NOKIA

Positive impact on a global scale

Nokia provides networks that connect societies, industries and consumers with each other. Our presence across 120 countries gives us the opportunity – and privilege – to make a positive environmental and social impact on a global scale.

Sustainability is not a limit to growth, it is a catalyst for impact at scale.

In an era defined by rapid technological advancement and urgent environmental and social challenges, the importance of aligning innovation and sustainability has never been clearer. The Nokia People & Planet report stands as a testament to Nokia's unwavering commitment to shaping a future where connectivity-driven digital transformation and responsible stewardship go hand in hand.

In March 2025, we published **Nokia's 2024 Sustainability Statement**, in compliance with the European Union Corporate Sustainability Reporting Directive (CSRD) and the European Sustainability Reporting Standards (ESRS) and the applicable Finnish legal requirements. In the statement we disclosed our company's sustainability performance, impact, risks and opportunities across environmental, social and governance dimensions. This report, People & Planet: Impact Report 2025, provides a storyline for our performance in areas where we had a positive impact on our value chain, as well as how those areas have the potential to drive a sustained economic and social transformation.

This report is not merely a reflection of progress. It is a blueprint for impact on a global scale. It chronicles how Nokia is leveraging its global reach, technological expertise, and collaborative spirit to drive meaningful change across industries, ecosystems, and communities. From decarbonizing our operations and enabling circularity in our product design, to bridging the digital divide and empowering marginalized populations, the initiatives outlined here demonstrate a holistic approach to sustainability grounded in science, guided by purpose, and propelled by innovation.

This progress is not just about Nokia. It is very much about our customers, suppliers, partners and the community we operate in. Over the past five years, we have reduced our total greenhouse gas emissions by 36%, including a 56% reduction among final assembly suppliers and a 30% reduction in emissions from our products in use by our customers. Since last year we have worked with over 9,300 suppliers globally, engaging particularly closely with 400 in order to make their practices and safeguards more responsible, sustainable and clear. We have been able to impact over 110,000 direct beneficiaries through our social digitalization projects, digital skills building, and connecting the unconnected or underserved.

My colleagues and I are proud to see how our teams, partners, and stakeholders have come together to deliver measurable outcomes that support the UN Sustainable Development Goals and advance Nokia's vision of a more inclusive, equitable, and resilient world. Whether through smart grids in Chattanooga, circular economy programs with Orange, biodiversity conservation in Finland, research collaborations with 34 universities across Europe, USA and Asia, or partnering with startup ecosystems through our venture capital arm, NGP Capital, this report showcases the power of technology to uplift people and protect the planet.

Let this document serve not only as a record of what we've achieved, but as an invitation to join us in building a future where connectivity is a force for good, an engine for economic growth and a critical backbone for the AI supercycle.

Together we can build a future where technology empowers a sustainable and prosperous world.

"Together, we can build a future where technology empowers a sustainable and prosperous world."

Subho Mukherjee
Vice President & Global
Head of Sustainability

1.1. The potential of digital

Technological progress raises living standards and supports economic growth. This is historically true and it remains the case today. For example, consider the spread of the internet and devices on which to use it, such as laptops and mobile phones.

This internet-centered wave of innovation continues to progress**. Broadband, mobile connectivity and the cloud are all becoming even more powerful and efficient. At the same time, the AI supercycle is now firmly established**. It is part of a new wave of digitalization, including advanced manufacturing and wearable devices, which will create new opportunities for growth.

But it is hard to maximize the potential economic benefit of current and emerging waves of digitalization if the technologies they bring are not sustainable or accessible.

As of 2024, the ITU reported that **2.6 billion** people remain offline. This digital exclusion limits access to education, healthcare and other public services. It also makes it far harder for people in unconnected communities to start the modern, digital businesses that can drive economic opportunity.

Energy efficiency is equally vital. **Information and communications technology (ICT) sector accounts for approximately 2% of global greenhouse gas emissions and 5% of worldwide electricity consumption. It consumes $25 billion in energy annually, with up to 40% of operational costs tied to power**. Today's connectivity challenge arises from the lack of reliable

and affordable power in the areas where connectivity is most needed. Without sufficient energy infrastructure, it becomes difficult to deploy and sustain mobile networks—especially in rural and sparsely-populated areas.

Nokia is addressing these issues. **We are investing in technologies that possess best-in-class efficiency and are rolling out those technologies in ways that support economic growth in a range of settings**.

This report begins with an explanation of how Nokia can drive a positive impact, including by making our own operations as efficient as possible. It goes on to look at how we protect the environment, including maximizing the positive impact of digitalization while minimizing the negative impact of our operations and products. We then broaden the lens to take in the social impact of what we do – how we create effective ecosystems with various stakeholders, including suppliers and customers, in order to make sure the rollout of digitalization is accessible to all. The report concludes with some real-life case studies which demonstrate how Nokia's products and services enable sustainable innovation which is already driving gains in productivity and efficiency for our customers.

2.6 billion

As of 2024, the ITU reported that 2.6 billion people remain offline

2%

The ICT sector accounts for approximately 2% of global greenhouse gas emissions

1.2. Nokia's impact on the world

Nokia's networks support approximately 271 million fixed connections and 5.6 billion mobile subscriptions across 120 countries. We are the only truly global supplier of mobile and fixed networks. That means we have a unique opportunity to have a positive impact on a global scale.

As such, **sustainability is both a strategic priority and a driver of long-term value creation for Nokia**. This has been our view consistently: we have been reporting on sustainability for nearly two decades, beginning well before regulatory requirements or formal frameworks were established. This early adoption reflects our belief that consistent, credible reporting is essential to embedding sustainability across our operations, measuring progress toward our goals and demonstrating to investors, customers and peers that a focus on sustainability can drive commercial performance. This commitment continues

to be recognized globally: in 2025 Nokia was ranked #37 among TIME's World's Most Sustainable Companies (and #1 in Finland), was placed #44 overall, #7 in the information technology sector, and ranked #1 globally in its communications equipment category in the Corporate Knights Global 100 rankings, earned a place among the Corporate Knights Europe 50 Most Sustainable Companies, and achieved top marks in ABI Research's Telco Scope 3 Emissions Management ranking for both innovation and implementation.

There are two dimensions to Nokia's sustainability: the impact that comes through our own operations, and the impact that comes when customers use our products and services.

On the former, Nokia is a global company, with highly distributed supply and value chains. We employ over 70,000 people across 130 countries. We generated over €19 billion in net sales in 2024, and since 2000 we have invested over €150 billion in Research and Development. We have wide brand recognition and a unique portfolio.

We understand the responsibilities that come with running a business on that scale. The choices we make have an impact beyond our balance sheet or strategic execution. We take these responsibilities seriously.

