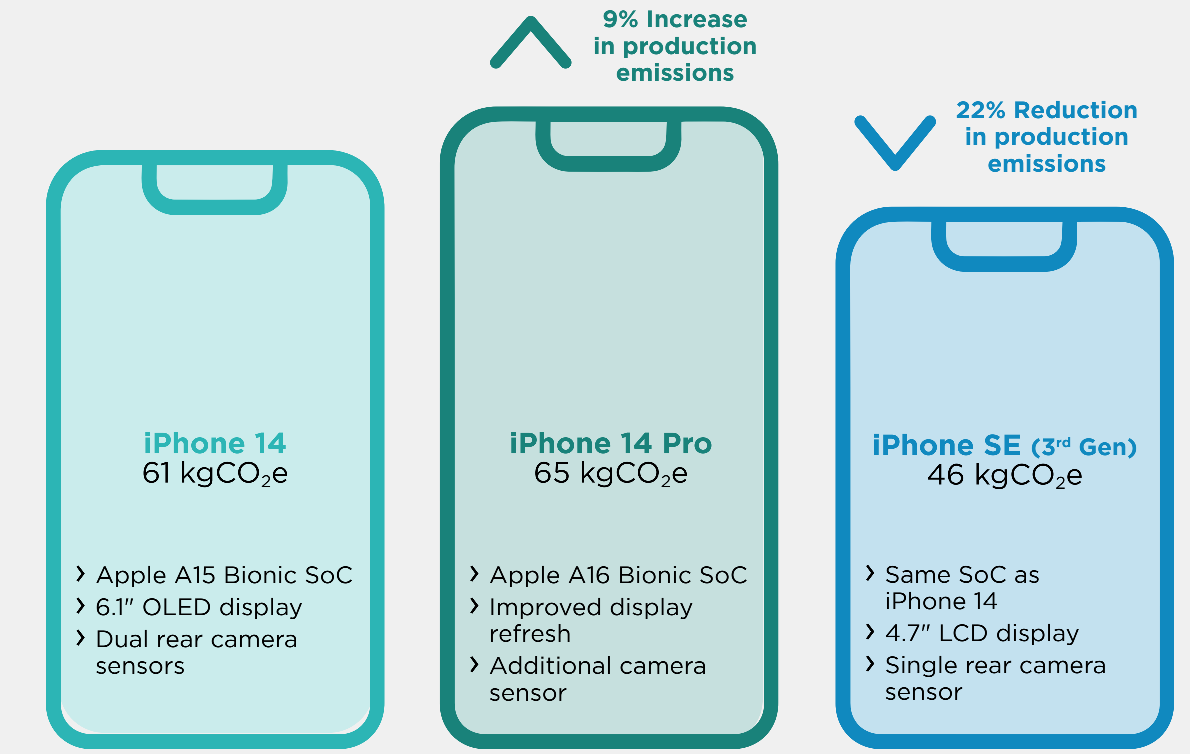
Of the three devices compared, they all share similar core features emblematic of the latest in smartphone technology, including Apple's A15 or A16 Bionic System on a Chip (SoC), 5G connectivity and NVMe flash storage.

Apple's entry level iPhone, the third-generation iPhone SE, shares similar computational performance with the iPhone 14 and achieves more than a 20% reduction in production emissions.

In comparison, the iPhone 14 Pro has an increase in production emissions of 9% relative to the iPhone 14 and includes premium features such as increased processing power through the next-generation A16 Bionic SoC, improved display and a third camera sensor.

As demonstrated with the iPhone SE, environmental performance is achievable today with the appropriate design intent.

**Figure 18** | iPhone SE – Apple's lower carbon iPhone




Source: Apple

70 apple.com/environment/pdf/products/iphone/iPhone_14_PER_Sept2022.pdf
71 apple.com/environment/pdf/products/iphone/iPhone_14_Pro_PER_Sept2022.pdf
72 apple.com/environment/pdf/products/iphone/iPhone_SE_PER_March2022.pdf

### 2.3.2. Business model innovation and circular economy (Categories 1, 2 and 11)

Considering the anticipated growth both in the number of global subscribers and smartphone penetration among subscribers...

**Operators should explore business model innovation to meet the demand for smartphones without increasing the production of new devices.**

***Business model innovation and circular economy***

**Implementation of circularity will require business model innovation in order to decouple economic value from physical output and enable robust implementation of circularity.**

Alternative business models should be explored including end-to-end, hardware as a service and device as a service, and will require rapid implementation and commercialisation of robust takeback and repair systems to displace production of new smartphones to satisfy demand and maximise value retained with the ecosystem.

On paper, extending the lifetime of devices is logical and the effect on Scope 3 emissions for MNOs is undeniably strong, particularly when paired with a focus on energy efficiency to mitigate the additional lifetime use phase emissions of the devices.

***Extending the lifetime of devices***

A plausible route towards addressing the challenge of reducing environmental impact and carbon emissions from manufacturing of devices while accommodating growth in global subscribers is extending the lifetime of devices. Studies, such as those undertaken by Fairphone, conclude that extending the use phase is a strong measure to influence overall environmental impact[73].

