ERICSSON

Digital transformation of industries to enable Net Zero

Contents

Foreword

In the race to save our planet, industries can make transformational impact through digitalization

Industrialization has changed our world in the most profound way, spurring unprecedented economic growth and enabling mass production that has helped to drive significant improvements in living standards over the past two centuries.

However, along with these positive impact, there are also negative ones. The acceleration of industrial output has fueled the exponential rise in greenhouse gas (GHG) emissions, driven today primarily by fossil-based energy consumption, but also exacerbated by the detrimental impact of deforestation and land use changes, as well as the release of fugitive emissions such as methane in mining.

Today, the world is on course to cross irreversible tipping points that would permanently alter the earth's critical climate system. The only emergency exit we have is the immediate and exponential reduction of GHG emissions, leading to a Net Zero state by latest 2050, as called for in the Paris Agreement.

As one of the major contributors to global warming, industries must lead by example to drive that change. However, achieving that will not be easy and will demand pervasive, and radical sectoral transformation.

Studies show a direct and significant causal impact between high-performance connectivity and CO2 emissions reductions. 5G, together with other exponential technologies such as Artificial Intelligence (AI) and the Internet of Things (IoT), can play a decisive role not only in architecting, accelerating, and scaling the required industrial revolution, but also in achieving global GHG reduction pathways.

Today, for example, multiple cross-sectoral proof points have already been established based on massive data collection and compute, remote collaboration, and automated workflows that can leverage electric equipment – driving operational efficiencies, reducing GHG emissions, and improving top-line growth.

Digitalization is also supporting the widespread industrial transition to low-cost renewables, generated on-site or enacted through renewable power purchase agreements made possible through virtual powerplants.

In this report, we explore many of these industrial examples where 5G and digital technologies are not only enabling significant emissions-reduction impact today, but demonstrate the potential to do even more tomorrow.

Industries and enterprise owners cannot solve those challenges alone. Enabling the required scale of industrial emissions reductions also hangs on the collective action of policymakers, regulators, investors and Information Communications Technology (ICT) providers. This report is also testament to that collective responsibility.

The pathway to emissions-free industries begins here and now.

Heather Johnson
Vice President of Sustainability and Corporate Responsibility

Åsa Tamsons
Senior Vice President and Head of Business Area Enterprise Wireless Solutions

Executive Summary

The mission

In 2023, the International Panel on Climate Change (IPCC) warned that the window to secure a 'livable and sustainable future for all is rapidly closing' [1].

Reaching global modelled decarbonization pathways, in line with the 2015 Paris Agreement, will require rapid, deep and, in most cases, immediate greenhouse gas (GHG) emissions reductions across all sectors this decade [2]. A growing number of companies, including Ericsson believe that to act in line with the 1.5°C ambition should strive to reach net zero by 2040, ten years ahead of the Paris Agreement.

The priority for enterprises is to eliminate emissions sources across their operations and value chains, while also considering the rebound effect of their actions. Carbon removal technologies can help to neutralize remaining value chain emissions.

To support cohesive climate action and provide clarity for customers, investors, governments, and other regulatory bodies, enterprises should align disclosure practices with standardized reporting instruments (for example the EU taxonomy). At Ericsson, we believe a market-based approach is the most effective way to demonstrate the absolute value of a company's environmental and emissions impact.

The solutions

5G connectivity, combined with other disruptive technologies such as AI, IoT, extended reality (XR), battery-electric vehicles, robotics, and more, has the power to enable significant GHG emissions reductions across today's most pollutant industries, including energy, transport, manufacturing, and others.

As a multi-purpose technology, 5G also presents a strong value proposition for enterprises beyond emissions reductions, enabling higher levels of operational scale, resilience, and efficiency, and providing a platform for top-line growth in coming years.

Today's applications enable possibilities for improved analytic insights through massive, distributed data collection and compute; as well as enhanced automation possibilities supported by XR and IoT.

By Ericsson's own modelling, we estimate that by 2030, a further 55–170MtCO2e of emissions savings per annum would be possible through the continued implementation of 5G technology. Furthermore, an Ericsson Research macro analysis of 181 countries for the period 2002–2020 confirms the correlation between connectivity and decarbonization, with a 10 percent increase in mobile broadband penetration found to cause a 7 percent reduction in CO2-emissions per capita [3].

For industrial sectors, the new ITU L.1480 'Net Zero' standard – demonstrated for the first time by Ericsson and Kiona, in partnership with the Carbon Trust – provides a fundamental framework for assessing the emissions impact of ICT solutions, taking a life cycle analysis approach. This aims to improve the consistency, transparency and comprehensiveness of how the use of ICT solutions impacts GHG emissions over time. In doing so, it will be decisive in enabling real, credible cross-sectoral decarbonization through ICT.

Industry takeaways

Ports

5G offers a scalable platform on which to improve the energy efficiency, resilience, and safety of port operations. Today's advanced port use cases include AI-based processing of massive real-time data monitoring from smart sensors, 3D Light Detection and Ranging (LiDARs) and Wide Dynamic Range (WDR) cameras to improve and optimize operations. Digital twin technologies also feature prominently, enabling control staff to immerse themselves in a virtual replica of the port environment, safely interacting and managing functions through XR interfaces. With systems, vehicles and devices fully connected, entire operational processes can also be fully automated.

Energy

The share of renewable energy is rising and forecast to account for 65 percent of global power needs by 2030. Managing this will require a more flexible and efficient energy distribution system that can accommodate a wider variety of energy production sites, handle bi-directional energy distribution, and support more advanced grid protection methods. High performance 5G – with the ability to harness machine learning and AI – can underpin this transition to smart, data-driven grids, further securing energy distribution and keeping critical energy infrastructure online.

Transport

5G connectivity can make transport more connected, safer, and more sustainable – enabling the rapid, system-wide transformation that is needed to decarbonize the sector. Reliable, secure data flow can support actors in the transport space with access to multiple sources of information such as sensors and charging points. This can help maximize vehicle and fleet efficiency which will be fundamental for cross border logistics and sustainable transport. Next generation connected technologies will allow for further sustainability improvements. Some, like autonomous vehicles, are already beginning to enter the market.

Mining

The combination of renewable energy sources, together with connected, low-carbon, and autonomous battery-electric solutions will be decisive in reducing operational emissions of mining sectors, currently accounting for 1 percent of all GHG worldwide. A pervasive 5G wireless infrastructure is the cornerstone that can enable this transition through innovative use cases such as autonomous vehicles, environmental monitoring, geofencing, and massive data collection. This presents the transformative potential to enhance safety, optimize machine efficiency and agility, and allow for remote operations and maintenance.

Manufacturing

Through energy-intensive processes and global supply chains, manufacturing accounts for 30 percent of global GHG emissions. In addition to high energy consumption, other key challenges facing the industry include resource optimization, waste reduction, and operational safety. By enabling agile, automated, and efficient production operations, private 5G network solutions lays a credible pathway for viable, scalable decarbonization of one of the world's most pollutant industries.

Buildings

Energy-efficient building management systems (BMS), underpinned by wireless technologies such as private 5G and wireless Wide Area Network (WAN), will be key to reducing building heating emissions in coming years. Technology use cases include real-time monitoring of energy consumption based on connected sensors and digital twins. This offers a platform for smarter decision-making, enabling efficient energy usage, predictive analysis of maintenance needs, and adaptive systems that respond to occupants' needs in real time. Insights derived from presence monitoring and crowd movement-modeling can enhance facility optimization and asset utilization.

Nature-based solutions & Agriculture

Agricultural sectors account for around 11 percent of global GHG emissions, rising to 23 percent when forestry and land-use changes are added. Supported by connected technologies such as remote real-time monitoring, nature-based agroforestry solutions can contribute up to 30 percent of climate mitigation needed by 2050.

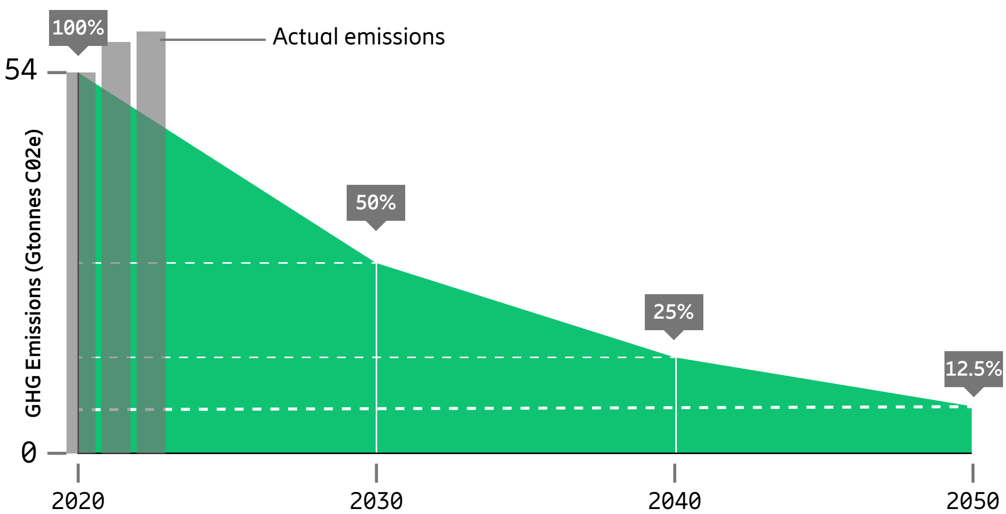
When rolled out across agricultural sectors, connectivity-based solutions can also provide a vital boost to local farming communities, creating a more equitable marketplace and reducing farmland degradation through precision agriculture. Automated solutions such as remote-controlled or autonomous harvesters, ground robots and offloading systems equipped with sensors and machine-to-machine communications can enable significant efficiency gains and thereby minimize environmental impact.

A world on fire

In 2023, our planet endured its hottest ever year on record, with more than a third of days breaching the 1.5°C threshold laid down in the Paris Agreement. The warning signs are now as palpable as the science is clear: the earth's temperature is on a trajectory to permanently cross catastrophic tipping points. [4]

The sooner emissions are reduced and the lower we can limit temperature rises, the better the outlook for humanity. In 2023, the International Panel on Climate Change (IPCC) warned that the window to secure a 'livable and sustainable future for all is rapidly closing', and that 'the choices and actions implemented in this decade will have impacts now and for thousands of years [5].

The 2015 Paris Agreement set the necessary targets needed to stabilize the global climate at 1.5°C above pre-industrial levels and secure a livable future for all. This means halving global greenhouse gas emissions by 2030 (from a 2020 baseline), halving again by 2040, and again by 2050. At the same time, natural carbon sinks and carbon removal technologies must be scaled up rapidly [6].



Every fraction of a degree of warming matters. In 2023, the world recorded its highest global mean temperature since records began [7]. This will impact us and our economy more than we can imagine.

Source: Exponential Roadmap. Business Playbook 1.5 Version 3

Figure 1. The Carbon Law – halving global greenhouse gas emissions every decade.
The estimated yearly emission level for 2020 is 54 billion tonnes of carbon dioxide equivalents.

Enabling the fastest sectoral transition in history

In this report, we explore the action plan for total industrial transformation through exponential mobile technologies, from AI-based port operations to autonomous electric mining equipment. Through agreed standards that bring global interoperability and enable economies of scale, the potential for rapid sectoral transition through disruptive, connected technologies is unmatched by any other platform.