Over the past five years, we have reduced our total greenhouse gas emissions by 36%, including a 56% reduction among final assembly suppliers and an 85% reduction in our own facilities. Our chipsets have made significant generation-over-generation advances in power consumption, such as FP5 consuming up to 75% less power than the previous generation, and our AirScale 5G massive MIMO base stations use up to 50% less energy compared to 2019. We've achieved these gains while improving material efficiency across our portfolio and expanding our network impact.

In 2024, we also worked with over 9,300 suppliers globally, with 80% of our supplier spend concentrated among approximately 400 partners, all engaged through our responsible sourcing program. **Through our social programs, we've positively impacted more than 800,000 direct beneficiaries over the past three years, including 112,453 in 2024 alone.**

For example, we are:

- **Investing in the rollout** of broadband solutions suitable for underserved communities

- **Incentivizing sustainable behaviors** by linking compensation to ESG performance

- **Embracing circularity** in our product design, so more products can be reused, repurposed or recycled when they reach the end of their lives

- **Reducing our own** greenhouse gas emissions through operational improvements and energy efficiency

- **Supporting workforce** well-being through global health, safety, and mental wellness initiatives

- **Advancing diversity and inclusion** through inclusive leadership programs and representation goals

We are leveraging our scale in service of sustainable and equitable business. We believe we can have a real, measurable impact in the pursuit of efficiency, productivity and growth across industries, businesses and communities.

Regarding the impact that comes when customers use our products and services, digital technologies hold the key to doing more with less.

AI, machine learning, digital twins, better semiconductors, scalable software solutions and as-a-service delivery models all lead to gains in efficiency and productivity, and the reduction or even elimination of waste. This is true for our key customer group of communications service providers (CSPs), but also for other customer groups such as hyperscalers, defense organizations and enterprises. Investing in these technologies can bring them higher performance, competitive advantage, CAPEX and OPEX efficiencies and better sustainability.

The benefits of digitalization are equally relevant when it comes to social factors such as improving equality of opportunity.

Digital technologies are by nature scalable and distributed. They can make services and computing power available more widely, including to places where they don't currently exist. That can mean rural communities, isolated workforces or villages lacking infrastructure or business investment.

Nokia's People & Planet report highlights some of the ways in which we are maximizing our positive impact – and minimizing our negative impact – on the world. It includes datapoints, visualizations and customer case studies in order to bring our sustainability story to life.

This report shows how Nokia is simultaneously driving the power of technology, human capital and economic and societal impact to improve the state of the world.

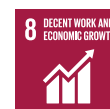# 1.3. The UN Sustainable Development Goals and our business

The United Nations Sustainable Development Goals (SDGs) help to inform our sustainability efforts, as well as those of many of our customers, suppliers and other stakeholders, including governments.

While digitalization and enhanced connectivity will continue to play an important role in accelerating and achieving all 17 SDGs, we believe that the SDGs 8, 9 and 13 are the most relevant to our business. Accordingly, this report focuses on these three goals, showcasing how Nokia's technology and operations contribute most meaningfully to their advancement.

Sustainable Development Goal 8

Decent Work and Economic Growth

- **Empowering communities through digital inclusion:** Nokia's technologies help bridge the digital divide by expanding access to connectivity, education, and digital skills—especially in underserved regions.
- **Driving economic growth through innovation:** By enabling digital transformation across industries, Nokia supports productivity, job creation, and sustainable economic development.
- **Fostering decent work and inclusive workplaces:** Nokia promotes fair labor practices, diversity, equity, and inclusion across its own operations and supply chain.

Sustainable Development Goal 9

Industry, Innovation and Infrastructure

- **Sustainability-by-design in next-gen networks:** Nokia embeds sustainability principles into the design of future networks, guiding the principles of these networks to become more energy, material, and resource-efficient from the outset.
- **Enabling circularity and resource efficiency:** Through product design, eliminating waste, and lifecycle management, Nokia supports circular practices and minimizes embodied emissions across its infrastructure.
- **Collaborating for systemic impact:** Nokia works with partners, standardization bodies, and academia to drive a 'network effect' of sustainable innovation and resilient digital infrastructure globally.

Sustainable Development Goal 13

Climate Action

- **Decarbonizing through digitalization:** Nokia's solutions help industries reduce emissions by improving operational efficiency, predictability, and automation.
- **Reducing environmental footprint:** The company continuously improves the energy and material efficiency of its products, supporting customers in achieving their climate goals. Nokia also works to decarbonize its own operations in line with its science-based targets, through renewable electricity use, facility energy efficiency, and low-carbon logistics.
- **Accelerating net-zero pathways:** Nokia is committed to achieving its science-based targets and reaching net-zero emissions across its operations and value chain, working closely with suppliers, customers, and partners to drive collective progress.

2.1. Our path towards net-zero greenhouse gas emissions

Understanding net-zero

Net-zero greenhouse gas (GHG) emissions refers to the state in which the amount of GHG emissions released into the atmosphere is balanced by the amount removed or offset, **typically through verified offset mechanisms including carbon removal technologies and natural sinks.**

For companies like Nokia, this means significantly reducing emissions across the value chain and **addressing any remaining emissions through credible carbon removal measures.**

This concept is central to global climate goals and regulatory frameworks, and it increasingly influences how businesses operate, report, and innovate. Net-zero is not a standalone initiative—it intersects with product development, supply chain, energy use, and customer expectations. It also requires robust data, governance, and transparency to ensure progress is measurable and accountable. **At Nokia, our net-zero ambition is a key part of our broader environmental strategy, which addresses interconnected challenges across operations and product lifecycles**.

Nokia's holistic approach to minimizing environmental impact

Building on our net-zero commitment, **Nokia's environmental strategy is holistic**. We understand that nature is a complex system in which many factors interrelate, and in which every business decision we make, from product design to supply chain logistics, has a potential impact.

Nokia's approach is designed to give **emphasis to three priorities: climate, circularity and biodiversity.** We believe that action in one of these domains must not come at the expense of another, and that all three domains must be addressed at once by measuring the precise impact of actions we take and solutions we design.

Vision and commitment

In 2024, Nokia accelerated its decarbonization plans. **Previously we had pledged to achieve net-zero greenhouse gas (GHG) emissions across our entire value chain by 2050 – now we want to achieve it by 2040. Furthermore, we accelerated scope 1 and 2 emissions to a 90% reduction by 2030 versus a 2019 baseline**. Monitoring and reporting mechanisms are in place to track progress and ensure accountability.

Our target is backed by science. In 2017 we became **the first telecommunications vendor to have their climate targets validated by the Science Based Targets initiative (SBTi),** and **in 2025 our accelerated net-zero target was approved by the SBTi**. This ensures that our targets align with the latest climate science.

