The Path to Net Zero

An analysis of the telecommunication industry

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Introduction

Premise

This report will provide an analysis of the telecommunications (telecom or Tlc) industry status and strategy in the context of the current climate crisis. As this industry is extremely broad, the focus is brought on the infrastructure managers (operators) excluding the service providers and the technology suppliers.

The telecommunications industry is widespread, reaching each corner of the globe and involves thousands of companies. To simplify this study, the largest companies of a representative western country were taken as a model with the assumption that the situation and solutions could be easily applied anywhere else.

Background: The Climate Emergency

The escalating impact of human activities since the 19th century led to consequences on Earth's climate system. Specifically, industrialisation started polluting the air through the emission of greenhouse gases (GHG), predominantly carbon dioxide, methane, and nitrous oxide, released from burning fossil fuels. These gases trap heat in the atmosphere, leading to a phenomenon called global warming.

The gravity of these issues was only recognised for the first time, by the international community, at the Earth Summit in 1992, where the United Nations Framework Convention on Climate Change (UNFCCC) was established (1).

Since 1995 the UNFCCC organises an annual Conference Of Parties (COP) to update the international community on the latest developments and to establish a strategy to prevent dangerous anthropogenic interference with the

climate system (2). Despite the countries' efforts, the planet continues to experience rising sea levels, extreme weather events, and disruptions to ecosystems, impacting human health and food security (3).

According to the latest estimates of the International Panel on Climate Change (IPCC), the current policies of the States are not yet sufficient to slow down the trend of global warming: at this rate, by the end of the century, it is estimated an increase in temperatures of 2.7°C (4), well above the 1.5°C limit proposed by the Paris Agreement and confirmed by the recent COP28.

To fight global warming and achieve a low-carbon economy it is necessary that each industry commits to reduce its impact in terms of GHG emissions from activities, facilities and services offered. This will ultimately guarantee an equilibrium in the ecosystem and secure a sustainable future for generations to come.

The role of the telecommunications industry

Some sectors play a decidedly more significant role than others in protecting the environment: one of these is telecommunications. This industry accounts for 1.4% of the global GHG emissions or about 700 million tons of CO_2eq per year (700Tg CO_2eq) (5).

The history of telecommunications goes hand in hand with that of industrialisation. Starting in the 19th century with telegraph and phones it experienced a ramping development in the following century with the advent of radio, television, cell phone and the internet (6). The new technologies brought faster communications and increased accessibility to the point that internet access is starting to be considered a right (7).

There are more than 5.3 billion internet users worldwide and for a large majority the understanding of this technology is mostly opaque or even erroneous (8). The underlying fabric of the internet is made of computers and storage, mostly gathered in datacentres, and in access networks such as electric cables, fibre optics and radio antennas. Thousands of companies work together in the background to build and maintain this infrastructure and end users usually only come across those who offer the final service. Due to their invisible nature this industry is rarely subject to the public and media scrutiny, to the detriment of the environment.

The Information and Communications Technology (ICT) industry, constituted by the telecom industry and the software industry, is currently saving 4% of global emissions; in the future the savings are estimated to reach up to 15% (5). This is a direct result of the wide spread of technologies which helps all other sectors to run their operations efficiently through faster connections and collection of enormous amounts of data.

Reducing the carbon footprint of third parties should not alleviate that of the telecom industry itself. 4% of the global electricity is consumed by this sector which often makes these companies some of the most energy-intensive in their geographic markets. As operators' energy consumption expands, so will their carbon footprint, hurting not just the environment but also their reputation and standing, particularly among the expanding class of socially responsible investors (9).

A Case Study

The telecommunication industry includes various sectors, such as retail and distribution, device vendors, content and advertising services, operators and infrastructure vendors (Figure 1).