## Orange 'Re' scheme: take-back and refurbishment in practice

**Orange**

For the decade to 2018, **Orange** collected more than 15 million phones across Europe and are committed to collecting at least 30% of their total sales volumes per year by 2025 in each of their European operating countries.

If the phone still works and has a market value, the customer can exchange it for a voucher or discount as part of the 'Orange reprise' initiative. It will then be sent to specialist partners who will refurbish the device ready for a second life[74, 75].

73 fairphone.com/wp-content/uploads/2020/07/Fairphone_3_LCA.pdf
74 Give your phone a second life with Orange | Corporate
75 Let's recycle our old phones | Corporate (orange.com)

The GSMA's Strategy Paper on the Circular Economy of Devices[76] sets out the vision for the industry to move towards a circular model that maximises the lifetime of devices and the analysis performed within this section explores the effect on Scope 3 emissions in doing so.

There are use phase implications to maximising the lifetime of devices because the use of sold products is a significant emissions contributor for MNOs.

**In order to capitalise on lifetime extension of devices, there must also be a strong focus on improving energy efficiency of devices to mitigate the lifetime energy consumption of devices with longer lives.**

Extending the lifetime of devices has a significant impact on the volume of smartphones produced and sold due to the large existing install base of smartphones relative to new smartphone users. The effect of a one-year increase in replacement rate, from an estimated three years in 2021 to four years by 2030, is demonstrated with a simple model[77] as shown in Figure 19.

Maximising the lifetime of devices will affect two Scope 3 categories:

- **Category 1** through the embodied carbon to manufacture devices which are then sold through to customers; and
- **Category 11** through the lifetime use phase emissions of devices sold through to customers[78].

Realising reductions in use phase emissions will require a continued focus on energy efficiency. For new devices, including handsets, tablets and, for some operators, customer-premises equipment (such as set-top boxes and gateways) as well, energy efficiency improvements to reduce device energy consumption by at least 25% should be targeted to stay on track for achieving targets. For re-used and refurbished devices, which have a significant role to play in reducing Scope 3 emissions from purchased goods and services, energy efficiency improvements implemented

**Figure 19** | Modelled effect of one-year increase to replacement rate on smartphone sales


Source: The Carbon Trust analysis

76 gsma.com/betterfuture/resources/strategy-paper-for-circular-economy-mobile-devices
77 The model captures both new smartphone sales resulting from the combination of increased subscribers and increased smartphone penetration, as well as smartphone replacements based on replacement rate.
78 Category 11 emissions are calculated according to the GHG Protocol Value Chain Standard by accounting for the lifetime use phase emissions of a product in the year that it is sold. An increase in device lifetime without a reduction in energy efficiency will result in an increase in category 11 emissions of that product.

during the life of the device through over-the-air firmware and software updates will be increasingly important.

*Bringing customers along the journey*

**Operators should engage with customers to increase their understanding of the environmental impact of their purchasing decisions and incentivise customers to keep their devices longer.**

Technology is not necessarily the limiting factor in extending device lifetimes. Customers are a critical component of the equation and have been historically marketed a short upgrade cycle since the advent of the smartphone. Smartphone performance and innovation has plateaued, which presents a golden opportunity to capitalise on longer life of devices, although it is expected that 5G will be a compelling reason to upgrade.

Example modelling to show the change in emissions by extending device lifetimes and improving their energy efficiency is shown in Figure 20.

### 2.3.3. Engagement in energy policy (Category 11)

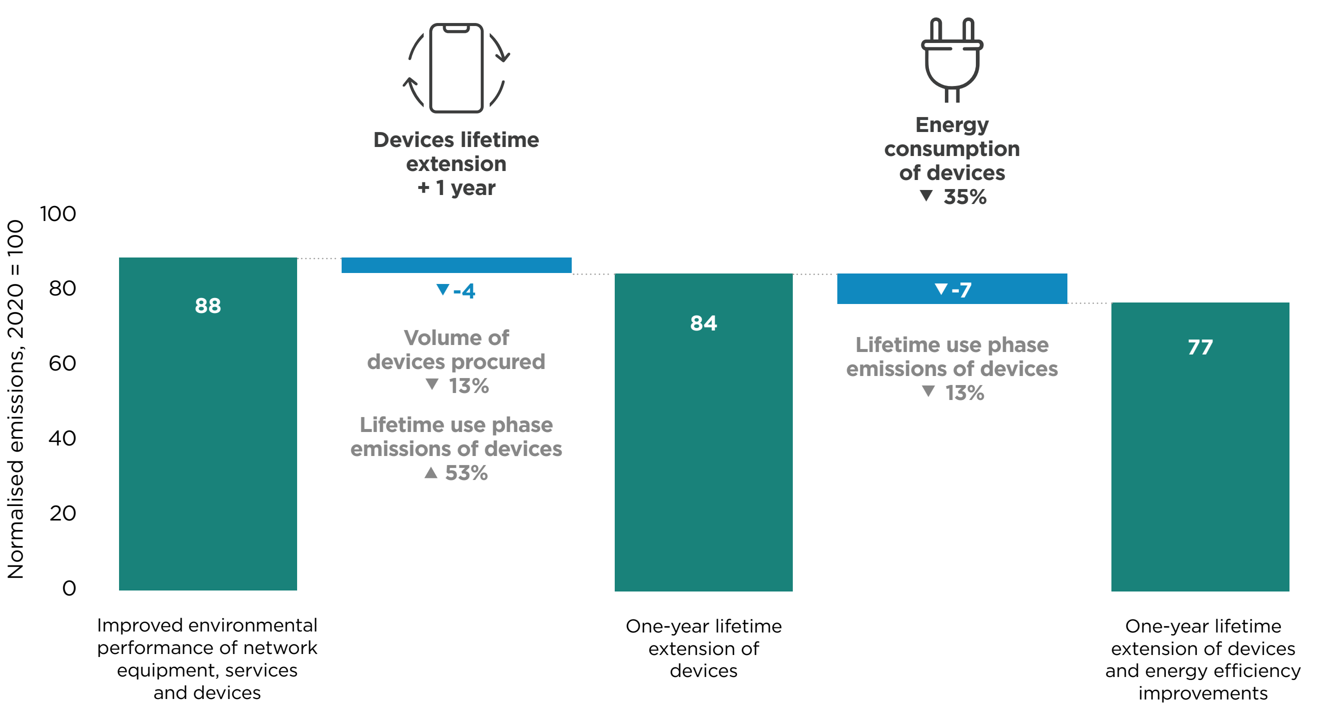
Due to the nature of energy and electricity supply...