Nokia's journey to net-zero emissions by 2040 will be driven by technology and ecosystem collaboration. Through these methods we seek to decarbonize our own operations, maximize the energy efficiency of our products and make sure our customers have at their disposal a range of solutions that allow them to improve productivity and resource efficiency in their own operations. This last aspect of decarbonization is especially important, given that in 2024 over 95% of Nokia's emissions originate from the use of products by our customers.

95%

of Nokia's emissions originated from the use of products by our customers in 2024

Nokia's journey to net-zero emissions by 2040 will be driven by technology and ecosystem collaboration.

There are two components of our path to net-zero greenhouse gas emissions

2.2. Decarbonizing our own operations

2.3. Decarbonizing our value chain

2.2. Decarbonizing our own operations

Facility emissions reduction

Nokia has made substantial progress in reducing GHG emissions from its facilities. In 2024, emissions were **78% lower than in our 2019 baseline year**, and **we are targeting an 85% reduction by the end of 2025**.

This reduction has been driven by a combination of energy efficiency measures and transition to renewable energy.

Renewable energy strategy

Our decarbonization strategy also prioritizes the transition to renewable energy sources. **In 2024, 87% of the electricity used in our facilities came from renewable sources.** We are planning to reach **100% by the end of 2025**.

Below you can find some renewable transition initiatives that can support Nokia in this endeavor:

- **On-site solar generation:** We've installed a 2.4MWp rooftop solar photovoltaic system at our Chennai factory in India and we are working to implement solar capacity at other sites as feasible.

- **Renewable electricity procurement:** We follow RE100 technical specifications and use a mix of Power Purchase Agreements (long-term contracts to buy renewable electricity directly from producers), Renewable Energy Certificates (proof that electricity

was generated from renewable sources), and Green contracts (renewable electricity products directly obtained from an energy supplier) to ensure our energy sourcing is verifiably renewable.

- **Renewable heating and cooling:** Our Oulu, Finland facility operates with renewable heating. We are working to replicate this model across our global operations whenever possible.

- **Collaborating with property developers** early in the design phase to reduce reliance on fossil fuel.

These efforts are central to our broader climate transition plan and demonstrate our commitment to decarbonizing our operations in a measurable way.

87%

In 2024, 87% of the electricity used in our facilities came from renewable sources

Energy savings: a commitment to the future

In early 2025, a new solar production unit became operational at our Carnaxide site in Lisbon, Portugal. Since then, it has enabled a consistent reduction of the site's reliance on grid-supplied energy, with remarkable results compared to the same period in 2024.

These figures represent not only a positive economic impact but also a significant step forward in reducing our environmental footprint — by lowering energy transmission losses and minimizing associated waste.

15%
reduction in **Q1** 2025*

20%
reduction in **Q2** 2025*

*Estimated absolute energy consumption. Measured monthly and aggregated quarterly. Compared to 2024. Other effects not considered.

Energy efficiency measures

- **Site selection:** Whenever it is feasible we choose locations with good energy performance and sustainability certifications (LEED, BREEAM, NABERS).

- **Workplace design:** We regularly assess opportunities to improve energy efficiency and sustainability in our building designs.

- **Infrastructure upgrades:** We are improving energy efficiency through upgrades to our cooling and electrical systems, where practical.

- **Building management:** Practices such as maintaining optimal temperature settings and switching to LED lighting have contributed to lower energy use.

Fleet cars

Nokia's green company car policy began in 2008. Since then, we estimate this policy has led to the average **CO_2 emissions per company car plummeting from 178 g/km in 2007 to a mere 25 g/km in 2024 – an 86% reduction.** This far surpasses the market average reduction of 50% during the same period.

In 2024, Nokia achieved a significant milestone in its journey towards a less polluting fleet. Despite a 4% increase in mileage, Nokia managed to reduce its CO_2 emissions by 11%, dropping from 19,334 metric tons in 2023 to 17,211 in 2024.

This achievement was a result of a deliberate shift to electrified vehicles. **85% of Nokia's new vehicles are electrified, rising to 95% of future orders**. We achieved this by encouraging our suppliers to offer more electrified vehicles across a broader range of models and incentivizing employees to choose them. The exact nature of the incentives vary from market to market but examples include offering more expensive, higher-performance electrified vehicles compared to vehicles with other engines.

2.3. Decarbonizing our value chain

Reducing energy consumption, increasing circularity and reducing GHG emissions throughout the lifecycle of our products remains a core objective.

When we design our products and services we assess the environmental impact according to the Recommendation ITU-T L.1410 (11/24), "Methodology for environmental life cycle assessments of information and communication technology goods, networks and services". There are four high-level life cycle stages:

1. Raw material acquisition
2. Production
3. Use
4. End of Life

Our aim is to reduce this impact across the value chain by
- continuing to improve material and energy efficiency of the solutions we provide
- using 100% renewable electricity across our facilities
- increasing the re-use, refurbishment and recycling of our products
- helping our suppliers and customers to reduce their impact

Environmental lifecycle

1. Raw material acquisition
- Material responsible sourcing
- Extraction and processing of materials
- Materials and energy used

2. Production
- ICT goods production incl. refurbishment
- Recycled content
- Materials and energy used
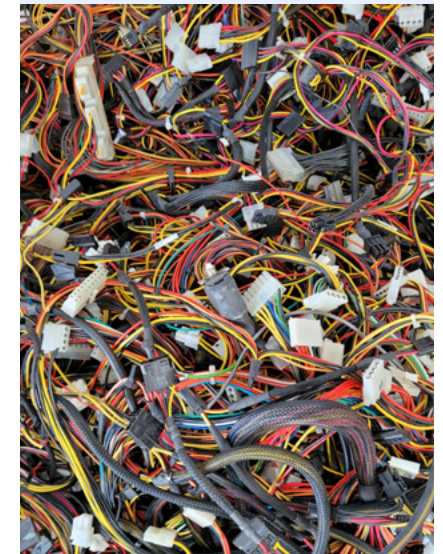- Circular practices

3. Use
- Energy used
- Lifetime sustenance (extension)

4. End of life
- Takeback, collection, storage
- Lifetime extension (incl. reuse and refurbishment)
- Material recycling
- Energy used

*Transportation / distribution related emissions are considered in the respective lifecycle across all stages.

2.3.1. Raw material acquisition

We produced **60,560 metric tons of hardware to produce our products in 2024**. These products are built from a variety of materials while their packaging consists of wood- and plastic-based components, each contributing to a distinct environmental footprint. Recognizing the challenges, Nokia's sustainable sourcing program is structured around four key pillars aligned with materiality assessments and Nokia's overall sustainability priorities:

• supplier due diligence

• climate action

• circularity

• responsible minerals sourcing

Through collaborative partnerships with our suppliers, we foster innovation and capacity building to create a more sustainable and transparent ecosystem. We actively engage with customers to implement improvements and share best practices across our shared supply chains, and we collaborate extensively within the ICT industry to maximize positive impact.

