The sustainability contribution of the European independent TowerCos sector

A report for the European Wireless Infrastructure Association

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Strategy realized

EY Parthenon

Building a better working world

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01
Foreword

The telecommunication sector will undoubtedly play a crucial role in the green transition. Thanks to 5G and the Internet of Things, consumers, businesses and public authorities will have the opportunity to implement new technologies and deliver new, more sustainable business models.

The sector is also, of course, an emitter of greenhouse gases and the European Wireless Infrastructure Association, along with its members and many other organizations across the economy and society, recognizes that sustainability is everybody's business and that the industry should embrace innovative business models and new technology to reduce wastage, reduce energy consumption and reduce emissions.

The EY organization is committed to helping our clients understand and communicate their carbon footprint, drive reductions in emissions and put sustainability at the center of how value is created. For this reason, we are excited to present this report, a collaboration between the EY organization and the European Wireless Infrastructure Association, focusing on how the independent TowerCo sector can play an important role in delivering green, sustainable future connectivity through reduced energy consumption and reduced duplication of infrastructure.

It gives us a huge sense of pride to introduce this report, thank you to all those who have contributed.

Olivier Wolf
EY-Parthenon
Global TMT Leader

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02 Executive summary

Access to fast, reliable and ubiquitous connectivity represents a unique opportunity for European citizens to unleash economic growth by exploiting the potential of new telecommunication technologies like 5G and IoT.

Mobile data consumption is expected to continue growing in the next decade, and governments across Europe are supporting further rollout of 5G outside urban centers.

Together, these factors will require the deployment of new tower sites to provide coverage in new areas and to increment network capacity in densely populated areas.

- Deploying this infrastructure will not come without a cost for the environment. Building a new site requires significant quantities of steel and concrete, two of the most carbon-intensive construction materials.
- Independent TowerCos, thanks to their inherent infrastructure sharing, are the most carbon-efficient way to deploy the infrastructure network needed to satisfy the demand for data consumption expected by 2030.
- Thanks to the ability to host active equipment from multiple mobile operators, a scenario where independent TowerCos are responsible for the deployment of 50% of all towers by 2030 will result in 109,000 fewer towers being built.
- Compared to current carbon offsetting strategies, in an independent TowerCo-led deployment scenario CO2 emissions associated with building and operating fewer towers will result in avoided, and not compensated, emissions.
- A TowerCo-led deployment by 2030 in Europe will result in the avoidance of almost 4 million tons of CO2 emissions. This is the equivalent of taking almost 200,000 cars off the road each year. Over 2 million tons of emissions will be saved through reduced energy usage, 1.1 million tons from reduced steel usage, 0.6 million tons from the reduced concrete requirements, and the remaining 0.1 million tons from emissions associated with construction.
- Additionally, a TowerCo-led deployment scenario will mean a decrease in the sector's environmental visual pollution as fewer towers will have to be deployed, especially in rural areas.
- Further reductions in CO2 emissions are expected following a reduction in travel to and from the towers by maintenance teams.
- Additionally, independent TowerCos will play a crucial role in enabling new technologies aimed at reducing carbon emissions of businesses and households.
- Supporting the deployment of 5G, independent TowerCos will enable a network of smart sensors, smart grids and connected devices that will support the de-carbonization of multiple industries in the future.
- Finally, independent TowerCos are leading the industry efforts to introduce new technologies and processes to decrease the carbon footprint of the sector. From the use of renewable energy sources in towers not connected to the grid to the deployment of technologies to monitor and reduce maintenance needs, independent TowerCos are proving that connecting Europe can be done in a sustainable, carbon-efficient way.

03 Introduction and context

Introduction

This report explores the beneficial impact of the independent TowerCo sector contributing to the carbon savings needed to achieve European targets of reducing emissions by 55% by 2030 and achieving net zero by 2050. The analysis shows how greater levels of network sharing achieved by independent TowerCos will reduce the carbon emissions associated with the creation of new sites and lower the carbon emissions through the more efficient operation of those sites.

Towers form a critical component of the passive wireless infrastructure which represents one of the three pillars of the wireless network services value chain, alongside active radio access networks (RAN) and the mobile network core. Towers and the associated site facilities for mobile, broadcasting and other wireless networks are operated either by the mobile network operators (MNOs) themselves or by tower companies (TowerCos).

In Europe today, 35% of towers are provided by independent TowerCos, and this share is set to grow as MNOs seek to increase the efficiency of wireless infrastructure through increased levels of sharing and to release capital which can be redeployed in their 5G network roll out by outsourcing.

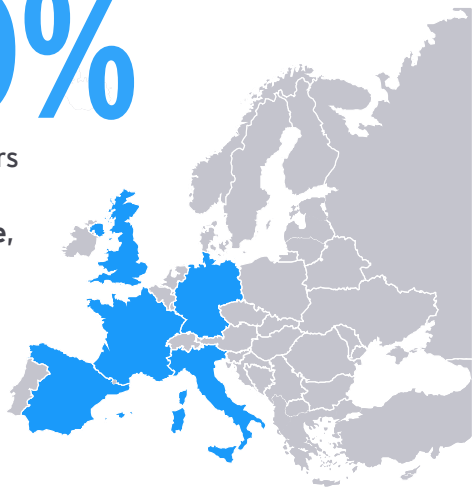
The context

Today, there are approximately 440k tower sites in Europe[1], including rooftops and other larger structures used for wireless communication (but excluding small cells and the distributed antenna system (DAS)). Around 60% of Europe's towers are located in Germany, France, Italy, Spain and the UK. Considering 5G rollout, the increasing coverage obligations and the growth in consumer data demand that will require further densification in urban areas, EY estimates a 1%–3% growth rate per annum in the number of towers for the next five years.

Around

60%

of Europe's towers are located in Germany, France, Italy, Spain and the UK.



