GSMA

Mobile Net Zero 2025
State of the Industry on Climate Action

June 2025

GSMA

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.

We invite you to find out more at **gsma.com**

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Foreword

2025 marks a pivotal moment in the global climate journey – we are now just five years from 2030, a key milestone on the path to net zero.

As we present the mobile sector's fifth annual assessment of progress toward our 2050 net zero goal, we see encouraging signs: while challenges persist, momentum is building. Despite a global surge in data demand and network coverage, emissions from mobile operators have fallen by 8% between 2019 and 2023, with reductions accelerating in recent years.

Regions such as Europe, North America and Latin America are leading the way, delivering emission reductions that surpass the trajectory needed to meet 2030 targets. Notably, our preliminary data for 2024 indicates the first-ever decline in operators' emissions in China – an important milestone with global significance.

Staying on track towards net zero requires accelerated progress across all regions and throughout the value chain. With 70% of the mobile industry's carbon emissions stemming from the value chain, engaging suppliers and customers is not optional – it is essential.

Yet, climate action is not just a necessity – it is also an enormous business opportunity. Our recent report on circularity reveals how evolving customer preferences and emerging regulatory trends are making a stronger business case for a more circular economy in the sector.

Climate action reduces costs, mitigates risk and opens new revenue streams. Energy-efficient networks, the use of renewable energy, green and circular products and services are helping the industry lead by example. Together, they can contribute to revenue growth, enhanced supply chain resilience and meeting rising expectations of customers, investors and employees.

The realities of climate change are now undeniable. Mobile networks – the backbone of our digital societies – are increasingly exposed to extreme weather events. This growing risk highlights the urgency of integrating both adaptation and mitigation into core business strategies through robust climate transition plans.

Ultimately, the race to net zero is a shared journey we must all complete. Reaching our climate goals will require industry-wide collaboration as well as supportive, forward-looking policies from governments.

Together, we can build a mobile industry that is not only resilient and competitive but also sustainable – for generations to come.

Alix Jagueneau

Alix Jagueneau
Head of External Affairs, GSMA

Executive Summary

Climate action is a strategic and business priority for the mobile industry. In 2019, the mobile industry set a goal to reach net zero by 2050, becoming one of the first sectors in the world to set such an ambitious target. This report is the fifth annual assessment of the industry's progress towards this goal, and provides key recommendations for how mobile network operators, suppliers and governments can work together to accelerate progress across the sector.

The GSMA Climate Action Taskforce now covers 80% of mobile connections with 77 members operating networks in more than 150 countries and territories around the world. This shows the willingness of operators to work together to reach net zero.

Mobile network operators are leaders in proactively committing to voluntary climate targets. As of April 2025, 81 operators have set or committed to near-term science-based targets (SBTs) under the Science Based Targets Initiative (SBTi), representing nearly half of the industry by connections and two-thirds by revenue. The SBTi has validated 71 of these targets. In addition, 45 operators have committed to net zero targets, of which 35 have been validated by the SBTi. The ambition is highlighted by the fact that half of the validated targets are aiming to achieve net zero by 2040 or earlier.

A growing number of operators are publicly disclosing their climate impacts. A total of 78 mobile network operators, representing nearly 60% of mobile connections globally, disclosed to the CDP in 2024, up from 61 in 2020. Data was also gathered from an additional 23 operators' sustainability reports, bringing the total coverage of disclosures to 101 operators, representing 82% of connections.

The quality of disclosures from operators continues to exceed other sectors, with 17 operators receiving an A score from the CDP in 2024. Mobile operators are exceptionally well-represented in the CDP A List, with 22% of disclosing operators receiving the highest (A) score, compared with less than 2% for all other companies disclosing to the CDP.

Operational emissions fell by 8% between 2019 and 2023, while mobile connections rose 9% and data traffic nearly quadrupled. Over the same period, global CO_2 emissions increased 3%, showing that the mobile sector is outperforming many other sectors in reducing emissions thanks to strong progress on energy efficiency and renewable energy.

Operational emissions in most regions fell between 2019 and 2023, led by substantial reductions in Europe (56% reduction), North America (44%) and Latin America (36%). Operational emissions in Greater China rose 8% but fell 7% in terms of emissions per connection. Preliminary data for 2024 indicate that emissions in Greater China fell in 2024 for the first time, contributing to a global reduction of over 4%. Further progress across all regions is needed to accelerate average annual reductions to 7.5% to achieve the sector's 2030 target.

Operators consumed around 290 TWh of electricity in 2023, or around 1% of global electricity use. Electricity use in 2023 was around 12% higher than in 2019, driven primarily by strong growth in Greater China. Electricity use by operators in Greater China has increased by 30% between 2019 and 2023, but growth rates have slowed in recent years. Electricity use per connection at the global level has been flat since 2019 at around 30 kWh per connection in 2023, with an average mobile connection using around 25 kWh, and an average fixed connection using around 50 kWh. Networks account for more than three-quarters of overall electricity use for most operators, primarily from mobile access networks.

Artificial intelligence (AI) is driving data centre energy demand growth but is expected to have limited impacts on energy use for most network operators. Global data centre energy use rose by 50% between 2019 and 2023, due to growing demand. Near-term data centre energy demand growth is expected to be driven by generative AI workloads in cloud and hyperscale data centres, with limited impact on most mobile operators. Within the context of other more significant drivers of data traffic and connections such as streaming video, IoT and extended reality, AI is unlikely to be an important driver of network energy use over the near term. AI and machine learning applications could help to improve the energy efficiency of network operations.

Renewable energy is already playing a major role in reducing mobile operators' emissions, accounting for nearly half of the reductions between 2022 and 2023. In 2023, operators disclosing to the CDP purchased 37% of their electricity from renewables (54 TWh), up from 14% in 2019. Without these renewable energy purchases, operational carbon emissions are estimated to have been 16 million tonnes (32%) higher in 2023. In 2023, 12 operators matched 100% of their electricity use with renewable energy purchases.

Around 70% of the mobile industry's overall carbon emissions are Scope 3 value chain emissions, highlighting the importance of engaging supply chains and customers. Operators have improved the coverage and quality of Scope 3 disclosures – the most difficult emissions to measure – with around 60% of operators disclosing to the CDP reporting on 10 or more Scope 3 categories. More than 80% of Scope 3 emissions came from just four categories: 1) Purchased goods and services; 2) Capital goods; 3) Fuel- and energy-related activities; and 11) Use of sold products. Varying business models, country contexts and accounting approaches result in significant differences in Scope 3 emissions across operators.

Suppliers are also making strong progress on climate, but further action and engagement is needed. An analysis of 70 top suppliers shows that nearly two-thirds of network equipment and customer premises equipment manufacturers and more than half of mobile phone manufacturers have set or committed to near-term SBTs.

Increasing the circularity of mobile phones and network equipment is critical to reducing value chain emissions. For example, materials and manufacturing account for around 70–90% of the life cycle emissions of a typical smartphone. This means that longer device lifespans can deliver substantial emission reductions and savings. Repaired and refurbished phones typically have 80–90% lower carbon emissions than new phones. A survey of 31 leading operators in 2024 shows that operators are making progress on circularity, including 50% of operators surveyed having made 'significant progress' on circularity of customer premises equipment, with high shares of takeback and refurbished equipment.

Circular business models are gaining traction in the mobile industry and beyond, and offer many commercial opportunities and benefits, including lower costs, new revenue opportunities and customer loyalty. The growing market for refurbished phones and repair services – projected to exceed $150 billion globally by 2027 – offers new revenue streams for manufacturers and operators.

The GSMA Global Consumer Survey on Circularity finds that consumers are increasingly interested in more circular products and services. Results from the survey of more than 13,000 mobile phone users in 32 countries found that consumers strongly value device longevity, with around 90% of consumers rating durability, longer software and security updates and easy and low-cost repair as important factors in their next purchase decision. The latest market data shows that average upgrade cycles have slowed to around 3.5 years globally, with new phone sales slowing in recent years. New smartphone sales fell 15% between 2021 and 2023, while used and refurbished phone sales rose 15%. Nearly half of consumers surveyed globally were likely to consider a refurbished phone for their next purchase, with cost savings cited as the most important benefit of buying refurbished.

Mobile network infrastructure and other critical infrastructures must become more climate resilient to continue operating and supporting our societies. Leading operators are clearly communicating their climate-related risks and opportunities and how they are enhancing resilience through Climate Transition Plans. The GSMA is working with operators to develop transition planning guidance for telecommunication services.

Achieving the industry's net zero goal requires concerted action from operators and suppliers, supported by enabling policies and investment from governments. For operators and suppliers, the biggest opportunities are in energy efficiency, renewable energy and circularity. Governments should play a key enabling role to support the private sector across these areas by implementing climate, energy and industrial policies that encourage investment in renewable energy and grids, accelerate energy efficiency and support circularity across the value chain.

1 Net zero ambition

In 2019, the mobile industry set an ambitious goal to reach net zero by 2050. This report is the fifth annual assessment of the industry's progress towards this goal.

Tracking the industry's progress towards net zero

In February 2019, the Board of the GSMA made a milestone commitment – to transform the mobile industry to reach net zero carbon emissions by 2050. The mobile industry became one of the first sectors in the world to set such an ambitious target.

This report represents a mid-way point between the commitments and near-term milestones in 2030.

The report aims to answer three key questions:

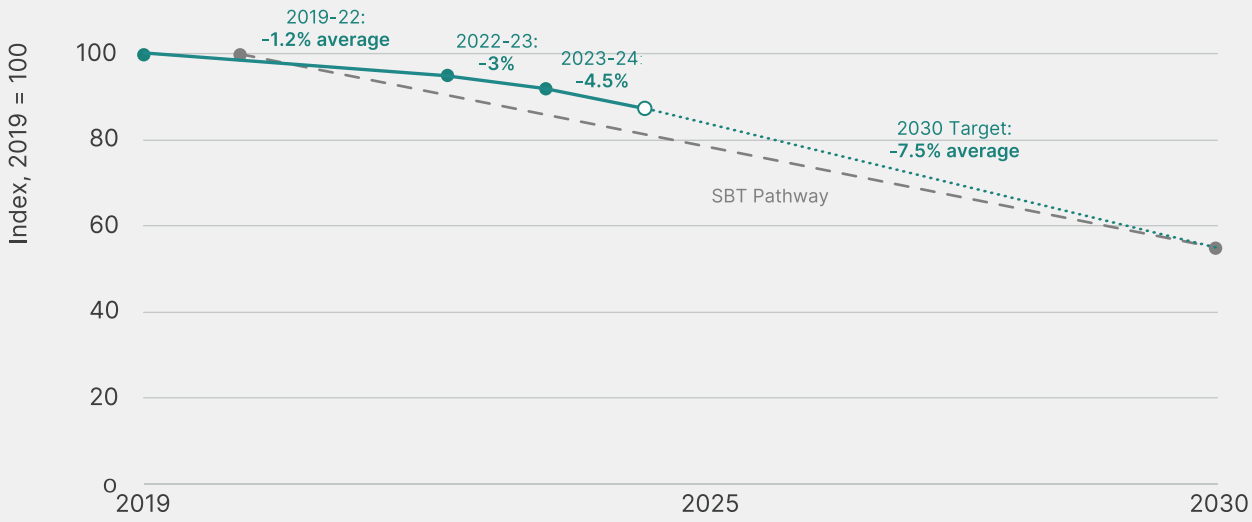
1. What progress has the mobile sector made towards net zero?
2. Is the sector on track to reach its short- and long-term climate targets?
3. Where is progress being made that could be replicated to achieve net zero?

Tracking progress towards climate targets

In February 2020, the ITU, GeSI, the GSMA and SBTi published guidance for information and communication technology (ICT) companies to set science-based targets (SBTs) aligned with limiting global warming to 1.5°C above pre-industrial levels. The guidance developed emissions reduction pathways for ICT subsectors, including a 45% reduction for mobile network operators between 2020 and 2030.

This report analyses mobile network operators' emissions trends from 2019 to 2023, with preliminary estimates for 2024. The analysis, detailed in Chapter 3, shows that the industry at the global level is not currently on track with the 45% reduction pathway by 2030 **(Figure 1)**. Some regions, including Europe and North America, have outpaced the reduction pathway, achieving average annual reductions of 19% and 14%, respectively. Further progress across all regions is needed to achieve the sector's 2030 target to increase the average annual reduction globally to around 7.5%.

Figure 1 Mobile network operators' progress towards their science-based targets pathway



Some regions have achieved rapid reductions since 2019, but further progress across all regions is needed for the sector to achieve its global target by 2030

Note: SBT pathway shows the subsector pathway for mobile network operators – a 45% reduction in combined Scope 1 and 2 emissions between 2020 and 2030 – as developed in the Guidance for ICT Companies Setting Science Based Targets. 2024 estimate for mobile operators is a preliminary estimate based on available data as of May 2025.

Source: GSMA analysis based on the latest CDP disclosures and corporate reports

1 https://www.gsma.com/solutions-and-impact/connectivity-for-good/external-affairs/gsma_resources/ict-guidance-report/

81 mobile operators – representing nearly half of mobile connections globally – have near-term science-based targets, including 71 operators with validated targets

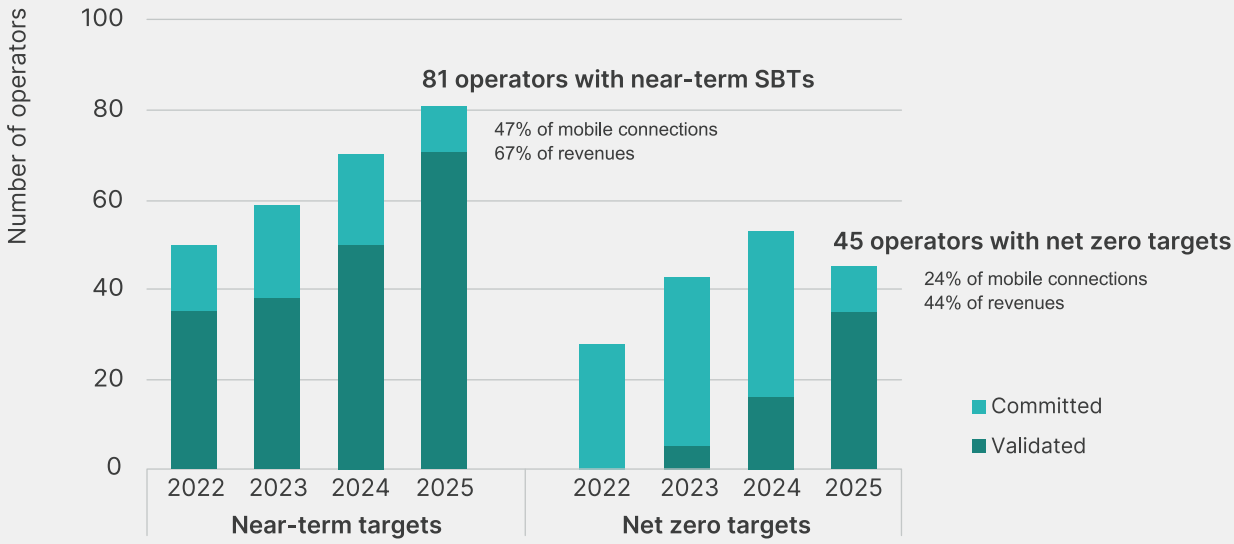
A growing number of mobile network operators worldwide have committed to rapidly reduce their carbon emissions, taking responsibility for their operational emissions as well as their indirect emissions up and down their value chains.

Near-term science-based targets (SBTs) are defined by the Science-Based Targets Initiative (SBTi) to set carbon-reduction targets in line with limiting global warming. First, an organisation commits to a target, then it is validated against a target level. Validated targets are in line with the ambition of the mobile sector to be net zero by 2050.

As of April 2025, 81 operators have set or committed to near-term SBTs, representing 47% of all mobile connections globally and two-thirds of revenue **(Figure 2)**. 19 targets were validated by the SBTi since January 2024, bringing the total number of validated targets to 71, representing 44% of all mobile connections.

Mobile operators' climate targets

Figure 2 Mobile operators' near-term science-based targets and net zero targets



81 mobile network operators, representing nearly half of mobile connections globally, have committed to near-term SBTs

Note: 2022 net zero targets are "Race to Zero" targets. 2025 data as of April 2025. Previous years' data are as of January of those years.

Source: GSMA analysis based on SBTi

Net zero targets submitted to the SBTi are validated by a team of technical experts of emissions reduction targets against the qualitative and quantitative corporate criteria.