To achieve **our target of a 50% reduction in our suppliers' emissions by 2030 (from a 2019 baseline)**, we need full transparency on our suppliers' decarbonization plans. This is especially important for our suppliers in energy-intensive sectors like integrated circuits (ICs), semiconductors and printed circuit boards. Nokia actively engages with its main suppliers in these sectors to review their roadmap to net-zero for Nokia's relevant emissions (Scope 1, 2, 3), their decarbonization levers to achieve their decarbonization targets and discuss any challenges. We are confident that strong collaboration and aligned targets are crucial to our success.

Nokia is committed to ensuring responsible and conflict-free sourcing of minerals and resources through legitimate trade channels. This commitment aims to foster sustainable improvements in high-risk regions. We expect our suppliers to source key materials from environmentally and socially responsible origins and to report on their due diligence regarding the sourcing of tin, tantalum, tungsten, gold, cobalt and mica, while also maintaining the relevant data for five years. Materials such as copper and aluminum are also prioritized in our circularity efforts. Collaboration with the Responsible Minerals Initiative (RMI) and the Public Private Alliance amplifies our impact through industry-wide efforts.

> Nokia provides training and support to its suppliers to help them implement sustainable practices and reduce their environmental footprint.

As more organizations seek to access various critical materials and minerals, our efforts and collaboration with our suppliers to increase the recycled content in product materials enhances business resilience by reducing our dependence on virgin materials. This approach also helps address the depletion of natural resources, lowers the carbon footprint associated with virgin material use, mitigates price volatility, and supports compliance with evolving regulatory and customer requirements.

50% | reduction in our suppliers' emissions by 2030 (vs 2019 baseline)

Nokia is committed to ensuring responsible and conflict-free sourcing of minerals and resources through legitimate trade channels.

Image for illustration purposes only

2.3.2. Production

Nokia is implementing energy-efficient practices in its manufacturing facilities. These include using renewable energy sources such as solar and wind power, investing in energy-efficient machinery and lighting, and leveraging Industry 4.0 technologies such as private wireless networks and industrial robots. We are committed to achieving 100% renewable energy in our own facilities by 2025.

Nokia is reducing waste generation and increasing recycling rates through lean manufacturing practices, partnerships with recyclers to recover valuable materials from waste, and exploring the use of sustainable materials like recycled plastics and biodegradable material.

Our 2030 target is to achieve 95% circularity rate for waste from our offices, labs, own manufacturing, installation, product takeback and supply chain final assembly factories. In 2024, our annual waste circularity rate outcome was 81%.

.

81%

Annual waste circularity rate outcome in 2024

Nokia has set an ambitious target for its final assembly suppliers. We want them to achieve zero emissions by 2030 for the portion of their manufacturing allocated to Nokia. The suppliers have developed detailed roadmaps at the factory level, and Nokia tracks their progress through regular business reviews. **In 2024, final assembly supplier emissions were 15% lower versus 2023, and 56% lower than the baseline year of 2019**. Additionally, Nokia has set a 50% emissions reduction target by 2030 for other non-final assembly suppliers, for example, for our suppliers in energy-intensive sectors like integrated circuits (ICs), semiconductors and printed circuit boards. We are confident that strong collaboration and aligned targets are crucial to achieve success.

Product packaging

We are moving from linear to circular packaging models and sourcing methods to ensure our packaging is fully recyclable and incorporates a greater proportion of recycled cardboard and plastic content while minimizing total plastic used in primary packaging. Nokia has set a new target for 2030 to reduce the high land use associated with biological materials in its packaging. This target specifically aims to minimize the need for virgin materials included in packaging materials such as carton, and wooden pallets.

We are making continuous progress towards hitting these targets. Every piece of Nokia equipment has its own packing conventions. For example, our Lightspan portfolio of optical line terminals, which are used in broadband deployments, are now shipped in 100% recyclable packaging. Foam, rubber and plastic wrappings are replaced with organic materials like corrugated cardboard, while bleaching, toxic materials or chemical treatments are eliminated. The new packaging is 60% smaller and 44% lighter compared to previous designs.

Logistics and distribution

Over the past two years, we have transformed how we transport our products. We've looked into air freight routes, traditionally one of the highest carbon-emitting modes,moving to a smarter, more efficient blend of sea, road, and multimodal transport solutions.

This work is often delivered together with local or sectoral experts. For example, we worked with Kuehne+Nagel on one specific project related to a trade route between China and Mauritania. Previously the route used air transport only, but we switched to multimodal transport in order to improve efficiency: the first leg of the journey from China to Dubai now goes by sea, then on planes for the final part of the journey. Making these changes reduced the carbon emissions on the route in total by 25%, with a minimal increase in transit time.

> This strategy is supported by our regionalization efforts, by bringing operations closer to our customers to reduce transportation distances. Coupled with enhanced container fill rates, these initiatives have collectively driven a **nearly 50% reduction in air transportation deliveries in the last two years,** leading to a significant decrease in CO_2e emissions.

In 2024, we also continued advancing **our sustainable aviation fuel (SAF) carbon in-setting model**—a pioneering approach that directly mitigates carbon emissions within our transport system by replacing fossil jet fuel with low-carbon alternatives. Unlike traditional offsetting, insetting enables reductions at the source, aligning with industry best practices such as those outlined by the Smart Freight Centre and supported by IATA's SAF accounting framework. The International Air Transport Association (IATA) recognizes SAF as the most effective tool for aviation decarbonization, capable of reducing lifecycle CO_2 emissions by up to 80% and contributing around 65% of the sector's net-zero target by 2050.

Our 2030 packaging targets

100% | Ensure all packaging is 100% recyclable

10% | Plastic packaging to be limited to no more than 10% by weight of total primary packaging

50% | Cardboard and plastic packaging materials should contain at least 50% recycled content

Nokia is also reducing packaging waste and reusing some materials in our global distribution hubs.

To further encourage sustainability among its logistics partners, Nokia promotes climate-related information disclosure through the CDP Supply Chain Climate program. This allows Nokia to monitor and manage emissions from its suppliers, driving continuous improvements in sustainability performance throughout its supply chain. In addition to CDP, Nokia leverages the EcoVadis rating system, which evaluates supplier sustainability across key environmental criteria, helping ensure transparency and accountability in logistics operations.

2.3.3. Product use

In 2024, 95% of Nokia's total GHG emissions stemmed from the use of its sold products within customers' networks. Nokia continues to refine its product design and innovation processes, aiming to reduce power consumption and enhance energy efficiency across its entire portfolio. Recent developments and product launches include:

- Our **5G massive MIMO base stations**—key components in next-generation mobile networks—**now use 50% less power on average** compared to 2019 models.