Decarbonizing through digital: the success of consumer markets

One example where ICT has already demonstrated its transformative impact is across consumer markets. Advances across the mobile broadband domain in recent years have transformed many consumer verticals, opened new business models and replaced others.

The emergence and growth of digital commerce, streaming, and commuting services, for example, have all facilitated a positive emissions impact compared to their respective traditional brick-and-mortar, hardware, and motorized predecessors.

Yet even with exponential growth in devices and data, the carbon footprint of the ICT sector remains around 1.4 percent of overall global emissions [8], factoring in all equipment energy consumption related to their use and entire lifecycle.

Therein lies the power of digital transformation; now imagine if those same possibilities were replicated across today's relatively immature industrial sectors, where near-limitless innovation opportunities can leverage global economies of scale. This is what 5G can enable, let's explore the potential for industry decarbonization.

One seat on a return flight across the Atlantic ocean generates more carbon emissions than 50 years of smartphone use. [9]

The industrial action plan

Reaching global, modelled and decarbonization pathways requires rapid, deep and, in most cases, immediate greenhouse gas (GHG) emissions reductions across all sectors this decade [10]. In doing so, this will enable the fastest economic and societal transition in history.

The Exponential Roadmap Business Playbook lays out four ways in which businesses can and must play a pivotal role:

Step 1: reducing their own emissions rapidly i.e. from energy sources and industrial processes

Step 2: reducing emissions across their value chain

Step 3: providing climate solutions (products, services and projects) that enable others to avoid and remove emissions

Step 4: accelerating climate action in society and helping to protect and restore nature

Net Zero pathways

Companies acting in line with the 1.5°C ambition should strive to reach net zero by 2040 at the latest and acknowledge that this is an intermediate step towards absolute zero and net negative emissions [11].

For companies, this means prioritizing the elimination of sources of emissions within their operation and value chain which follows a 1.5°C reduction trajectory. It's only when there is no possibility to eliminate more emissions that companies can neutralize their value chain emissions with carbon removal technologies.

The first step towards decarbonization begins by setting a framework for reducing emissions and increasing removals in alignment with global modelled pathways.

Companies and the rebound effect

When developing their decarbonization pathways, companies must account for the rebound effect of their actions. This can manifest in two ways: direct rebound, where the consumption of the decarbonization solution itself increases due to improved accessibility; and indirect rebound, where efficiency gains in terms of money or time are redirected towards other activities, partially or fully offsetting the initial efficiency improvement.

In this regard, it's important that the negative rebound – which is the positive effect of efficiency-driving solutions – outweighs both the direct and indirect rebound effects.

Temperature check on industry emissions

Global greenhouse gas emissions by sector, 2020

- **Land use change and forestry** 1.39 billion MtCO2e
- **Electricity and heat** 1.52 billion MtCO2e
- **Buildings** 2.98 billion MtCO2e
- **Industrial processes** 3.13 billion MtCO2e
- **Agriculture** 5.87 billion MtCO2e
- **Manufacturing and construction** 6.22 billion MtCO2e
- **Transport** 7.29 billion MtCO2e

Source: climatewatchdata.org

Assessing the emissions impact of ICT on sectors

Across the ICT domain, the International Telecommunications Union (ITU) has developed a series of credible frameworks for assessing the impact of ICT sectors and solutions. This includes a methodology that assesses the environmental life cycle impact of ICT goods, networks, and services **(L.1410)**, their impact at the city level **(L.1440)**, and guidance for setting Net Zero targets across ICT sectors **(L.1471)**.

For industrial sectors, the new ITU **L.1480** 'Net Zero' standard provides a fundamental framework for assessing the emissions impact of ICT solutions on all sectors at an individual, organizational, and global level, combining elements of both consequential and process-sum life cycle assessment (LCA) methods. In doing so, it will be decisive in enabling real, credible cross-sectoral decarbonization through ICT.

The methodology assesses three different orders of effects:

- First-order effects relating to the environmental impacts caused at each stage of their lifecycles
- Second-order effects (positive) enabled through vast efficiency gains in all sectors of the economy
- Second-order effects (negative) caused by ICT solutions serve to maintain or even increase the fossil-based economy
- Higher order effects (including rebound effects) caused by structural impact on a societal level in reshaping lifestyles

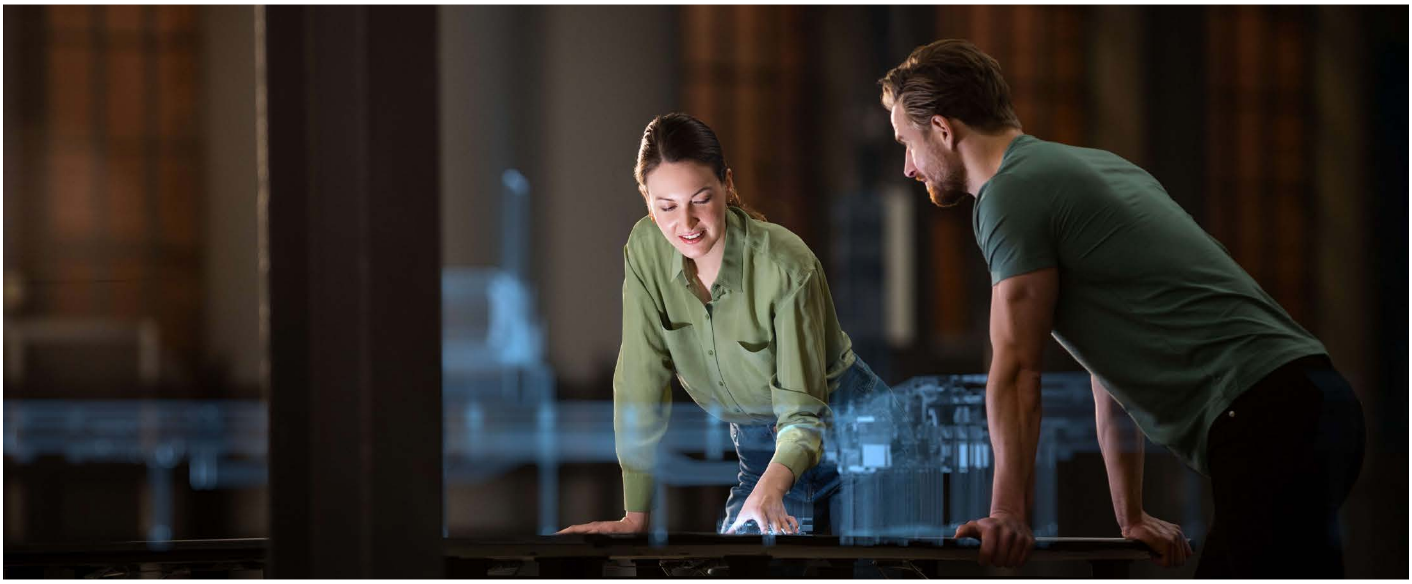
In partnership with the Carbon Trust, Ericsson demonstrated the full impact of the new standard together with building management solution provider Kiona. This case study – the first of its kind – sets a new precedent that industries can replicate as part of their Net Zero trajectories.

Company reporting: a common framework for decarbonization

Ensuring alignment of company disclosure practices is key to enabling cohesive climate action on both a micro and macro level.

On a company level, standardized reporting instruments such as the EU taxonomy are integral to ensure the credibility of decarbonization pathways, as well as provide necessary clarity for customers, investors, governments, and other regulatory bodies. In this regard, interim reporting of sustainability-related KPIs must be elevated to the same level as financial reporting.

While Ericsson supports both a market and location-based approach to reporting, we believe that a market-based approach is the only way to demonstrate the absolute value of a company's environmental and emissions impact.



The decarbonization impact of mobile technologies

Underpinned by a strong causal relationship for emissions reductions, high-performance connectivity platforms will be decisive in enabling cross-sectoral decarbonization pathways in line with 1.5°C trajectories.

An analysis [12] between 2002 to 2020 of 181 countries found that an initial increase in CO2 emissions for a country at an average emission level once mobile broadband is introduced was greatly offset by the positive externalities of connecting to and using the network: on average a 10 percentage points increase in mobile broadband penetration causes a 7 percent reduction of CO2 emissions per capita.

While noting the 'rebound effect', where reducing the marginal cost of energy enabled by digital solutions can lead to increased energy consumption as exponential end points are connected and used, this empirical evidence suggests that while the number of subscriptions to both fixed and mobile broadband services have increased, country level emissions have decreased.

In Europe alone, we estimate that by 2030, a further 55–170MtCO2e of emissions savings per annum would be possible through the continued implementation of 5G technology, the equivalent of taking one in seven of the EU's fossil-fuel powered cars off the road.

Overview of mobile infrastructures:

Private 5G: A private 5G dedicated network, owned and operated by the enterprise on-site, provides an enabling connectivity platform for all manner of connected use cases and applications from autonomous vehicles and robots to digital twins. It's significantly more resilient, secure, and performant than Wi-Fi alternatives, across indoor and outdoor environments.

Public 5G with network slicing: A public 5G network, operated by a communication service provider (CSP), that features a customizable service level agreement that gives a guaranteed quality of service to enterprises, from latency to data rates. Global mobile standards mean that interoperable applications and use cases, such as vehicles and devices, can drift between public and private networks with seamless mobility.

Wireless WAN: While private 5G networks are confined locally, wireless wide-area network (WAN) solutions such as those developed by Cradlepoint, provide high-performance connectivity to enterprises and facilities distributed across a broader geographical area. In doing so it leverages public cellular infrastructure giving the enterprise similar performance attributes, albeit with less granular control over network features.

5G Standalone: 5G Standalone uses a single radio access technology (RAT). With no 4G legacy setup, or anchoring bands to look after, 5G Standalone enables around 6x faster access to 5G spectrum. 5G Standalone leverages the flexibility of end-to-end network slicing capabilities to accommodate new cases within the same physical network.