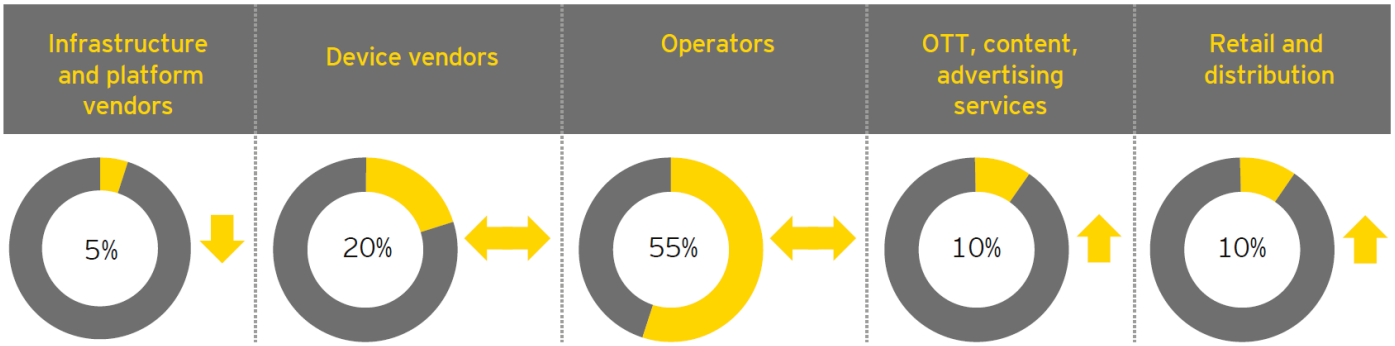

Figure 1. Telecommunications industry value chain - 2015 share of revenues by segment (27).

Figure 1 highlights that operators control the largest market share in the industry, representing companies responsible for owning and managing the infrastructure, typically providing connection services as well. These companies are usually country specific as, even if the internet does not, physical infrastructure has borders.

A case study was conducted specifically on leading Italian operator companies: TIM, WindTre and Vodafone. The findings of this study offering insights applicable to other entities within the industry or scalable to the entire telecommunications sector. Italy is a valid test case as it is one of the top world economies with a high human development index (HDI) and with cellular and internet connected users equal to 133% and 86% of the population respectively (10).

To better understand the comparison, the three companies have a revenue of 15, 6 and 5 billion euros for TIM, WindTre and Vodafone respectively (11) (12) (13). All environmental data from these companies are extracted from their 2022 Environmental, Social and Governance (ESG) reports (11) (12) (14).

Figure 2. The top three operators in Italy: TIM, Vodafone, WindTre

How do Operators Pollute?

As previously mentioned, operators primarily focus on providing telecommunication connection services. These rely on an extensive access network which in turn is supported by a core network. The operations include maintaining network functionality, implementing upgrades, and expanding network capacity. The underlying infrastructure requires large numbers of the latest hardware which is powered by an equally large amount of energy. All this entails an enormous carbon footprint with the consequences on the planet expressed above.

To have a unique number to compare GHG pollution, the gram of CO_2 equivalent ($g\ CO_2eq$) is used. Depending on the operations these have different distributions within the three scopes as summarised in Table 1.

	Scope 1	Scope 2	Scope 3	TOTAL
TIM	113Gg (2%)	342Gg (7%)	4606Gg (91%)	5061Gg
WindTre	6.7Gg (1%)	164Gg (18%)	737Gg (81%)	908Gg
Vodafone	9.1Gg	2.2Gg	n/a	n/a

Table 1. Emissions by scope for each operator in Gg of CO2 eq and as percentage of total.

TIM is the historic operator in Italy, they own and operate the most capillary landline network reaching all Italian households. This hardwire network is partially leased to the other network operators including WindTre and Vodafone. This is one of the reasons why TIM's emissions are an order of magnitude larger compared to the other two companies.

Direct emissions, known as **Scope 1**, are those directly produced by the companies through the combustion of fossil fuels. These are low in Tlc with WindTre and Vodafone reporting respectively 6.7 and $9.1Gg\ CO_2eq$. Primary contributors include ICE vehicles (≈50%) with a smaller share from refrigerant gases (≈30%) and office heating (≈10%).