- **MantaRay's Energy Anomaly Detection** simplifies the identification of sites requiring energy optimization, while its **Energy and CO₂ dashboards allow customers to closely monitor network energy and emissions trends, enabling faster, more informed actions.**

- Wavence simplified microwave backhaul site solution and sleep modes for the microwave radios offer **up to 25% lower power consumption** when sleep modes are enabled.

- The **FP5 network processor**, central to our IP routers, uses **up to 75% less power than its predecessor, without impacting performance**, even at full scale under all network loading conditions. FPcx, our newest network processor, delivers similar energy-efficiency with deterministic performance, comparable to FP5, to a broader range of IP routing applications.

- **Our new PSE-6s engine reduces the energy required to transmit data over long distances by up to 40% per bit**, compared to today's coherent optical solutions, including Nokia's previous-generation PSE-V engine.

- Our latest coherent optical engine, **ICE7**, delivers higher density and improved power efficiency and supports higher data rates compared to previous technology

generation. It can **reduce network-wide power consumption by up to 30%** and power per bit per km by as much as 39%.

- The **Quillion chipset** in our fixed access **broadband nodes uses 50% less power on average** compared to other comparable chipsets.

- Our latest **ReefShark chipsets**, integrated into our AirScale baseband units, **reduce energy consumption by up to 90%** compared to previous generations, while enabling more compact and efficient 5G deployments.

- Our **private wireless solutions**, powered by mission-critical industrial edge technologies, can **help reduce greenhouse gas emissions by up to 22% and health and safety incidents by 39%**, based on use cases such as environmental monitoring, predictive maintenance, and remote-controlled operations.

Nokia has also leveraged the power of AI and automation to make its networks more efficient and responsive:

- In 2024, the **Nokia Autonomous Networks Energy Efficiency solution** continued to evolve, helping more than 60 mobile operators **reduce energy consumption** in their networks. The solution uses AI to analyze real-time network traffic, adjusting the network's energy usage down during quiet periods and optimizing resources during peak demand.

- Nokia also addresses energy consumption through, and the launch of the **MantaRay Energy Saving Modules** enabled by AI and machine learning (ML), and Digital Design for Energy Efficiency service **slashing radio network's energy consumption down further, without compromising network performance,**

In 2024, GHG **emissions from the use of sold products decreased by 28% compared to 2023** and by 30% compared to the base year of 2019. This reduction was due to a reduction in the power consumption of sold products and a different product mix, as well as lower sales volumes.

One of the emerging trends in the GHG emissions calculation methodologies is to be able to report based on specific **blended emission factor** (combining customer-specific, verified emission factors, country-average emission factors and the global average emission factor) instead of global average emission factor only.

We are working with our customers to ensure a more comprehensive and accurate assessment of environmental impact. That includes enhancing the precision of Scope 3 Category 11 reporting, and shifting from a global emission factor to a blended emission factor. In 2024, our Radio Access Network emissions was **24% lower** if we were to report using a blended emission factor versus using a global emission factor. However, given the regulatory requirements in Europe, as well as reporting as per SBTi guideline, in our annual sustainability statement in 2024 we have used a global emission factor.

Nokia's strategy also involves modernizing aging infrastructure. In many parts of the world, operators are still running energy-intensive 2G and 3G networks. Through software and hardware upgrades—such as Nokia's Single RAN platform—legacy systems are being transformed into efficient, flexible networks that use less energy per transmitted bit and can support multiple technologies simultaneously. This modernization process is vital not only for emission reduction but also for preparing communities for a world increasingly reliant on high-performance connectivity.

In 2024, GHG emissions from the use of sold products decreased by 28% compared to 2023.
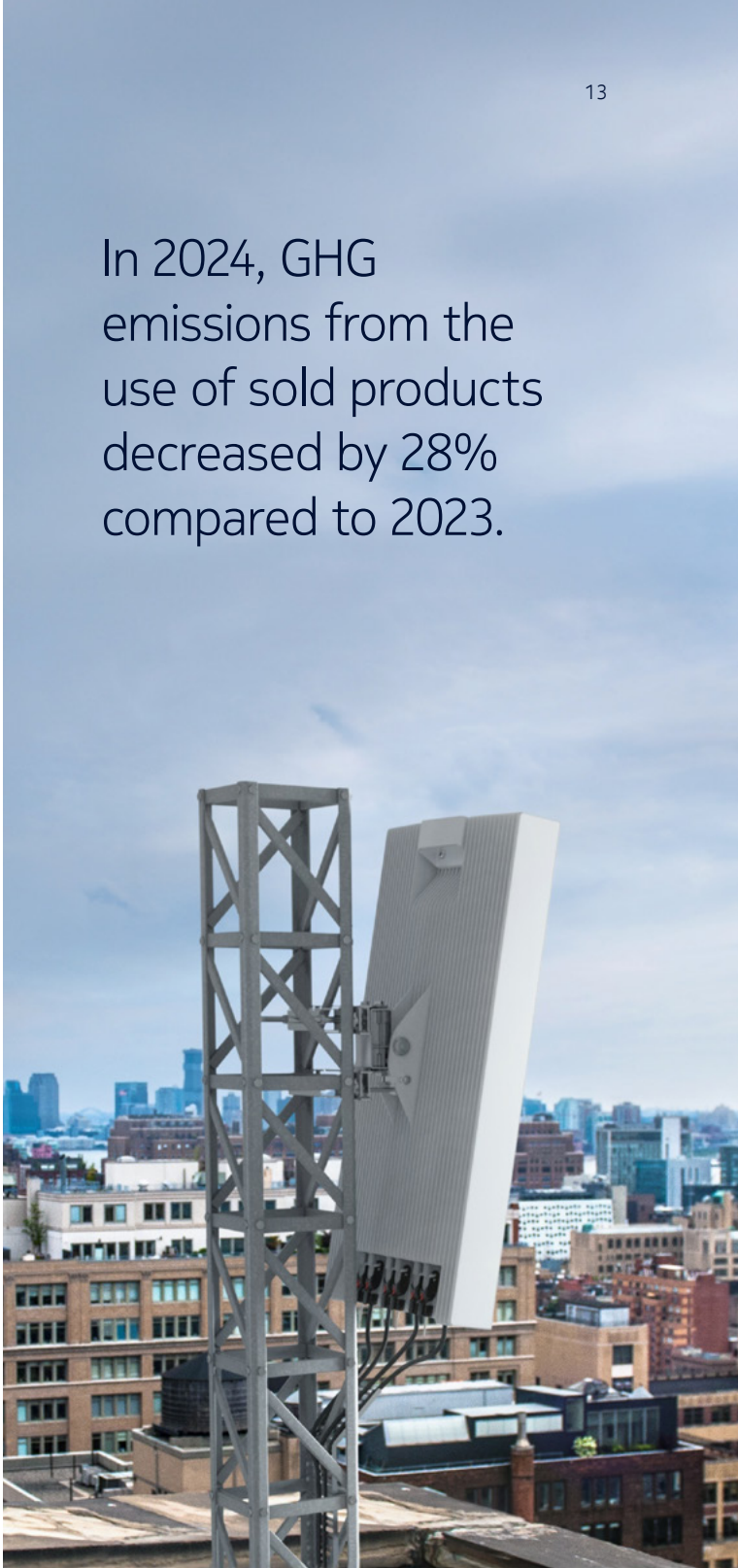
Our technologies are deployed across the network—from access to edge, including radio access networks, core, transport, fixed networks, and customer premises equipment—supporting customers in reducing energy consumption, lowering emissions, and improving operational efficiency.