Of the 45 operators that have submitted net zero targets to the SBTi, 35 have been validated. Since early 2024, 19 targets have been validated, more than doubling the number of validated targets, but several commitments were "removed" from the SBTi Dashboard due to companies not meeting deadlines for submitting validated targets or not reaching successful validation.[2] Half of the validated targets aim for net zero by 2040 or earlier, with the earliest being a 2030 target from TDC NET and 2035 targets from Tele2 and Swisscom.

For information explaining how to set science-based targets for mobile network operators, see the GSMA's step-by-step guide on Setting Climate Targets.

Case study **TDC NET**
Halfway to net zero in 2030

[2] For more details, refer to SBTi Service's Commitment Compliance Policy https://docs.sbtiservices.com/resources/CommitmentCompliancePolicy.pdf

The GSMA Climate Action Taskforce now has 77 operators across more than 150 countries and territories, representing 80% of mobile connections globally

Progress towards net zero has been strengthened and accelerated through collaboration between operators across the sector. To provide a forum for this collaboration, the GSMA created a Climate Action Taskforce in 2019.

The Taskforce has grown rapidly over the last six years and now has 77 members, representing more than 80% of mobile connections and networks in 159 countries and territories around the world

Members of the GSMA Climate Action Taskforce

The Climate Action Taskforce has four main purposes:

- To promote and encourage leadership on climate action to move the industry towards net zero carbon emissions by 2050.
- To agree climate policy frameworks and advocacy engagement to gain support from governments and other stakeholders for a fair and equitable net zero transition.
- To share best practices on climate action so operators support each other and raise their ambitions.

To create thought leadership and research on how mobile technologies support climate mitigation and adaptation.

Climate Action Taskforce Project Groups

There are currently three active project groups under the Climate Action Taskforce, focusing on the following topic areas:

- Circular Economy for Mobile Devices
- Climate Transition Planning
- Assessing Scope 3

The Climate Action Taskforce welcomes new mobile network operator members

Please contact the GSMA at **betterfuture@gsma.com** if you would like to join.

If you are not a mobile network operator but would like to follow the latest industry climate updates, please subscribe to the GSMA External Affairs newsletter.

2 Tracking progress on climate action

The latest data from operators show strong progress in most regions, demonstrating how operators in other markets can take action to reduce emissions.

This report analyses energy and emissions data from more than 100 mobile operators, including a record 78 disclosures to the CDP in 2024

Public disclosure of climate impacts is vital for transparency and to understand progress towards net zero. The CDP provides the most widely used global disclosure system for investors, companies, cities, states and regions. In 2024, nearly 25,000 companies reported environmental data through the CDP.

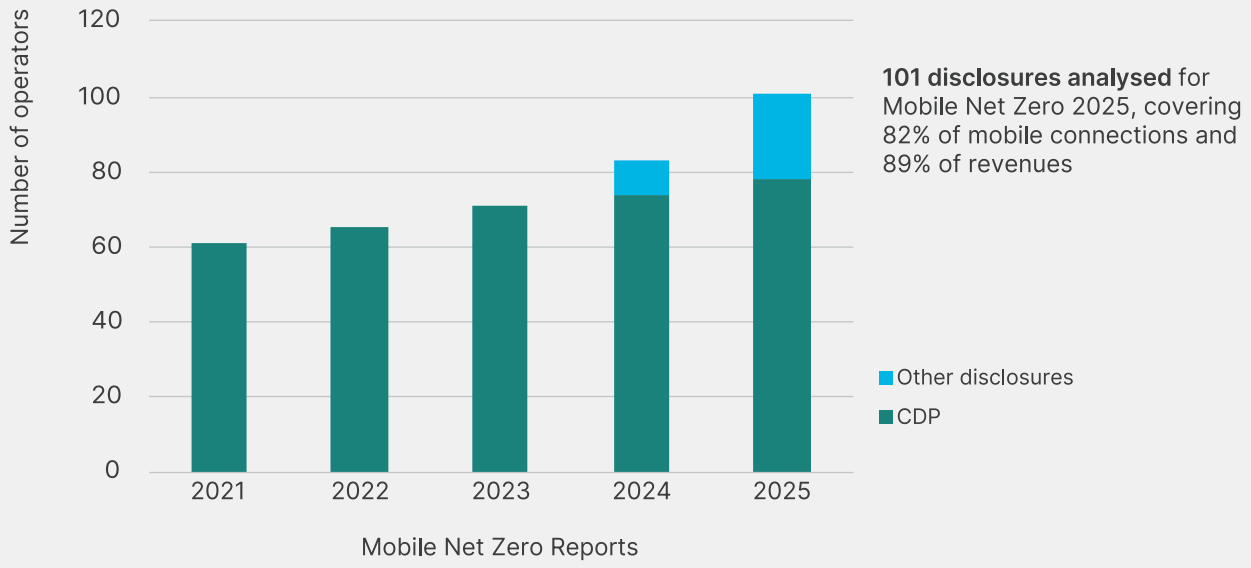
In the 2024 disclosure cycle, 78 mobile network operators disclosed to the CDP, four more than the previous year and 17 higher than in 2020 **(Figure 3)**.

Most mobile connections in North America (99%), Latin America (88%), Europe (77%), Sub-Saharan Africa (69%) and Asia Pacific (64%) disclosed to the CDP in 2024.

For operators that did not disclose to the CDP, this report also analyses other public disclosures of emissions and energy data (e.g. sustainability reports), covering 23 operators and 25% of mobile connections (see the Annex for additional details). These include disclosures from large operators in China, helping to bring the total share of mobile connections analysed in Greater China to 99%, compared with 25% of connections covered by the CDP disclosures.

In 2024, 17 operators – 22% of disclosing operators – received the highest disclosure score (A) from the CDP. This compares with less than 2% across all other companies disclosing to the CDP on climate receiving an A in 2024[3].

Figure 3 CDP and other disclosures analysed in Mobile Net Zero



This report analyses disclosures from 101 operators, including a record 78 disclosures to the CDP in the 2024 disclosure cycle

Note: The CDP disclosure years are one less than the year of Mobile Net Zero, e.g. Mobile Net Zero 2025 uses data disclosed to CDP in 2024, covering data from 2023.

Source: GSMA analysis based on CDP disclosures

[3] https://www.cdp.net/en/data/scores

More broadly, ESG (Environmental, Social and Governance) data and analysis have become increasingly important for investors to identify risks and opportunities. To harmonise ESG reporting across mobile operators, the GSMA published the first voluntary ESG mobile industry reporting framework in 2022, which was updated in 2024. 24 operators, covering nearly one-third of global mobile connections, participated in the ESG Metrics for Mobile Benchmarking 2024 project.

Measuring and reporting emissions

The greenhouse gas (GHG) emissions of nearly all companies globally are reported using the GHG Protocol Corporate Accounting and Reporting Standard[4]. Companies report three types or "scopes" of emissions.

Scope 1 and 2 emissions are typically referred to as a company's "operational emissions", as these are primarily within the control of the company.

Although companies are not directly responsible for Scope 3 emissions, these emissions are considered part of their overall emissions footprint, since they have some degree of influence on their suppliers, employees and customers. For Scope 3 emissions, a higher margin of error should be factored into estimates given the current complexity and difficulty in gathering and processing data. There are also methodological constraints and a lack of Scope 3 accounting harmonisation.

To address this challenge, the GSMA, GeSI, and ITU jointly published Scope 3 Guidance for Telecommunications Operators in June 2023, harmonising methods for operators to assess their Scope 3 emissions to increase coverage and transparency.

Three scopes of GHG emissions

Scope 1

Direct emissions from owned and controlled sources, including fuel combustion, company vehicles and fugitive emissions. For a mobile operator, this could include emissions from its vehicle fleet for network maintenance or diesel generators to operate base stations.

Scope 2

Indirect emissions from the generation of purchased electricity, steam, heating and cooling consumed by the reporting company. For an operator, most Scope 2 emissions come from the electricity used in network base station sites, data centres and other buildings.

Scope 3

All other indirect emissions the organisation is indirectly responsible for, up and down its value chain. For example, emissions related to the buying of network equipment and those produced by its suppliers, as well as emissions from operator services when subscribers and enterprises make use of them. For operators, Scope 3 is the largest type of emissions and the hardest to measure accurately.

[4] https://ghgprotocol.org/corporate-standard

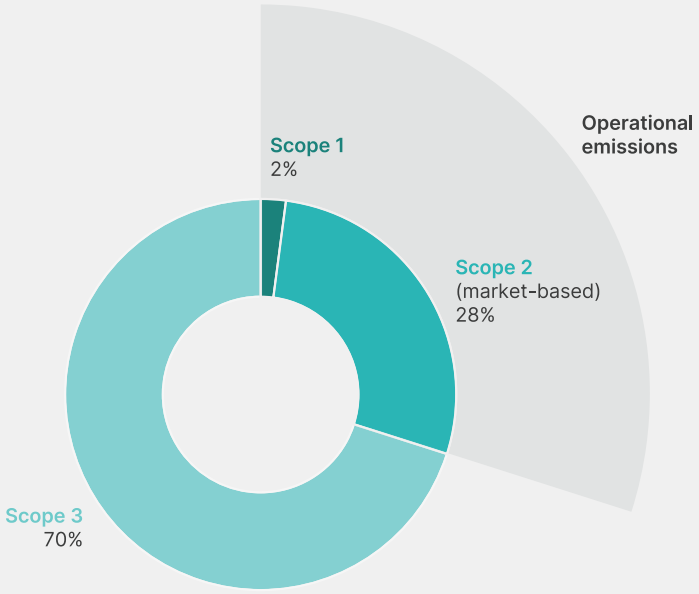
Operational emissions in 2023 were around 125 $MtCO_2e$, equivalent to just 0.2% of global GHG emissions

Industry-wide emissions from mobile operators were estimated based on operator data disclosed to the CDP and corporate reports covering a combined 82% of global mobile connections[5].

The mobile industry's operational emissions (Scope 1 and Scope 2 market-based) were an estimated 125 million tonnes (Mt) CO_2e in 2023, equivalent to around 0.2% of global GHG emissions[6]. Operational emissions account for around 30% of the industry's global carbon footprint **(Figure 4)**.

Value chain emissions (Scope 3) were an estimated 290 $MtCO_2e$, or 70% of the total emissions of the industry. A total of 93% of Scope 3 emissions came from six out of the 15 Scope 3 categories: 1) Purchased goods and services; 2) Capital goods; 3) Fuel- and energy-related activities; 8) Upstream leased assets; 11) Use of sold products; and 15) Investments. Value chain emissions are discussed in further detail in Chapter 4.

Figure 4 Mobile operators' total emissions by scope, 2023



70% of mobile operators' overall emissions are Scope 3 emissions from supply chains and customers

Note: Scope 2 emissions are market-based. Using location-based Scope 2 would result in the following shares: Scope 1 (2%), Scope 2 location-based (31%), Scope 3 (67%).

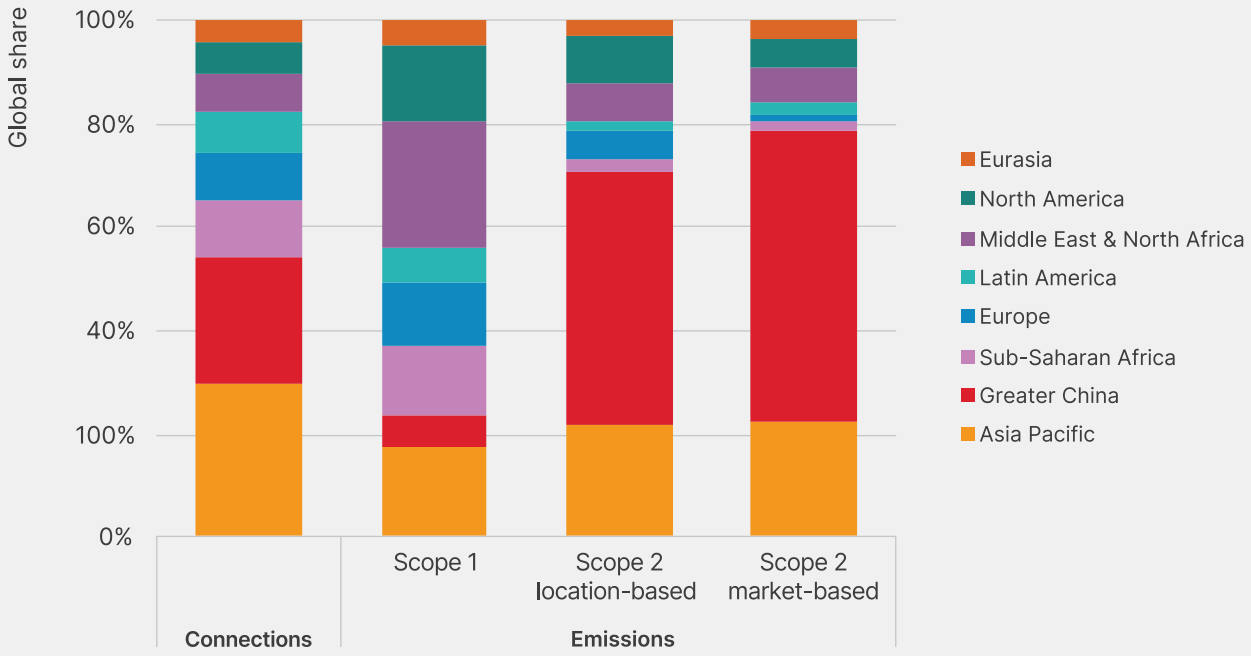
Source: GSMA analysis based on latest CDP disclosures and corporate sustainability reports

[5] Refer to the Annex for details on the data sources and modelling methodology
[6] Based on global emissions of 57.1 GtCO2e in 2023 from UNEP (2024), Emissions Gap Report 2024

Around 60% of the industry's overall emissions[7] and three-quarters of operational emissions[8] in 2023 came from the Asia Pacific and Greater China regions, accounting for 54% of global mobile and fixed connections **(Figure 5)**.

Sub-Saharan Africa, Europe and Latin America accounted for a much smaller share of operational emissions (2–3% each) than connections (11%, 9%, and 8%, respectively).

Figure 5 Regional breakdown of connections and emissions, 2023



Regional share of emissions varies significantly by Scope

Note: Connections include mobile and fixed broadband connections.

Source: GSMA analysis based on latest CDP disclosures and corporate sustainability reports

[7] Scope 1, Scope 2 market-based, and Scope 3
[8] Scope 1 and Scope 2 market-based

3 Emissions from mobile operators

Despite strong growth in demand for data and connectivity, operational emissions of the industry have fallen steadily since 2019, thanks to progress on energy efficiency and renewable energy.

Operational emissions of mobile operators are falling, despite surging demand for connectivity

Operational emissions of the industry – combined Scope 1 and 2 (market-based) emissions – fell by 8% between 2019 and 2023, while the number of mobile connections globally rose 8.5% and mobile data traffic quadrupled **(Figure 6)**. This means that the operational emissions per mobile connection fell by 17% between 2019 and 2023, while emissions per unit revenue fell by almost 20%.

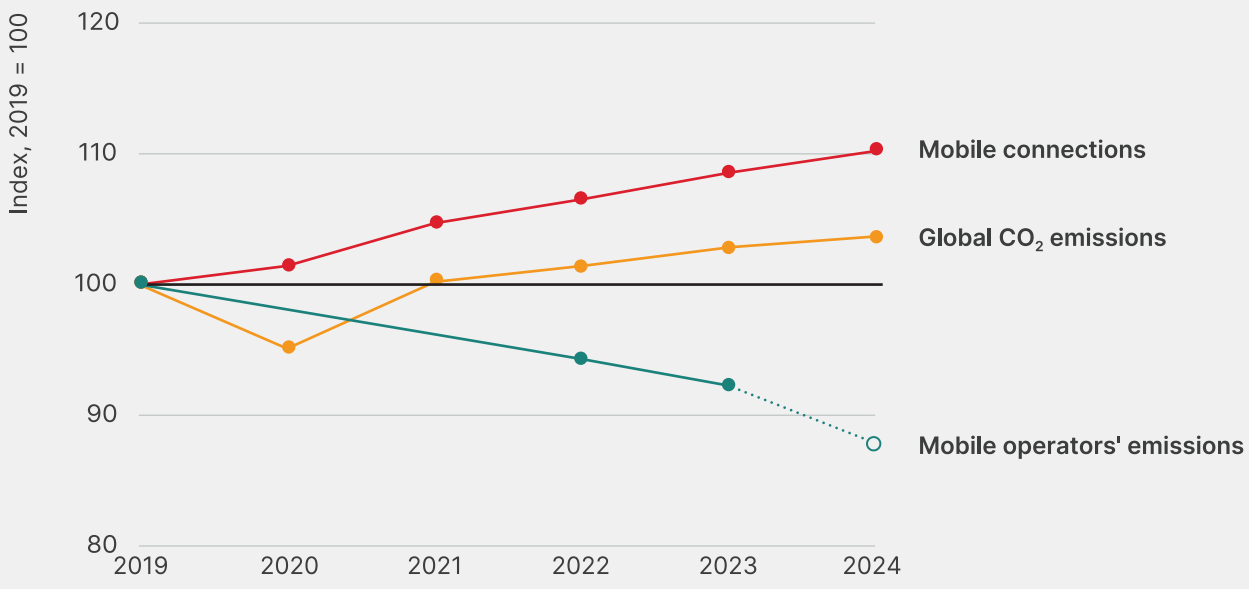
Over the same period, global energy-related CO_2 emissions rose 2.8%[9], while global electricity-related emissions increased 8.5%[10].