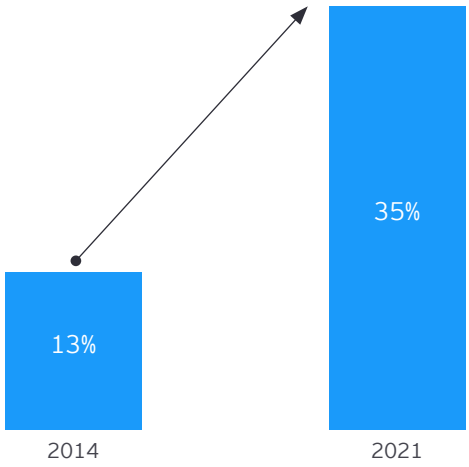
[1] EY-Parthenon, EWIA member companies, updated January 2022.

Over the last couple of decades, tower ownership has increasingly been transferred from MNOs to separate TowerCos as MNOs look to more efficient business models in the face of increasing capital intensity. These TowerCos can take the form of an internal division within an MNO, a separate entity controlled solely or jointly by MNOs, or a wholly independent entity.

Independent TowerCos represent the most mature model of wireless infrastructure sharing, owning the passive infrastructure on a site and leasing space to MNOs to host their active equipment. TowerCos typically either build the infrastructure or acquire it from an MNO in sale-and-lease-back transactions.

In the past few years, the share of towers directly owned by MNOs in Europe has declined, with independent TowerCo penetration growing from 13% in 2014 to 35% in 2021[2]. While the past two years have shown an acceleration in terms of independent TowerCo penetration, it remains low when compared to other regions (90% in the US, 55% in Central and Latin America and 52% in India)[3].

Independent TowerCo penetration



Previous studies[4] conducted by EY for EWIA in 2020, 2021 and 2022 have highlighted how sharing towers with multiple tenants reduces the overall cost for mobile operators, helps increase coverage and reduces consumer prices.

Thanks to infrastructure sharing, previous economic modeling results have demonstrated how a site managed by an independent TowerCo is up to 40% more efficient than one managed by an MNO – including spin-off and joint ventures – resulting in economic savings of more than €30 billion across Europe by 2030.

Independent TowerCos are expected to play a key role in enabling a cost-efficient 5G rollout, especially in less populated and rural areas. Previous estimates[5] from EY suggest that up to €28 billion of capital could be released through outsourcing to independent TowerCos, providing much-required capital to MNOs to improve coverage and accelerate 5G rollouts.

Capital availability to support widespread 5G network rollout is not the only challenge facing the wireless network services sector. With increasing data demand, the sector will face the need for further tower densification as well as increasing energy consumption, with important environmental consequences.

The TowerCo business model represents not only the most financially efficient way to ensure the successful deployment of 5G networks across Europe but, thanks to the lower number of sites due to higher sharing and tenancy ratios, also the one with the least impact on the environment.

Independent TowerCos are already making sustainability a core principle in their business strategy. Use of renewable sources, new energy-saving technologies and improved deployment strategies are actions which are currently being taken by EWIA members to reduce the carbon footprint of the sector, as set out in the case studies below.

[2] Ibid.
[3] Ibid.
[4] "The economic contribution of the European tower sector", a report for the European Wireless Infrastructure Association. 2019, 2020 and 2022.
[5] Ibid.

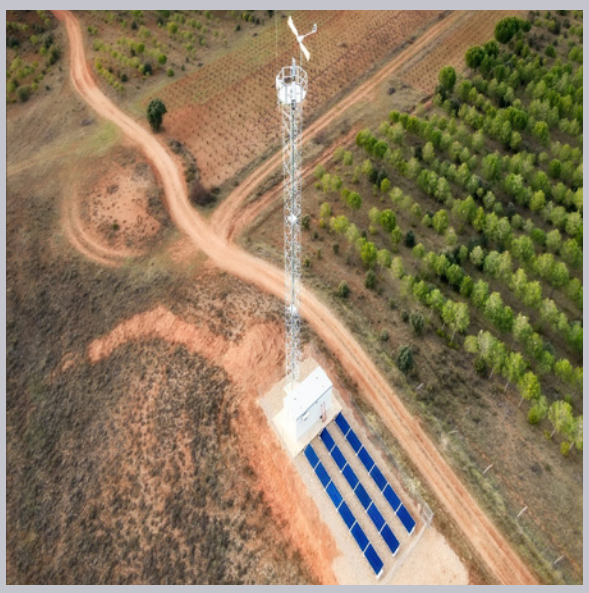
CASE STUDY 1

Cellnex

Sustainability is at the core of Cellnex, with environmental, social and governance (ESG) principles integrated in every aspect of the company strategy.

After designing and publishing the 2021-2025 ESG plan, Cellnex further committed to the path of sustainability developing a list of main ESG key performance indicators (KPIs) with defined targets to be accomplished by 2025. The monitoring, disclosure of the results, and evaluation is conducted independently and publicly.

Cellnex has put in place a decarbonization strategy aiming to become carbon neutral by 2035 and net zero by 2050. In this context, a number of innovative solutions and programs have since been implemented, including solar power self-generation solutions for almost 700 sites by the end of 2022.



5G rural site. Image property of Cellnex.

Cellnex, in collaboration with the Phinergy company, has successfully completed the pilot program to test and validate the use of aluminum-air batteries as backup power at its sites. The project was carried out at Ossa de Montiel, located near the Lagunas de Ruidera Park in the province of Albacete (Spain) and consisted in replacing a diesel generator set with these innovative aluminum-air batteries.

This innovative technology developed by Phinergy leverages the fact that renewable energy from hydroelectric power plants is stored in blocks of aluminum, a metal that is very abundant in nature and easy to transport and handle. Subsequently, to generate energy, the aluminum is combined with oxygen from ambient air using state-of-the-art air electrodes in a totally silent process that generates no emissions or pollution. Once the energy stored in the aluminum has been used, the end result is an aluminum oxide which can be processed again to convert it into aluminum, thus closing the cycle without generating any type of polluting waste.