**MNOs must engage in policy to steer the grid towards rapid decarbonisation by 2030.**

Customer use phase emissions are dependent on grid average electricity emissions associated with the region of use so, in order to realise use phase emission reductions, decarbonisation of regional and national grid electricity is required.

Grid decarbonisation plays a critical role in not only decarbonising the emissions of the telecommunications sector, but also decarbonising the global economy. In the context of MNOs' Scope 3 emissions, decarbonisation of the electrical grid will translate into emission reductions

**Figure 20** | Addressing emissions from devices through lifetime extension and energy efficiency




Source: The Carbon Trust analysis

in customer use of devices[79]. This is demonstrated in Figure 21, which builds on the interventions previously modelled across categories 1, 2 and 11.

Refer to Section 2.2.4 Engagement in Energy Policy for more information on policy initiatives and actions that MNOs can take.

### 2.3.4. Opportunities for engagement with investments and joint ventures (Category 15)

**Operators should engage directly with their joint ventures to accurately track and report emissions from JVs and to aid in target setting and understanding the best carbon reduction opportunities.**

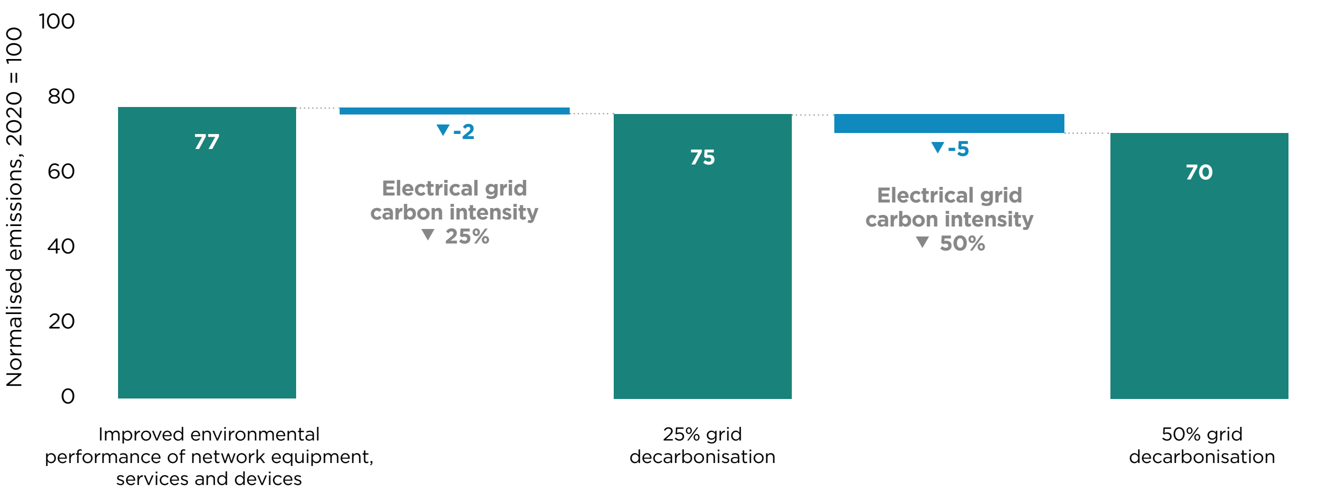
For many MNOs, investments contribute a considerable proportion of Scope 3 emissions. In addition to the interventions discussed and explored, decarbonisation of investments – which, for many MNOs, are joint ventures in the telecommunications industry including tower companies – requires a collaborative approach. For many JVs in the telecommunications space, the concepts explored across this guide will be applicable.