Viable platform for scale and top-line growth

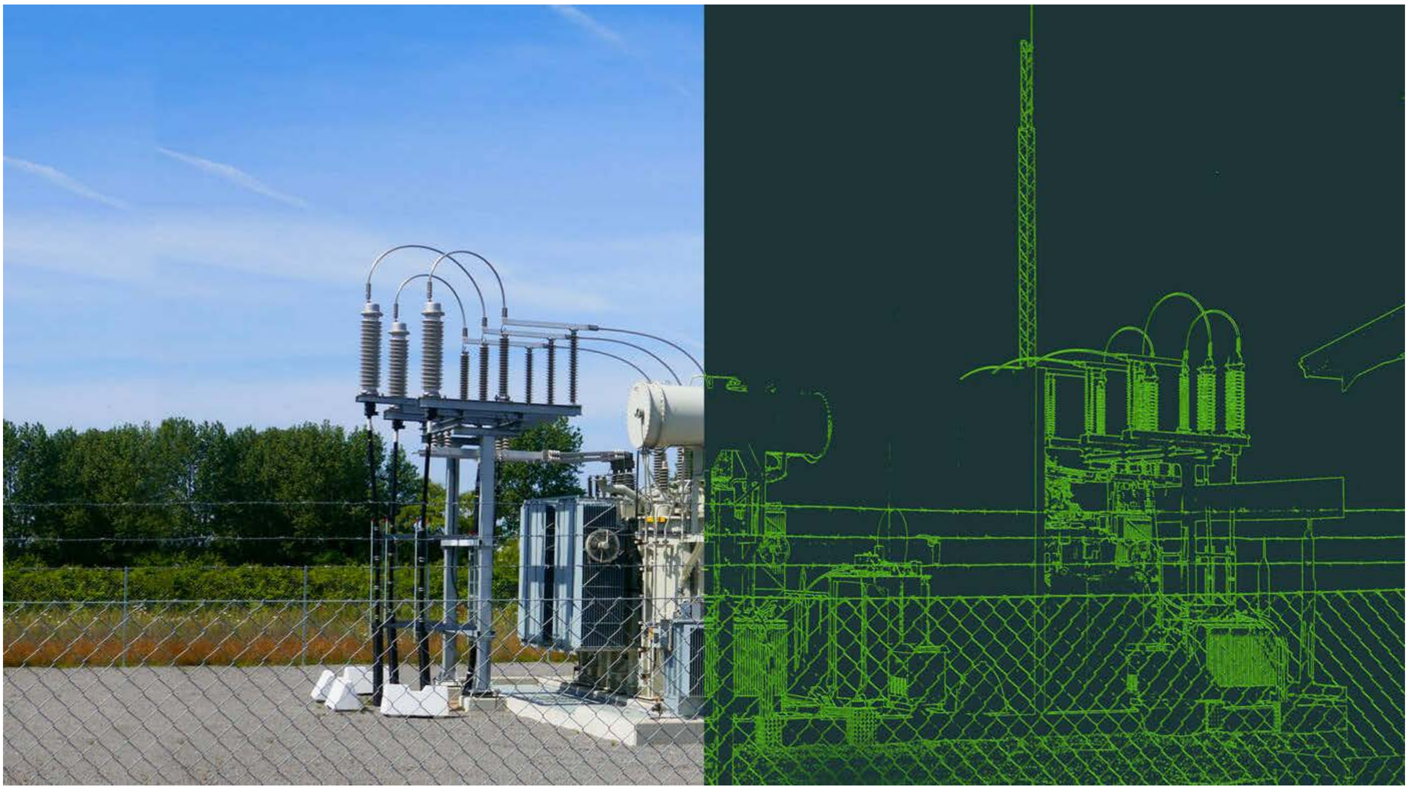
Transformational 5G private networks also bring a step change in capacity, throughput and functionality enabling new levels of resilience, efficiency, and scalability of industrial operations.

This forms multiple value propositions for today enterprises, including clear cost benefits, making it a viable platform capable of supporting the overhaul of industrial applications such as logistics and manufacturing, renewable energy systems, low-carbon transportation, and many other sectors detailed in this report.

In the following pages, we explore today's proof points where mobile technologies such as massive, distributed data collection and enhanced automation are laying the groundwork for the unprecedented industrial transformation that must take place this decade.

Energy

By 2030 the share of renewable energy is forecast to increase to 65 percent [13]. By 2050, it is expected to be over 80 percent. Securing, a low-latency 5G connectivity can facilitate these changes, as well as fulfil other critical resilience needs of substations and remote renewable energy production sites, such as windfarms and solar farms.



Example of a digital twin for substation monitoring in the grid

Emissions outlook

Energy sectors are the largest contributor to global greenhouse gas emissions, accounting for roughly 38 percent of all global CO_2 emissions in 2022 [14]. Approximately 70 percent of all emissions in this sector are the result of coal-fired power, making it the most destructive contributor to global warming by a distance [15] and by far the biggest challenge which industries must overcome.

The transition to renewable energy sources, combined with energy efficiency improvements across all industrial processes, buildings, transportation and sites, make this pathway possible.

Today, economic tipping points for renewable energy have already been crossed, buoyed by the exponential worldwide expansion of clean energy. As such, the economic impetus for a sectoral transition to renewables has never been stronger.

Technology and infrastructure

For energy distribution, the consequences of this accelerated shift towards renewables are multiple. Demand for electricity is surging, energy systems are morphing to become decentralized and grids must account for more volatile renewable power production.

At the same time utility operators need to strengthen the distributed grid, making it more resilient related to system inertia, voltage and frequency control enabling various services to strengthen the power grid stability.

Achieving stable renewable energy distribution depends upon deeper, broader and more harmonized use of data, underpinned by increased connectivity.

> "The outcome [of COP 28] is the beginning of the end [of the fossil fuel era]. Now all governments and businesses need to turn these pledges into real-economy outcomes, without delay."
>
> **Simon Stiell,** UN Climate Change Executive Secretary

Our energy is increasingly going to be delivered through renewable electricity, generated from a wider range of sites that must be efficiently connected. The Distribution System Operation (DSO) need a clear energy transition roadmap and ICT plays a vital role in this through the connection of multiple distribution assets, which support energy diversification such as large windfarm, solar farms, but also energy storage (which aids grid stability and flexibility).

Today there are opportunities for individuals/companies to produce and consume renewable energy (prosumers) which will play a vital role in the energy transition and decarbonizing the power grid such as transport sector, with smart and connected Electric vehicle, EV, smart building, and smart distributed Telecom sites can play a significant role. The new adoptions will demand for more visible, and better observability considering a distributed network of multiple entry points of Renewable energy sources. This demands an overhaul of power grids and their management, where access to electricity produced by disparate sources is made predictable thanks to data-driven operations.

The power distribution system of the future must have the ability to:

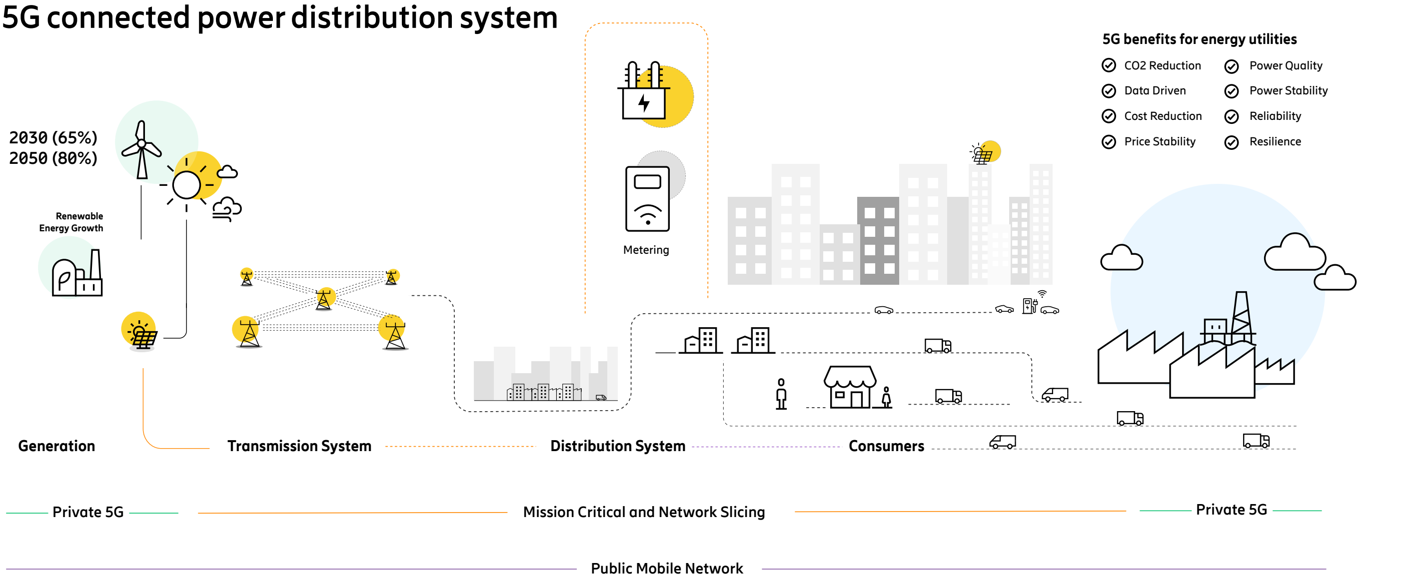
- Manage a large number of volatile renewable power generation sources, accounting for power, voltage and frequency fluctuations
- Introduce and scale flexibility solutions and power management
- Observability of assets
- Enable a Data driven automation
- AI based observability
- Handle bi-directional energy distribution (both taking energy from and pushing energy to the grid)

Balancing the needs of the 'tomorrows' power distribution system demands both increased connectivity and automation in power networks that leverage smart solutions. APIs, protocols and advanced interfaces will have a key role to play in this development, with data harmonization and interoperability essential for it to function at scale.

These solutions will enable DSOs to scale up renewable energy sources while accounting for their volatility, leverage dynamic load management, minimize costs associated with interruptions or faults, and increase their brand value as sustainable operators.

Distribution System Operators (DSOs) and Transmission System Operators (TSOs) need a tighter collaboration to enable grid support for multiple aggregators to participate. [16]

5G connected power distribution system



Harnessing connectivity to keep the sustainable energy ecosystem in sync

Data-driven mechanisms are already available to protect and predict the flow of energy in power grids, but many medium and low-voltage networks still use non-communicative legacy solutions such as overcurrent or distance relays that cannot fulfil all the needs of a decarbonized energy grid.

5G connectivity can secure a reliable connection sharing information on different levels, to/from TSO/DSO and to prosumers.

Furthermore, advanced, connected protection methods like differential protection are more sensitive. They can detect the direction of a current, a feature of growing importance as renewable energy increases. But differential protection is also more demanding and requires communication which transmits momentary values from one remote substation to another in a fast and reliable way.

Securing system redundancy and system availability will be an important factor needed for virtual inertia in the system, voltage regulation and stabilization, including fault localization which can be manage with enhanced connectivity. High-performance 5G can connect different assets in the grid in a fast, flexible and secure manner and unlock a deeper level of control, which reduces the need for cabling, maintenance and lowers capex investment in the grid communication infrastructure. Many parts of the grid are in remote locations and therefore this is pivotal. [17]

A smart grid is needed to facilitate a reliable renewable energy distribution system that can leverage connected sensors, real-time network monitoring, and data insights on power and frequency quality, consumption spikes or broken connections to boost efficiency.

Connecting all assets together increases the observability of the operation and performance of the distributed assets, while at same time enables more flexibility. Furthermore, the use of AI allows for improved prediction and decision making in the smart grid. Machine learning and AI will help reduce power outages and ease investment decisions through predictive maintenance. With the help of ICT, it is estimated that interruption times can be reduced by as much as 50-75 percent compared with today. [18]

Case Study

Fossil-free Energy Districts

The demand to accelerate the transition from fossil energy sources to renewables has only intensified, for example the EU's targets to reduce greenhouse gas emissions 40 percent by 2030 and 95 percent by 2050. One of the biggest consequences of the shift is more volatile power supply, with larger variation in power prices over shorter time periods. But it also creates an opportunity for buildings, previously only consumers of energy, to become suppliers by making surplus energy available to the market via a Virtual Power Plant (VPP).

Ericsson is one of the partners in the Fossil-free Energy Districts (FED) project in Gothenburg, Sweden, which developed solutions for the future energy market's volatile power supply and prices. The project connects renewable production units to the market using hourly pricing, creating connectivity between buildings in the area, and controls their energy consumption. Individual autonomous software acts on the behalf of both buildings and energy production units to forecast energy consumption and place bids on a local energy trading market.

Cloud-based, horizontal and cross-industry IoT technology is a key component of the FED system, connecting the physical infrastructure to the local energy marketplace. It also manages the marketplace's hourly decisions by providing instructions to buildings and energy production units.

Solutions like the FED project can play an important role in maintaining grid stability despite the increased volatility of renewable energy sources, as well as reduce the need for energy imports by creating a data-driven, localized energy marketplace.