Green off-grid site. Image property of Cellnex.

The aluminum-air battery module used in the pilot project delivers 4kW, enough to power a medium-sized telecommunications infrastructure, with a ~20 hours capacity.

Once the pilot project was completed and in view of the results, the aluminum battery system was kept on site, with the aim of being the normal backup power system and to evaluate the potential to incorporate it into the technological solutions that Cellnex uses at its sites. In this way, the company continues to make progress in fulfilling its ESG commitments to use renewable energy sources at its facilities.

The use of aluminum-air batteries as the backup power at a telecommunications site is just one of the many possible applications of this technology. Given the ease of transport and installation, it is possible to use these batteries with zero environmental impact in rural locations, areas of difficult access, offshore sites and generally wherever a conventional power line is technically or economically unfeasible. Even electric vehicles will be able to benefit from this technology, with packs that will allow them to extend their autonomy when chargers are not readily available.

CASE STUDY 2

NOVEC

Martin Haneveld
Manager Operations

NOVEC, as service provider for OTC, has recently started has recently started to develop its sustainability strategy, with the goal of understanding and quantifying the carbon footprint of its operations as well as of its contractors and upstream providers.

Currently, the company is active on multiple fronts in terms of sustainability initiatives. From a regulatory perspective, NOVEC is in the process of obtaining the ISO 14001 certification, aiming at improving its environmental performance through more efficient use of resources and reduction of waste.

From an operational perspective, NOVEC has recently started to renew its commercial and technical fleet by promoting the use of electric, hybrid or more energy-efficient vehicles, setting a carbon emission cap on the company fleet. Finally, from a strategic perspective, NOVEC is currently in the process of evaluating and quantifying the carbon footprint in its scope 1 and 2 (direct and indirect) emissions.

"I think a lot can be achieved cost neutral, once we better understand from where our carbon emissions are mostly generated," tells Mr. Martin Haneveld, operations manager at NOVEC and in charge of the sustainability transformation. "NOVEC's environmental commitment is driven by a conscious ethical decision. We believe companies should commit to a sustainable future, especially when this doesn't require fundamental changes to the way we operate."

NOVEC supports EWIA's position that independent TowerCos represent an efficient way to decrease the industry footprint, avoiding duplication of network infrastructure and the associated energy consumption. "In a world where the energy factor is more and more crucial," concludes Mr. Haneveld, "maximizing infrastructure sharing is key to ensure a sustainable and energy-efficient future for the industry."

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Martin Haneveld
Manager Operations

04
Future sustainability challenges and opportunities

The wireless telecommunication sector can play a fundamental role in enabling new technologies that will help decarbonizing some of the most carbon-intensive industries.

The provision of mobile services and, more specifically, 5G are expected to play a fundamental enablement effect in helping other industries, like power and energy, transport, building management and manufacturing, to drastically reduce their own CO2 emissions.

Important productivity gains are expected to derive from the combination of digital infrastructure and artificial intelligence (AI), resulting in lower energy consumption and associated CO2 emissions reduction.

GSMA[6] estimates that mobile and digital tech can enable emissions savings of 40% in the four industries (power and energy, transport, buildings and manufacturing) that make up 80% of global emissions.

However, as part of the ICT industry, mobile networks also play a non-negligible role in terms of CO2 emissions, mostly through the radio access network (RAN)[7]. Recent estimates from GSMA suggest that more than 70% of overall energy consumption comes from the RAN, with the remaining share being distributed between core energy consumption and operations[8]. This estimate doesn't include any consumer-related energy consumption, for example, energy use to power and recharge a smartphone.

The deployment of 5G technology, a new radio (NR) standard that it is far more spectrally efficient than 4G (and even more so than 3G) will provide operators with the ability to drastically increase the amount of traffic per unit of spectrum and power. Nevertheless, because new 5G use cases will drive significant increases in average data usage and create the need for network densification, there is a possibility that 5G will lead to higher energy consumption overall. This is combined with the requirement for new sites to be built, resulting in higher emissions through increased demand for carbon-intensive construction materials such as concrete and steel.

MNOs and network infrastructure managers, such as TowerCos, are already heavily investing in new technologies to reduce energy consumption and expand renewable energy use. All major MNOs have committed to a net zero target by 2050, with many operators already achieving a carbon-neutral position in recent years[9].

[6] GSMA, 2022 Mobile Industry Impact Report: Sustainable Development Goals, September 2022.
[7] With networks, excluding terminals, representing the most carbon-intensive part of the RAN.
[8] GSMA Intelligence, 2021.
[9] GSMA, Mobile Net Zero State of the Industry on Climate Action, 2021.

Data demand increase

Data demand increase is expected to continue growing exponentially in the next decade, driven by an increase in the time spent online using the mobile network, as well as by an increase in data requirement from new 5G use cases.

In the next decade, new use cases enabled by 5G connectivity will drive the increase in data traffic exchanged over mobile networks. New applications, including augmented reality (AR) and virtual reality (VR), as well as the expansion of Massive Internet of Things (MIoT) services for the deployment of smart cities and smart agriculture technologies, will drastically increase mobile traffic demand. Monthly data consumption is expected to growth at a rate of 20% per year in the next decade, with Western European consumers outperforming the global average[10].

In addition to this, consumers are expected to continue spending more and more time online from their devices, both indoors using Wi-Fi connectivity as well as outdoors using 5G. The expansion of 5G services will open new opportunities in terms of work mobility and streaming services consumption while transiting from home to work, also supported by an increasing number of MNOs offering unlimited data subscription plans.

The increased data consumption will put a strain on MNOs' capacity to meet demand, requiring them to activate the higher frequencies allocated to 5G and densify their networks through the addition of new sites.