### 2.3.5. Summary of Scope 3 emission reduction opportunities

The results of the opportunities explored in this section have been summarised in an example roadmap to achievement of Scope 3 emissions reductions on the scale required to meet near-term SBTs (Figure 22). This demonstrates the scale and breadth of action required, including a focus on reducing emissions in the Scope 3 categories not specifically addressed in this guide.

While the exact path chosen by each organisation will vary, identifying and implementing opportunities across the supply chain is necessary to achieve emission reductions on the scale required for science-based targets.

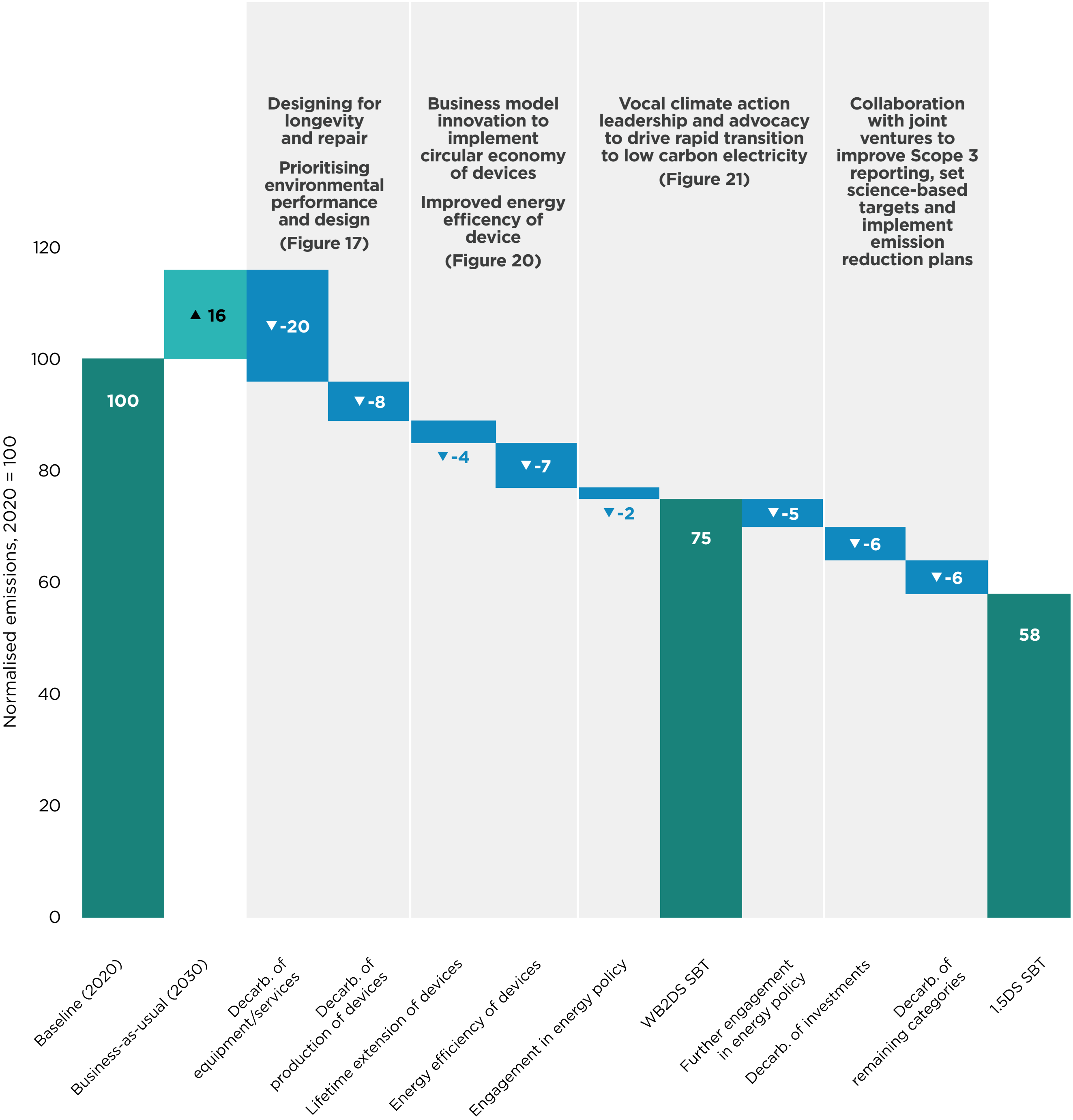
**Figure 21** | Effect of electrical grid decarbonisation on Scope 3 emissions




Source: The Carbon Trust analysis

79 This is demonstrated with a 25% reduction in electrical grid carbon intensity yielding a 3 percentage point reduction relative to previously modelled interventions and achieving a WB2DS scope 3 target (key message). A further 3 percentage point reduction is achieved with a 50% reduction in grid carbon intensity.

**Figure 22** | Example roadmap to Scope 3 near-term science-based target achievement




Source: The Carbon Trust analysis

# 3. Develop an implementation plan to achieve targets

Assess emission hotspots → Identify emission reduction opportunities → **Develop implementation plans**

Operators should develop an implementation plan to consider how the opportunities identified across Scopes 1, 2 and 3 will stack up to achieve science-based targets.