TIM reports a higher Scope 1 emission of $113Gg\ CO_2eq$, attributed to cogeneration use in their datacentres (55%), extended usage of motor vehicles (29%) and only in smaller shares refrigerant gases (9%) and office heating (7%).

Indirect emissions, known as **Scope 2**, are those indirectly produced by the companies through the consumption of electricity. Datacentres and base transceiver stations (BTS) demand enormous quantities of electricity. TIM self produces part through cogeneration while emitting an additional $342Gg\ CO_2eq$ for the remaining part. WindTre releases $164Gg\ CO_2eq$ for electricity demand as a third of it comes from renewable sources.

Vodafone has the lowest scope 2 emission, emitting $2.2Gg\ CO_2eq$, owing to sourcing all energy from renewable sources. The small number is greater than zero as even renewable energies have a minimal unavoidable emission.

Scope 3 includes all the remaining emissions produced by the value chain, involving the purchase or use of goods and services by suppliers and clients. Telecom operators fall within the tertiary sector therefore their emissions are predominantly within this scope. For these a paragraph is dedicated below.

What are their Current Plans and Policies?

	TIM	WindTre	Vodafone
Carbon Neutral	2030	2030	2025
Net Zero	2040	-	-
Increase Efficiency	✓	✓	✓
Cooling	Cogeneration	Free Cooling	Free Cooling
Automotive	✓	✓	-

Table 2. Current targets and lines of action.

Vodafone has the most ambitious goals as it aims to reach **carbon neutrality** by 2025, meaning the reduction of their own emissions (Scope 1 & 2) to zero. Vodafone starts with an advantage in this regard as their electricity is already certified from renewable sources, although it is not clear how they intend to reduce the emissions from the transports and the refrigerant gases.

WindTre has set itself the relaxed target of 2030 for the same goal. TIM on the other hand has a target of 100% renewable energy consumption by 2025, and **net zero** (Scope 1, 2 & 3) by 2040.

All three companies, outside renewable electricity, have **energy efficiency** in mind. 95% of WindTre energy consumption comes from the network infrastructure, specifically the electricity consumption of the apparatus present between telephone exchanges and BTSs. Telephone exchanges are the centres forming the core network, these process calls and internet data from millions of users. Companies are aware of the energy efficiency of the current and newly purchased devices and are currently installing power meters to calculate the PUE (Power Usage Effectiveness), a value that returns the number of data bits processed per joule.

Additionally, WindTre states to have developed a method to dynamically calculate the traffic in a given point and switch off the apparatus by rerouting the data when the demand drops. Vodafone is installing new equipment, such as amplifiers, capable of replacing multiple old ones ultimately reducing consumption. TIM is decommissioning old and obsolete technologies such as the 3G network, cable TV and radio and dial-up, resulting in -50GWh in 2022.

The second part of the energy consumed comes from the buildings that contain the electronics. As a result of normal and prolonged operations devices heat up, **cooling** is necessary to elongate the lifespan of these. All companies so far use conditioning units which are generally power demanding. Vodafone and WindTre are introducing free cooling, or the practice of using fans to move external fresh air into the enclosed ambient. TIM's strategy is to use cogeneration that is the production of cooling from the excess heat of electricity generators, therefore producing both electricity and cooling for their buildings. The result for TIM is a reduction of electricity consumption of 50GWh in 2022.

Half of WindTre and Vodafone scope 1 emissions comes from **automotive** including work vehicles, mixed use and sharing vehicles. TIM's automotive emission is only 30% of the total (scope 1) but due to the higher overall emission it is nearly 10 times that of the other two companies. While Vodafone does not tackle this problem, WindTre and TIM are introducing electric and hybrid vehicles and promoting initiatives such as carsharing and carpooling schemes.