Compared with 2022, total operational emissions were 2% lower in 2023. Based on preliminary data covering 40% of mobile connections, operational emissions for 2024 are estimated to drop by 2% from 2023 levels.

Operators disclosing to the CDP collectively reported a 5% reduction in operational emissions between 2022 and 2023, with more than three-quarters of operators reporting a decrease in operational emissions. Nearly half (48%) of the reported decrease in operational emissions was driven by increased renewable energy consumption. Other emission reduction efforts, such as energy efficiency and electrification of transport and buildings, contributed 44%. Changes in methodology, mostly related to changes in emission factors, accounted for 5% of the net decrease.

Nearly half (46%) of the net increase in operational emissions was driven by growth in activity and output (e.g. growth in customer base, data traffic, expansion of networks), followed by acquisitions and mergers (25%).

Figure 6 Trends in operational emissions, mobile connections and global emissions



Between 2019 and 2023, operational emissions fell 8%, while mobile connections rose by 9% and mobile data traffic nearly quadrupled

Note: 2024 operational emissions are estimated as of May 2025 based on preliminary data from operators.

Source: GSMA analysis. Mobile connections and revenue data from GSMA Intelligence; CO_2 emissions data from IEA

[9] IEA (2025), Global Energy Review 2025
[10] IEA (2022), Electricity Market Report January 2022; IEA (2025), Electricity 2025

Operational emissions in most regions fell between 2019 and 2023, led by a 56% reduction in Europe

These latest estimates show positive progress since 2019, when the GSMA Board committed to reaching net zero by 2050. Operational emissions in most regions fell between 2019 and 2023, led by a 56% reduction in Europe **(Figure 7)**. Several operators in Europe reduced operational emissions by more than 80% over this period, including Tele2, Telefónica, Telenor, Telia and Vodafone.

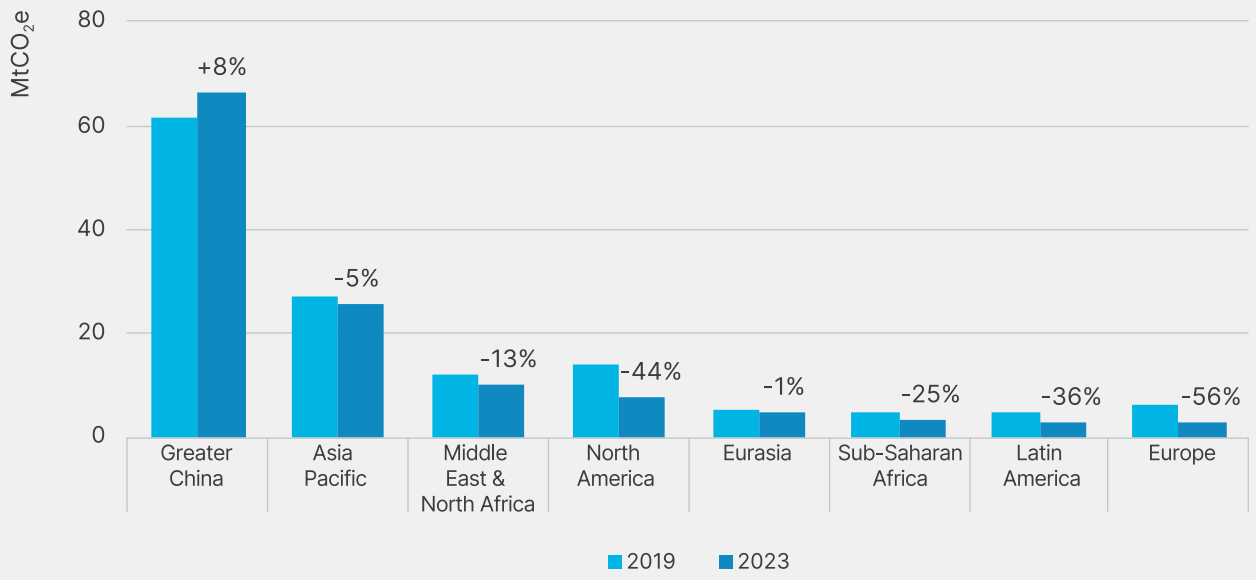
Emissions from North American operators fell by 44% over the same period, led by a 90% reduction from T-Mobile US by sourcing 100% of their electricity usage through renewable sources. Reductions in North America accounted for the largest share of the net reductions between 2019 and 2023 **(Figure 8)**.

Operators in Latin America reduced emissions by 36%, led by TIM's Brazil operations. Operators in Sub-Saharan Africa reduced their emissions by a quarter, led by large reductions in Scope 2 emissions from MTN and Safaricom. However, Scope 1 emissions from the region increased by more than 60% between 2019 and 2023, driven by increased use of diesel generators. Sub-Saharan Africa was the only region globally to see an increase in Scope 1 emissions over this period.

Emissions from operators in the Middle East and North Africa (MENA) fell 13%, while those from the Asia Pacific region decreased 5%. The four operators in Japan reduced their combined emissions by 40%, counterbalancing large increases in other parts of the region.

Emissions from operators in Greater China rose by 8%, driven by a 30% increase in electricity consumption. The number of mobile connections rose 10% while fixed broadband connections increased 37%, resulting in operational emissions per connection falling by 7%.

Figure 7 Regional changes in operational emissions, 2019-2023

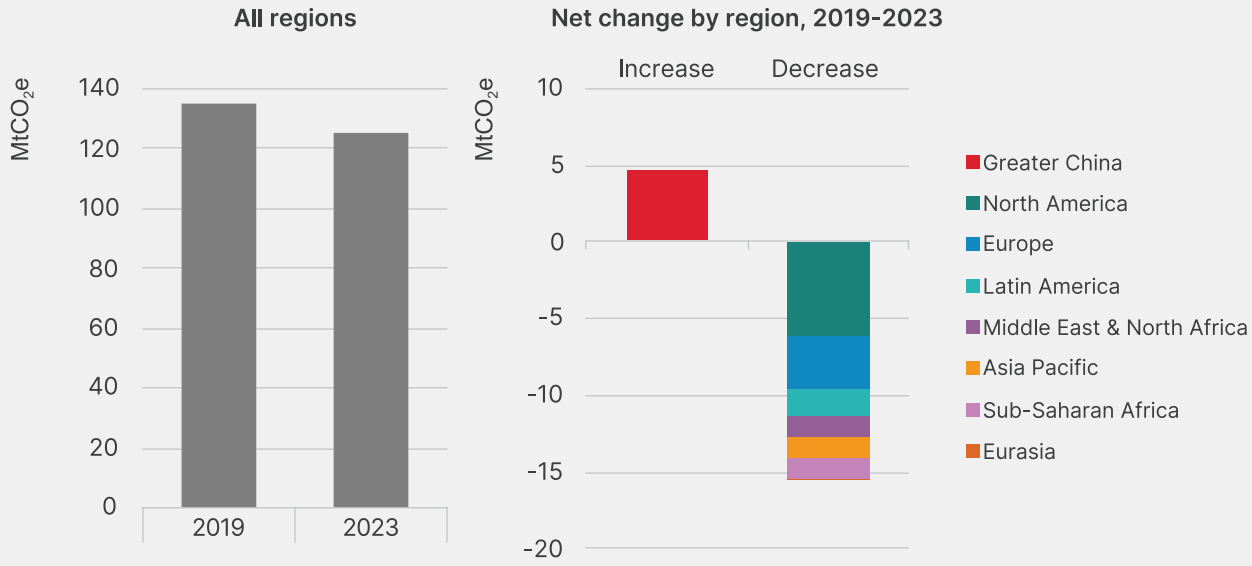


Operational emissions fell in most regions between 2019 and 2023, led by a 56% reduction in Europe

Note: Operational emissions include Scope 1 and Scope 2 market-based emissions.

Source: GSMA analysis based on latest CDP disclosures and corporate sustainability reports

Figure 8 Net change in operational emissions, 2019-2023



Operational emissions fell in most regions between 2019 and 2023

Note: Operational emissions include Scope 1 and Scope 2 market-based emissions.

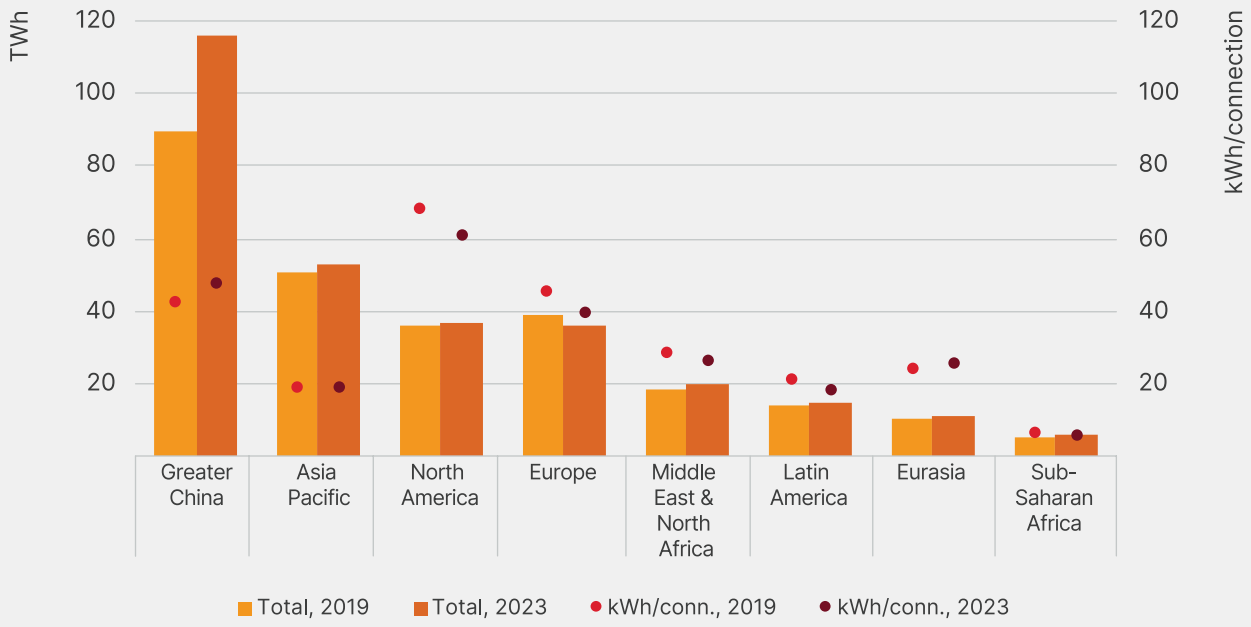
Source: GSMA analysis based on latest CDP disclosures and corporate sustainability reports

Operators consumed around 290 TWh of electricity in 2023, or around 1% of global electricity use

Most operational emissions globally came from generated and purchased electricity. Operators consumed around 290 terawatt-hours (TWh) of electricity in 2023, or around 1% of global electricity use[11]. This includes electricity used to power mobile and fixed networks, data centres, offices, stores, electric fleet vehicles, and other operations.

Electricity use in 2023 was around 12% higher than in 2019, driven primarily by strong demand growth in China, where electricity growth increased by nearly 30% **(Figure 9)**. The Greater China region accounted for the largest share of electricity use globally in 2023 (40%), followed by Asia Pacific (18%), North America (13%) and Europe (12%).

Figure 9 Mobile operators' company-wide electricity consumption by region, 2019-2023



Greater China accounted for 40% of global operator electricity use, while North America had the highest electricity use per connection

Note: Connections include mobile and fixed broadband.

Source: GSMA analysis based on latest CDP disclosures and corporate sustainability reports

[11] IEA (2025), Electricity 2025

Between 2019 and 2023, the number of connections[12] globally rose 11%, resulting in a slight increase in electricity use per connection. The average connection in 2023 consumed around 30 kilowatt-hours (kWh), with an average mobile connection consuming around 25 kWh and an average fixed connection consuming around 50 kWh. The highest average electricity use per connection was in North America (60 kWh/connection), followed by Greater China (47 kWh/connection) and Europe (39 kWh/connection).

Sub-Saharan Africa, with relatively low 5G penetration, very few fixed broadband connections and poor access to grid electricity, had an average electricity use of just 5 kWh per connection.

However, these figures do not include generation from on-site diesel generators, and in some cases, the energy used by tower companies. Mobile operators in Sub-Saharan Africa generated around 2 TWh from on-site diesel generators, while tower companies consumed an estimated 5 TWh of energy in 2023, mostly from on-site diesel generators. Including these figures, the average connection in Sub-Saharan Africa consumed around 12 kWh of energy per connection.

Case study **Axian Solar4All in Uganda**

[12] Connections include mobile connections and fixed broadband connections

For most operators, networks account for more than three-quarters of electricity use – primarily from mobile networks

More than 30 operators, primarily from Asia Pacific and Europe, disclosed disaggregated data regarding the sources of Scope 2 emissions, a proxy for electricity use by end use (e.g. networks, data centres, buildings).

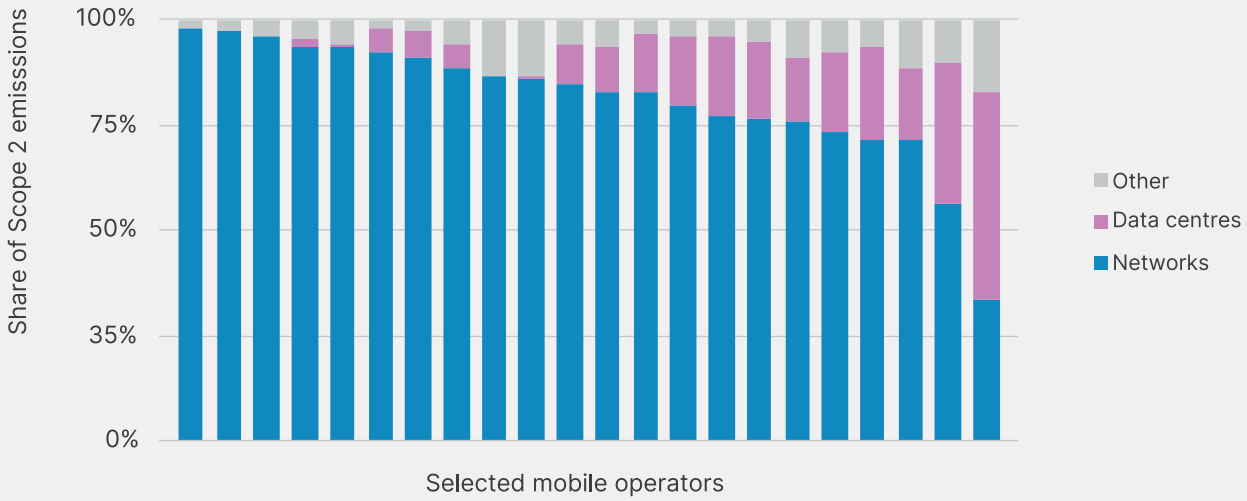
For nearly all operators disclosing this data – except for those with large data centre businesses, mostly in Asia – networks accounted for more than three-quarters of Scope 2 emissions **(Figure 10)**. For operators that further disaggregated network-related emissions, mobile networks typically accounted for 60–80% of network-related emissions (20–40% for fixed).

Since most operational emissions come from electricity use, reducing them requires action in two key areas: energy efficiency, particularly in networks; and increasing the share of renewable and low-carbon electricity.

Case study **Telefónica** Autonomous network journey programme

Case study **BT Group** Driving down emissions with electric vehicles

Figure 10 Scope 2 location-based emissions by end use for selected operators, 2023



Networks accounted for more than three-quarters of Scope 2 emissions for most operators, of which the majority came from mobile networks

Note: Other includes offices, other building operations, and electric vehicles.