Key case statistics:

Aims for

80% ▼ reduction in fossil energy peaks

Transport

Transport is responsible for approximately one quarter of all energy-related GHG emissions [19] worldwide. As a major contributor, the ongoing electrification of road freight sectors can facilitate significant emissions reductions. Mobile connectivity is a key enabler of this transition, enabling reliable data streams that connect sensors and charging points, maximizing vehicle and fleet efficiency. Emerging autonomous vehicles are also expected to radically transform the sector in coming years.

Emissions outlook

As a sector, transport has proven historically difficult to decarbonize. Even countries that have succeeded in achieving sustained overall emissions reductions in recent years have had limited success reducing emissions specific to transport.

Rapid, system-wide transformation is needed in the sector, in which electric vehicles and connected technologies are essential. Cross-sectoral partnerships, such as Ericsson's work with Scania on next generation transportation technology [20], will be integral to delivering the required advancements needed.

Achieving a 60 percent share of electric and plug-in hybrid vehicles on the road would save more than 60 billion tons of CO2 between now and 2050 [21]. Such significant reductions can only occur with widespread digitalization of transport.

Technology and infrastructure

High performance networks are the glue that bind the key actors across sustainable transport solutions, effectively linking vehicles with energy providers. The benefits go beyond sourcing energy for vehicles: truly smart vehicle connectivity can provide valuable data from which insights are derived to make vast improvements.

Routing, driver performance, logistics flow, and cross-border operations can all be made more efficient. Cellular technology is a key enabler to make all of this possible and bring decarbonization of transport one step closer.

Connecting the road to sustainable transport: securing data and securing energy

In a decarbonized transport ecosystem, reliable connectivity and secure data flow will make it easy to find charging points, book charging timeslots and ensure green electricity is available at the point of need.

It will also have consequences beyond the delivery of energy: harnessing the data from connected vehicles can continuously underpin the development of better, more efficient, more sustainable products. Predictive maintenance will minimize vehicle downtime and keep them running in the most energy efficient way for as long as possible, reducing waste.

And breakthroughs in autonomous vehicle technology that are already occurring today can further improve the efficiency of transport logistics, enabling 24/7 operations.

Bounded, reliable latency is fundamental for all of this to function at scale, ensuring consistent connectivity as vehicles pass through transport corridors across borders. The secure, consistent connectivity needed is already being harnessed by next generation vehicles, thanks to services like Cradlepoint Netcloud and technological advancements like network slicing.

Standardization and collaboration are also fundamental to accelerate the shift. Partnerships between communications technology providers, network operators and transport leaders are already bearing fruit. One of many examples is the 5G Automotive Association. [22] However, more change is needed to achieve the required depth and scale.

Underpinned by mobile connectivity, new technologies that will make transport more connected, safer, and more sustainable are already available, and further advancements regularly being developed. If these can effectively be delivered at scale, then the decarbonization of transport is possible.

Case Study

Autonomous Logistics

Autonomous electric vehicles have an important role to play in sustainability progress. Einride [23], a leading freight mobility company that provides digital, electric, and autonomous solutions, has eliminate tailpipe emissions and increase the efficiency of freight transport through maximizing the total vehicle space dedicated to goods capacity. Their all-electric, digital and autonomous transport ecosystem can help drive the transformation of road freight transportation towards a decarbonized future. Einride has teamed up with Ericsson in the US to provide the 5G network for Einride's electric, autonomous vehicles. Most recently, Ericsson has implemented a network to support a fully autonomous transport solution for Einride's customer GE Appliances that is capable of supporting full time flows with zero tailpipe emissions. This follows Einride's previous pilots in the US, including one in 2022 which was the first public road pilot in the US for a purpose built autonomous, electric truck without a driver on board.

The Einride vehicles achieve the reliable connectivity needed to communicate with their remote operators who monitor the vehicle thanks to Ericsson Radio System and Ericsson Cloud Core for 5G. A clear example of how advanced connectivity supports a more sustainable transport model, 5G powered autonomous transport systems mean less downtime, more reliability, healthier air quality, which ultimately contribute to overall cost-effectiveness and more sustainable cities.

Key case statistics:

90% ▼ reduction in CO_2 emissions using fully electric vehicles

Ports

Shipping is responsible for about 2.9 percent of global GHG emissions [24], with the risk it could rise to 10 percent by 2050 if the current trajectory continues. Digitalization will be key to evolving port operations in coming years to meet carbon reduction pathways. Private 5G can provide a scalable platform to improve the resilience and efficiency of port operations through use cases such as digital twin intelligence, remote cargo tracking, and automated equipment and machinery.

Emissions outlook

Shipping is a cornerstone of international economic activity, accounting for about 90 percent of global trade [25]. The reduction of GHG emissions across every vertical in the industry, including port operations, will be crucial to facilitate continued shipping traffic growth forecast in coming years.

Industry-wide regulations and targets play a key role in driving these changes. The International Maritime Organization (IMO) recently revised its GHG Strategy [26], aiming for Net Zero GHG emissions from international shipping by 2050, as well as a reduction in transport-related GHG emissions by at least 40 percent by 2030.

Technology and infrastructure

Emerging technologies

Efficiency-driving advanced connectivity solutions can enable the required optimization and automation of port operations to reduce GHG emissions.

Massive, real-time data collection – together with AI compute, such as digital twin intelligence, for real-time management and control – can help to reduce GHG emissions by optimizing port planning and operations, including equipment, systems, devices, and cargo.

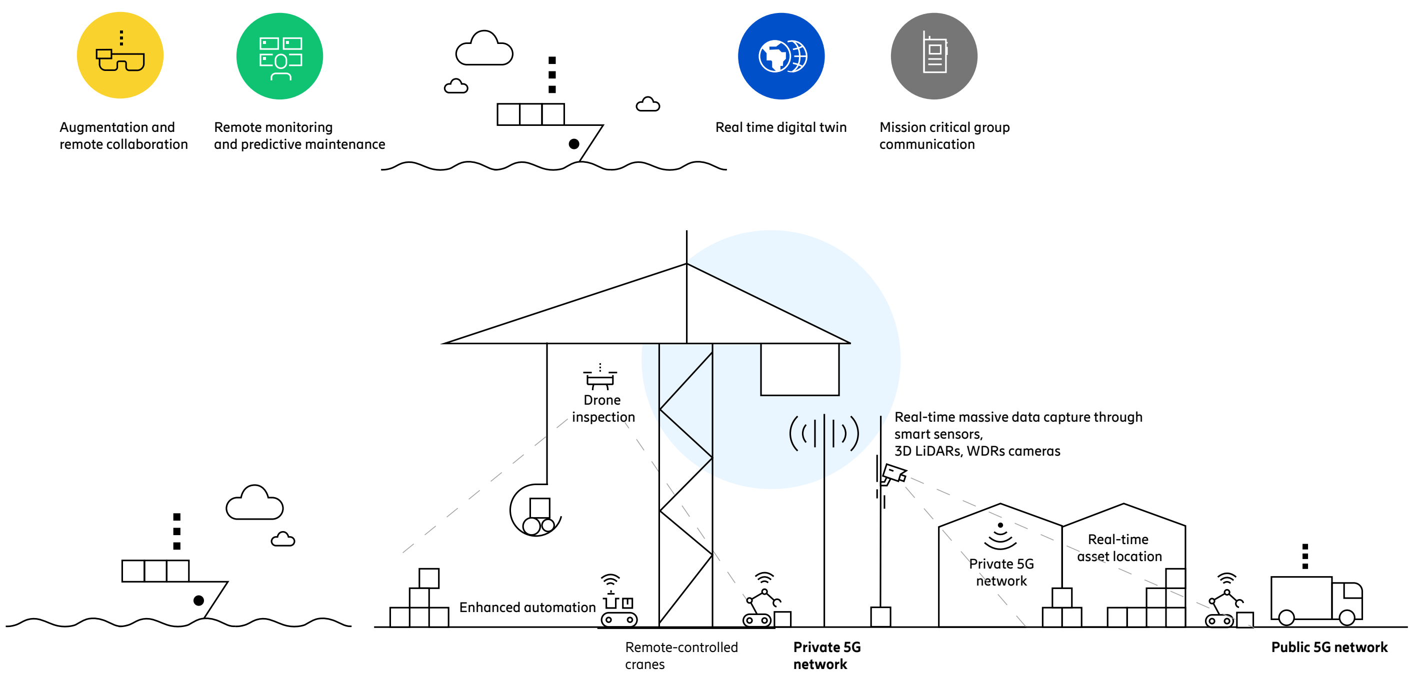
Digital twins create a digital replica of the port area complete with assets, equipment and devices, so changes can be simulated in a risk-free environment before being rolled out into the physical, and fully connected site. With connected systems and devices (including vehicles), entire processes can be automated. This facilitates an optimal logistical flow of port equipment and vehicles, such as cranes, forklift trucks, and outbound haulage, enabling immediate, significant fuel savings. Similarly, optimizing crane payloads can improve energy efficiency.

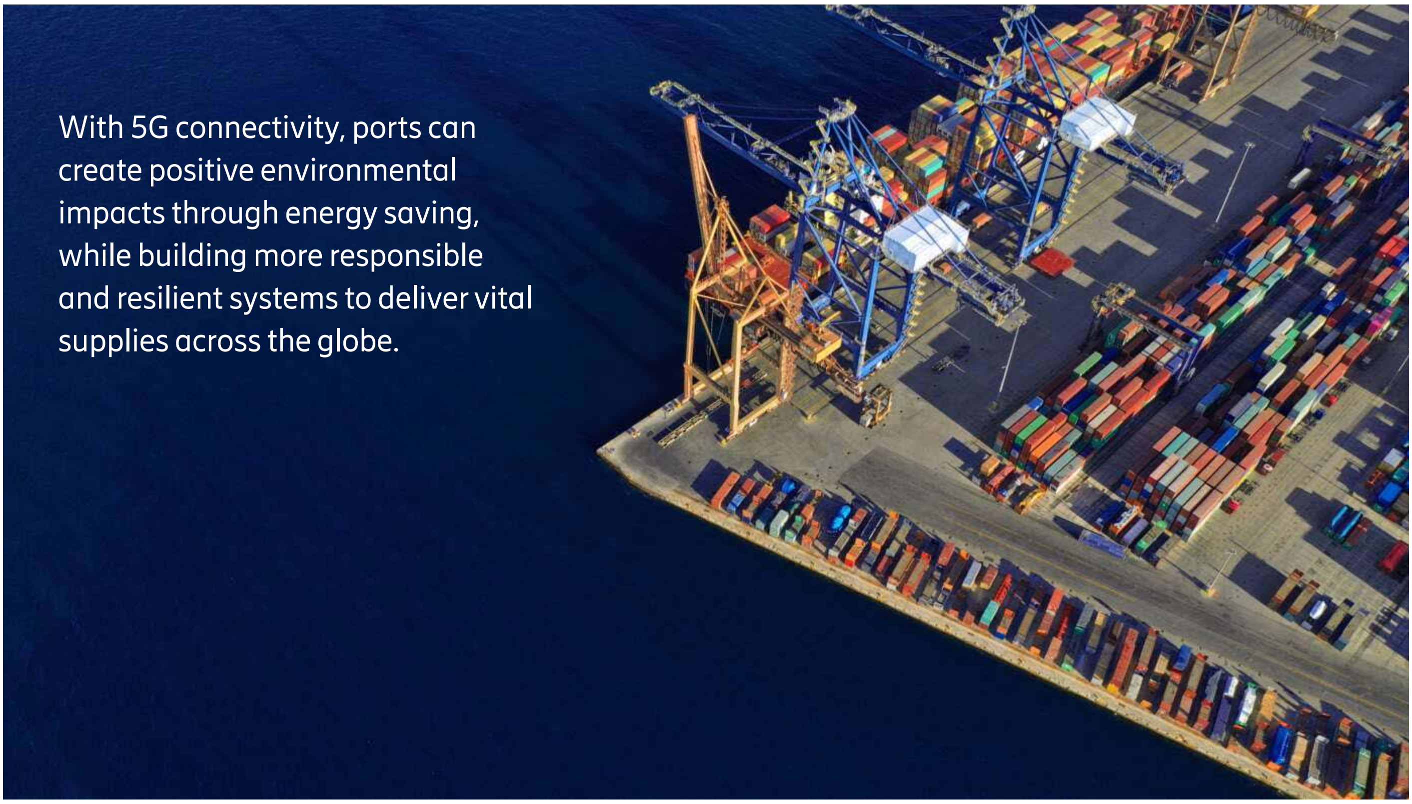
The ability to remotely monitor and manage operations through a digital platform can reduce travel emissions, as well as ensure the safety of workers in busy industrial settings, an important focus area for sustainable development. Control staff can even immerse themselves in the port's digital environment, safely interacting and managing functions through the use of Virtual Reality (VR) and Augmented Reality (AR) interfaces.