Where is Scope 3?

Scope 3 emissions are generally harder to quantify as they are not strictly related to the company operations but rather given by the emissions produced upstream and downstream. This does not mean though that the company has no control over them as they can still influence them through their actions.

As seen from Table 1 scope 3 are by far the largest emission of telecom operators. This is because these companies are service providers, their emissions are generated upstream by the devices they buy to provide the services rather than the usage of those devices. Just like most industries, telecom companies lack a consolidated plan on scope 3 reduction. Out of the three companies in analysis only TIM has a scope 3 reduction target. WindTre only mentions their emission figure while Vodafone does not analyse their scope 3 relying solely on its parent company goal of net zero by 2040 (13).

Out of the 15 scope 3 categories (15) TIM only calculated 3: purchased goods & services (cat.1), capital goods (cat.2) and use of sold products (cat.11). This is far from a comprehensive calculation lacking emissions such as both upstream and downstream transportation of purchased equipment (cat.4&9), travel (cat.6&7) and waste generated (cat.5).

The vast majority (72%) of TIM scope 3 emissions are from the production of purchased **capital goods**. 3339Gg CO_2eq are emitted each year in the atmosphere through the acquisition of new electronic equipment. This is exacerbated by a greater reliance on Chinese supply chains which tend to make it harder for telcos to meet climate goals. Huawei and ZTE, some of the largest telecom supply manufacturers, have very high carbon footprints per unit

of energy consumed, as they have no sustainability commitments and the Chinese grid is dependent on coal (16; 17). The second largest category is the purchase of service or in this case the sub-contracted technician services operating on the network (19%). This is likely a combination of the transport required by the technicians and the consumables used during reparations.

As previously mentioned, most electronic equipment suppliers are in China, consequently long distance **shipment** is used but is not accounted for in the scope 3 computation. **Travel** on the other hand, including both business and commuting, is sort of mentioned by all three companies in the context of carsharing and carpooling. This is further discussed in the following paragraph. Despite TIM dedicating several pages on circular economy and virtuous **waste management** techniques, they are not tied to the scope 3 emissions.

Scope 3 emissions may not be under direct control of the companies, and this is what makes them relatively hard to tackle. Reduction of these emissions does not require major investments and company reorganisations but rather simpler policies that force suppliers to adhere to stringent emission policies. Telecom companies could introduce more evaluation criteria in the energy sustainability when ranking their suppliers. As there are only few suppliers in this market, operators should group to increase their purchasing power and influence to ask for transparent practices across all sectors. The result is a **virtuous circle** where even the suppliers start reducing their direct emissions and their own value chain emissions.