[10] Ericsson, Mobile data traffic outlook 2022.

5G coverage expansion

> Coverage expansion with 5G is a top priority for European policymakers and will require the deployment of new sites across Europe.

The European Commission set out a European approach to a digitalized economy and society, taking into account the strategic importance of digital transformation. The 2030 Digital Compass Communication "The European way for the Digital Decade"[11] outlined this approach.

The Commission proposes to raise the level of ambition at the EU level regarding the deployment of 5G infrastructures. It aims to ensure that all European households are covered by a Gigabit network by 2030, with all populated areas covered by 5G.

Currently, 5G networks in Europe are mostly deployed in dense urban areas and localized infrastructure with a relatively high number of users, including airports, campuses and stadiums. Expansion of 5G coverage will therefore require the deployment of new antennas, through small cells, rooftop sites and ground-based sites.

[11] "The European way for the Digital Decade", European Commission.

More energy efficiency technologies and decommissioning of old networks

There are a number of energy efficiency features with 5G technology that will help reduce the sector's energy consumption per Mbps compared to previous mobile technology generations.

It is expected to revolutionize the sector not only from a user experience perspective but also in terms of carbon emissions.

The 5G networks are expected to be more efficient than previous generation networks per GB of traffic transmitted. 5G can reduce carbon emissions through more efficient use of energy, thanks to a number of technological innovations.

Smart-sleep mode technology enables the 5G site to enter into a "sleep" mode when there is no traffic, for example, at nighttime. This allows an important reduction in terms of energy consumption without compromising network performances or reliability.

Beamforming technology enables antennas to focus the wireless signal on where the consumers' devices are positioned, reducing energy spent on broadcasting the signal in locations where devices aren't present.

Massive multiple-input, multiple-output (mMIMO) antennas, compared to the previous generation, allow improvement of the quality and capacity of the radio signal without increasing energy consumption.

Finally, MNOs are starting to announce the decommissioning of less efficient legacy 3G networks, with the planned switch off already announced in some European countries. This will allow the use of the previously allocated spectrum for more modern mobile technologies, primarily 5G, which will bring the associated energy efficiency benefits.

How digitalization can help reduce global carbon footprint

> TowerCos and mobile connectivity will enable a green revolution in multiple industries, from energy to transport and manufacturing, reducing the overall carbon footprint.

Mobile technology is a primary enabler of digitalization, enabling fast, reliable connectivity almost anywhere in the world. With the introduction of the most recent mobile technology, 5G, consumers and Internet of Things (IoT) devices can now access high-speed/low-latency connectivity, opening the floor for a number of new use cases and applications, improving productivity, reducing energy consumption and providing the tools that different industries need to help achieve their carbon emission goals.

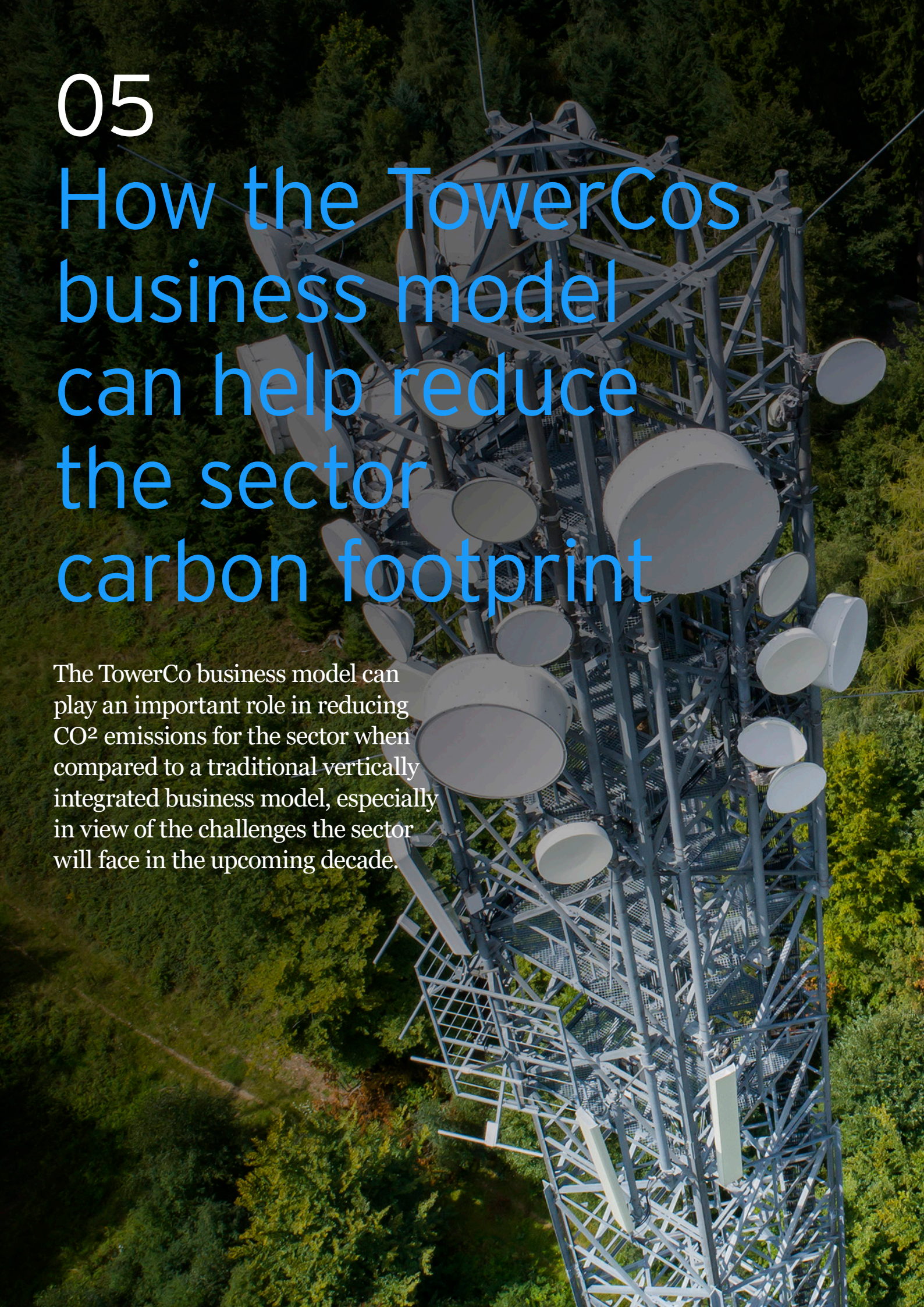
Big data and IoT have the potential to be significant drivers for emission reduction and mitigation solutions. Their application will assist the transport, manufacturing, agriculture, building, energy and other sectors in reducing greenhouse gas (GHG) emissions and increasing the efficient use of resources while protecting the environment.