Connectivity infrastructure

5G networks can provide a scalable platform on which to improve port resilience and energy efficiency. This is underpinned by performance capabilities such as low latency, guaranteed quality of service, network interoperability and the capacity to deploy many different use cases with varying requirements. High-performance wireless cellular technology can help to overcome comparative performance limitations of traditional infrastructures such as wired fiber and wireless wi-fi.

5G connected port





Case Study

Intelligent operations reduce emissions at the Port of Livorno

The Port of Livorno served as a test bed to pilot various 5G-enabled technologies, demonstrating improved site management and lower energy consumption through smarter, more efficient logistic operations.

Real-time operational data was collected from solar-powered cameras, creating a live digital twin that was developed to optimize vessel berthing, improve site management, and reduce energy consumption.

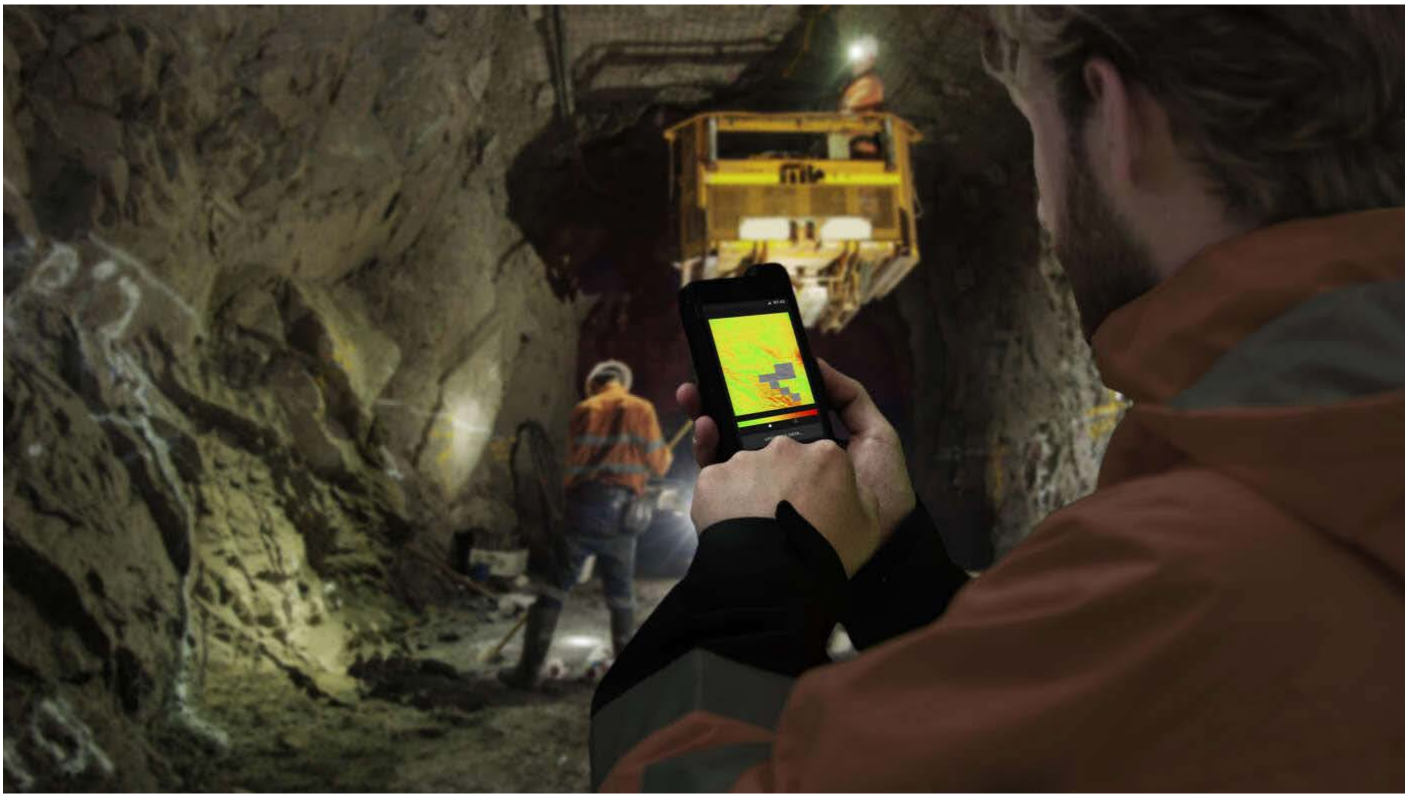
As a result of the 5G technologies introduced and the subsequent improved yard movements in the terminal processes and KPIs, GHG emissions per terminal operation decreased by an estimated 8.2 percent. Additional results included lower fuel consumption, a 25 percent improvement in productivity and time savings delivering a cost reduction of EUR 2.5 million.

A similar approach was taken at the Port of Aveiro in Portugal, in a larger-scale proof-of-concept focused on cargo management. Leveraging Vodafone's private 5G network, it also included indoor storage areas, adapting the same digital twin and AI and AR/VR technology for indoor usage to minimize environmental impact and reduced operating costs.

Ericsson Research and the Italian Interuniversity Consortium for Telecommunication (CNIT) began cooperation on the "Port of the Future" project at Livorno in 2016. The container terminal operations process 5G trial in Livorno is also part of the COREALIS project, under the EU Horizon 2020 program.

Mining

Mining operations are responsible for 4 to 7 percent of global GHG emissions [27]. Transitioning to renewables, as well as improving operational efficiencies through electrification and digitalization, will be key to reducing operational emissions, currently accounting for 1 percent of all GHG emissions worldwide. High-performance connectivity provides a resilient and scalable platform for this, enacted through efficiency-driving technologies such as autonomous machinery, massive data collection and compute.



Emissions outlook

Mining has developed a deep-rooted relationship with fossil-based fuels. Breaking this dependance will require a deep and extensive transition to renewable energy sources across the mining chain. Today, this is being enacted through renewably sourced power purchase agreements or even emerging mobile renewable energy solutions, both of which can provide significant cost incentives to mining operators.

As the source of many cross-sectorial supply chains, the decarbonization of mining carries a decisive impact not only on a multilateral level, but also on a supply chain level. Today, cross-sectoral standards such as the Initiative for Responsible Mining Assurance (IRMA) and the International Council on Mining and Metals (ICMM) are key to enacting and aligning decarbonization efforts. For the latter, this includes setting high-level targets to introduce greenhouse gas emission-free surface mining vehicles by 2040, as well as

minimize the operational impact of diesel exhaust by 2025. On a national and regional level, decarbonization is being driven by heightened regulatory and ESG (Environmental, Social & Governance) reporting scrutiny, as well as increased licensing requirements.

The combination of renewable energy sources, together with connected, low-carbon, and autonomous electric solutions serve as the cornerstone of ongoing sectoral transformation.

Technologies and infrastructure

Transformational and pervasive wireless infrastructure such as private 5G can serve as the nexus between today's energy-intensive carbon-based operations and emerging highly efficient emission-free alternatives that can connect, monitor, and support the decarbonization of traditional mining processes.

The integration of autonomous vehicles, environmental monitoring, geofencing, and massive data collection through sensor technologies presents the transformative potential to enhance safety, optimize machine efficiency and agility, and allow for remote operations and maintenance.

Aside from improving operational uptime and efficiency, the deployment of autonomous vehicles can also carry several positive second-order effects, for example, removing the need for energy-intensive ventilation systems.

Private, public, and mixed network infrastructures

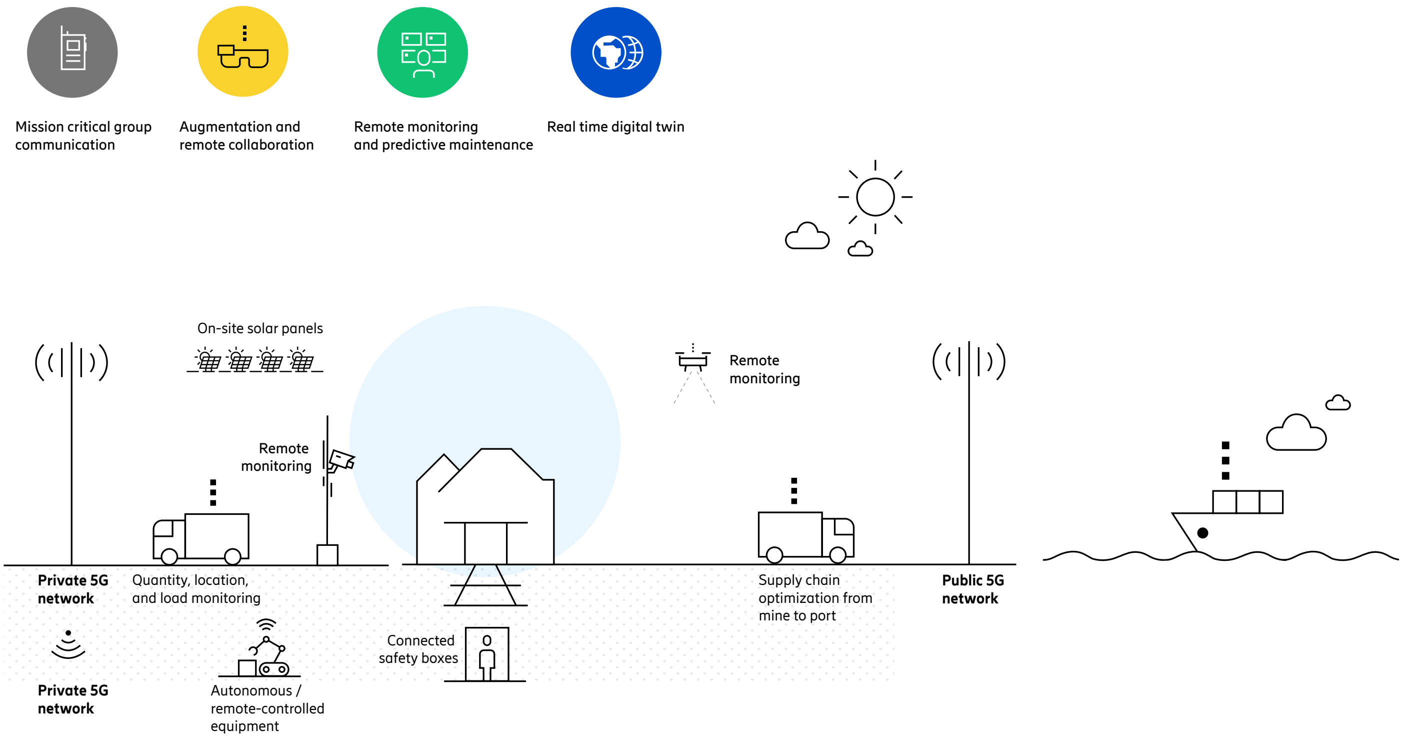
High-performance, wireless connectivity provides the enabling foundation for emerging innovative mining applications, such as autonomous and remote-controlled operations. Today, there are many infrastructural options available to mining operators, each with varying degrees of resilience and performance. This includes private networks, public networks with a dedicated network slice, and a multiservice platform that integrates private cellular networks with potential extensions to mobile operators.