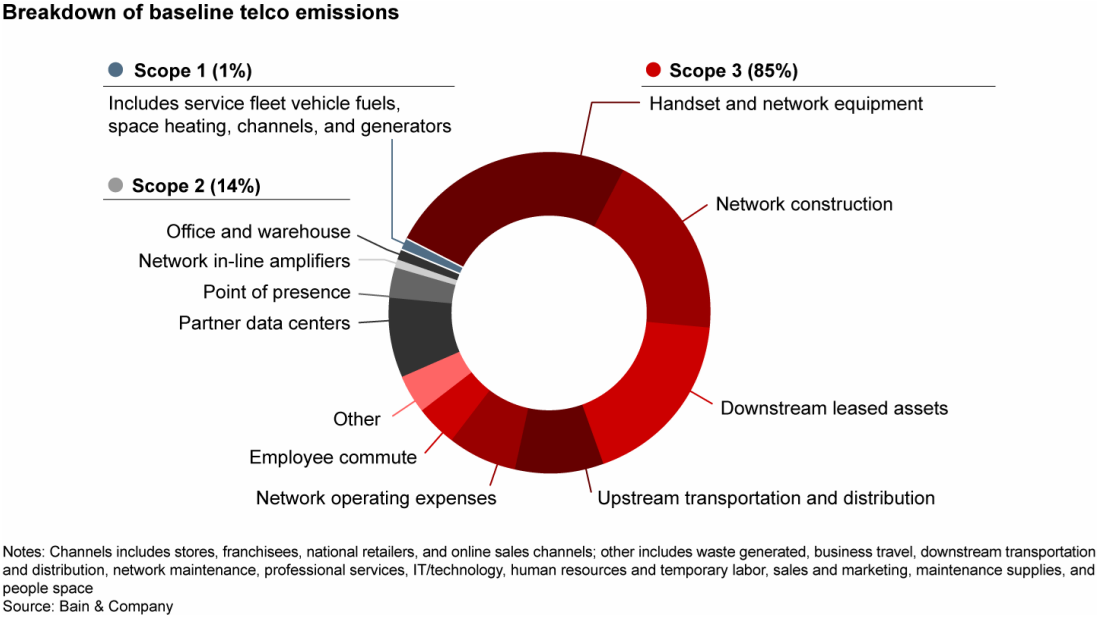

Figure 3. Overview of GHG Protocol Scopes across the Telco value chain (25)

Flaws and Revision of Plans and Policies

TIM has a relaxed plan with targets for reaching carbon neutrality by 2040. They are aiming to buy only renewable energy by the next 2 years, but their energy efficiency plans seem to rely on a reduction in electricity consumption in favour of fossil fuels. **Cogeneration** plants do reduce overall energy demand compared to pure electricity operations, but they increase the carbon footprint. While electricity can be sourced from renewables, the gas used is not. As the company has recently installed and is planning to push on this technology it will be impossible to offset their 58Gg CO_2eq emitted. This is the reason why by 2030 TIM will still emit 198Gg CO_2eq scope 1&2 combined, they are effectively postponing the problem to the next decade.

Energy efficiency is a key point in reducing GHGs, but all companies seem to be doing little other that installing smart meters and computing the PUE. Energy efficiency should begin during the procurement evaluation of new devices. It would be counterproductive to buy less efficient apparatus while pledging the reduction of carbon footprint, but there is no mention of this factor being taken into consideration.

Regarding the reduction in conditioning energy, **free cooling** is introduced as a novelty. It is shocking how such a basic concept, of using outside fresh air to cool the rooms, has not been implemented sooner. TIM does not mention free cooling, perhaps because they already use it, but instead they try to improve their cooling efficiency by installing temperature probes and 'improving' performance on existing units, without specifying how. Where companies should really invest is water cooling. This technique is increasingly being used for the thermal management of electronic components especially in high performance computers, but it is only now appearing on telecommunications equipment. Huttunen et al. (18) experimented with water cooling on a BTS and proved a 70% energy saving and 80% CO_2 emission

reduction compared to air cooling. This system could use either passive radiators or active cooling depending on the outside air temperature.

Sourcing electricity from **renewable energies**, despite being secondary to efficiency, is an easy and quick switch. WindTre and TIM should immediately change their energy supplier contracts to some providing Guarantees of Origin (GO). This action would instantaneously bring Scope 2 emissions to zero instead of waiting until 2030 and 2040, respectively. In the long term electricity should be self-produced to alleviate stress on the grid and to be market independent. Datacentres are industrial warehouses with extended rooftops, these are perfect candidates for photovoltaic installations. While BTSs cannot accommodate many photovoltaic panels, they can still benefit from the shade provided by few. This is because a BTS is usually located on a rooftop or high grounds which makes the equipment exposed to solar radiation increasing the cooling energy demand.

Another problem that is only marginally touched is the **car fleet** these companies employ. TIM has by far the largest fleet with more than 12500 vehicles, while WindTre has 1500 and Vodafone was estimated to have 1500 as well. Vodafone does not seem to be concerned with this, despite accounting for half of their scope 1 emissions, even though its parent company pledges to phase out purchasing of ICE vehicles in favour of electric (13). WindTre is slowly introducing electric (EV) and hybrid-electric vehicles (HEV) for a total of 180 vehicles. The problem with these is the lack of charging stations, only 28 are installed so far, which is insufficient compared to the growing fleet. TIM has a big burden in this regard, most of their cars is still powered by diesel with only 5% being EVs or HEVs. They aim to reduce the fleet by 8% and have installed 47 charging stations as an incentive, this is far from enough.