Source: GSMA analysis based on latest CDP disclosures and corporate sustainability reports

Electricity use per connection varies significantly across operators and regions, with an average of 30 kWh per connection in 2023

Electricity use per connection[13] varies significantly between operators and regions. At the global level, the overall average electricity use per connection has increased 3.5% since 2019, reaching 30 kWh per connection in 2023.

There are diverging trends at the regional and country levels. For example, Europe, Latin America, North America, and Sub-Saharan Africa have seen electricity use per connection drop by more than 10% since 2019, while China has seen a 12% increase.

Many factors contribute to differences in the average energy use per connection, including technical factors such as network deployment as well as other factors, such as population distribution, geography and topography. For example, operators with more advanced 5G connectivity – including a higher number of 5G base stations or wider 5G coverage – tend to use more electricity per connection. There are other technical considerations that also affect energy intensity. For example, operators relying more on low-band spectrum can achieve wide 5G coverage without having to densify their networks as much as operators relying on mid-band spectrum.

Despite the higher energy efficiency of 5G per unit of data transmitted, the greater densification of towers and increase in antenna elements mean there is expected to be an increase in electricity consumption of mobile networks over the near-term. This increase can be mitigated by the retirement of older, less energy efficient 2G and 3G networks, by the switch from copper to fibre for fixed networks, and through the deployment of energy-efficiency features of 5G, such as AI-optimised sleep modes.

Case study **Huawei**
0 Bit 0 Watt 0 Loss: Green solutions to enable optimal experience and energy efficiency

[13] Connections include mobile connections and fixed broadband connections

The energy intensity of data transmission has fallen by an average of 10–30% per year between 2019 and 2023

Energy efficiency is a top priority for mobile network operators. Energy accounts for an important share of operational costs, and volatile fossil fuel prices have increased the urgency of maximising energy efficiency.

There are different ways to measure the energy efficiency of networks. For mobile networks, measurement methodologies are defined in the international standard ITU-T L.1331[14] and European standard ETSI ES-203-228 (V.1.4.1).[15]

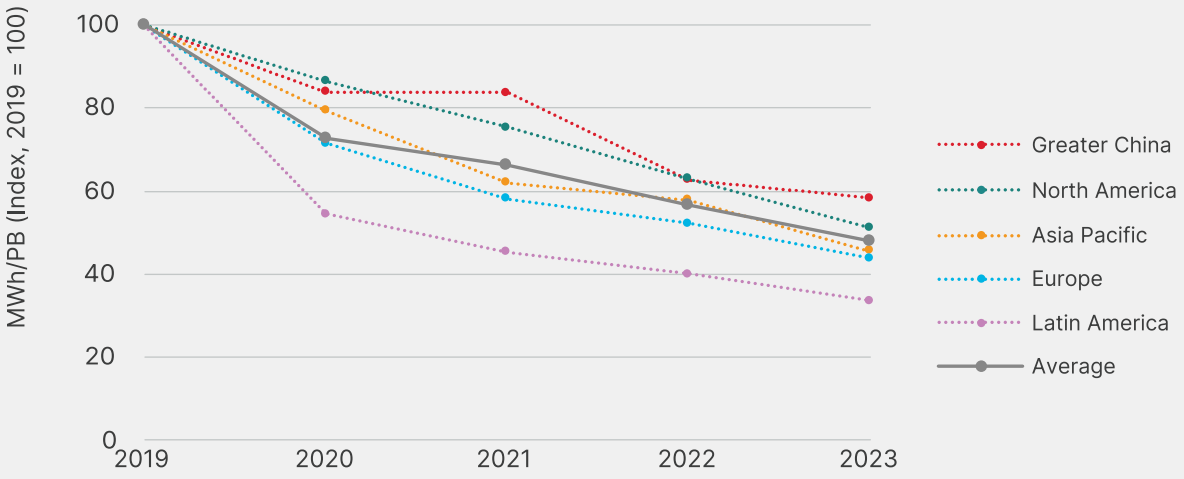
The most common reported metric by operators is the energy intensity of data transmission (i.e. energy use per unit data), typically reported in kWh per gigabyte (kWh/GB) or megawatt-hours per petabyte (MWh/PB). Operators that report this metric typically report based on company-wide or network-wide energy use.

Public data from 19 operators show that the energy intensity of data transmission fell by an average of of 10–30% per year between 2019 and 2023 **(Figure 11)**. However, there is significant variation between operators – both in terms of their absolute energy intensities (26 to 490 MWh/PB in 2023) as well as average annual improvement rates since 2019 (1–41%).

Similar results and trends are observed in other data sets. All 12 operators reporting energy intensities as part of the GSMA ESG Metrics for Mobile Benchmark 2024 had a range of 25–170 MWh/PB. All 12 operators had improved their energy intensities compared with the previous year (3–30%).

Sixteen operator groups participating in the GSMA Intelligence Energy Efficiency Benchmark 2024 had an average mobile network energy intensity of 100 MWh/PB. The average mobile connection consumed 14 kWh/GB per year, and the average network site consumed 24 MWh per year.

Figure 11 Energy intensity of data transmission of selected operators, 2019-2023



Based on data from leading operators, the energy intensity of data transmission has fallen by an average of 50% since 2019

Note: The data shown are averages across a limited number of operators disclosing this data and are intended to show indicative trends.

Source: GSMA analysis based on corporate sustainability reports

[14] https://www.itu.int/rec/T-REC-L.1331
[15] https://www.etsi.org/deliver/etsi_es/203200_203299/203228/01.04.01_60/es_203228v010401p.pdf

Wide-ranging energy intensity metrics, scopes and values point to the need for greater alignment across the industry

In addition to the energy intensity of data transmission, some mobile operators report other energy intensity metrics **(Table 1)**. These indicators can provide useful insights into overall industry-level progress on energy efficiency or a specific operator's progress on energy efficiency over time.

One-quarter of the top 50 operators (by total electricity use) report energy intensity based on data traffic, such as kWh/GB or MWh/PB. One-third reported energy per revenue.

The reported values across each of the metrics are wide-ranging, differing by a factor of up to 20. The large ranges likely stem from differences in definitions and scope (e.g. mobile vs. total traffic), measurement methods and assumptions, as well as data quality.

Given the lack of standardised approaches and metrics, it is not appropriate to use absolute values to compare the relative energy efficiency of different networks and operators, or to use

Table 1 Reported energy intensity metrics, 2023

Denominator	Example units	Example operators	Reported values (min. – max.)	Operators reporting*
Data traffic	kWh/GB MWh/PB J/bit Indexed value	Axiata, China Telecom, Deutsche Telekom, Singtel, STC, T Mobile US, Telefónica, TIM	25–500 MWh/PB	26%
Service	kWh/sub./year kWh/conn./year kWh per customer	AT&T, CelcomDigi, Far EasTone	45–85 kWh per subscription	6%
Revenue	kWh/$	AT&T, China Mobile, China Telecom, Deutsche Telekom, LG Uplus, KT, Singtel, SK Telecom, Vodafone	6–160 MWh per million $	34%

Some operators publicly report on energy intensity metrics to track progress on energy efficiency, but there is a lack of standardised definitions and methods

Note: *Share of operators reporting publicly based on analysis of public disclosures of top 50 operators by electricity use.

Source: GSMA analysis based on corporate sustainability reports and other public disclosures

them as thresholds for what is considered "energy efficient". This is because there are large differences in energy intensity between different networks, partly driven by factors beyond the control of operators, such as population distribution, geography, topography, customer behaviour, network type and network maturity[16]. Some of the differences also stem from differences in energy intensity between fixed and mobile networks[17].

The GSMA ESG Metrics for Mobile recommends that operators report key network energy consumption metrics, including total network energy use, energy intensity (per unit data and/or subscription), as well as year-on-year changes in the intensity metric.

Case study **Liberty Global** Designing innovative and sustainable data centres for the future

Case study **Safaricom** Improving energy efficiency in data centres

[16] NGMN (2023), Green Future Networks: KPIs and Target Values for Green Network Assessment
[17] Lundén et al. (2022), Electricity Consumption and Operational Carbon Emissions of European Telecom Network Operators

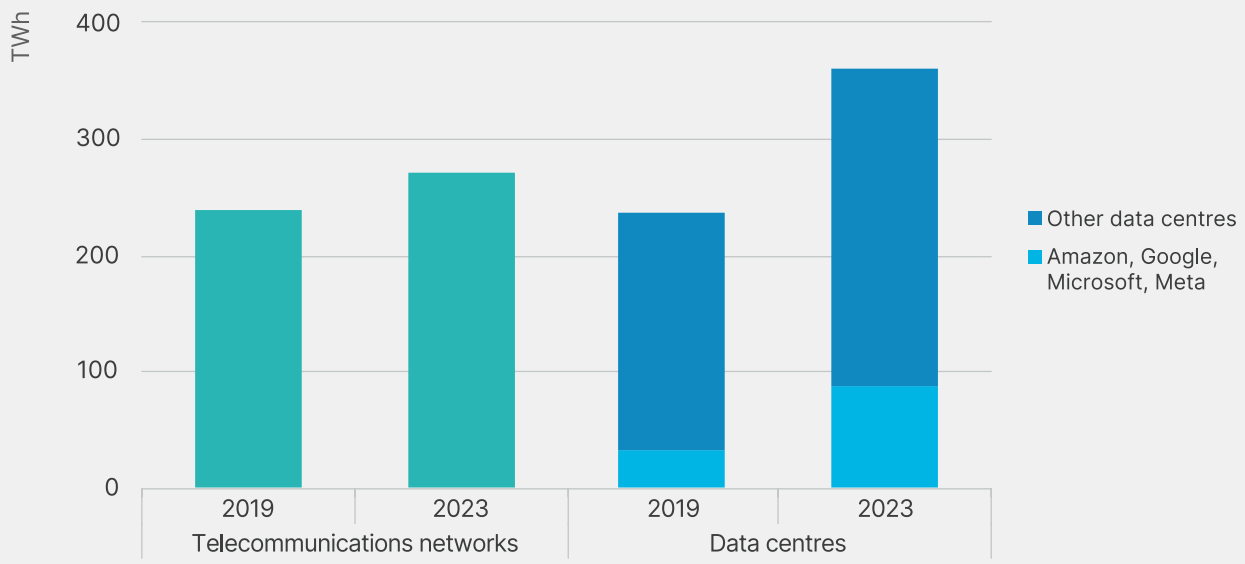
AI is accelerating data centre energy use globally, with limited impact on the energy use of mobile network operators so far

Global data centre electricity use rose by 50% (+120 TWh) between 2019 and 2023[18], due to growing demand for data centre services, including AI **(Figure 12)**.

The four largest hyperscalers – Amazon, Alphabet (Google), Meta and Microsoft – saw their combined data centre electricity use more than double to around 90 TWh in 2023[19]. Over the same period, electricity use of telecommunication networks rose by less than 15%.

Near-term data centre energy demand growth is expected to be driven primarily by accelerated servers (e.g. GPUs) to serve generative AI workloads, primarily in cloud and hyperscale data centres. Global data centre energy use is projected to nearly triple between 2023 and 2030, with energy use from accelerated servers more than quadrupling[20]. Even with this rapid growth, data centres only account for one-tenth of the overall global electricity demand growth to 2030, less than the growth from industrial motors, air conditioning or electric vehicles[21].

Figure 12 Electricity use trends of telecommunication networks and data centres, 2019-2023



Data centre energy demand has risen quickly since 2019, especially among the largest hyperscalers who are responsible for the bulk of global AI workloads currently

Note: Telecommunication networks include mobile, fixed and core networks, and exclude data centres operated by telecommunication operators. "Other data centres" include other hyperscale operators, colocation operators, cloud service providers, enterprise, edge and telco data centres.

Source: GSMA analysis based on IEA (2025), EDNA (2025), and company sustainability disclosures

[18] IEA (2025), Energy and AI
[19] EDNA (2025), Data Centre Energy Use: Critical Review of Models and Results
[20] IEA (2025), Energy and AI
[21] IEA (2025), Energy and AI

In contrast to its impact on data centres, AI is expected to have relatively limited impacts on the energy demand growth for most network operators, except those with major data centre operations. Mobile operators with significant data centre operations are primarily located in Asia, including operators based in China, Japan, Korea and Singapore. Several of these operators have announced projects or partnerships to build large data centres focused on AI workloads in the next couple of years. While these data centres will have important energy implications for individual operators and local electricity grids, at the global level, they will remain a relatively small share of overall electricity use by mobile network operators.

In terms of network operations, the widespread adoption of generative AI could increase uplink data from increased video-based generative interactions[22], but within the context of other more significant drivers of data traffic and connections, such as streaming video, IoT and extended reality – AI is unlikely to be driver of network energy use.

One of the most important implications of AI for networks is that use of AI and machine learning could help increase energy efficiency of network operations, including by anticipating data demand to turn off parts of the network. AI could also help enable mobile sites to participate in demand response programmes to help grid operations.

Case study **China Telecom**
Energy saving in data centres

Case study **Ericsson**
AI solutions for improved 5G energy efficiency

[22] Ericsson (2024), Impact of GenAI on mobile network traffic

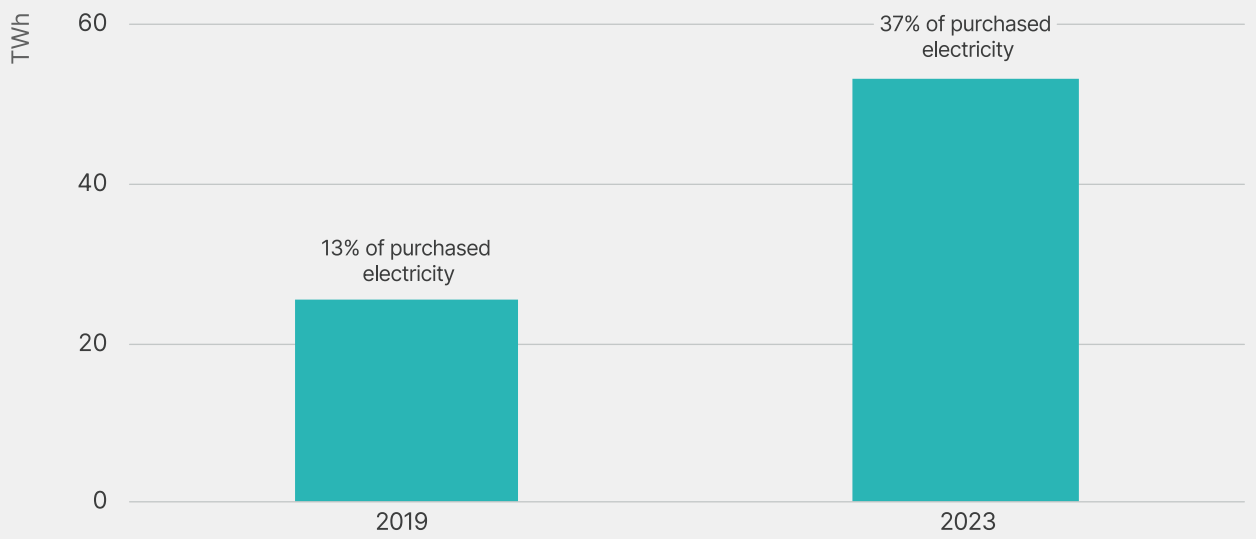
Mobile operators are buying and using more renewable energy, with renewables accounting for 37% of purchased electricity for operators disclosing to CDP

Renewable energy is already playing a major role in reducing mobile operators' emissions, accounting for nearly half of operational emission reductions between 2022 and 2023.

Operators disclosing to the CDP, representing 60% of mobile connections, collectively purchased 54 TWh of renewable electricity in 2023, equivalent to the annual electricity demand of Greece. In terms of renewable electricity generation, this aggregated total would rank 26th among countries, ahead of nations such as Argentina and Poland.

Among those disclosing to the CDP, the share of electricity use from purchased renewables has nearly tripled from 13% in 2019 to 37% in 2023 **(Figure 13)**. In 2023, 12 operators matched 100% of their electricity use with renewable energy purchases.

Figure 13 Purchased renewable electricity in CDP disclosures



Operators collectively purchased 54 TWh of renewable electricity in 2023, more than doubling their purchases from 2019

Note: Analysis based on disclosures of 78 operators to the CDP.

Source: GSMA analysis based on latest CDP disclosures

Based on the data disclosed by RE100 members, there was a growing share of renewable electricity purchased through power purchase agreements (PPAs), up 4 percentage points to 28%. Around half of the purchased renewables was sourced from energy attribute certificates (EACs) and 23% came from green tariffs with electricity suppliers.