Today, the adoption of advanced wireless infrastructure is being slowed through dependence on legacy Wi-Fi infrastructure and a lack of standardized connectivity protocols across the industry. Global infrastructural differences also pose a significant challenge, creating a clear disparity between technology frontrunners and slow adopters.

Decarbonization as a growth engine

Beyond standards and regulatory drivers, the economic benefits of digitalization and electrification present a compelling incentive. Mining sectors face unprecedented growth in coming years, driven in part by a high demand for commodities arising from renewable energy, expanded electrical grids, and electric vehicles — that in turn will be crucial in enabling exponential decarbonization of other sectors. Sustainable, low-emissions operational models will be key to delivering scale, viability, and a competitive edge in emerging marketplaces.

5G Connected Mine



Case Study

Lowering emissions and cost-per-ton through automation

The electrification and automation of mining processes such as in-pit drilling, digging, loading and hauling will be key to realizing low-emission, energy-efficient and safer mining operations. Resilient, high-performance connectivity is the fundamental enabler of this.

At Boliden's copper mine in Aitik, Sweden, [28] the utilization of autonomous equipment, enabled by a private 5G cellular network, demonstrates the significant operational impact of automation in terms of increasing efficiency, reducing emissions, and improving safety.

This is validated through:

- Forecasted 10 percent saving in operational fuel consumption, corresponding to a reduction of 9,400 tons of CO2 emissions.
- 25 percent increase in operating hours potential, while simultaneously minimizing fuel consumption and eliminating the need for extra staff, service stations, and transport infrastructure.
- 1 percent overall cost saving, generating a EUR 2.5 million net saving across the mine.

The site will continue to develop its automation capabilities in the coming years. This will include the automation of complex drilling, hauling, and planning and dispatch. For the latter, Boliden's private 5G network will be required to handle several 3D video streams and manage complex tasks remotely.

Ericsson currently deploys private 5G cellular networks across 60 mines worldwide.

EUR 2.5 million

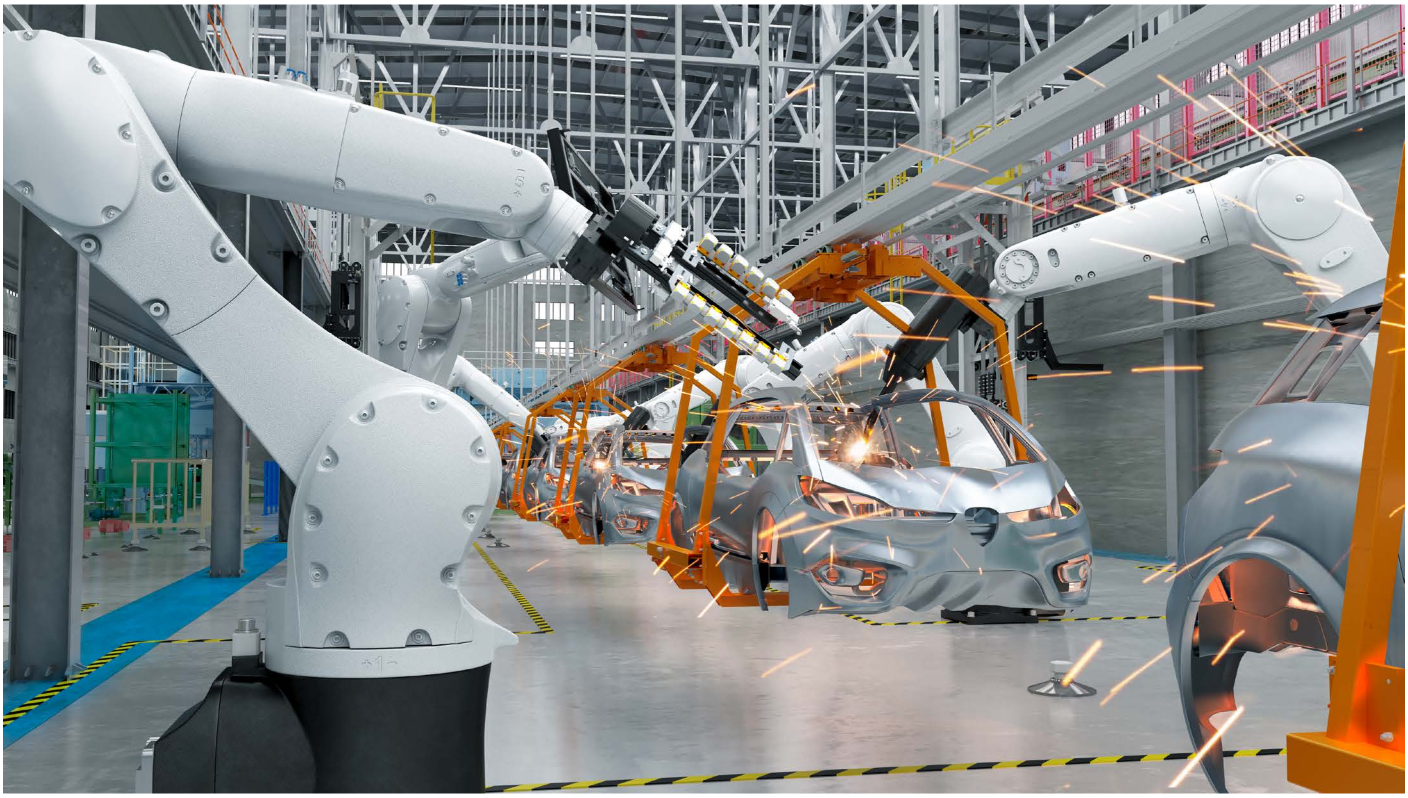
annual cost saving based on five autonomous drill rigs

9,400 tonnes

annual saving of CO2 emissions forecasted

Manufacturing

Manufacturing accounts for 30 percent of global GHG emissions [29], with energy-intensive processes and global supply chains presenting key challenges, in addition to resource optimization, waste reduction, and operational safety. By enabling agile, automated, and efficient production operations, private 5G lays a credible pathway for viable, scalable decarbonization of one of the world's most pollutant industries.



Emissions outlook

Manufacturers play a dual role in the realm of sustainability. They are essential contributors to reducing their own emissions, and also serve as a catalyst for sustainability across other industries. Positioned at the core of supply chains and innovation, influencing the entire spectrum of emissions, directly impacting the carbon footprints of businesses they collaborate with.

The adoption of sustainable manufacturing practices such as sustainable product design, efficient production processes, responsible supply chain management and end-of-life considerations contribute not only to environmental preservation but also positive economic impact. This reinforces the principle that sustainability is an opportunity rather than a cost.

Notably, the economic advantages of sustainability efforts, through efficiency improvements and reduced energy consumption, as well as ensuring the well-being of workers, provide a strong incentive for decision-makers and companies. Meeting these needs requires heightened efficiency and automation, underpinning the value of connectivity and digitalization, enabling flexible production lines, automated logistics and real-time data analysis.

Technologies and infrastructure

The manufacturing industry is highly diverse, encompassing a multitude of sectors, each requiring tailored technological solutions. In this dynamic landscape, the integration of advanced technologies is not only a catalyst for energy efficiency but also a driving force behind safety, performance, and overall operational precision.

Through benchmark speed, latency, bandwidth, resilience, and agility, private 5G meets the necessary performance criteria needed to enable advanced technology use cases such as massive real-time data collection, extended reality, and latency-sensitive automation technologies. Beyond cost and performance benefits, many of these use cases are crucial to enabling operational emissions reductions.

Disruptive shop-floor technologies

Efficient energy monitoring and management practices are crucial pillars for decarbonization and can enable the industry to make substantial strides towards smart, lean, and energy-efficient production operations. Massive sensor distribution and AI-driven video analytics, provide real-time insights into operations, minimizing downtime and errors while significantly reducing waste materials. Implementing predictive maintenance technologies and streamlining the inspection of product quality not only provides better overall equipment efficiency but also helps to reduce waste in terms of material, time and energy.

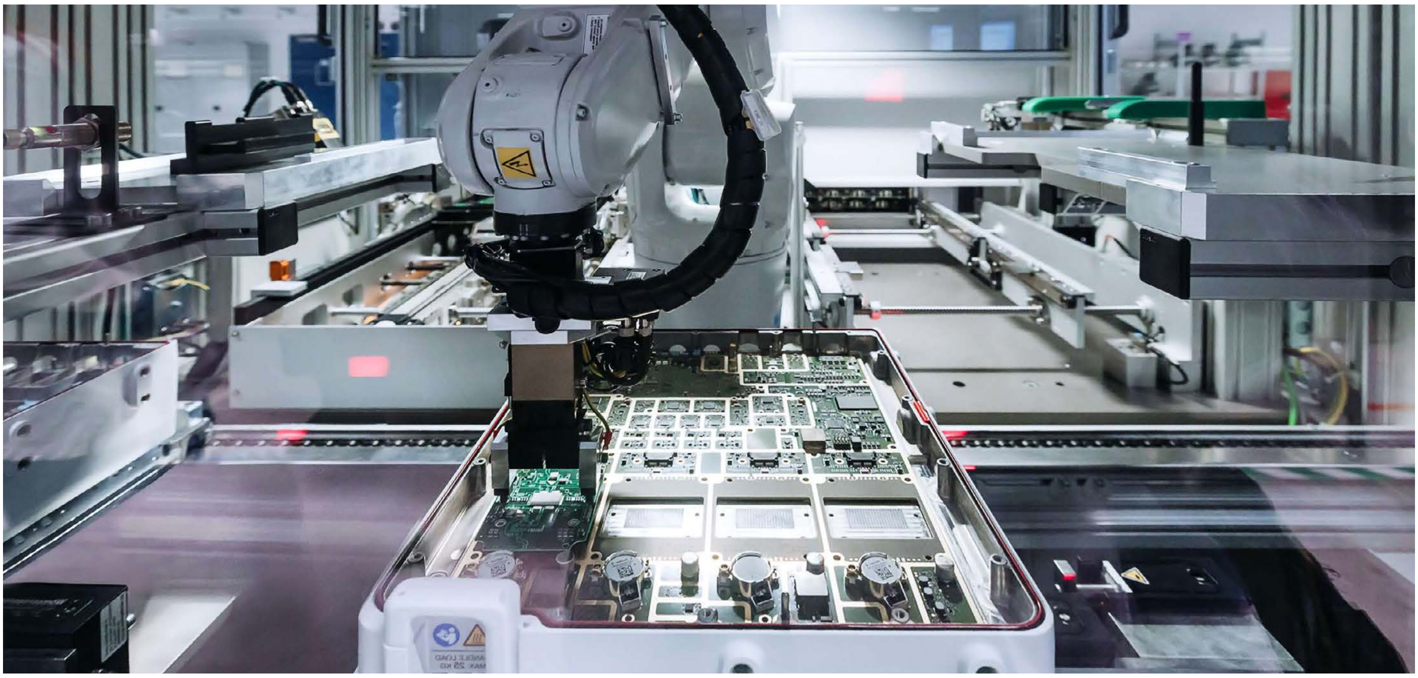
Extended reality (XR) that offers augmented possibilities can elevate decision-making capabilities, facilitate remote collaboration and technical support, and enhance overall workforce efficiency.