A last problem, which seem to be obscure due to the complete lack of plans in regard, is the dispersion of **refrigerant gases**. After the 1987 Montreal protocol CFCs were abandoned as a refrigerant gas as they were ozone-depleting, the industry switched towards HFCs and HCFCs (19). Although these do not harm the ozone layer, they are extremely potent GHGs with a Global Warming Potential (GWP) thousands of times higher than carbon dioxide (20). These gases are used in every conditioning unit and during normal operations or because of wrong disposal they leak in the atmosphere. There are already strong EU F-gas regulations regarding their disposal (19) therefore, the cause is likely attributable to leakages. Companies should spend in maintenance of their appliances to fix these leaks instead of refilling the refrigerants periodically to avoid the thousands of tons of CO_2 equivalent dispersed in the atmosphere.

Greenwashing stalemate

The green transition has become a "fashion" in the last years with more people, especially younger generations, aware of their carbon footprint. As a result, Tlc companies, especially those in contact with the public, try to appear "greener" and more sustainable to lure further clients (21). This rush to a **green façade** leads to poor decision making and investments accompanied by some greenwashing.

Greenwashing is the voluntary or accidental practice of emphasising some, usually irrelevant, sustainable actions while avoiding the real environmentally damaging practices.

Both TIM and WindTre for example invest in the energy efficiency of their offices and their retail stores by installing LED **lighting** with presence detection sensors. This is despite them stating that only 2% of the electricity is consumed by the offices and the stores. As a result, enormous investments are made in actions that do not bring major improvements to GHGs reduction.

WindTre mentions a green logistic despite them not accounting it in their scope 3 emissions because the company does not transport enough goods to be relevant. At the same time WindTre in 2022 has planted an "urban forest" consisting of **1800 trees**. They claim this would sequestrate 270 tons of CO_2 from the atmosphere in 20 years or over $13 Mg\ CO_2$ per year. Leaving to wonder how this can help to offset the $908\ Gg\ CO_2eq$ per year (Table 1).

The introduction of EVs and HEVs in the company fleets is another problem. Other than introducing a small percentage of these vehicles out of the entire fleet, there is a lack of **charging stations** installed in the company's car parks. As most of these vehicles are hybrid electric rather than fully electric, it is likely that the vehicles are ran on their ICEs because of no charging. This is proven by the figures given by WindTre's parent company which states that 'increases in gasoline/petrol usage was as a result of the expansion of the hybrid car fleet at WindTre' (22).

Greenwashing is a deceitful and unethical practice as it misleads investors and consumers. Often consumers seeking environmentally friendly solutions are willing to pay a premium for green solutions which leads to higher returns to those companies pledging sustainable practices. However, while it is tempting to publicise their pro-environmental practices, operators must be careful about overpromising or worse, making unsubstantiated claims. Deceptive messages can be noticed by consumers and regulators and can have a negative impact on a brand's credibility (21). The same candour is key to attracting and retaining internal talent.