These figures exclude non-purchased renewable and low-carbon sources from grid electricity, which varies significantly between countries. Whilst it is difficult to calculate a combined figure for purchased and grid renewable electricity due to an overlap between the two, it is possible to state that without these renewable energy purchases by operators, operational emissions are estimated to have been 16 $MtCO_2e$ (32%) higher in 2023. Operators also generated approximately 900 GWh from on-site renewables, helping to displace generation and emissions from grid electricity and diesel generators.

Case study **Globe Telecom**
Powering a sustainable future with renewable energy

Case study **América Móvil**
Low-carbon energy consumption at Claro Argentina

4 Emissions from supply chains and customers

Scope 3 emissions account for three-quarters of the industry's overall footprint. Further engagement with suppliers is critical to improve measurement and reduce emissions.

More than 80% of operators' Scope 3 emissions came from just four categories: 1) Purchased goods and services; 2) Capital goods; 3) Fuel- and energy-related activities; and 11) Use of sold products

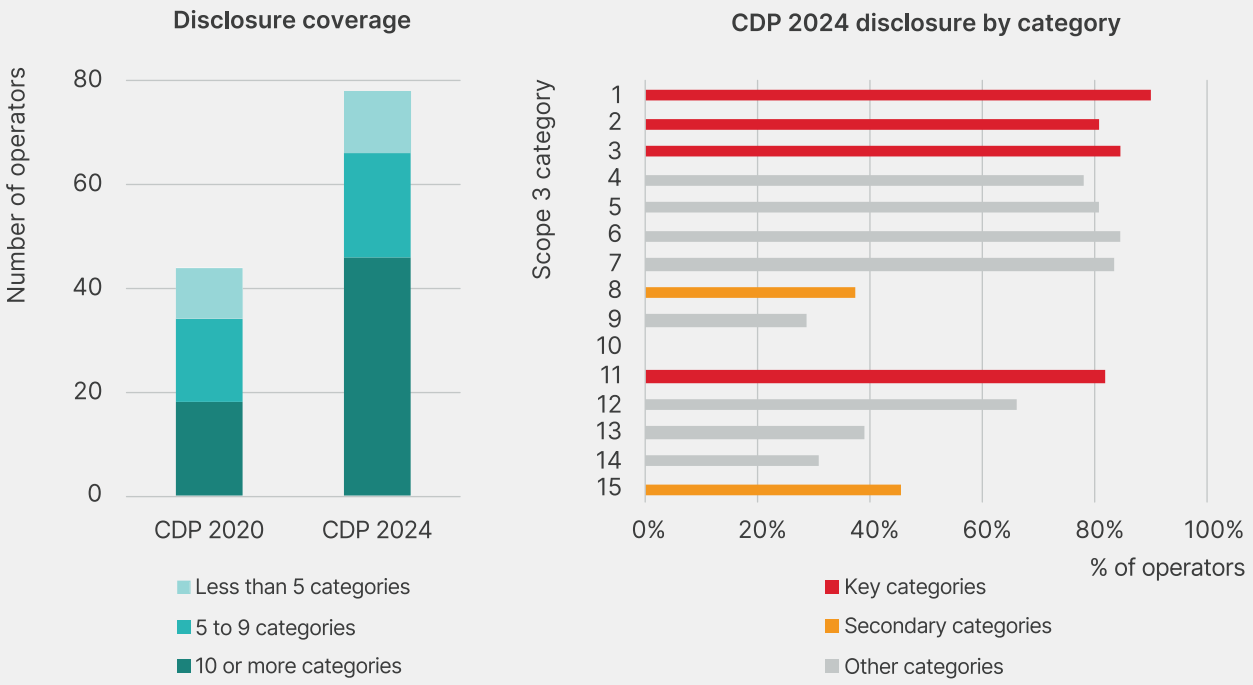
Nearly all operators reporting to the CDP in 2024 disclosed their Scope 3 emissions, including nearly 60% of operators disclosing 10 or more categories, up from 40% in 2020 **(Figure 14, left)**.

Four key Scope 3 categories – 1) Purchased goods and services; 2) Capital goods; 3) Fuel- and energy-related activities; and 11) Use of sold products – accounted for more than 80% of operators' overall Scope 3 emissions, led by category 1 (42%) and category 11 (16%).

More than 80% of operators reported on each of these categories **(Figure 14, right)**, including 70% of operators reporting on all four categories.

Categories 8 (upstream leased assets) and 15 (investments) each account for around 5% of total Scope 3 emissions but are not relevant categories for all operators.

Figure 14 Scope 3 disclosure coverage



Operators are disclosing a growing number of Scope 3 categories, including on key categories that account for more than 80% of operators' Scope 3 emissions

Note: Analysis based on disclosures of 78 operators to the CDP.

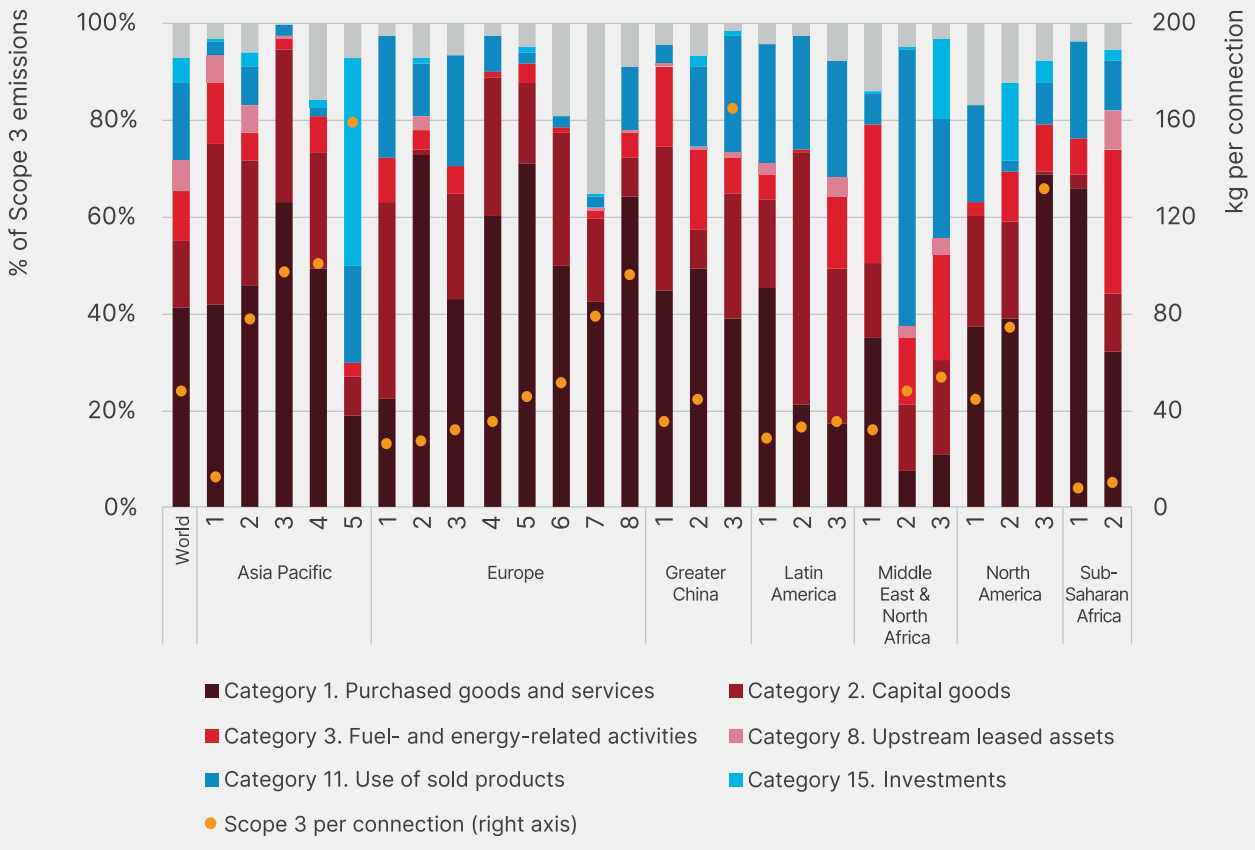
Source: GSMA analysis based on latest CDP disclosures

Differences in business models, country contexts and accounting approaches result in major differences in Scope 3 emissions across operators and regions

There is a wide range of Scope 3 emissions per connection between operators and regions, ranging from less than 10 kg per connection in Sub-Saharan Africa to more than 100 kg per connection for some operators in advanced economies **(Figure 15)**. The relative shares of Scope 3 emissions from different Categories also differ substantially between operators and regions.

Some of these differences may stem from differences in their business models and operations. For example, an operator that serves many fixed broadband customers may have higher Category 11 or 13 emissions due the energy use of customer premises equipment (e.g. Europe operator #7, North America operator #1). Operators in countries with high carbon electricity may also

Figure 15 Scope 3 emissions by Category for selected operators



The breakdown of Scope 3 emissions between Categories can differ substantially between operators and regions

Note: World shows the industry-level total of all operators disclosing Scope 3 data to CDP. Connections include mobile and fixed broadband.

Source: GSMA analysis based on latest CDP disclosures

see relatively higher Category 11 or 13 emissions as well (e.g. Middle East & North Africa operator #2). Operators with significant investments are likely to have higher Category 15 emissions (e.g. Asia Pacific operator #5). A large conglomerate with other (non-telecommunication) businesses may have different sources of Scope 3 emissions than a dedicated network operator.

Scope 3 emissions may also differ over time for a given company due to structural factors or differences in methodology and data sources. For example, a highly capital-intensive year could have significantly higher Category 1 and 2 emissions compared with other years. Some differences may stem from methodological differences or a lack of data.

Case study **Virgin Media O2**
Tackling supply chain emissions

Case study **Singtel**
Leveraging internal carbon pricing to empower decarbonisation

The GSMA is supporting operators to align the industry on Scope 3 emissions and data sources

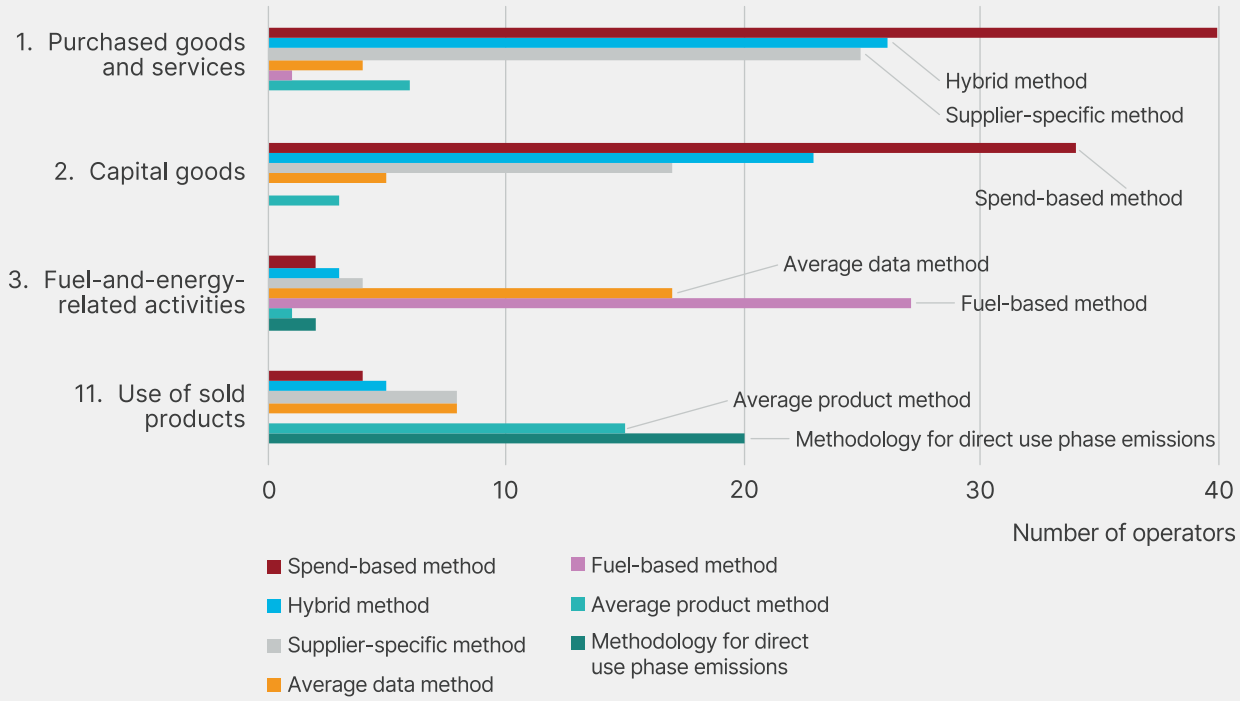
To help align methodologies and advise on data sources, the new GSMA Scope 3 Guidance for Telecommunication Operators was launched in 2023 and has already been used by many operators. A survey of 39 operators in September 2024 showed that 85% of operators surveyed had used the guidance.

The type of data and assumptions also has major impacts on the quality and accuracy of Scope 3 estimates. Analysis of the CDP disclosures show that spend-based methods (i.e. industry average emission factors) remain the most common approach to estimate Scope 3 emissions from category 1 and 2 **(Figure 16)**. Given the limitations of industry average emission factors – including different sources of industry average emission factors – the use of supplier-specific emission factors can help to improve the quality of Scope 3 disclosures.

The GSMA is working with operators to help improve supplier data availability through the CDP Supply Chain Programme. There is also interest from operators in accessing more data on specific products to develop more granular estimates of embodied carbon from purchased equipment (e.g. mobile phones, customer premises equipment, network equipment) as well as the use of sold and leased products.

The GSMA has recently developed new guidance on Quantifying the Carbon Savings of Circularity to help operators calculate how circularity initiatives affect Scope 3 emission inventories.

Figure 16 Scope 3 emissions by accounting approach



Spend-based methods are more common than supplier-specific methods for Categories 1 and 2, indicating the need for supplier-specific emission factors

Source: GSMA analysis based on latest CDP disclosures

Suppliers are also making strong progress, but further action is needed to help operators reduce their Scope 3 emissions and reach their climate targets

For most operators, more than half of their Scope 3 emissions come from Category 1 (purchased goods and services) and 2 (capital goods). Most of these emissions come from a select group of common suppliers across the industry, falling into five main groups:

- Network equipment and customer premises equipment (CPE) manufacturers
- Mobile phone manufacturers
- Tower companies
- Cloud and IT service providers
- Others

Based on the top suppliers of more than 20 mobile operators, a list of 70 top industry suppliers was developed. Of these 70 companies, 46 (65%) disclosed to the CDP in 2024.

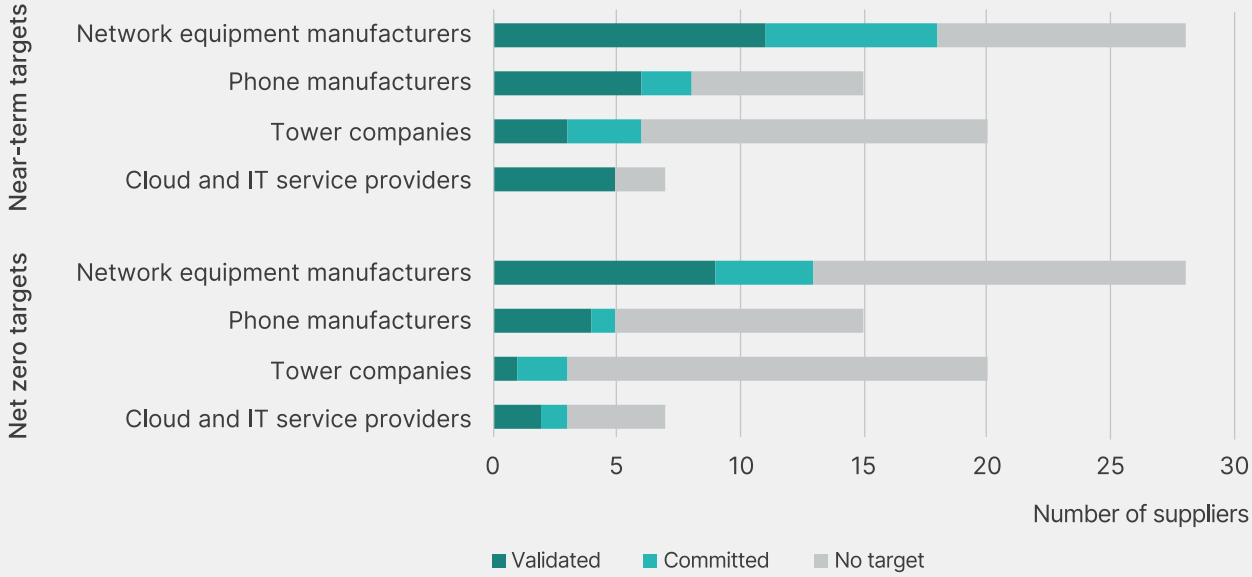
Suppliers' climate targets

Out of the 28 network equipment and CPE manufacturers analysed, 18 (64%) had set or committed to near-term SBTs, with 11 of them validated **(Figure 17)**.