In the energy sector, smart grids are an ideal candidate for 5G and IoT-enabled digitalization, and can be a critical enabler in making the energy sector more efficient. Empowered with IoT sensors and online controllers, transformers, meters and other utility equipment, power flows can be monitored from generation points to consumption. Coupled with cloud computing, smart grids can be used to adjust electricity flows according to supply and demand automatically.

In the building management sector, smart meters, as enabled by 5G IoT networks, will enable the optimization of electricity usage for lighting and heating in private and commercial buildings. Coupled with AI solutions, they will allow a smarter and more efficient use of energy based on usage patterns, time of the day and seasonality.

In the transport and traffic management sector, 5G and 5G-enabled IoT devices can save time, fuel and vehicle emissions by reducing traffic congestion and idling. Smart cities equipped with sensors and cameras allow traffic managers to obtain real-time data on traffic, keeping it flowing and modifying traffic light intervals to avoid delay. Mobile technology can also help reduce the number of cars on the road by helping drivers find parking spaces and enabling ridesharing.

In agriculture, 5G-enabled sensors and IoT networks can optimize agricultural production, including water use. Furthermore, smart agriculture — defined as the use of sensors — data analytics and AI will allow farmers to better understand the life cycle of the crops to ensure the plants are harvested at the right time. Food freshness and spoilage can also be detected by sensors, allowing consumers to know when food is safe to eat without depending on expiration dates.



05

How the TowerCos business model can help reduce the sector carbon footprint

The TowerCo business model can play an important role in reducing CO^2 emissions for the sector when compared to a traditional vertically integrated business model, especially in view of the challenges the sector will face in the upcoming decade.

Reduced number of sites

Independent TowerCos will enable greater levels of infrastructure sharing, resulting in a smaller number of sites to be built in the next 10 years without compromising coverage and or capacity. This will result in concrete and steel materials not being used, leading to a net carbon emission saving.

There are two principal types of towers – ground-based towers and rooftop towers. Ground-based towers are typically freestanding structures, comprising a steel structure on a concrete foundation, and are more prevalent in less densely populated areas. Rooftop towers are (usually) comprised on just a steel structure which is set up on pre-existing buildings and are typically located on the roof, roofing pavement or high windows (e.g., in the case of a church bell tower being used as a rooftop tower).

We expect that up to 85% of new tower sites built by 2030 will be represented by ground-based towers. This is based on a number of assumptions: first, the fact that 5G coverage expansion will require deployment in suburban and rural areas where this type of site is usually deployed. Second, with the increase of market penetration of small cells, we expect this kind of antenna system (rather than rooftop towers) will provide more and more capacity in urban and densely populated areas.

Thanks to the infrastructure sharing aspect, deployment of the future 5G networks through independent TowerCos will require a reduced number of towers, without compromising coverage or network capacity. This means that concrete and steel, two of the building materials needed to deploy a tower, will not have to be generated, representing a true savings in terms of carbon emissions.

Furthermore, site construction also involves carbon emissions, for example, in terms of transportation of building material to the site. With no need for deployment of new towers thanks to sharing infrastructure, this represents an additional net carbon saving.

An average ground-based tower requires 80 tons of concrete[12] and six tons of steel[13] to be built and additional resources in terms of transportation and installation costs.

Based on the expected growth rate of sites in the next 10 years, we expect that up to 109,000 fewer towers will have to be built in a scenario where the TowerCos sharing business model dominates compared to a scenario led by MNO deployments.

In addition to this, the financial savings deriving from infrastructure sharing could be re-invested by MNOs in greener technologies or in deploying additional active equipment, expanding 5G coverage and capacity, and driving an acceleration in the greening enablement effect discussed above.

Based on the expected growth rate of sites in the next 10 years, we expect that up to 109,000 fewer towers will have to be built in a scenario where the TowerCos sharing business model dominates compared to a scenario led by MNO deployments.

[12] Source: EY, EYP, EWIA members, desk research.
[13] Ibid.

Energy savings

Independent TowerCos sharing of passive equipment, including cooling and air conditioning infrastructure, as well as energy saving technologies and use of renewable resources, will drive energy savings.

Operational energy savings is another area where independent TowerCos can play an important role. Two aspects in particular are expected to drive energy savings: shared cooling facilities and an innovative energy savings feature, coupled with the use of renewable sources.

Cooling systems are a necessary feature for sites that don't have an outdoor cabinet and are in geographical areas where the climate requires cooling. In Europe, this represents up to 50% of the total towers[14].

For new towers deployed over the next decade, we expect that the sharing of cooling infrastructure on sites requiring cooling, coupled with the energy saving feature could bring down annual energy consumption of a ground-based site by up to 15%.