Automation, with its focus on efficiency and optimal asset utilization further complements these efforts. Remote control capabilities and enhanced automation through data-driven automation technologies ensure fewer errors, optimal material usage and new opportunities for process automation. Real-time digital twins also present transformative possibilities, enabling smarter, more efficient, and more agile operations.

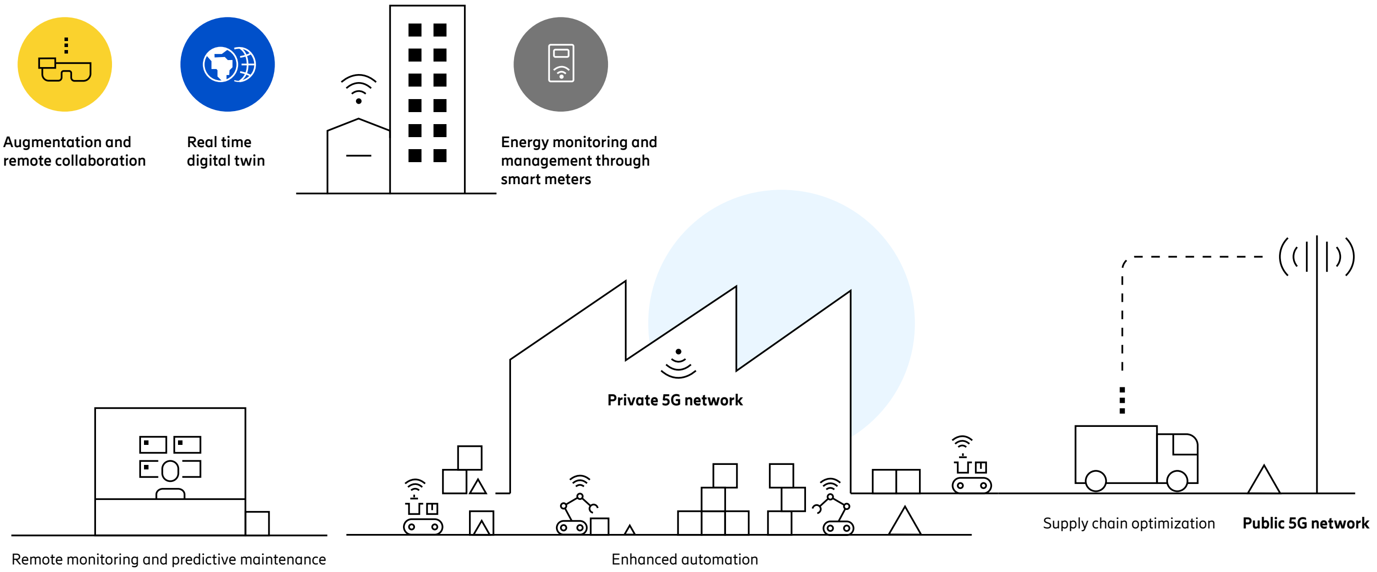
Additionally, the integration of autonomous mobile robots (AMRs) and other tools addresses operational challenges of a flexible and efficient production line. These technologies not only enhance safety but contribute to the seamless incorporation of automation elements into the factory cloud.

The synergy between efficient energy monitoring, worker augmentation, monitoring technologies and automation paints a comprehensive picture of a sector evolving towards sustainability and precision.

> 'The transition toward a low-carbon manufacturing and industrial system is set to revolutionize nearly every step of the value chain.'



5G Connected Factory



Case Study

Sustainable manufacturing at Ericsson's USA 5G Smart Factory

Ericsson's 5G Smart Factory in Texas, USA, showcases how smart manufacturing can optimize efficiency while minimizing environmental impact. The factory has introduced 25 new disruptive technologies, utilizing shared spectrum in the 3.5 GHz Citizens Broadband Radio Service (CBRS) band for rapid and secure connectivity. Emissions-reducing technology use cases include:

- Energy monitoring and management: Leveraging tools to track energy consumption and optimize strategies for efficient factory management
- Environmental monitoring: Connected sensors collect environmental data in real time like humidity and temperature, optimizing building management systems and minimizing waste
- AR for remote support: Wireless AR headsets streamline remote support with real-time video sharing, reducing maintenance complexities and costs
- Mobile alerting and escalations: Smart devices provide timely alerts, preventing production loss due to equipment issues

Investments in innovative and sustainable technologies will continue to enable the smart factory to operate with Net Zero carbon emissions from building energy consumption and occupant transportation—already 24 percent more energy efficient than the baseline.

Many leading companies have already realized the potential of similar technological advancements. Notably, Mercedes-Benz Cars and Atlas Copco Airpower have independently collaborated with Ericsson.

Key case statistics:

5% ▼ reduced production waste through data-driven building management

40 - 50% reduced travel cost through AR support

Buildings

Building operations account for 26 percent [30] of global energy-related emissions, comprising both direct emissions from buildings themselves and indirect emissions from energy production. The integration of wireless technologies into building management systems is transforming buildings into data-driven spaces, optimizing energy use and enabling predictive maintenance through IoT sensors, AI and more. Combined with a continued strong policy focus on building energy codes, this can enable significant emissions reductions required across the sector in coming years.

Emissions outlook

The most pollutant impact of today's building operations arises from the daily consumption of energy across homes, business, and public buildings – including heating, cooling, ventilation, lighting, and appliance use.

Efficient building management systems, underpinned by wireless technologies, can make a significant contribution to decarbonization of the sector and will be integral to meeting global targets. Regulatory drivers, such as stronger building energy codes, will be key to accelerating that change and can complement the strong cost incentive already presented by energy-reduction solutions.

Regional frameworks such as the European Green Deal [31], Renovation Wave Initiative [32] and the REPowerEU [33] plan in Europe will be key to making this happen. One example includes the European Solar Rooftop Initiative [34], part of the REPowerEU plan, that instates a binding solar rooftop obligation for certain building categories.

Technology and infrastructure

Smart buildings are not just structures; they are ecosystems of connectivity and intelligence built from sustainable materials and designed to facilitate minimal energy consumption.

By harnessing IoT and advanced connectivity solutions, smart buildings drive a paradigm shift in how we conceive, construct and operate spaces. Through digitalization, buildings are evolving into dynamic, data-driven environments.

IoT sensors enable real-time monitoring of energy consumption, optimizing usage and minimizing waste. This enables proactive maintenance, ensuring enhanced efficiency, security, and even predictive management.

AI-driven solutions such as digital twins can facilitate smarter decision-making, enabling efficient energy usage, predictive analysis of maintenance needs, and adaptive systems that respond to occupants' needs in real time. Insights derived from presence monitoring and crowd movement modeling enhance facility optimization and asset utilization.

Indoor 5G networks, including wireless WAN solutions, provide a high-performance, robust, and agile wireless infrastructure that can support high data rates, massive data collection and compute.

As illustrated by Rigado and Cradlepoint who deployed wireless sensors to support operations across commercial spaces, such as offices, stores and restaurants. This recent advancement in wireless sensor technology has made it far more cost-effective to gather real-time data, automate reporting and trigger alerts to optimize business operations, making it more affordable for companies of all sizes. [35]

However, while technology presents promising solutions, the building sector's journey towards sustainability demands collective efforts and innovative strategies. Collaborative, open and focused approaches are essential to leverage the potential of digitalization in this sphere and drive meaningful change.

'The transformative potential of digitalization resonates profoundly within the realm of buildings. It marks a paradigm shift in how we perceive, construct and manage these spaces.'

Case Study

Kiona's Edge AI steers residential sustainability

The retrofitting of energy efficient building elements such as windows and insulation will be required to improve building energy codes, however cost factors can limit its potential for scale. Digital solutions underpinned by wireless infrastructure provide a cost-effective and easy-to-deploy means of driving down heating emissions.

Ericsson and Kiona, a building management solution provider, embarked on a comprehensive study [36] to assess the influence of its Edge AI steering function on energy consumption and GHG emissions within 356 residential buildings that rely solely on district heating, based in Sweden and Finland.

The solution, including a network of sensors, connectivity hubs and a cloud-based AI steering platform, has contributed to an immediate and profound reduction in heating-related emissions. This accounted for a 7 percent reduction in average electricity consumption, and a 6 percent decrease in GHG emissions. As the sample data set comprises of buildings that exclusively use district heating (with relatively low emissions), this indicates even greater potential for savings in locations with less favorable conditions.

Today, Edge AI is active in over 6,500 buildings, where it proactively manages heating systems and visualizes BMS data enabling remote management by building operators.

Key case statistics:

17 GWh of consumed energy saved throughout 2022

1 Ktonne CO2e saved across 365 buildings (in 2022)

Agriculture and nature-based solutions

Agricultural sectors account for around 11 percent [37] of global GHG emissions, rising to 23 percent [38] when forestry and land-use changes are added. Supported by connected technologies such as remote real-time monitoring, nature-based agroforestry solutions can contribute up to 30 percent [39] of climate mitigation needed by 2050. When rolled out across agricultural sectors, connectivity-based solutions can also provide a vital boost to local farming communities, creating a more equitable marketplace and reducing farmland degradation through precision agriculture.

Nature-Based Solutions

Emissions outlook

Rising temperatures, erratic rainfall, pests, disease and extreme weather events are intensifying, exerting immense pressure on the earth's critical natural ecosystems to withstand and reduce the effects of climate change. This includes critical biodiverse and ecological systems across forests, coastal areas and wetlands.

Nature-based solutions supported by digital technologies, can contribute a significant 30 percent of the necessary GHG reductions by 2050 [40], as well as tackling biodiversity loss. Both the IPCC [41] and the UN Panel on Biological Diversity and Ecosystem Services (IPBES) [42] identify them as important solutions in enabling widescale decarbonization in coming years.

Technology and infrastructure

The deployment of mobile technology use cases can make a significant impact in sustaining the earth's vital natural and biodiverse ecosystems. The build out of cellular infrastructure is much less intrusive than traditional fixed solutions such as fiber and carries fewer risks to local ecosystems and communities, particularly in vulnerable or protected areas.

However, the remote nature of forests and wetlands can present challenges regarding mobile coverage and power supply, making renewable energy sources such as solar power a key part of the equation. Depending on the country where the technology solution is to be deployed, it can also be challenging to find local partners who can provide the necessary IoT and AI solutions.