This can be broadly summarised in a four-step process:

1. Incorporate opportunities into an implementation plan
2. Model emission inventories to determine feasibility of implementation plan
3. Account for and track emission reductions over time
4. Enable success within the business

## 3.1. Incorporate opportunities into an implementation plan

An implementation plan will serve as a useful tool and guide as companies set out to achieve their science-based targets, gain support within the organisation and track progress over time. Operators should follow these steps to develop their plan:

***Summarise opportunities identified across Scopes 1, 2 and 3***

A summary of the opportunities identified across Scopes 1, 2 and 3 will help to formulate the implementation plan.

**For each opportunity, operators should summarise the emission reduction potential, expected implementation costs and time, as well as ease and likelihood of implementation.**

The summaries of decarbonisation opportunities presented in Section 2.2 serve as an example of this.

***Map out emission reduction opportunities that are planned for implementation across the target timeframe***

**Next, operators should map the specific reductions that are targeted for implementation against the implementation timeline and target timeframe.**

It will be helpful to separately map opportunities against Scopes 1, 2 and 3, particularly when the organisation has separate targets governing these Scopes. Reference Section 2.2.5 of this guide for an example of an implementation roadmap for Scopes 1 and 2.

***Engage with leadership early to gain support***

> **Gaining early buy-in from leadership will be important to taking action on the opportunities in the implementation plan.**

The implementation plan and feasibility assessments will facilitate initial communication of the strategy to achieve science-based targets and demonstrate the scale of action required.

## 3.2. Model emission inventories to determine feasibility of implementation plan

Modelling emissions inventories throughout the model timeframe will enable organisations to assess the feasibility of their implementation plan and refine as necessary. This process is iterative and will be useful to perform periodically throughout the target timeframe as implementation plans progress and evolve.

***Begin with modelling a business-as-usual pathway based on emission hotspots, growth and industry trends***

A useful starting point in this process is to evaluate a business-as-usual emissions pathway. This will enable organisations to assess the impact of growth of the business of GHG inventories and consider the effect of industry trends.

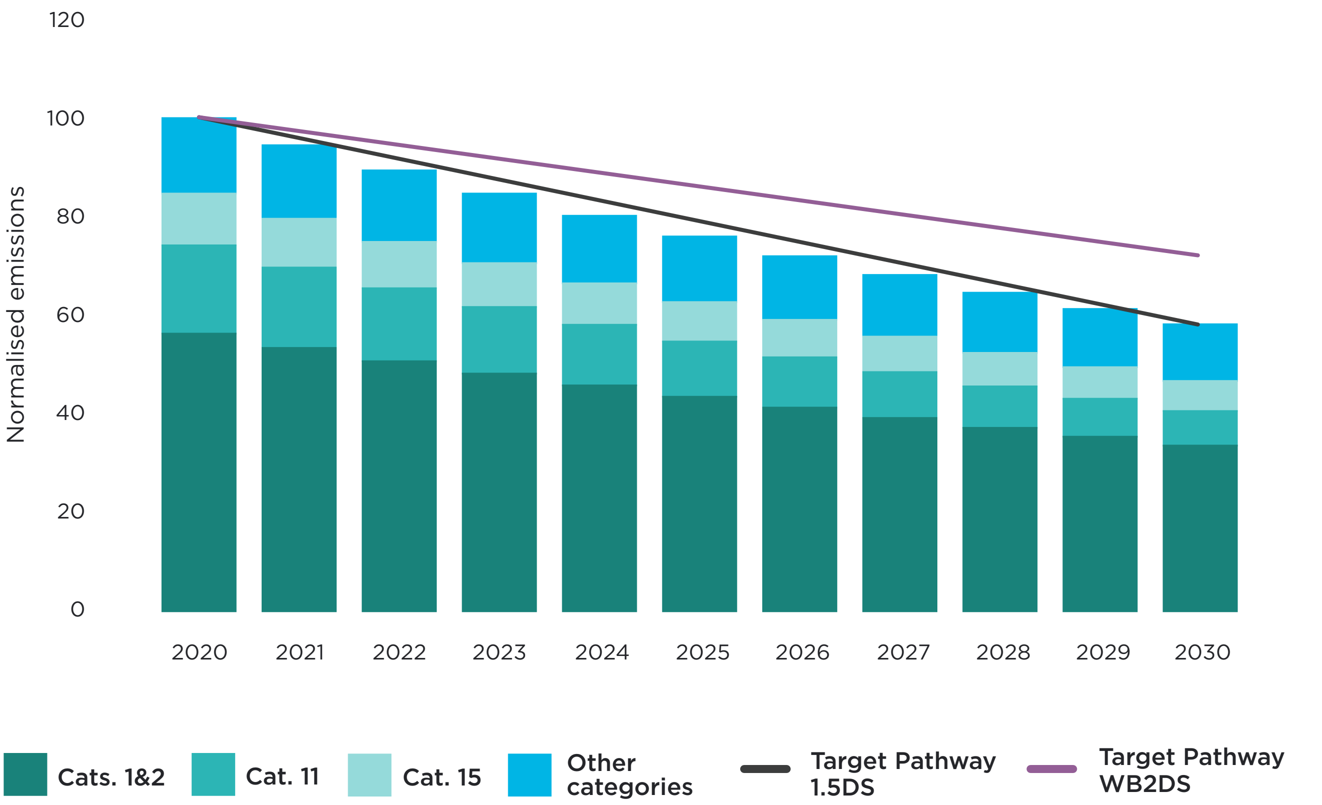
Generally, a BAU emissions pathway will start with the base year emissions inventory, scale the inventory against a business metric to model the effect of growth and then apply the effect of industry trends.