5G Core

Efficient operations, real-time monitoring, and intelligent automation that support broader sustainability goals
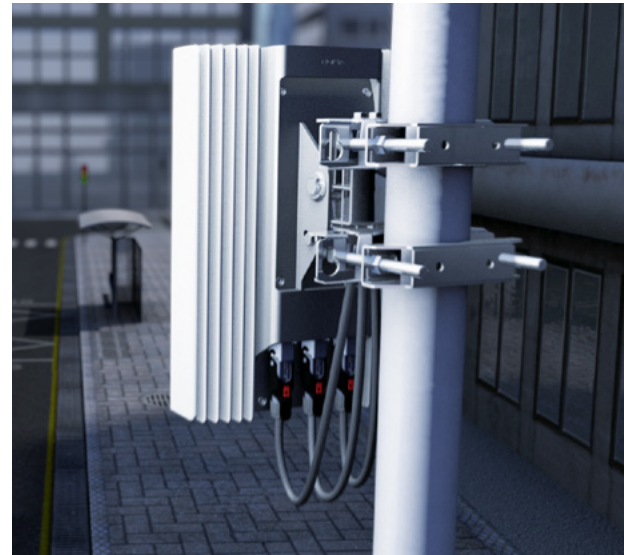
2.3.3.1. Radio Access Networks

A Radio Access Network is the part of a network that connects mobile devices to the core network and it typically represents the largest share of energy use across mobile networks. Therefore, the central challenge for telco operators is how to reduce energy consumption without compromising the network performance.

New Nokia solutions include **Extreme Deep Sleep mode for mMIMO radios**, traffic-aware energy-saving software for **Wavence microwave links**, and the launch of the **MantaRay Energy AI/ML-enabled 4G Energy Saving Module**, each designed to optimize energy consumption and minimize environmental impact within a RAN setting.

Innovations such as **Extreme Deep Sleep demonstrate our commitment to zero traffic zero energy by reducing energy consumption in zero traffic condition by up to 95%**.

2.3.3.2. Core

The core network handles data routing between different locations and networks. In collaboration with our partners, we have developed a suite of solutions that leverage the power of cloud-native technologies and machine learning to optimize the core's energy consumption. For example, using Intel's Xeon processors and power management software, **approximately 40% runtime energy savings** were achieved using Nokia's cloud-native 5G Core. These runtime power savings are on top of any generation-to-generation energy savings provided by Intel's Xeon processors.

Nokia's core networks enable efficient resource allocation and network optimization, leading to reduced energy consumption. Virtualization and cloud-native solutions further contribute to lower energy usage and smaller physical footprints.

2.3.3.3. Datacenters

Datacenters are the powerhouses that fuel the internet and AI. The rapid increase in AI workloads worldwide mean that **datacenters consume a significant and growing amount of energy.**

Nokia is investing in its datacenter connectivity business as part of a broader commitment to enabling more sustainable digital infrastructure. While our solutions focus on the connectivity layer—representing a smaller share of total datacenter energy use—they play a critical role in enabling energy-efficient operations, real-time monitoring, and intelligent automation that support broader sustainability goals.

Zero traffic, zero Watt

Not only does our latest generation of 5G Massive MIMO radios now use up to 50% less energy than the previous models, but we've launched an extreme deep sleep energy-saving mode that goes further than previous similar solutions by disconnecting additional hardware subsystems. This shuts down radio equipment in no-traffic periods, achieving **"zero traffic, zero Watt"** consumption and resulting in eight times the energy reduction of the previous deep sleep mode without affecting performance or the customer experience.

Optus, one of Australia's leading operators, is deploying energy-efficient components from Nokia's AirScale RAN portfolio, including Habrok Massive MIMO radios and Levante baseband units, as part of its 5G network modernization. These deployments reflect growing industry adoption of energy-saving innovations designed to reduce operational emissions and improve network sustainability.

Deep sleep modes are found elsewhere in our portfolio too. For example, in our Wavence microwave radios, **sleep modes result in up to 25% lower energy consumption than previous models.**

OPTUS

Monetizing backup batteries

Nokia's virtual power plant solution, or VPP, addresses the need for greater flexibility and storage in power grids as renewable energy becomes a larger part of the global energy mix. The product provides a way to use a base station's backup batteries not only as a power backup for the base station itself, but as an asset that can help the operator of the entire power grid to balance fluctuations in supply and demand in real time. Our VPP is the world's **first real-time virtual power plant solution, with 10 patents pending.**

Telia is working with us, and energy market aggregator **Fortum**, to use **virtual power plants in pursuit of greater energy efficiency**. Like Nokia, their ultimate aim is to achieve net-zero by 2040.

Today, traditional dispatchable sources of energy are being decommissioned as they're no longer sustainable or cost efficient. **Over a third of the 38 OECD countries have now totally phased out coal power**, for example. Electricity grids are instead relying increasingly on renewable sources. While this is good news for sustainability, it's creating an energy landscape where the energy systems require more flexibility to cope with the volatility that renewable energy generation inevitably creates.

Mobile network operators typically have backup batteries at thousands of radio network sites, and these are usually idle. Nokia's Virtual Power Plant Controller allows operators to monetize their backup batteries while contributing to stabilizing the energy grid.

More traffic within the same energy

AI and large language models (LLM) have become key drivers of digitalization, but AI modelling consumes a lot of power and water (to fuel and cool data centers). The industry is actively pursuing solutions to decouple data growth from escalating energy demand and emissions. Promising approaches include the development of smaller, more efficient language models, innovative cooling technologies such as liquid cooling, and other advancements in data center design and technology. Nokia is supporting data center providers to address this issue.

In 2024 we signed a deal with **CoreWeave**, the AI Hyperscaler™, to build a high-performance wide area network across the US and Europe. This supports the growing demand for AI inference workloads, which are increasingly hosted in regional and metro data centers. Nokia's continues to work to enable solutions that support **more traffic within the same energy envelope**, contributing to more efficient scaling of AI infrastructure.