Furthermore, site maintenance – both ordinary and extraordinary, for example, in case of damages deriving from weather destruction – requires maintenance teams to deploy one or more vehicles to the site. These vehicles are mostly represented by vans or heavy-duty vehicles, the production and use of which have an important carbon footprint.

Thanks to a reduced number of towers, we expect a reduction in maintenance visits, reducing both the number of kilometers travelled by maintenance teams, as well as the size of the fleet needed. This will be translated in an overall reduction of pollution deriving from CO2 emissions of maintenance vehicles.

[14] Ibid.

Reduction in visual pollution

There is increasing public pressure to avoid unnecessary visual impact from the construction of new mobile towers, including from local authorities. Thanks to infrastructure sharing, independent TowerCos will reduce the number of towers needed in the next 10 years.

The deployment of 5G networks is re-opening age-old concerns about the impact of wireless network infrastructure on the environment around it. Policymakers have scrambled to keep pace and to tackle this issue of visual pollution while also striving to maintain incentives for continued network investment. Planning authorities typically encourage the sharing of existing infrastructure where this can be achieved, rather than deployment of new sites.

In particular, the prospect of massive site grid densification, as described above, will be achieved by deploying a combination of traditional multi-band ground base towers and, for the first time, introducing scores of small cells in extremely close proximity to maximize capacity and improve signal quality.

06
Quantifying the future carbon emissions of the telecommunications sector

Our analysis and assumptions

We have assessed how a future 5G TowerCo-led scenario rollout could result in fewer greenhouse emissions when compared to a traditionally MNO-led scenario, based on a number of assumptions detailed below and in the annex. It must be noted that the current (2022) situation is in the middle, as the shift to a more TowerCo driven model has already started.

We have maintained similar inputs and assumptions used in the 2022 economic impact assessment model to provide a coherent reflection of the economic and, now, environmental benefits of the independent TowerCos business model.

Our analysis assumes a 3% annual net growth in points of presence over the next 10 years. These scenarios below are hypothetical and are based on the assumed inputs and on the likely evolution of the independent TowerCos market from a starting point which has been updated to January 2022.

MNO-led scenario

Proportion of towers owned by independent TowerCos: 17% – assumes that the proportion of towers owned by independent TowerCos hypothetically remains as they were in 2018 in order to align with the hypothesis of the economic study.

New towers required to meet predicted demand: circa 220,000.

TowerCo-led scenario

Proportion of towers owned by independent TowerCos: 50% – assumes that a large proportion of towers that are controlled by MNOs today are outsourced to TowerCos but assumes that those towers that are part of a joint venture are more difficult for MNOs to outsource.

Also assumes that MNOs sell more of their ground-based towers – 70% of the towers acquired from the MNOs by the independent TowerCos are assumed to be ground-based.

Background and methodology

We have estimated the environmental impact of independent infrastructure sharing in Europe over the period 2019 to 2029. In order to quantify the impact between the two scenarios set out above, we have used our proprietary computable general equilibrium model,[15] "EYGEM" to calculate the variance in Greenhouse Gas emissions. EYGEM models all Kyoto gases across the supply chain in their carbon dioxide equivalent (CO2e).

Using the economic quantification derived in the previous economic impact study and provided in further detail in section five of this report, we modeled the impacts of the 109,000 towers saved and the respective capital and operating expenditure reductions in the communications sector through the TowerCo-led business model. Our approach modeled the overall savings in emissions between the two scenarios, taking into consideration emissions not emitted at all stages of the supply chain and, therefore, considering scope one, two and three emissions.

> Our results found an estimated range of 3.3 to 3.9 million tons saving in emissions across the 10-year time horizon modeled.

The EYGEM model

EYGEM is a scenario-based model which quantifies the global impact of a market or policy change in a given sector or region, further detail on the model has been provided in the appendix to this report.

In order to model the impact of the sector moving to a TowerCo-led business model, we defined a view of the economy in its current state, and then, set against this, we modeled the impacts of a market change.

In order to define the current-state economy ("a base case"), we aligned a number of variables in EYGEM to external data and forecasts to 2029. Within our base case, we defined a number of variables including GDP, labor supply and emissions forecasts. Given the uncertainty around future emissions pathways, we have provided a range of forecasts, including a pathway representing little action to reach net zero and a more optimistic pathway in line with European emissions targets to reach net zero.

Set against our base case, we modeled the impact of the 109,000 towers saved and the reduction in concrete, steel, construction and energy required by the communication sector in the TowerCo-led scenario versus the MNO-led scenario. Using a combination of EYGEM and a literature review, we reached our final estimates of the potential CO2 equivalent (CO2e) savings between the two scenarios.

When comparing the TowerCo-led scenario against our baseline MNO-led scenario, we are able to see the aggregate global CO2e emissions reduction as a result of the reductions in capex and opex in the communications sector. Our results found an estimated range of 3.3 to 3.9 million tons saving in emissions across the ten-year time horizon modeled.

This saving considers the direct and indirect emissions reduction from the reduced requirements of steel, concrete, construction and energy. Alongside this, there will be further emissions savings from the reduction in heating, ventilation and air conditioning (HVAC) units required under the shared cooling system infrastructure. There will also be 109,000 less sites that require the fitting of fiber cables, as well as an overall reduction in maintenance and the emissions associated with this. These savings have not been directly quantified in our modeling, however, they still remain important considerations and show how estimates are at the bottom end of the range of the environmental benefits that infrastructure sharing can bring.

[15] Computable general equilibrium (CGE) modelling is a sophisticated technique used to measure the flow-on effects of changes in the economy.

Contextualizing the savings

In line with commitments to global climate action under the Paris Agreement, both the EU and the UK aim to be climate neutral by 2050, meaning they are required to be economies with net zero greenhouse gas emissions.

Under the Paris Agreement, both the EU and the UK aim to be climate neutral by 2050.