Business metrics used to scale the inventory should have as direct a relationship as possible on the emission sources of the business operations.

For example, MNOs may consider the number of subscribers they serve or the quantity of base stations they operate as a growth metric. Economic metrics may also be used, but tend to have less of a direct relationship to emission sources.

For further detail, see Appendix for an example and detailed description of the business-as-usual scenario developed for use in this guide.

**Figure 23** | Example model of Scope 3 emissions inventory against implementation plan




Source: The Carbon Trust analysis

***Reference implementation plan to model the emission reductions from actions taken across Scopes 1, 2 and 3***

Building on the business-as-usual pathway developed, the implementation plan should be incorporated into the feasibility assessment.

It is important to consider the range of uncertainty associated with the emission reductions of each opportunity in the implementation plan to gain an accurate view of the feasibility of achieving science-based targets.

***Compare against science-based target***

The modelled emissions pathway should be compared with the organisation's science-based targets to determine whether they are projected to achieve said targets and if not, to assess the gap to target and identify areas of the GHG inventory for further exploration of reduction opportunities. An example of the output of this approach is provided in the figure above.

***Iterate to incorporate and adjust new opportunities to achieve target and manage uncertainty***

This process is intended to be iterative. In the early phases of planning an implementation plan, variations of the implementation plan should be evaluated to determine effectiveness.

Throughout the target timeframe, it is also helpful to revisit and update the feasibility model to account for opportunities that have been effectively implemented, reassess feasibility of target achievement and build new emission reduction opportunities into the implementation plan.

Operators may consider performing this process annually alongside tracking GHG inventories or as significant changes to the implementation plan occur.

# Climate Leadership A-listers

**Thirteen mobile network operators make the grade**

**AT&T, BT, Deutsche Telekom, KDDI, KPN, Proximus, SK Telecom, Taiwan Mobile, Tele2, Telefónica, Telekom Austria, Telstra** and **Vodafone** were recognised by the CDP as climate leaders through inclusion in CDP's 2022 A list for climate change. These companies demonstrate climate leadership through their governance structure, with board-level oversight of climate-related issues, supply chain engagement, use of internal carbon pricing to drive energy efficiency and low-carbon investment, and more.

### 3.3. Account for and track emission reductions over time

**Operators should monitor GHG inventories, track progress against targets and publicly disclose results annually.**

Recommendations for reporting and disclosure include communication of GHG inventories within annual sustainability reports and through CDP.

Tracking progress over time will enable MNOs to assess the effectiveness of implementation and make adjustments as necessary during the target timeframe, while disclosure will provide a transparent means of communicating progress towards target commitments.

***Monitoring GHG inventory for changes due to data quality and estimation methodology***

**MNOs should establish and follow a recalculation policy to manage this process.**

Refer to the GHG Protocol Corporate Standard and Value Chain Standard for further information.

Organisations will naturally seek to improve the quality of data and accuracy of estimation methodologies that support accounting and reporting GHG inventories.

It may be necessary to recalculate base year emissions during the target timeframe as GHG inventory quality improves. This will ensure a consistent baseline for tracking progress against targets.

***Scope 3 emissions variations and uncertainty***

Accurate reporting of Scope 3 emissions is necessary for operators to effectively set targets and track their progress towards target achievement. Scope 3 emissions are challenging to accurately report due to the scale of data requirements, as well as the difficulty of obtaining accurate datasets from across the value chain. Organisations set different boundaries to define what is included in their Scope 3 inventory and methodologies used to estimate these emissions may vary from operator to operator, making comparison between organisations a challenge.

***Maturation of GHG accounting to accurately estimate emissions and track reductions***

Maturation of GHG accounting is required to more accurately report and track progress towards achieving carbon emission reduction targets. Furthermore, many GHG inventories, particularly Scope 3, rely on secondary and proxy data sources which do not accurately reflect emissions in the supply chain.

The sector recognises this as a critical hurdle to overcome on its pathway towards achieving SBTs and a collaborative effort by GSMA, ITU and GeSi aims to achieve standardisation of Scope 3 emissions reporting across the sector.

**Operators should use the latest industry guidance on Scope 3 accounting and reporting to align methodologies and streamline data requirements across the industry.**

Product-level footprinting must also rapidly scale and improve in order to realise carbon emission targets in the supply chain with focus areas on network equipment, devices and cloud services.