In terms of the technology use cases, remote monitoring secures and preserves protected sites, ensuring their security and contribution to conservation efforts. This remote oversight reduces the carbon footprint from site visits, crucial for environmental protection. This can be enabled through mobile-enabled technologies such as massive data collection through sensors and drones, together with real-time video footage and AI-enabled data analysis.

Case Study

Connected mangroves

Mangrove forests act as natural shields against the elements for coastal communities. They also serve as nurseries and habitat for fish and other sea creatures. The mangroves also have a role to play in mitigating climate change, as their roots trap carbon dioxide.

Ericsson works with partners in the Philippines and Malaysia to reforest and conserve critical mangrove communities through connected technologies such as solar-powered environmental sensors and real-time camera footage, all of which is accessible remotely via a digital dashboard.

The project has helped to increase the survival rate of mangrove saplings from 40 percent to up to 80 percent, thus aiding carbon sequestration and adaptation. Fishermen in local communities, who can face up to twenty typhoons each year, have also gained benefits to their livelihood, as they can now monitor the water conditions before they set out to catch fish.

Key case statistics:

80% ▲ in mangrove survival rate through connected remote monitoring

30% of emissions mitigation needed by 2050 can result from nature-based solutions

Agriculture and farming

Emissions outlook

One third of the world's farmland is currently degraded. Traditional farming practices can exert pressure on nature's delicate balance, through the extraction of water, deforestation, biodiversity loss and the erosion of essential soil nutrients.

Global marketplaces have also made it difficult for small-scale local farmers to compete on a more equitable basis with large-scale competitors operating with economies of scale. This creates a global value chain that contributes to increased transportation and logistics with associated GHG emissions.

Technology and infrastructure

Precision agriculture and a move to automated operations is needed to redress land degradation, as well as enhance the competitive proposition of local small-scale farmers.

Putting these solutions in place requires a transformation of value chain business models and new cross-sectoral collaborations. In this regard, the role of governments as well as local ICT ecosystems will be key.

In terms of technologies, automated solutions such as remote-controlled or autonomous harvesters, ground robots and offloading systems equipped with sensors and machine-to-machine communications can enable significant efficiency gains and thereby minimize environmental impact. They can also collect crucial crop volume data and perform challenging or hazardous tasks, improving safety. As an example, autonomous ground robots can enable bruise-free picking while simultaneously measuring fruit ripeness, reducing spoilage.

Real time data collected from devices monitoring soil health, pest and crop quality metrics also offers a platform for data-driven decision making, allowing operators to act, creating economic and environmental impact.

Conclusion

Enterprises acting in line with the 1.5°C ambition must strive to reach net zero by 2050 at the latest, eliminating emissions both within their operations and across their value chains.

Transparent reporting practices, aligned with standardized instruments like the EU taxonomy, are essential for fostering cohesive climate action. The ITU L.1480 'Net Zero' standard provides a fundamental framework for assessing ICT solutions' and their CO2 impact, combining consequential and life cycle assessment methods.

Exponential technological development, enabled in part by 5G and other disruptive technologies such as AI, IoT, XR, autonomous vehicles, robotics and more, serves as the bedrock of ongoing sectoral transformation and in doing so, can make a decisive impact in mediating the shift towards more efficient, low-carbon industrial operations, as well as more sustainable consumption.

In this report, we highlight some of the 5G use cases that are driving this formative shift. Across ports, for example, the disruptive technology domains of massive data collection, digital twins and XR are combining to improve, optimize and automate logistical operations. Across energy sectors, 5G and AI is setting the foundation for a transition to smart, data-driven grids, further securing energy distribution (i.e. through virtual powerplants) and keeping critical energy infrastructure online. Across building sectors, private 5G and wireless WAN are laying the blueprint for energy-efficient building operations, for example through AI-based platforms that can enable predictive analysis of maintenance needs and adaptive systems that respond to occupants' needs in real time.

Three 5G value pillars that will be key to enabling global industrial decarbonization:

Limitless innovation

Unleashing the programmability of networks through unified, open network APIs has the potential to deliver an entirely new creative dimension of mobile innovation, powering a disruptive new wave of mobile applications and devices, and capable of enabling the required sectorial transition at scale.

Global scale

As a standardized and interoperable system, 5G offers a platform capable of supporting global economies of scale. 5G is the fastest-scaling mobile generation in history, expected to reach 85 percent population coverage worldwide by 2029 [43].

Commercial viability

5G is the most resilient, innovative and commercially viable connectivity platform that exists. As a more performant alternative to other wireless alternatives and more cost-efficient and less environmentally intrusive than fiber, it enables a multitude of value propositions for enterprises not only to meet sustainability goals, but drive strong top-line growth.

As mentioned above through connected technologies, the private and public sectors can harness all manner of uses and solutions to combat decarbonization and climate change. It is fair to anticipate many unforeseen uses and benefits in the years ahead. As the IPCC notes, however, we are running out of time. In spite of that, in 2020-21 during the pandemic era, we saw that practices and emission levels can change rapidly. Building on these insights, we can use digitalization, underpinned by mobile network services and cloud technologies, to accelerate the decarbonization of enterprises by years.

Stakeholder call to action

We need to act now and continue spurring that digitalization, starting with increasing access to the innovation platform 5G, allowing scalable technologies, digital practices and lower carbon generating solutions.

Policy makers	• Ensure policy is geared to maximize investment, deployment and use of transformational connectivity and amplify this through public funding when there is clear evidence of market failure • Provide tax incentives for industry sectors to digitally transform and lower the carbon intensity of their operations • Make available favorable financing terms for adaptation and mitigation plans across different sectors • Use public procurement and public services as anchor tenants to accelerate digitization and lower carbon operations across the economy
Industrial Enterprise	• Establishing and ensuring all CSR Reporting follows the correct standards • Proactively commit to a Net Zero Pathway, providing full transparency across all scopes • Collaborate with ICT ecosystems to embrace new digital-enabled solutions, that provide climate action impact
Technology Providers	• Leverage the Global network platform, that being 5G. Explore Open Network APIs which provide the possibilities for innovation at scale • Collaborate with industries, tech providers and CSPs to develop viable ICT solutions which can enable fundamental reductions in GHGs, whilst also providing social and economic benefits
Communication Service Providers	• Collaborate with enterprises and technology partners to develop live solutions, which can enable environmental, social and economic benefit, whilst also demonstrating the true value that 5G can bring • Proactively commit to a Net Zero Pathway, providing full transparency across all scopes • Establishing and ensuring all CSR Reporting follows the correct standards

References

1. IPCC Synthesis Report for the Sixth Assessment Report, 2023.
2. Exponential Roadmap Business Playbook 1.5, Version 3
3. Edquist, A; Bergmark, P 2023, 'How is mobile broadband intensity affecting CO2 emissions? – A macro analysis', <https://www.sciencedirect.com/science/article/pii/S0308596123001799>
4. Copernicus Climate Change Service/ ECMWF
5. IPCC Synthesis Report for the Sixth Assessment Report, 2023.
6. IPCC Synthesis Report for the Sixth Assessment Report, 2023.
7. Copernicus Climate Change Service/ ECMWF
8. ICT carbon footprint for 2015, as reported in Malmodin and Lundén (2018). The Energy and Carbon Footprint of the Global ICT and E&M Sectors 2010–2015. Sustainability. doi:10.3390/su10093027.
9. https://www.ericsson.com/en/blog/2020/2/climate-impact-of-digital-technology#:~:text=To%20illustrate%20this%2C%20we%20calculated,of%20networks%20and%20data%20center
10. Exponential Roadmap Business Playbook 1.5, Version 3
11. Exponential Roadmap Business Playbook 1.5, Version 3
12. Edquist, A; Bergmark, P 2023, 'How is mobile broadband intensity affecting CO2 emissions? – A macro analysis', <https://www.sciencedirect.com/science/article/pii/S0308596123001799>
13. https://www.ericsson.com/en/cases/2019/enabling-the-energy-system-of-the-future
14. Distribution of carbon dioxide emissions worldwide in 2022, by sector, Statisa
15. Power sector emissions worldwide from 2000 to 2022, by source, Statista
16. https://consultations.entsoe.eu/markets/public-consultation-networkcode-demand-response/ and https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32019R0943
17. https://www.ericsson.com/4a6f5b/assets/local/industries/2022-09-ericsson---solving-wind-energys-connectivity-challenge.pdf
18. https://www.ericsson.com/en/reports-and-papers/industrylab/reports/bringing-5g-to-power and Whitepaper on smart grids with 5G backup for utilities (ericsson.com)
19. https://www.unep.org/resources/emissions-gap-report-2022
20. https://www.ericsson.com/en/cases/2017/scania-and-ericsson
21. https://www.unep.org/explore-topics/transport/what-we-do/electric-mobility/electric-light-duty-vehicles
22. https://www.ericsson.com/en/connected-vehicles/ecosystem
23. Einride – Intelligent movement | Einride
24. European Commission, 2023, https://climate.ec.europa.eu/eu-action/transport/reducing-emissions-shipping-sector_en
25. Organisation for Economic Co-operation and Development (OECD), 2023, https://www.oecd.org/ocean/topics/ocean-shipping/
26. International Maritime Organization, 2023, https://www.imo.org/en/MediaCentre/HotTopics/Pages/Cutting-GHG-emissions.aspx
27. Global Data, 2022, https://www.globaldata.com/data-insights/mining/total-ghg-emissions-of-major-metals-and-mining-companies-worldwide-by-revenue-2090961/
28. Boliden's copper mine in Aitik, Sweden
29. IPCC, 2022: Climate Change 2022: Mitigation of Climate Change. Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. Available at: https://www.ipcc.ch/report/ar6/wg3/chapter/chapter-11/
30. International Energy Agency, https://www.iea.org/energy-system/buildings
31. https://www.consilium.europa.eu/en/policies/green-deal/
32. https://energy.ec.europa.eu/topics/energy-efficiency/energy-efficient-buildings/renovation-wave_en
33. https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal/repowereu-affordable-secure-and-sustainable-energy-europe_en
34. https://www.iea.org/policies/15691-repowereu-plan-joint-european-action-on-renewable-energy-and-energy-efficiency
35. Rigado + Cradlepoint Operations Monitoring Solution for Commercial Spaces | Cradlepoint
36. Saving energy and decarbonizing residential homes using connected Edge AI technology. Ericsson. Available at: https://www.ericsson.com/4a73a2/assets/local/about-ericsson/sustainability-and-corporate-responsibility/environment/saving-energy--decarbonizing-residential-_brochure.pdf
37. Agriculture Solutions' Climate and Clean Air Coalition. Available at: https://www.ccacoalition.org/content/agriculture-solutions
38. Ibid.
39. Griscom et al, 2017, https://www.pnas.org/doi/10.1073/pnas.1710465114
40. Ibid. Griscom et al, 2017, https://www.pnas.org/doi/10.1073/pnas.1710465114
41. https://www.ipcc.ch/sr15/
42. https://www.ipbes.net/global-assessment
43. Ericsson Mobility Report 2022

Ericsson enables communications service providers, enterprises and the public sector to capture the full value of connectivity. The company's portfolio spans the following business areas: Networks, Cloud Software and Services, Enterprise Wireless Solutions, Global Communications Platform, and Technologies and New Businesses. It is designed to help our customers go digital, increase efficiency and find new revenue streams. Ericsson's innovation investments have delivered the benefits of mobility and mobile broadband to billions of people globally. Ericsson stock is listed on Nasdaq Stockholm and on Nasdaq New York.

ericsson.com