Of the top 15 mobile phone manufacturers, covering more than 95% of the global market by unit sales, eight had near-term SBTs. There were 7 cloud and IT service providers analysed, with five of them having set near-term SBTs.

As a supplier group, there were fewer tower companies that had disclosed to the CDP or set climate targets. Just six of the top 20 tower companies (by number of towers) had set or committed to near-term SBTs.

Figure 17 Key suppliers with science-based targets, by supplier type



More than half of key network equipment suppliers and mobile phone manufacturers have committed or set near-term science-based targets

Note: Analysis covers 70 top suppliers extracted from top supplier lists from mobile operators. Mobile phone manufacturers include the top 15 manufacturers covering more than 95% of the global market. Tower companies include the top 20 by number of towers. Network equipment includes manufacturers of network equipment and customer premises equipment.

Source: GSMA analysis based on latest CDP disclosures and the SBTi

Case study **Ericsson**
Engaging suppliers to set targets and improve accuracy

Case study **Helios Towers**
Solar rollout in Ghana

Case study **ZTE**
Increasing clean energy in manufacturing and products

Case study **e&**
Working with tower companies and partners to reduce dependency on diesel generators

Case study **ZTE**
Collaborating with suppliers to reduce value chain emissions

Consumer trends and regulations are strengthening the business case for circularity

Circular business models are gaining traction in the mobile industry and beyond, and offer many commercial opportunities and benefits, including lower costs, new revenue opportunities and customer loyalty.

Results from a GSMA survey of 31 leading operators in 2024 show that operators have made the most progress on circularity for their **customer premises equipment** (CPE), such as modems, routers and set-top boxes **(Figure 18)**. Some leading operators have achieved CPE takeback rates of more than 80%, of which a majority are refurbished and redistributed to customers.

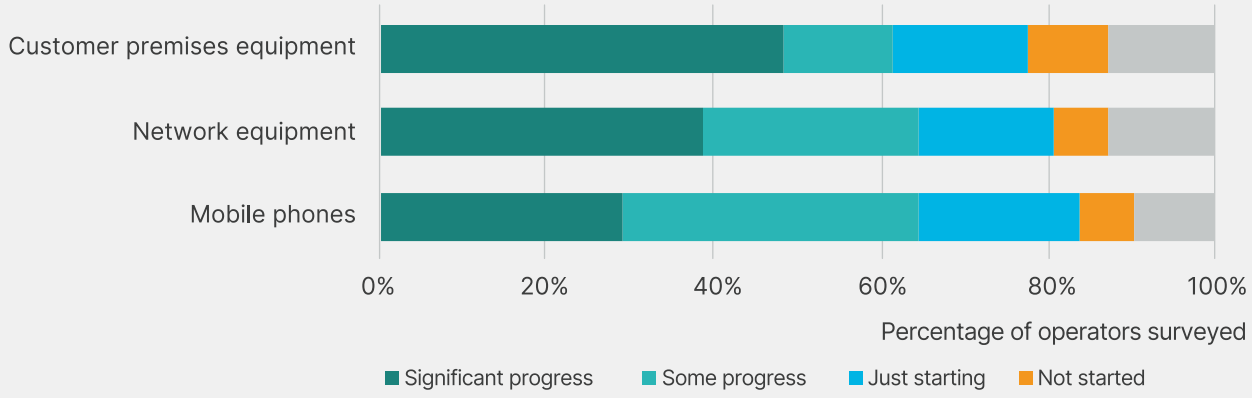
Operators have also made progress on circularity of **network equipment**, with nearly 40% reporting having made "significant progress".

Case study **Liberty Global**
Re-thinking the circular economy

Case study **MTN**
Project Infinity: Enhancing circularity

Case study **Turkcell**
Circular economy initiatives

Figure 18 Mobile operators' reported progress on circularity



Operators have made the most progress on circularity in CPE, with high shares of takeback and refurbished equipment

Survey question: How do you think your company has progressed on circularity related to the following aspects (mobile phones; customer premises equipment, network equipment)?
Note: Results based on responses from 31 operators. N/A includes operators who did not have related business operations or did not know.

Source: GSMA (2025), Rethinking Mobile Phones: the business case for circularity

Progress on the circularity of **mobile phones** trails CPE and network equipment, but consumer trends and regulation are helping to strengthen the business case for circularity for mobile phones. The growing market for refurbished devices and repair services – projected to exceed $150 billion globally by 2027 – offers new revenue streams for manufacturers and operators[23]. Producing and supporting durable and repairable devices fosters customer satisfaction and loyalty, strengthens brand image and resonates with environmentally conscious consumers and investors. Supply chain vulnerabilities and price volatility can be mitigated by using renewable energy, improving material efficiency and reducing reliance on critical minerals through repair, refurbishment and recycling.

More than 90% of mobile network operators surveyed by the GSMA in 2024 had at least one circular business model for mobile phones, with the most common being refurbished products (90%), e-waste collection and management programmes (87%), and trade-in and buyback programmes (84%).

Case study **Safaricom**
Promoting mobile devices and network circularity

[23] GSMA (2025), Rethinking Mobile Phones: the business case for circularity

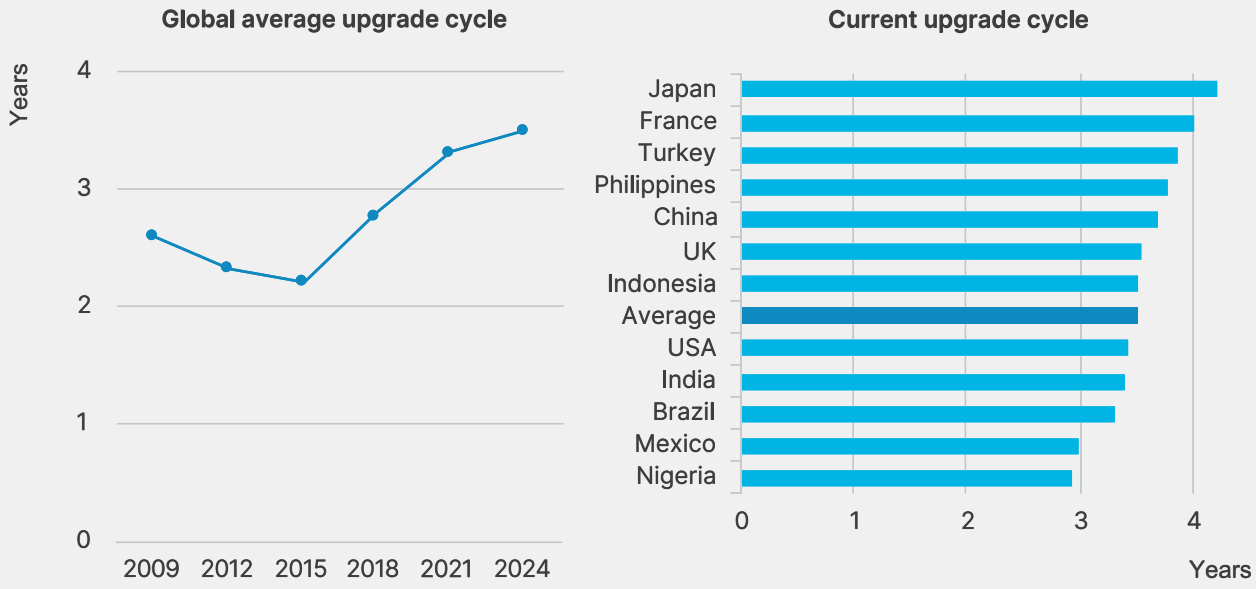
The GSMA Global Consumer Survey on Circularity finds that consumers are increasingly interested in more circular products and services

The GSMA Global Consumer Survey on Circularity surveyed more than 13,000 mobile phone users in 32 countries. Around 85% of consumers surveyed said sustainability is a "very important" (49%) or "important" (35%) factor in their next mobile phone purchase. Around 70% of consumers said they were willing to pay a premium for a more environmentally friendly mobile phone, including 30% of consumers willing to pay a premium of more than 10%.

The survey results show that consumers are keeping their phones for longer and are interested in buying used and refurbished phones. Average upgrade cycles have slowed to around 3.5 years globally **(Figure 19)**, with new phone sales slowing in recent years. New smartphone sales fell 15% between 2021 and 2023, while used and refurbished phone sales rose 15%.

Consumers strongly value device longevity, with around 90% of consumers rating durability, guaranteed software and security updates for at least seven years, and easy and low-cost repair as important factors in their next purchase decision.

Figure 19 Global upgrade cycles of mobile phones, 2009-2024 (left) and current upgrade cycle for select countries (right)



Consumers are keeping their phones for longer, particularly in advanced economies

Note: Data on right chart is based on survey results of average lifespan of previous phone combined with expected lifespan of current phone.

Source: GSMA (2025), Rethinking Mobile Phones: the business case for circularity

Around 10% of consumers surveyed had acquired their current phone as a used device, compared with 4% who bought refurbished devices and 86% who purchased new ones. Half of consumers globally were “likely” (36%) or “very likely” (10%) to consider a refurbished phone for their next purchase. In India, more than 20% were “very likely” to consider a refurbished device – the highest among the 32 countries surveyed. Nearly half of consumers surveyed globally said that cost savings were a “very important” benefit of buying refurbished phones.

Case study **Telia**
“Leia uus kasutus” - Find a New Use

Case study **Vodacom**
Good as New devices programme: raising awareness in Africa

Repaired and refurbished phones typically have around 80–90% lower carbon emissions than new phones

More than 1.2 billion new smartphones were sold in 2024, emitting more than 60 $MtCO_2e$ from manufacturing alone. These emissions can be reduced by increasing the circularity of mobile phones in three main ways: 1) using recycled materials and renewable energy; 2) increasing the lifespan of phones by repairing, reusing and refurbishing existing phones, designing phones to be more durable and repairable and providing adequate software and security support; and 3) ensuring no device ends up as waste by recovering and recycling phones that cannot be reused.

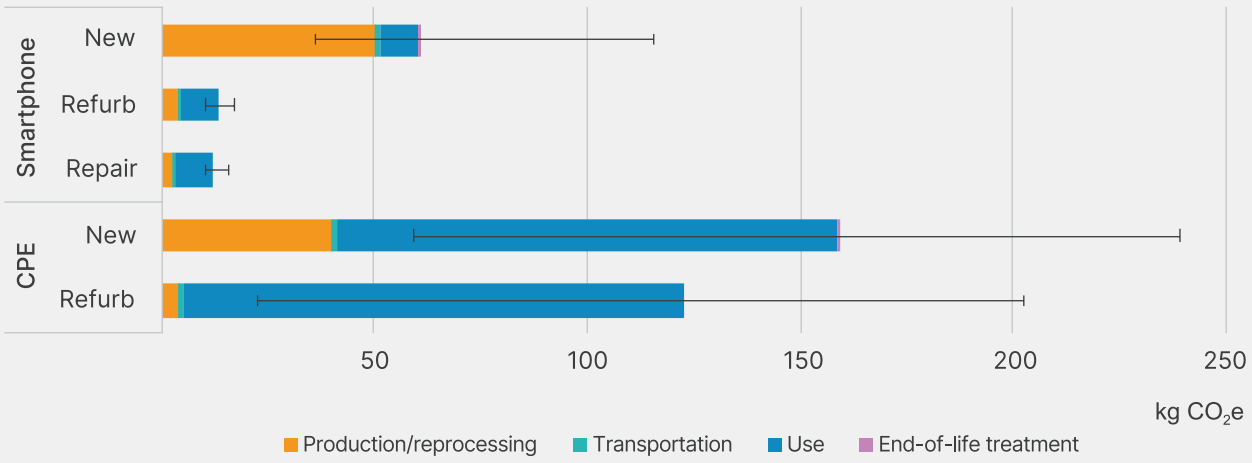
Circularity is a critical lever to reduce upstream Scope 3 emissions for both operators and manufacturers. Materials and manufacturing account for around 70–90% of the life cycle emissions of a typical smartphone[24]. This means that longer device lifespans can deliver substantial emission reductions and savings.

For example, using a device for five years instead of three years reduces its annual carbon footprint by around 30%, even when factoring in a battery replacement[25]. The environmental footprint of refurbishing a phone is about 90% lower than manufacturing a new one. Across its full life cycle, repaired and refurbished phones typically have around 80–90% lower carbon emissions than new phones **(Figure 20)**.

The GSMA has developed new guidance to help operators align on methods and approaches to calculate the carbon savings of repair and refurbishment. The guidance is supported by an accompanying modelling tool, which allows operators to enter their own custom baselines and scenarios and to model the carbon impacts of refurbishment initiatives for specific products.

For more information, refer to the new GSMA guidance: Quantifying the Carbon Savings of Circularity.

Figure 20 Typical life cycle carbon emissions of new, refurbished and repaired mobile phones and customer premises equipment (CPE)



Repaired and refurbished phones typically have around 80–90% lower carbon emissions than new phones

Notes: For simplicity and ease of comparison, all smartphones assume three-year lifespans and CPE assume five-year lifespans. In reality, refurbished and repaired models are likely to have shorter lifespans (and therefore smaller use-phase emissions, but requiring more frequent replacement). Error bars indicate approximate range of typical emissions, depending on product and country of use (grid carbon intensity)

Source: GSMA (2025), Quantifying the Carbon Savings of Circularity

[24] GSMA (2025), Rethinking Mobile Phones: the Business Case for Circularity
[25] Sánchez et al. (2024), Life Cycle Assessment of the Fairphone 5

There are around 10 billion dormant phones sitting idle worldwide that could be recovered for reuse or recycling

Many phones are seeing a second or third life, with more than 30% of consumers surveyed by the GSMA giving their old phones to a family member or friend and nearly 20% trading in or selling their used devices.

But nearly a third of consumers surveyed globally kept their previous phone as a backup after replacing it. Three-quarters of consumers surveyed reported having at least one old handset sitting unused at home, while 20% had at least three phones at home.

Based on these figures, there are likely around 10 billion dormant phones sitting idle worldwide. These phones contain valuable minerals, including 100,000 tonnes of copper, seven million ounces of gold and one million ounces of palladium – collectively worth around $20 billion based on current market prices.