The results estimate that the TowerCo-led business model has the potential to **reduce** European emissions by up to

3.9
million tons
of CO2 by 2030.

This total is made up of over

2.1 million tons
of emissions saved through reduced energy usage

1.1 million tons
from reduced steel usage

0.6 million tons
from the reduced concrete requirements

0.1 million tons
from emissions associated with construction

Independent TowerCos can make a substantial contribution to the reduction of carbon emissions needed to deliver European targets of 55% reduction by 2030, which set us on a trajectory to net zero by 2050. Overall, we estimate that independent TowerCos can save emissions of nearly four million tons of CO2 over a 10-year period, equivalent to 0.3% of the European emissions reduction target. To put this into context, this is the annual carbon footprint of more than 500,000 European citizens or the equivalent of taking 200,000 cars off the road each year.

GSMA[16] estimates that the total footprint of the ICT sector is approximately 700 million tons of CO2 per year worldwide. This is equivalent to 1.4% of global carbon emissions and around 4% global electricity use. It is estimated that around 110 million tons of this relates to mobile networks.

The results of the present study only quantify a reduction in CO2 emissions deriving from a TowerCo-led deployment scenario in Europe. Given the European mobile market represents approximately 15% of the global market share in terms of subscribers, the results show the potential impact of the independent TowerCo model in achieving substantial carbon emissions reductions globally. Additionally, in order to reach net zero targets by 2050 and European targets of reducing emissions by 55% in 2030, the European Environment Agency estimates an annual emissions reduction of 134 million tons of CO2 is required between 2021 and 2030.

As far as natural resources are concerned, the independent TowerCos-led scenario saves nine million tons of concrete and 650,000 tons of steel in Europe.

While the resulting saving may seem small in percentage terms, this percentage applies to the total emissions of the whole human and industrial activity in Europe. The 0.3% reduction in emissions annually from independent TowerCos highlights the scale of emissions in Europe and the need for all industries to work to achieve net zero by 2050. Through its encouragement of sharing infrastructure and reducing wastage, EWIA is doing its part to reduce emissions by just under four million tons over the 10-year time horizon.

Moving to a TowerCo-led business model would contribute up to

0.3% of this **reduction** annually

The reduction in emissions is also equivalent to the annual carbon footprint of

568,570
European citizens

or

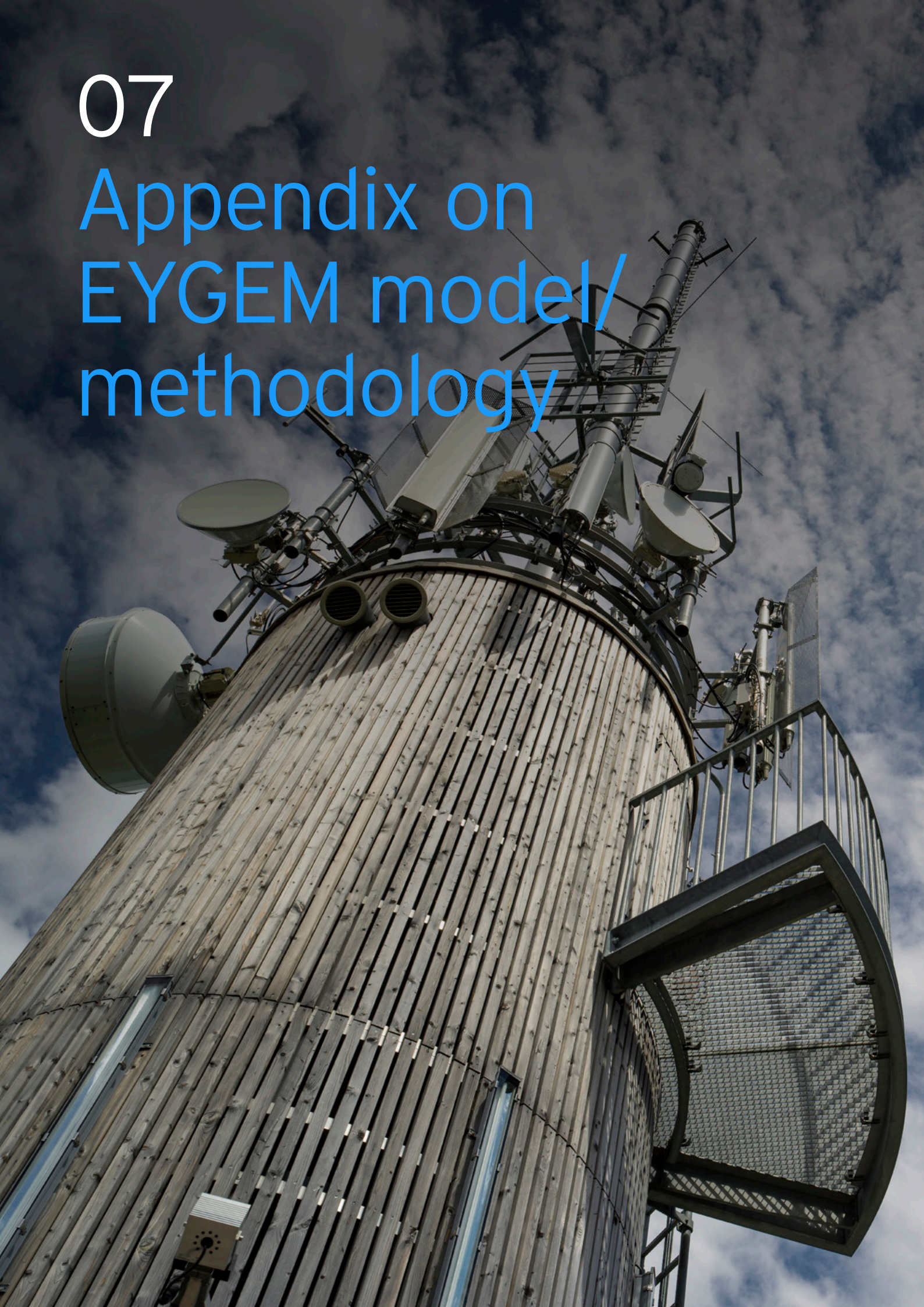
the equivalent of taking up to

200,000
cars off the road each year

As far as natural resources are concerned, the independent TowerCos-led scenario saves

9 million tons of concrete and **650,000** **tons** of steel in Europe.