The Rest of the World

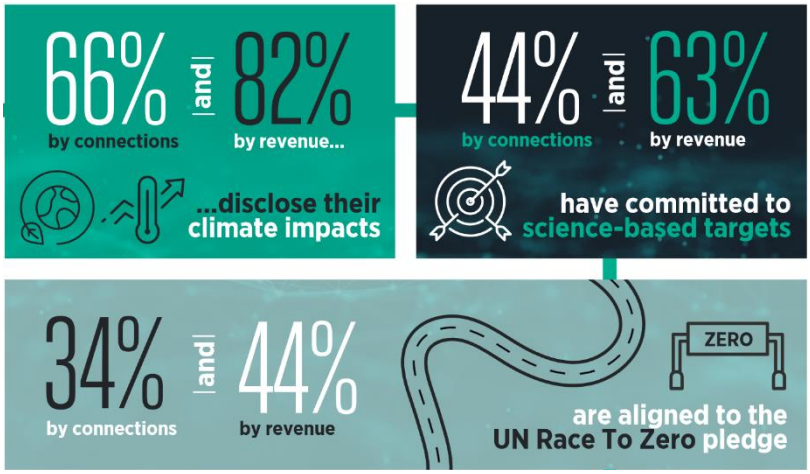

Figure 4. Reporting and targets in the Tlc industry (17)

As of 2022, **50 global operators** have pledged to reduce their carbon footprint over the next decade, up from 19 pledges in 2021 (17). Additionally, operators making up 44% of global telecom revenue committed to net-zero targets by 2050.

As discussed above this case study is representative of the situation in a major economy of a developed country. For some aspects this is a worst case scenario such as the higher energy consumption due to the larger number of connections. On the other hand, these companies can afford higher investments, benefit from large grids and larger shares of renewable energy available to purchase.

In emerging markets, low grid coverage often means operators must supply their own power with a generator set, increasing their operation costs and carbon footprint (9). European operators are at the forefront of renewables usage, as they can access renewable energy more easily via the grid. Overall, the entire industry consumed **293TWh** of electricity, of which 82% sourced from non-renewables (17).

Despite the data traffic increased by 31% in 2021, electricity and associated carbon emissions increased only 5% and 2% respectively (17). Considering most of the traffic increase would surge in emerging market, this indicates that all operators are making **efforts** towards sustainability initiatives and are achieving some small gains.

The Future

There are several technologies introduced in the last years that will directly or indirectly help the telecommunication industry reduce its carbon footprint.

The **latest technologies** such as 5G have been developed with energy efficiency already in mind with savings up to 90% in energy used compared to previous wireless technologies (17). These energy saving measures include sleep or shutdown functions in the transceiver and low-energy schedulers. Despite this efficiency 5G is sometimes considered more energy consuming than 4G when accounting the use cases. The exponential growth in traffic expected because of this new technology, in combination with the new spectrum band will require many more mobile sites, outstripping potential benefits (9).

Idling equipment is a significant problem among the operators, all the network infrastructure must be kept active and ready in case of surges in demand. It is estimated that only 30% of the electricity used by the chipsets produce revenue (23). In combination with all the auxiliary energy consuming equipment, conditioners, power converters and fans, out of all the electricity produced by or for this industry only 15% is used productively (23).

Today, thanks to the latest technological innovations, complete real-time monitoring of the network infrastructure is possible. **Intelligent controllers** powered by AI have advanced volume management capabilities allowing telcos to identify potential hotspots, energy performance and delivery inefficiencies. 73% of the electricity is consumed by the Radio Access Network (RAN) (17) - which includes BTSs - and each station could have vastly different numbers of connected users and therefore energy consumption. Optimisation can be applied by identifying the location and energy profile of each rack on a given station relative to its connectivity demand (21). This capability to map energy

distribution and site cooling capacity allows operators to move energy flow from rack to rack to improve air control and optimise thermal management.

Thermal management could be further improved by reducing the dependency on inefficient and polluting air conditioners by using liquid cooling solutions. By using water cooling apparatus can be cooled individually avoiding those inactive or sleeping. This targeted heat sequestration is also faster compared to air cooling as the heat is removed only from the required hotspots without cooling the entire room which in case of datacentres is a large warehouse. This technology is relatively new in the telecom apparatus but is already commercially available and some companies such as BT are already replacing their old air cooled equipment.