[26] (2024) GSMA Global Consumer Survey on Circularity

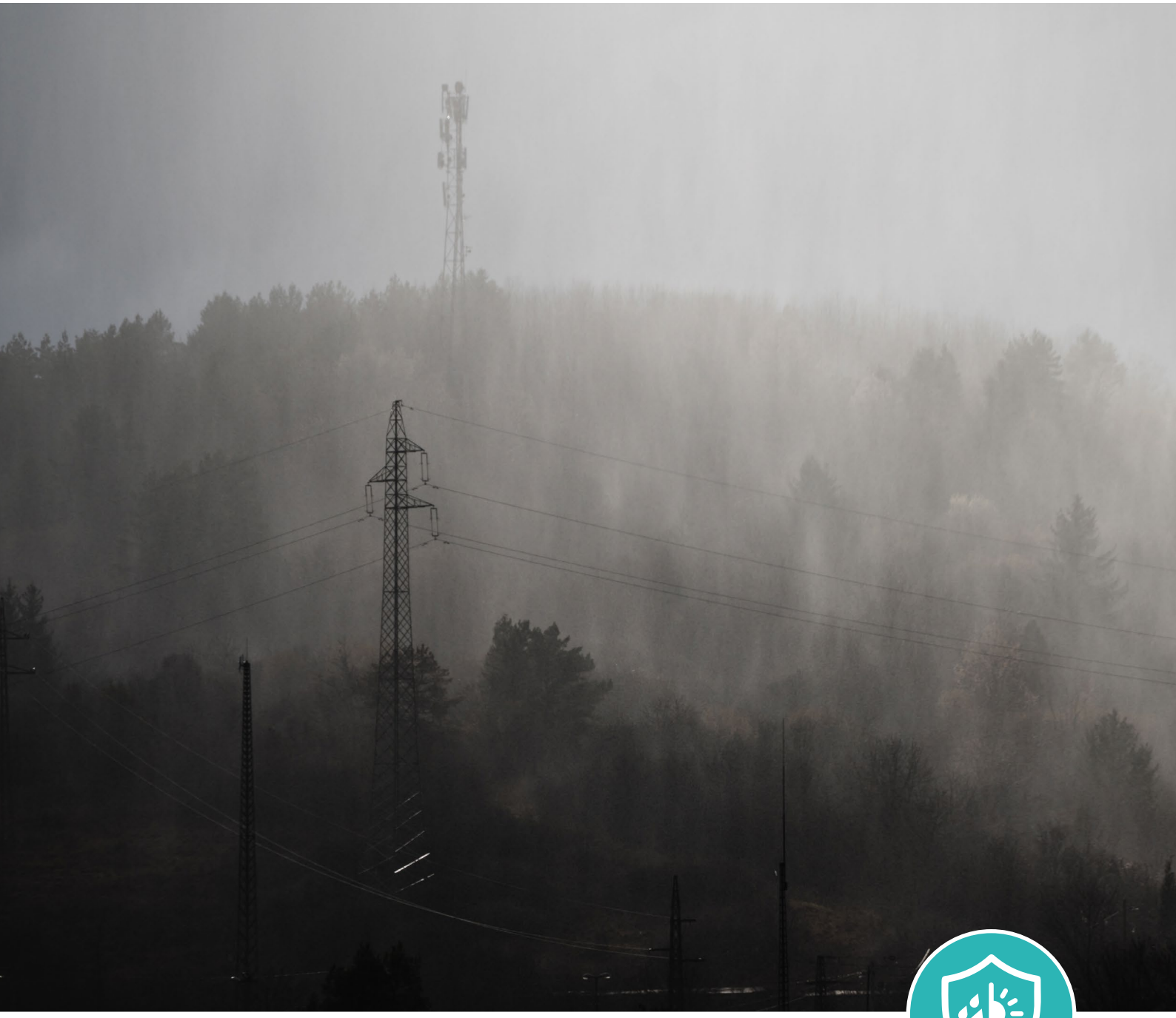
16 leading operators have committed to industry targets on take-back and zero waste

In June 2023, the GSMA announced that leading operators had committed to two new targets to reduce the environmental impact of mobile phones by boosting their circularity through reuse, repair and recycling:

- By 2030, the number of used mobile devices collected through operator take-back schemes will amount to at least 20% of the number of new mobile devices distributed directly to customers.
- By 2030, 100% of used mobile devices collected through operator take-back schemes will be repaired, reused or transferred to controlled recycling organisations.

The GSMA invites all mobile network operators to consider aligning to these targets to help expand the industry's efforts to move towards a more circular economy. For more information, please contact **betterfuture@gsma.com**.

As of June 2025, 16 operators have signed up to the circularity targets, representing more than a billion connections.



5 Adaptation and resilience

Mobile network infrastructure and other critical infrastructures must become more climate resilient to continue operating and supporting our societies in a changing climate.

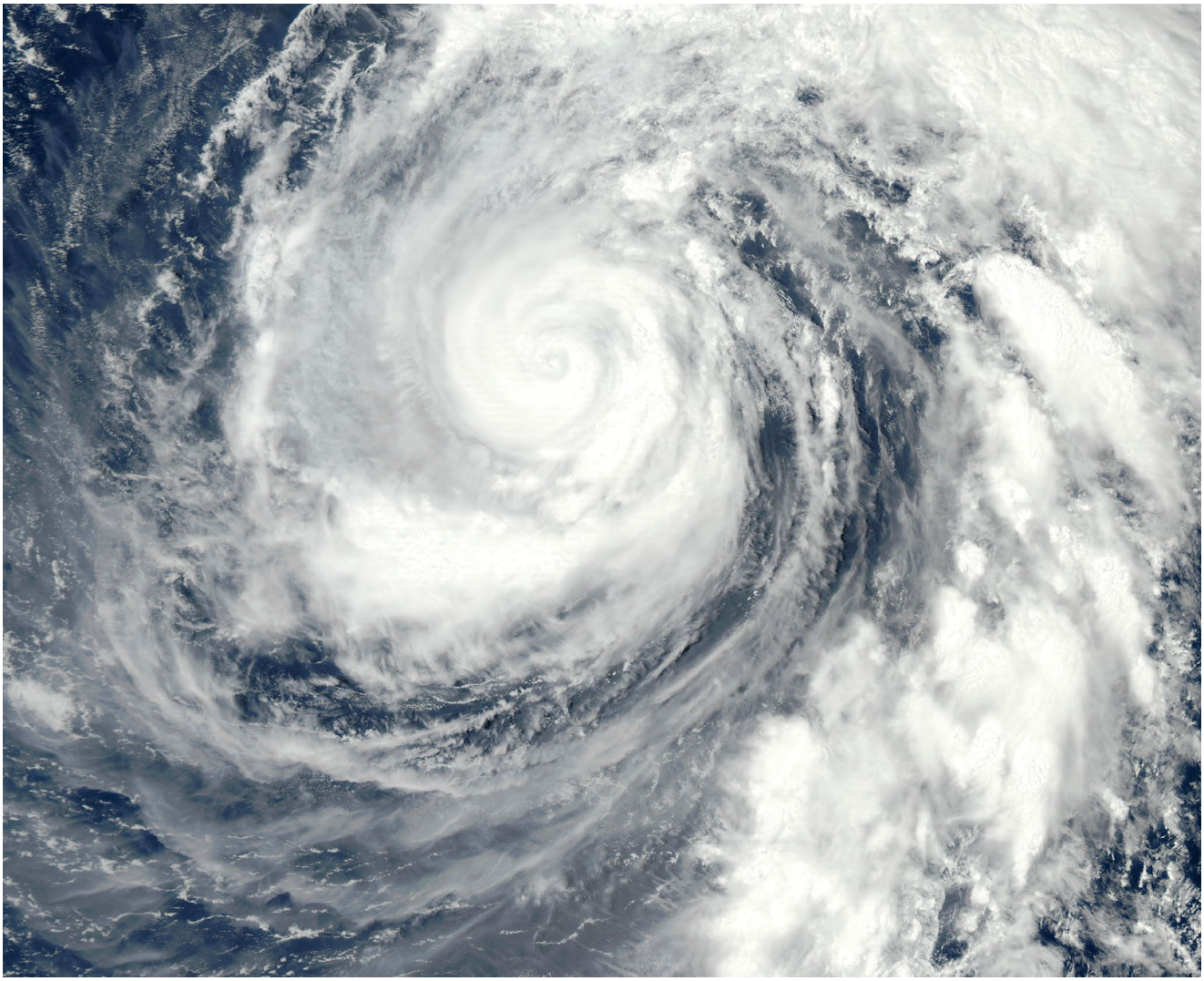
Mobile network infrastructure and other critical infrastructures must become more climate resilient to continue operating and supporting our societies

The mobile industry and all other sectors must reduce emissions rapidly to net zero by 2050 to avoid the worst impacts of climate change. But as all countries are experiencing, the impacts of climate change are already here, and they are worsening. This requires us to reduce emissions while also preparing and adapting to a changing climate.

Mobile network infrastructure and other critical infrastructures, including electricity grids, must become more climate resilient to continue operating and supporting our societies. For example, the use of on-site renewables and batteries offers benefits for both mitigation and adaptation, while also reducing operating costs compared with existing diesel generators.

More frequent and intense extreme weather events could damage telecommunication networks and electricity grids more often, resulting in service interruptions for customers and greater financial risks for operators. Network operators are especially exposed to climate-related financial risks because their valuable assets (base stations) are scattered everywhere, including areas at highest risk.

Many operators have already undertaken short- or long-term climate change risk and opportunity analysis. Nearly all operators disclosing to the CDP have identified climate-related risks, both in their direct operations and value chains, while 11% have identified climate-related risks only within their direct operations.



Leading operators are clearly communicating their climate-related risks and opportunities and how they are enhancing resilience through Climate Transition Plans

Climate Transition Plans are essential to implement net zero targets

Climate Transition Plans (CTPs) are essential for organisations to implement their net zero targets. They offer a clear blueprint for strategic delivery and coordinated action across a company. This ensures that senior leaders and teams in all business functions are synchronised in their effort to meet climate targets.

By disclosing ambitions and actions across three core channels, a CTP articulates how the organisation is decarbonising, how it is responding to climate-related risks and opportunities and how it is contributing to an economy-wide transition.

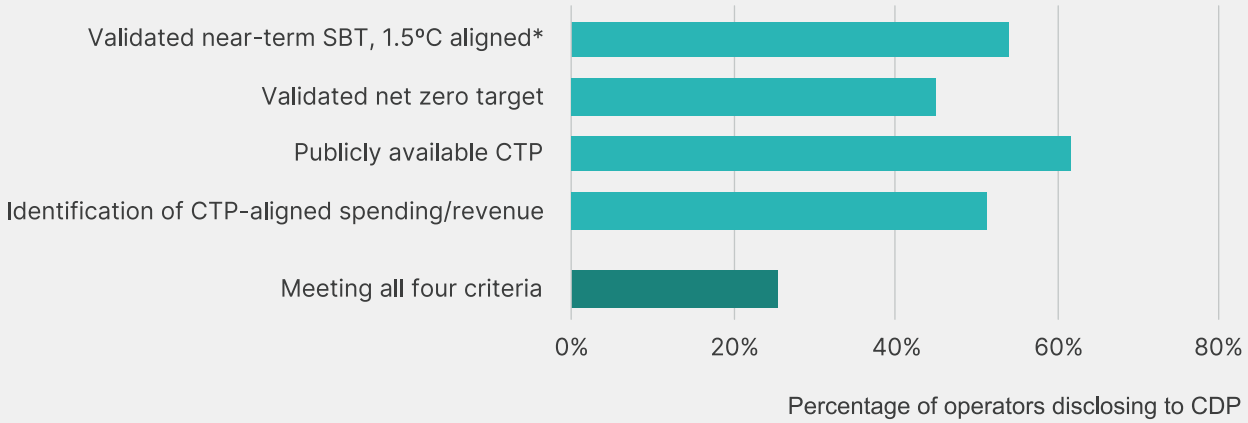
This information is also valuable to customers, policymakers and investors who are interested in understanding how services, critical infrastructure and investments will adapt as the economy transitions to net zero. Importantly, this can also arm investors with the information they need to finance the transition.

Leading operators have published CTPs

Disclosure of a CTP is required under the ISSB's IFRS S2, to comply with the Corporate Sustainability Reporting Directive (CSRD) and within the new SBTi draft Corporate Net-Zero Standard V2.

Aligned with guidance from the Transition Planning Taskforce, several mobile operators have published a standalone transition plan, including leading operators, such as Vodafone and Telefónica. Meanwhile, some operators have cross-referenced information about their transition plan within their Integrated Annual Assessments – according to IFRS S1 (par. B45–47). Based on disclosures to the CDP in 2024, around one-quarter of operators disclosing to the CDP met four minimum criteria that can be used to determine the credibility of a climate transition plan **(Figure 21)**.

Figure 21 Operators meeting key criteria of a credible climate transition plan



Based on the CDP disclosures in 2024, around one quarter of disclosing operators have met key criteria for credible climate transition plans

Notes: The criteria for near-term SBTs includes coverage of all three scopes. The criteria for validated net zero targets include a requirement to cover the entire organisation and a net zero target by 2050 or sooner. According to the CDP Technical Note for 2024, the criteria for credible transition plans include a possible 47 indicators, nine direct and 38 supporting. A selection of crucial, direct indicators is analysed here

Source: GSMA analysis of latest CDP disclosures

The GSMA is working with operators to develop transition planning guidance for telecommunication companies

Existing transition plans vary in their scope and completeness. In 2025, the GSMA is developing sub-sector transition planning guidance for telecommunications companies. It will provide a complementary telco-specific interpretation of the Transition Planning Taskforce Disclosure Framework, to harmonise mobile operators on their approach to transition planning.

Case study **Vodafone** Climate transition plan

Case study **e&** Climate plan to 2030

Case study **Nokia** Net zero transition plan

Figure 22 Developing a strategic and rounded transition plan

Source: GSMA based on Transition Plan Taskforce

6 Enabling climate action

Digital technologies and services can help reduce emissions from all sectors and make our systems and infrastructure more climate resilient.

Mobile and digital technologies can enhance our resilience to growing climate impacts

Mobile and digital technologies hold enormous potential to help people and businesses become more climate resilient, helping us better anticipate and prepare for natural disasters, limit damage during disasters and accelerate response and recovery.

For example, satellite data and geographic information systems (GIS) can aid in hazard mapping as well as assessing damage after disasters have occurred. In the event of a disaster, mobile text alerts can help communicate emergency information to populations quickly and effectively. Virtual and mixed reality can also plan an important role in visualising climate impacts and promoting adaptation strategies. AI and IoT can improve our ability to predict disasters and provide early warnings to populations. Early warning systems save lives, and just 24 hours' notice of an impending hazardous event can reduce the ensuing damage by 30%.

In 2022, the UN Secretary General launched the Early Warnings for All (EW4All) initiative, aiming to ensure that every person worldwide is covered by an early warning system. The mobile industry has played a crucial role in the development and implementation of early warning systems for decades. The GSMA is taking a leading role in the initiative by profiling industry leadership, hosting multi-stakeholder convenings, providing technical assistance to members and publishing demand-driven research. An example of the technical assistance provided to members is the collaboration of Tanzania's mobile operators, alongside government and non-government organisations, to develop a cell broadcast blueprint for a national early warning system. GSMA research includes a publication on the use of cell broadcast technology for early warning systems and guidance on how to make risk alerts inclusive for all.

In support of the EW4All initiative and to demonstrate the vital role of the mobile industry, The GSMA and ITU launched an Industry Pledge at COP28 **(Figure 23)**. All operators are encouraged to join the pledge to leverage and promote the lifesaving power of mobile networks.

Figure 23 Mobile Industry Pledge: Early Warnings for All

The mobile industry has longstanding experience in the development and implementation of early warning systems and is committed to the ambition of the Early Warnings for All initiative for everyone to be protected by 2027

Digital technologies are a critical enabler of emission reductions across other sectors and services

Digital technologies, including mobile connectivity, are key enablers of climate action. Several reports, including the GSMA's Enablement Effect 2019 and 2021, have shown how smart and connected technologies can help reduce emissions across the economy, including in services, transportation, manufacturing and energy.

In the transport sector, intelligent and connected mobility can improve the efficiency of transportation systems, while also shifting people and goods to lower carbon modes of transport. Smart and connected factories with 5G and IoT are able to improve productivity, lower energy consumption and reduce CO_2 emissions. AI and machine learning can accelerate innovation in clean materials and catalysts, for example in electric vehicle battery design and performance.

One of the biggest enablement opportunities lies in electricity systems, which account for nearly a third of global GHG emissions. Smart energy systems enabled by connectivity and AI can help balance electricity demand and clean electricity supply to increase the use of variable renewables. Smart energy systems are becoming a reality with record sales of electric vehicles (EV), widespread smart meter adoption and variable tariffs becoming more common. Smart EV charging and vehicle-to-grid were highlighted as one of five key opportunities in the GSMA report on Smart Energy Systems.

The ITU Recommendation L.1480 provides a methodology for assessing the net GHG emission impacts of using digital solutions, including consideration of second order and higher-order effects, such as rebound effects. The guidance aims to improve the consistency, transparency and comprehensiveness of assessments of how the use of digital solutions impacts GHG emissions over time.

Case study **Tele2**
Avoided emissions through digital solutions

Case study **HKT**
Supporting cross-sector innovation and promoting environmental responsibility

Case study **China Unicom**
Low-Carbon Life: Enabling individuals and advocating for a green lifestyle

7 Recommendations to accelerate progress

Achieving the industry's goal of net zero emissions by 2050 while enhancing resilience to climate impacts requires strong and concerted action from operators and suppliers, supported by enabling policies and investment from governments.

Key recommendations for operators, suppliers, and policymakers

Moving the entire mobile industry to net zero emissions by 2050 needs concerted effort and action by all stakeholders. Over the past year, the GSMA has collaborated with operators to support this transition, with an immediate focus on achieving the rapid emissions reductions required by 2030.

The following table outlines key recommended actions to enhance resilience and accelerate the industry's progress towards net zero.