[16] GSMA | Climate FAQs – #BetterFuture – mobile networks are defined here as including network equipment manufacture, construction of network sites and mobile masts, and the operation and maintenance of the networks.



07
Appendix on EYGEM model/ methodology

Overview

EYGEM is an in-house, state of the art computable general equilibrium model authored by EY professionals. The model is a large scale dynamic, multi-region, multi-sector model of the global economy based on a substantial body of accepted economic theory. The model addresses year-on-year over a specified timeframe providing a rich and realistic representation of how changes in one part of the economy impact others through its supply chain and trade linkages.

The model provides relationships between economic activity and greenhouse gas emissions, which are reflected in the model on a CO2e basis, allowing for detailed analysis of the impacts of various economic and policy changes across a pre-determined time horizon on the output of greenhouse gas emissions.

Given the equilibrium nature of EYGEM, a certain number of independent and dependent variables are required in order to balance the model, and the changes in these variables are applied to the model by applying shocks to relevant variables.

Rather than a forecasting model, EYGEM is a scenario-based model which aims to compare a number of scenarios against a base case (representing no change in the economy). A typical scenario is comprised of this base case projection that forms our initial basis of the analysis. In the base case scenario, a small number of variables are specified in order to build the environment – usually variables such as GDP, labor supply, population and often a forecast emissions pathway to allow the model to represent a change in energy mix over time.

Set against this scenario is a counterfactual scenario, which demonstrates the impacts of a market change, such as a different path of CO2e emissions, a change in market demand or the introduction of a tax. Results from the model are analyzed in terms of the difference in the counterfactual scenario versus the base case.

Specifying EYGEM to represent the telecommunications sector

EYGEM is a model of the global economy, representing the national accounts of over 141 jurisdictions and 65 regions. We tailor the model to the relevant regions and sectors in our study. Further detail on this approach has been provided below.

Timeline

The model is capable of providing scenario analysis to 2100. We reduced this time horizon to 2019 to 2029 to reflect the 10-year period assessed in the previous study completed by the EY organization.

Regions

Within EYGEM, we are able to model the impacts of market and policy change on individual jurisdictions or defined regions. In order to balance the complexity and run time of the model with ensuring accurate trade links, we specify a number of key jurisdictions and aggregate the remaining regions. We defined specific regions for UK, France, Germany and Spain, aggregating the rest of Europe into a region named "Rest of Europe." The remaining jurisdictions were designated under the "Rest of World" region in order to enable global trade flows within the model.

Detailed regional breakdown

Region	Jurisdictions
UK	UK
France	France
Germany	Germany
Spain	Spain
Rest of Europe	Albania, Austria, Belarus, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Demark, Estonia, Finland, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Sweden, Switzerland, Ukraine, Turkey, Rest of EFTA, Rest of Eastern Europe.
Rest of World	Argentina, Armenia, Australia, Azerbaijan, Bahrain, Bangladesh, Benin, Bolivia, Botswana, Brazil, Brunei Darussalam, Burkina Faso, Cambodia, Cameroon, Caribbean, Central Africa, Chile, China Mainland, Colombia, Costa Rica, Cote d'Ivoire, Dominican Republic, Ecuador, Egypt, El Salvador, Ethiopia, Georgia, Ghana, Guatemala, Guinea, Honduras, Hong Kong, India, Indonesia, IR Iran, Israel, Jamaica, Japan, Jordan, Kazakhstan, Kenya, Korea, Kuwait, Kyrgyzstan, PDR Lao, Madagascar, Malawi, Malaysia, Mauritius, Mexico, Mongolia, Morocco, Mozambique, Namibia, Nepal, New Zealand, Nicaragua, Nigeria, Oman, Pakistan, Panama, Paraguay, Peru, Philippines, Puerto Rico, Qatar, Rest of Central America, Rest of East Asia, Rest of Eastern Africa, Rest of Former Soviet Union, Rest of North America, Rest of Oceania, Rest of South Africa Customs Union, Rest of South America, Rest of South Asia, Rest of Southeast Asia, Rest of World, Rest of Western Africa, Rest of Western Asia, Rwanda, Saudi Arabia, Senegal, Singapore, South Africa, South Central Africa, Sri Lanka, Taiwan, Tajikistan, Tanzania, Thailand, Togo, Trinidad and Tobago, Tunisia, Uganda, United Arab Emirates, United States of America, Uruguay, Venezuela, Vietnam, Zambia, Zimbabwe.

Sectors

Our model contains over 65 sectors, representing all sectors within an economy. We tailored these sectors to those that were of most relevance to EWIA, including defining specific sectors for communications, concrete and steel, construction and energy. Similarly, to the regional aggregation, we group the remaining sectors into a number of high-level industries due to the complexity and model run time. Within the model, we had a total of 23 sectors, and those not mentioned above were aggregated into categories, including manufacturing, services and trade.

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About the EWIA

The European Wireless Infrastructure Association (EWIA) is the European trade association of independent wholesale wireless infrastructure providers. EWIA has nine TowerCo members operating in 16 countries (Austria, Cyprus, Denmark, Finland, France, Germany, Ireland, Italy, Malta, the Netherlands, Poland, Portugal, Spain, Sweden, Switzerland and the United Kingdom). They develop, acquire and operate communication towers together with investment in the fiber-connected small-cell networks in buildings and on city streets needed for 5G.

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