Climate change awareness and the industrialisation contribution acknowledgement is on an increasing trend. Policies and regulations in the EU for example will likely make reporting first and then action mandatory across many industries (24). Consumers are even willing to **pay a premium** for "greener" services. Companies can further engage customers through awareness campaigns, energy saving tips and recycling and take-back programs to optimise device lifecycles. Telcos that successfully position themselves this way in the market can invest some of the incremental revenue back into their internal decarbonisation initiatives (25).

What is Scope 4?

Scope 4 emission is a category that is still not officially described by the GHG Protocol (15) but has been increasingly discussed. The most common use of the term Scope 4 emissions is to describe **avoided emissions**.

Avoided emissions are the emissions reductions which occur outside a products lifecycle or value chain but because of the use of the product (26). Telecommunication services are often used as the most relevant example when explaining this scope as they have the most visible impact on everyday life. Remote communication has allowed humans to have reliable, fast, and convenient means of sharing knowledge, resulting in the avoidance of using other resources that are less environmentally friendly. Messaging has avoided the need for mail, websites allow to share information without the need for prints and calls avoid the need for physical movement of people. As a prime example the COVID-19 pandemic brought a reduction of GHG emissions as a result of less travel and employees working from home, among other things (26).

The introduction of new technologies and the increase of telecom users can potentially **reduce** up to 15% of the global emissions (5) which is an order of magnitude more that the current (1.4%) telecom industry GHG emissions. This should not be used as an excuse for the sector to avoid reducing their footprint, as, through their value chain, they still influence a larger industry. But at the same time companies should not be penalised for temporarily increasing their emissions to develop solutions which have higher benefits in the long term.

With a firm understanding of scope 4, organisations can allocate resources to research and development to try and innovate products at a rate or in a way that will not increase emissions. This will allow to develop emissions scenarios that clearly outline the potential outcomes of developing a more sustainable product (26).

Conclusions

While the mobile industry has continued to see double-digit growth in data traffic, their environmental impacts have grown at a much slower pace. This is a positive sign which shows the industry is moving in the right direction. Yet, continued efforts are needed to prevent new emissions rising and to rapidly decrease them.

A major component of reducing carbon footprint is optimising energy consumption. Nearly all scope 1 and 2 emissions of this industry come from the energy intensive capillary network. Inefficiencies are the main contributor as most of this energy does not generate profit. While telecom operators have started to make some progress in this regard, they still need to prioritise efficient solution to reduce the energy demand in the first place and subsequently shift to renewable provision to eliminate all their direct emissions.

This goes through the purchase of new devices, introducing effective liquid cooling, reduce ICE vehicles use and install photovoltaics or wind plants on their sites. Some savings also lie in deploying artificial intelligence, machine learning and the internet of things to manage volume in a smart way and optimise current energy consumption. The extent of the potential savings is broad and will inevitably vary by operator and market.

On the other hand, this report also outlined how the entire telecom industry is not a large contributor of greenhouse gas emissions, but most of their footprint is given by the value chain their create. Scope 3 emissions from activities across suppliers, product lifecycles, and customer usage comprise most emissions. While progress has been made on

scope 1 and 2 emissions, scope 3 emissions remain a blind spot that demands urgent action. Currently there is a lack of visibility into supplier and vendor emissions.

Telecom operators should start demanding greater transparency and coordination between suppliers by enforcing stringent evaluation criteria during the competitive bidding processes. Addressing scope 3 emissions is vital for telecommunications companies to meet climate goals and lead the transition to a sustainable digital future.

While operators can publicise their proactivity towards sustainability to lure more climate conscious clients and charge higher for their services, they must be careful about overpromising or worse, making unsubstantiated claims. Greenwashing will eventually be noticed by consumers and regulators, damaging the company's reputation.

Figure 5. Summary of the decarbonisation plans (17)

In conclusion, the industry players can start by taking individual small steps to better manage and assess their own environmental behaviours. Ultimately, courageous leadership and collective diligence across telecommunications companies' value chains are imperative to drive progress. The moment for action has come.

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