**Operators should collaborate with industry groups such as the GSMA, the GeSI and the ITU to identify opportunities and implement solutions to simplify the data collection and reporting process.**

The improvement of footprinting methods for the semiconductor industry is instrumental to improving product footprinting capability of telecommunications companies because it has high carbon impact potential and rapid technological development means that modern LCA techniques typically lag by a number of years. Refer to Section 1.3 for more specific information.

## 3.4. Enable success within the business

Bringing an emission reduction strategy to fruition requires strong climate leadership that pervades the entire organisation and catalyses action across the industry. Companies that have proactively set science-based targets, begun to formulate and implement low carbon transition plans and transparently report on progress towards targets have already demonstrated qualities of climate leadership. However, there is more to climate leadership than setting carbon targets and reporting on performance towards target achievement.

***Ensure accountability for climate action***

Climate leadership begins with governance and, for climate-related issues, the buck stops at the highest levels of the organisation: the board of directors, CEO and C-suite executives. In practice, this means board-level oversight of climate-related issues and a C-suite that is personally in charge of taking climate action.

A clear governance structure for climate-related issues must be created to establish accountability and transparency. Direction must come from the top, with executive leadership setting the expectations for the scale and urgency of the response to today's climate crisis. Business leaders are fundamental in establishing the strategy within their organisation to reduce greenhouse gas emissions in their own operations and supply chain. Executive leadership must motivate and support their teams by:

- Ensuring adequate resources within the organisation are devoted to climate action;
- Encouraging the development of innovative business models supported by climate-friendly products and services;
- Engaging with policymakers to advocate for widescale renewable electricity projects; and
- Incorporating performance on climate action into executive remuneration.

***Embedding climate strategies in the business***

Climate leaders make climate action a priority and embed sustainability strategies into the business at a fundamental level. Common practices among climate leaders include:

- Climate-related performance remuneration
- Procurement and purchasing processes
- Risk and opportunity planning
- Internal carbon pricing

***Transparent and vocal climate advocacy***

Finally, delivering on climate action cannot be done in isolation and public policy plays a pivotal role in achieving science-based targets. It is essential that corporate climate leaders wield their influence to vocalise their advocacy for strong climate policy. This means dedicating funding for engagement in climate policy advocacy, aligning trade associations and industry bodies and aligning policy advocacy efforts across the organisation with sustainability and climate objectives.

This guide is designed to provide a suite of options and suggested plan for mobile network operators to consider when designing and implementing a strategy to reduce carbon emissions in line with science. Each company is different and so will need to develop its own specific approach considering factors such as technology availability and cost, current level of climate knowledge and development, policies in markets where operations occur, company structure and resourcing, among others. This guide shows that reaching such targets is both feasible and desirable, and will prepare a company well for the future.

# Appendix

## Scope 3 feasibility model methodology

This appendix documents the key model characteristics and assumptions used to generate the modelling results and analysis presented within the Decarbonising Scope 3 Emissions for MNOs section of this report.

The modelling philosophy is to create a model that can demonstrate the impact of change to high-level parameters that affect Scope 3 emissions for MNOs, such as the carbon intensity to produce network equipment and carbon intensity of the electrical grid. Therefore, the model can be used as a tool to guide high-level decision-making and establishment sub-targets governing each of the modelling parameters. The model is not intended to be used as a forecast for what is expected to happen to Scope 3 emissions, but instead sheds light on what the overall effect on Scope 3 emissions for a representative MNO would be were the improvements to the modelling parameters realised.

## Model characteristics

The feasibility model used reflects a simplified Scope 3 footprint, following the GHG Protocol Value Chain Standard methodology. Each category comprises simple modelling parameters which enable the model to reflect changes in key contributors to MNOs' Scope 3 emissions.

***Categories 1 and 2: Purchased goods and services and capital goods***

Categories 1 and 2 are modelled as a combined category with six distinct modelling parameters, as described in the equation below.

$$\textbf{Cat. 1 and 2 emissions} = (\textbf{volume}_{\text{network equipment}} \times \textbf{carbon intensity}_{\text{network equipment}}) + (\textbf{volume}_{\text{devices}} \times \textbf{carbon intensity}_{\text{devices}}) + ()\textbf{volume}_{\text{services}} \times \textbf{carbon intensity}_{\text{services}})$$

This is primarily designed to reflect the key contributors to Scope 3 emissions as the embodied carbon from manufacture and procurement of network equipment, devices and services.

***Category 11: Use of sold products***

Category 11 is modelled with three distinct modelling parameters as described in the equation below. This reflects that category 11 emissions for MNOs are usually completely composed of lifetime emissions of devices sold on to customers.