Operators	Suppliers	Governments and Policymakers
Climate targets and strategy		
Set science-based and net zero targets aligned with a 1.5°C pathway Develop a climate transition plan that clearly outlines the ambitions, actions and accountability needed to meet climate targets, supporting an organisation-wide transformation	Set science-based and net zero targets aligned with a 1.5°C pathway Develop a climate transition plan that clearly outlines the ambitions, actions and accountability needed to meet climate targets, supporting an organisation-wide transformation	Prioritise a just transition to economy-wide net zero emissions by 2050 at the latest, including strengthening countries' nationally determined contributions and 2030 targets in line with a 1.5°C trajectory Implement and enhance national climate, energy and industrial policies to enable the achievement of these targets Support the private sector in its decarbonisation efforts, including through policies and incentives to reward companies' low-emissions strategies
Climate disclosure		
Assess and publicly disclose energy and emissions data and climate risks and opportunities, for example through the CDP Harmonise measurement approaches and data reporting with other operators in the country/region	Assess and disclose carbon emissions and climate risks and opportunities through the CDP	Consult with operators to harmonise and simplify reporting of key energy and emission indicators
Energy efficiency and electrification		
Optimise energy use of networks by adopting energy- efficient hardware and best practices and retiring legacy networks Reduce fossil fuel use in fleets and diesel generators	Develop more energy efficient equipment, devices and systems	Support innovation for the development and deployment of more efficient technologies Support the retirement of 2G/3G and copper-based legacy networks in consultation with industry Expand grid infrastructure in off-grid and bad-grid areas, in low- and middle-income countries, to reduce reliance on diesel generators

> continued

Operators	Suppliers	Governments and Policymakers
Renewable energy		
Purchase and use renewable energy Assess and invest in on-site renewables and/or battery storage to reduce operating costs and emissions while increasing resilience	Purchase and use renewable energy	Ensure electricity markets and regulations encourage renewables and actively engage in dialogue with private sector where there is a lack of access for the private sector Facilitate electricity market designs that incentivise load shifting to support grid operations and increased renewable energy integration
Circularity		
Engage suppliers on climate action and integrate climate requirements into procurement Develop circular economy initiatives for network equipment, mobile phones and customer premises equipment	Incorporate eco-design and circularity principles in devices and equipment, including longer software and security support Engage supply chains on climate action, including encouraging suppliers to use renewable energy and recycled materials Develop circular economy initiatives for network equipment, mobile phones and customer premises equipment	Implement laws and regulations that ensure used mobile phones can be recovered and recycled responsibly
Adaptation and resilience		
Integrate climate risk assessment into network planning, investment and technology deployment decisions	Design equipment for greater operational resilience in a wider range of future operating conditions	Facilitate cross-sector collaboration to address interdependencies during climate-related disasters Work with operators to finance and develop early warning systems Support operators in responding to climate disasters
Enabling climate action		
Deploy and commercialise digital solutions that enable climate action across all sectors	Deploy and support digital solutions that enable climate action across all sectors	Recognise the enablement effect of the digital transformation and foster innovation and investment in green digital technologies and solutions

8 Regional insights

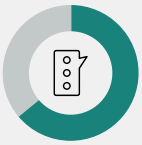
Mobile operators around the world are making progress on climate action while navigating diverse regional contexts to achieve our collective net zero goal.

Asia Pacific

- **The Asia Pacific region is highly diverse with a range of economies**, network operations and energy and climate contexts.
- **Operators in the region have made strong progress on disclosure and setting targets.** Nearly two-thirds of operators (by connections) disclosed to the CDP in 2024, while 54% have validated near-term SBTs and 20% have validated net zero climate targets.
- **Operational emissions per connection fell 9% between 2019 and 2023**, while electricity use per connection was unchanged. Operators in Japan collectively reduced their emissions by more than 40%. However, other parts of the region saw large increases, driven in part by the rapid growth in 5G and connectivity, notably in India, South Korea and Southeast Asia.
- **Operators in the region face challenges in accessing renewable energy.** The share of purchased renewables remains relatively low at around 12% due primarily to the lack of options for companies to purchase renewables in many countries in the region. The Asia Clean Energy Coalition, established in 2022, aims to accelerate demand and supply of renewable energy across Asia.
- **Governments and the energy sector can play a key role in enabling renewable energy across the region.** More ambitious climate and energy policy, changes to electricity markets and regulations to increase investment in clean energy, and the continued expansion of regional grid infrastructure in South East Asia, are all crucial to help operators in the region access renewable energy and reduce their emissions. Given the region's key role in mobile industry supply chains, decarbonising it will also contribute to reducing Scope 3 emissions for operators globally.

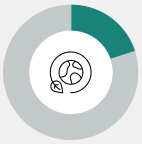
Disclosures and targets

(% regional connections)



64%
disclosed to CDP

54%
set science-based targets



20%
committed to net zero target

Energy and emissions

(% change, 2019-23)

0%
Change in electricity use per connection

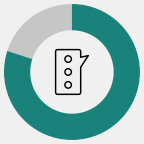
-9%
Change in operational emissions per connection

Europe

- **Operators in Europe are leading the way on climate ambition and action.** More than 80% of mobile connections in the region are covered by validated near-term SBTs and more than 60% are covered by validated net zero targets.
- **Operational emissions per connection fell by nearly 60%** between 2019 and 2023, with several operators achieving reductions of more than 80%, including Tele2, Telefónica, Telenor, Telia and Vodafone.
- **Electricity use per connection fell despite increasing demand for data and connectivity**, thanks to energy-efficiency improvements from the retirement of older, less energy-efficient 2G and 3G networks and the switch from copper to fibre for fixed networks.
- **Operators disclosing to the CDP purchased 21 TWh of renewable electricity, or nearly 40% of the global total.** This means that around three-quarters of electricity came from purchased renewables, the highest share of any region.
- **Operators are encouraged to further increase their impact by opting for power purchase agreements** over green tariffs and certificates where available. They should also consider moving towards matching their renewable energy purchases to account for both time and location.
- **Given the strong progress on operational emissions, operators should increasingly shift their attention to engaging supply chains** to reduce their Scope 3 emissions.

Disclosures and targets

(% regional connections)



80%
disclosed to CDP

81%
set science-based targets

61%
committed to net zero target

Energy and emissions

(% change, 2019-23)

-13%
Change in electricity use per connection

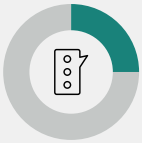
-59%
Change in operational emissions per connection

Greater China

- **Nearly all connections in the Greater China region were represented by public disclosures** of energy and environmental data. Operators are encouraged to disclose to the CDP.
- **Surging demand for connectivity and data has led to increased electricity demand.** Electricity use increased by almost 30% between 2019 and 2023, but strong reductions in Scope 1 emissions and higher renewable energy purchases helped to moderate growth in operational emissions.
- **Despite world-leading deployments of clean energy in China, the electricity grid remains dependent on fossil fuels**, which account for about two-thirds of the electricity mix. The share of low-carbon sources has increased from 22% in 2013 to 35% in 2023.
- Given the presence of many mobile industry supply chains in Greater China, decarbonising the electricity mix in the region will also help reduce emissions from raw materials and manufacturing
- For an in-depth analysis of the Greater China region, please refer to Mobile Net Zero: Greater China – Regional Focus on Climate Action 2025.

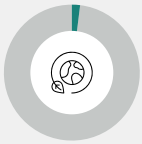
Disclosures and targets

(% regional connections)



25%
disclosed to CDP

2%
set science-based targets



2%
committed to net zero target

Energy and emissions

(% change, 2019-23)

+12%
Change in electricity use per connection

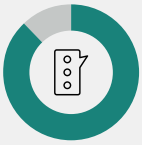
-7%
Change in operational emissions per connection

Latin America

- **Mobile operators in Latin America are leaders on disclosure and setting climate targets.** More than 80% of operators (by connections) in Latin America have validated SBTs.
- **Operators in the region have also made major strides in reducing emissions** over the past few years, reducing operational emissions per connection by 46%. Telefónica's Latin American operations, TIM Brazil and América Móvil have each reduced their emissions by more than 40%.
- **The region is also a leader on renewable energy.** Operators disclosing to the CDP purchased more than 5 TWh of renewables, or more than 40% of their overall electricity use. Algar Telecom, Telefónica (Brazil, Chile and Peru) and TIM Brazil have achieved 100% renewable electricity.
- **Operational emissions per connection in Latin America are among the lowest in the world**, due to the relatively high share of renewables on the grid.
- **Further policy support is needed across all countries in the region** to increase access to renewable energy.

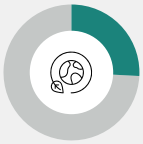
Disclosures and targets

(% regional connections)



88%
disclosed to CDP

81%
set science-based targets



26%
committed to net zero target

Energy and emissions

(% change, 2019-23)

-13%
Change in electricity use per connection

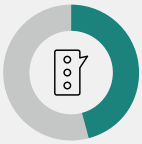
-46%
Change in operational emissions per connection

Middle East and North Africa

- **Operators in the Middle East and North Africa have made strong progress on climate action.** Nearly half of operators (by connections) in the MENA region disclosed to the CDP in 2024, while 42% have validated SBTs.
- **Operational emissions per connection fell by a quarter**, while electricity use per connection dropped 7%. Turkcell had the largest reduction in emissions among operators in the region, thanks to their renewable energy purchases.
- **Renewable energy purchases increased strongly between 2019 and 2023**, rising from less than 1% of electricity use to 22% for operators disclosing to the CDP.
- **The region holds significant potential to scale-up on-site solar generation.** Scope 1 emissions account for a relatively high share (20%) of operational emissions compared with most other regions, partly because of a reliance on on-site diesel generators. With excellent solar resources across the region, operators are encouraged to install on-site solar and batteries to reduce Scope 1 emissions.

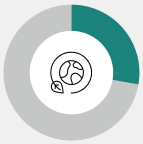
Disclosures and targets

(% regional connections)



46%
disclosed to CDP

42%
set science-based targets



28%
committed to net zero target

Energy and emissions

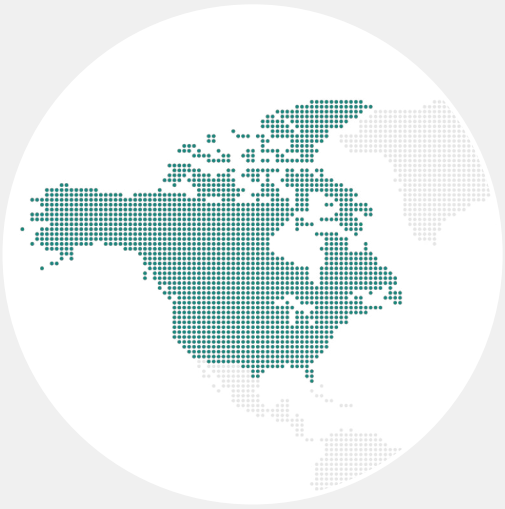
(% change, 2019-23)

-7%
Change in electricity use per connection

-25%
Change in operational emissions per connection

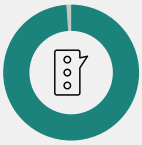
North America

- **Operators in North America are leaders on disclosure and setting targets.** Nearly all North American operators disclose to the CDP and have committed to climate targets.
- **This strong level of ambition is matched by action**, with operational emissions per connection falling by half between 2019 and 2023, thanks to strong progress on energy efficiency and renewable energy.
- **Mobile operators collectively purchased 16 TWh of renewable electricity in 2023**, or nearly half of their total electricity use. T-Mobile US matched 100% of their electricity use with renewable energy, leading to a 95% reduction in operational emissions. AT&T and Verizon also achieved strong reductions, thanks to progress on energy efficiency and renewable energy.
- **One area for further progress is fleet electrification.** Vehicle fleets account for a relatively high share of operational emissions compared with other regions, highlighting the significant potential emission and fuel savings from switching to electric vehicles. Government policies and incentives for fleet electrification can help operators accelerate this transition.



Disclosures and targets

(% regional connections)



99%
disclosed to CDP

95%
set science-based targets

29%
committed to net zero target

Energy and emissions

(% change, 2019-23)

-11%
Change in electricity use per connection

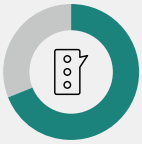
-51%
Change in operational emissions per connection

Sub-Saharan Africa

- **Operators in Sub-Saharan Africa have made strong strides in climate disclosure, target-setting and emissions reductions** over the past few years
- **Operational emissions per connection fell by nearly 40%** between 2019 and 2023, led by substantial reductions from Safaricom and MTN.
- **One of the biggest challenges in the region is access to reliable and clean electricity**, resulting in a heavy reliance on costly and emissions-intensive diesel generators. The lack of reliable grids has resulted in Scope 1 emissions – primarily from diesel generators – to increase by more than 60% between 2019 and 2023.
- **Policymakers in the region should implement policies and regulations that encourage private sector investment in renewable energy and grid infrastructure**. Additional recommendations are highlighted in the GSMA report on Energy Challenges for Mobile Networks in Sub-Saharan Africa.

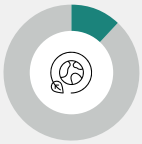
Disclosures and targets

(% regional connections)



69%
disclosed to CDP

42%
set science-based targets



12%
committed to net zero target

Energy and emissions

(% change, 2019-23)

-15%
Change in electricity use per connection

-42%
Change in operational emissions per connection

Annex: Methodology

Data sources

This analysis relies primarily on data from 78 mobile network operators disclosed to the CDP Climate Change 2024 Questionnaire. These operators represent 57% of mobile connections globally.

For operators not disclosing to the CDP in the 2024 cycle, we gathered key emissions and energy data from corporate reports (e.g. integrated annual reports, sustainability reports), if available. Data from 23 operators was collected via public reports, covering 25% of global mobile connections.

We conducted data quality checks to flag potential anomalies in the data (e.g. unit errors), including checking year-over-year-changes in emissions and energy use, intensity metrics (e.g. emissions and electricity use per connection, Scope 2 emissions per unit electricity consumed) and comparing any outliers with publicly reported data.

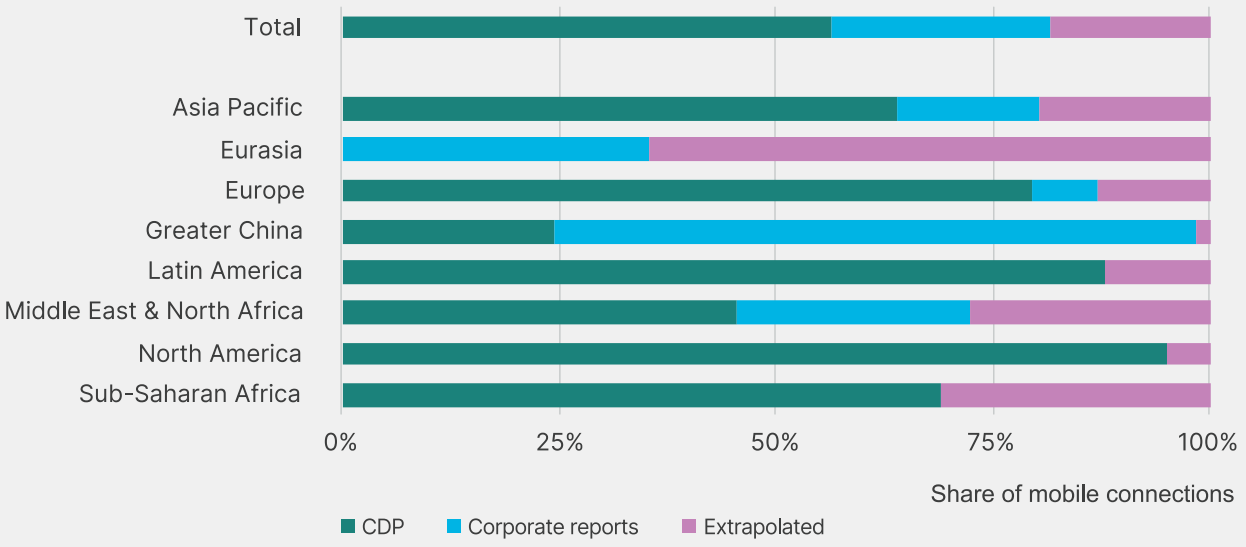
Modelling approach

Scope 1 and 2 emissions and energy data for non-disclosing operators were extrapolated at a country or regional level based on the reported data from other operators in each country or region (e.g. average Scope 1 emissions per mobile connection).

Scope 3 emissions for non-disclosing operators were extrapolated using average emissions per connection of operators disclosing all four key categories (1, 2, 3, 11) in each region.

This report updates historical (2019 and 2022) estimates presented in Mobile Net Zero 2024 to ensure comparability, increase data coverage from corporate reports and update the extrapolation approach.

Figure 24 Energy and emissions data sources, by region



The industry-level totals have been estimated using all available data sources

Note: Corporate reports include integrated annual reports, ESG and sustainability reports, and other publicly disclosed data.

Source: GSMA analysis

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