Nokia provides trusted, purpose-built IP, optical, fixed, and datacenter connectivity solutions that underpin the global internet, enable economic growth, and support mission-critical industries worldwide. Our technologies offer a resilient foundation for enterprise digitalisation and innovation, while **empowering governments to deliver essential public services** that foster thriving communities.

2.3.4. End-of-Life

Nokia integrates circularity into its end-of-life processes by maximizing the reuse and recycling of materials and components from its products, minimizing waste and environmental impact. We approach circularity from two angles. First, we focus on **increasing the use of recycled materials in the design and production** of our products and packaging — reducing reliance on finite resources. Second, we strive to achieve **maximum waste circularity throughout our entire operational value chain**, including leveraging take-back of products to ensure that products, components, and material are reclaimed to their fullest potential.

By keeping materials in use for longer, minimizing waste, and recovering valuable components, Nokia is taking steps to reduce its environmental footprint in a space which is easy to overlook – the hidden value in discarded products. In 2024, Nokia reused 46,378 units of equipment that were returned by our customers.

Image for illustration purposes only
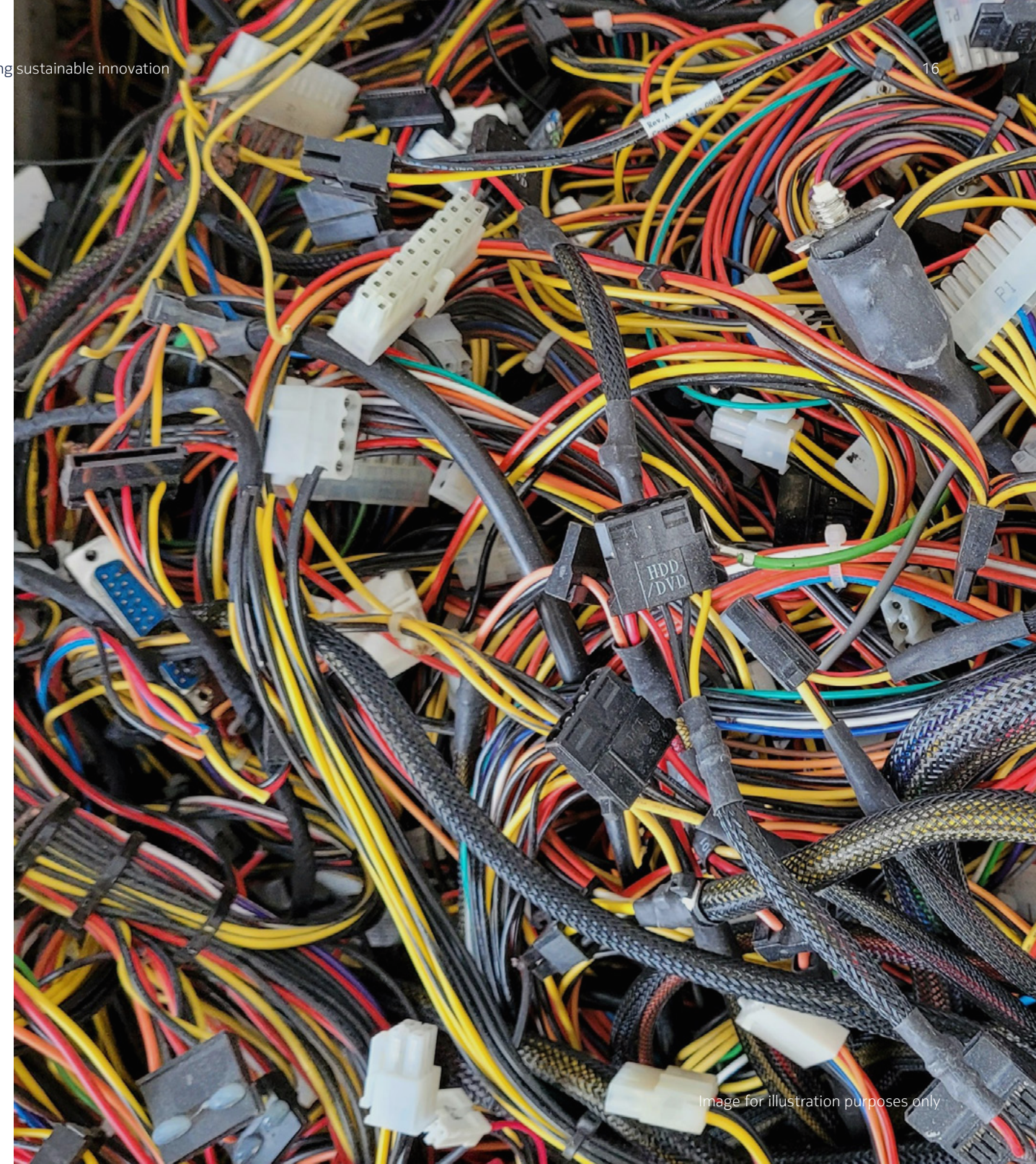
Partnering with Orange

Tech and waste: a growing problem

Waste is a big problem for the planet and for the technology sector. As digitalization expands, the prominence of electronics in our rubbish heaps increases: the world produced an estimated **56 million metric tons of electronic waste in 2022, of which less than 22% is recycled.**

At the same time, the availability of certain valuable resources, including the rare earth elements found in many telecommunications products, is scarce.

The circular economy – where products are designed to minimize material use, last longer, and divert materials from becoming waste – reduces the negative impacts caused by human consumption and activity. It is part of the answer to both the increasing amount of waste and the scarcity of certain materials.

Nokia is working with its customers to find solutions that allow for more recycling and less waste.

Lightening the load

In 2020, telecom operator Orange decided to take the lead in circular economy practices. It developed its **OSCAR (Orange Sustainable and Circular Ambition for Recertification)** program. The objectives of which is to encourage teams to reuse and buy refurbished hardware wherever possible, rather than going for brand-new equipment by default and to push its ecosystem of partners to develop a circular business model.

In 2021 Orange invited Nokia to join OSCAR by refurbishing and extending the usage duration of our Radio Access Network (RAN) equipment across Orange's footprint. This was a big undertaking as a radio network can contain hundreds of thousands of base stations radio sites.

By **extending the lifecycle of this equipment**, we're reducing waste, GHG emissions linked to manufacturing stage and the need for new minerals and rare earth elements.

To Egypt and beyond

While Orange and Nokia's OSCAR efforts have been particularly successful in Europe, an area for high impact for the program was identified as the Middle East & Africa, where recycling companies have been struggling to find **economically viable methods to recycle e-waste** materials.