***Category 15: Investments***

$$\textbf{Cat. 11 emissions} = \textbf{volume}_{\text{sold devices}} \times \textbf{lifetime energy consumption}_{\text{sold devices}} \times \textbf{grid carbon intensity}$$

Category 15 is modelled with two distinct modelling parameters as described in the equation below. This reflects the fact that category 15 emissions for MNOs are typically composed of Scope 1, 2 and 3 emissions from joint ventures.

$$\textbf{Cat. 15 emissions} = \textbf{Equity share}_{\text{investments}} \times \textbf{Scope 1, 2 and 3 emissions}_{\text{investments}}$$

# Modelling methodology

*All remaining categories*

All remaining categories are modelled together as a simple one-parameter reduction pathway that reflects total emissions across these categories.
To generate an emissions projection, there is a three-step modelling methodology:

1 Establish a representative Scope 3 emissions baseline for 2020, composed of the categories and parameters described above and normalised to 100.

A representative Scope 3 baseline for 2020 was established using data provided by GSMA Intelligence, representing 29 MNOs from Asia, North America, Europe, Middle East and South America. For each category, a weighted average emissions value was calculated. The weighted average emissions values for each category were then used to estimate the proportion of total Scope 3 emissions attributable to each Scope 3 category. The resulting proportions used in the model are shown below.

**Representative baseline Scope 3 emissions for MNOs**

| Category | Emissions (Normalised to 100) |
|---|---|
| 1 and 2 | 56 |
| 11 | 18 |
| 15 | 10 |
| Other | 15 |
| Total | 100 |

Categories 1 and 2 required further breakdown to represent the contribution of network equipment, devices and services to these emissions categories. A representative simple split of 70/30 was used for goods/services and, within goods, a simple split of 50/50 was used for network equipment/ devices. This was sense-checked against GSMA member data.

**Representative baseline makeup of category 1 and 2 emissions**

| Product | Proportion of emissions |
|---|---|
| Network Equipment | 35% |
| Devices | 35% |
| Services | 30% |

2 Generate a value for each modelling parameter in 2030 relative to that parameter's 2020 baseline and expressed as a percentage of the 2020 value.

3 Apply the relative 2030 value to each parameter in the model and aggregate Scope 3 emissions results.

# Modelling assumptions

***Target Pathways***

The target pathways used in the analysis for comparison against the emissions model assume that the full Scope 3 footprint is included in the target boundary. A base year of 2020 and a target year of 2030 were used. The target pathway assumed an absolute Scope 3 emissions near-term target following either a well-below 2°C (WB2DS) or 1.5°C (1.5DS) pathway, both of which are currently compatible with the SBTi's Net-Zero Standard, corresponding to a 25% reduction and 42% reduction in absolute Scope 3 emissions respectively in the target period.

***Business-as-usual (BAU) scenario***

To demonstrate the effect on Scope 3 emissions with a business-as-usual approach, a BAU scenario was developed. This scenario assumes that growth occurs at a rate coupled to growth in global subscribers to 2030 translating to an increase in products purchased, investment in JVs and handsets sold through to customers. Small improvements to energy efficiency may occur, but there is no coordinated effort across the supply chain to manage energy efficiency of sold devices or decarbonisation of the electrical grid.

Total global subscribers are assumed to grow from 5.2 billion in 2019 to 5.7 billion in 2025 and an approximate of six billion in 2030, representing a compound annual growth rate of 1.3% over this time period. The 2019 and 2025 figures are sourced from GSMA's The Mobile Economy Report 2019 and The Mobile Economy Report 2022 respectively. No projections for a 2030 data point could be found, so a simple assumption of six billion was used in 2030. There is uncertainty associated with this estimate, however it was determined to be reasonable because it sits within the range of growth from global population projections (0.9% CAGR from 2021 to 2030 based on UN figures[80]) and extrapolation of available GSMA data and projections (1.5% CAGR between 2019 and 2025).

Procurement of network equipment and services, along with financial equity of investments, are coupled to growth in global subscribers at 1.3% CAGR. Growth in global smartphone sales is modelled to reflect a three-year replacement rate and additional smartphone sales from new subscribers, resulting in a CAGR of 1.7% to 2030. For simplicity of modelling, sold devices inherit the growth assumption related to smartphones. Carbon intensity to manufacture and produce network equipment, devices and services is assumed to remain fixed at 2020 levels, as is carbon intensity related to investments. All other emissions categories are coupled to global growth in subscribers.

### BAU parameter values

| Category | Description | YOY % Change | Change to 2030 (relative to 2020) |
|---|---|---|---|
| 1 and 2 | Volume of network equipment | 1.3% | 14% |
| 1 and 2 | Carbon intensity of network equipment | 0.0% | 0% |
| 1 and 2 | Volume of devices | 1.7% | 18% |
| 1 and 2 | Carbon intensity of devices | 0.0% | 0% |
| 1 and 2 | Volume of services | 1.3% | 14% |
| 1 and 2 | Carbon intensity of services | 0.0% | 0% |
| 11 | Volume of sold product | 1.7% | 18% |
| 11 | Lifetime energy consumption of sold products | 0.0% | 0% |
| 11 | Grid carbon intensity | 0.0% | 0% |
| 15 | Financial equity | 1.3% | 14% |
| 15 | Emissions of investments | 0.0% | 0% |
| Other | Emissions | 1.3% | 14% |

80 un.org/en/development/desa/population/events/pdf/other/21/21June_FINAL%20PRESS%20RELEASE_WPP17.pdf, population.un.org/dataportal/home

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