Egypt is of particular interest. Its telecommunications market is one of the largest in Africa, **producing 20% of the continent's e-waste but recycling less than 5% of it.** Orange and Nokia saw an opportunity to address this discrepancy by extending their OSCAR partnership to join the One Circle pilot, which supports the circular transition of the electronics value chain in Egypt.

As part of the One Circle pilot, in 2024 Orange and Nokia have established a repair center in Cairo, Egypt, to save on unnecessary transport costs and emissions. It will grow to become a fully certified refurbishment center for the

whole country, with local technicians being recruited and trained to ensure skills transfer and long-term capacity building. The ambition is to make such center a platform for the whole Middle East & Africa region through Orange's other affiliates.

Beyond RAN

So far, Nokia has been participating in OSCAR and the One Circle pilot in terms of our RAN equipment, but we're now the first partner in the program looking to extend our participation to our other network equipment – including IP routing (cloud computing, video conferencing, internet services), optical fiber access and transport (internet backbone, data centers, fiber-to-the-home) and microwave (mobile backhaul, point-to-point links, satellite communications).

2.4. Smart solutions for the planet

While climate action remains a central pillar of our environmental strategy, Nokia's products and solutions also contribute to broader sustainability outcomes across industries and ecosystems. From enabling biodiversity protection and advancing industrial efficiency to supporting the transition to clean energy, our technologies are helping address environmental challenges beyond greenhouse gas emissions. These innovations reflect our commitment to creating smart solutions for the planet.

This chapter highlights three areas where digital innovation intersects with sustainability impact

Biodiversity monitoring

Biodiversity through conservation efforts and technology-enabled monitoring

Industrial automation

Industrial automation where 5G connectivity enhances operational efficiency and resource use

Sustainable energy management

Sustainable energy management through advanced grid orchestration and renewable integration
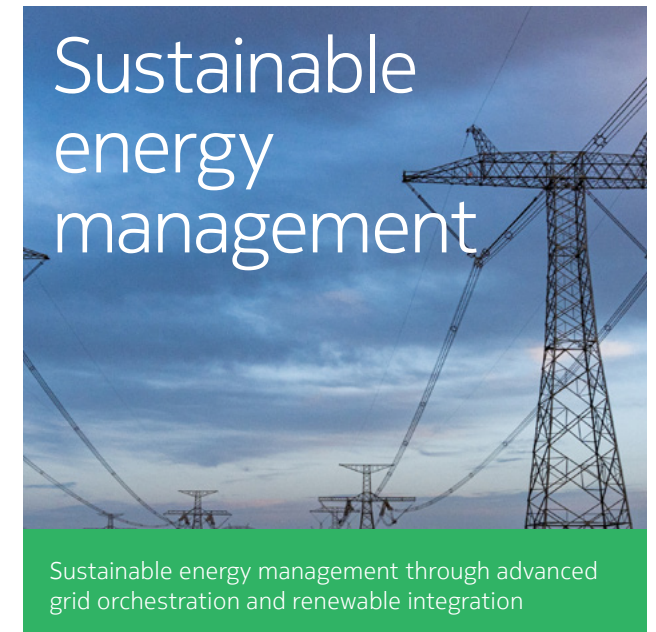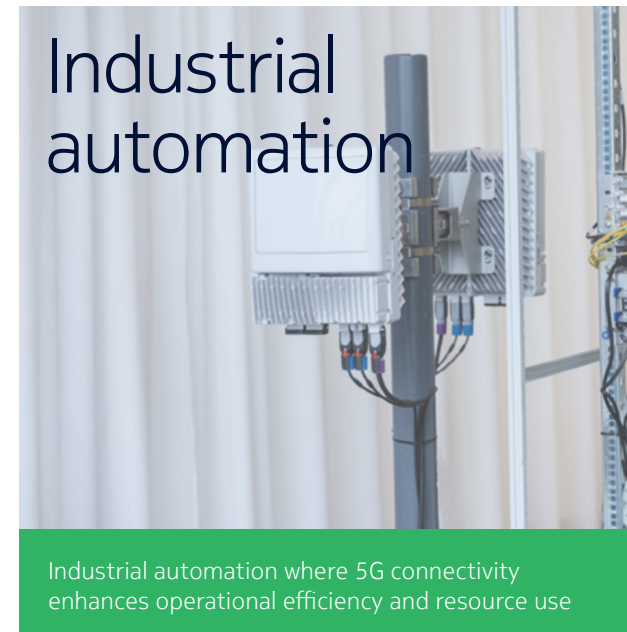
These examples reflect how digitalization can drive measurable improvements in environmental performance, resilience, and long-term value creation.

2.4.1. Biodiversity monitoring

Nokia's approach to biodiversity is based on understanding and minimizing our own impact, collaborating with partners to advance sustainable practices, enabling sustainable practices across industries, and actively protecting and conserving Nokia owned natural areas.

In 2024, Nokia established two new nature conservation areas in Finland, expanding the total protected area to 242 hectares. These areas encompass forests, islands, and marine environments. Our forest protection efforts are particularly focused on **preserving biodiversity-rich areas in Finland**, such as the Kitkajoki-Arvunki conservation area in Kuusamo.

We recognize the powerful role technology can play in supporting biodiversity protection and environmental sustainability. Nokia's products and services have the potential to enable it. For example:

In 2024, Nokia's total protected area expanded to 242 hectares.

Wildlife monitoring & conservation
Mobile networks can enable **real-time tracking and monitoring of wildlife**, supporting efforts to protect endangered species. **GPS collars and tags** can transmit data via mobile networks to enable anti-poaching alerts, migration tracking, and health monitoring.

Remote surveillance using drones
Drones connected via mobile networks may be used to **survey ecosystems, particularly in remote or hazardous areas**. Real-time video transmission over 4G/5G could support habitat mapping, wildlife population assessments, and detection of land use changes.

AI and big data via mobile networks
The integration of AI with data collected through mobile networks can support **pattern detection, predictive modeling, and automated threat identification**. For instance, AI is already being used to detect **illegal logging patterns** from satellite or drone data and predict habitat loss hotspots.

Disaster response & ecosystem recovery
Mobile networks can **support early warning systems for natural disasters** that impact biodiversity, such as floods, hurricanes, or wildfires. They can also enable timely communication and coordination of rescue operations, wildlife relocation, ecosystem restoration, and post-disaster monitoring. Fiber sensing technologies complement these capabilities by enabling **large-scale seismic detection** through the combination of coherent receivers, enhanced Photonic Service Engine (PSE) streaming telemetry, and seismometer networks. **These systems** can provide **early warnings for earthquakes, volcanic eruptions, and tsunamis**, including in subsea environments. Additionally, fiber sensing may contribute to climate research by monitoring sea floor temperature changes and tracking marine mammal migrations.
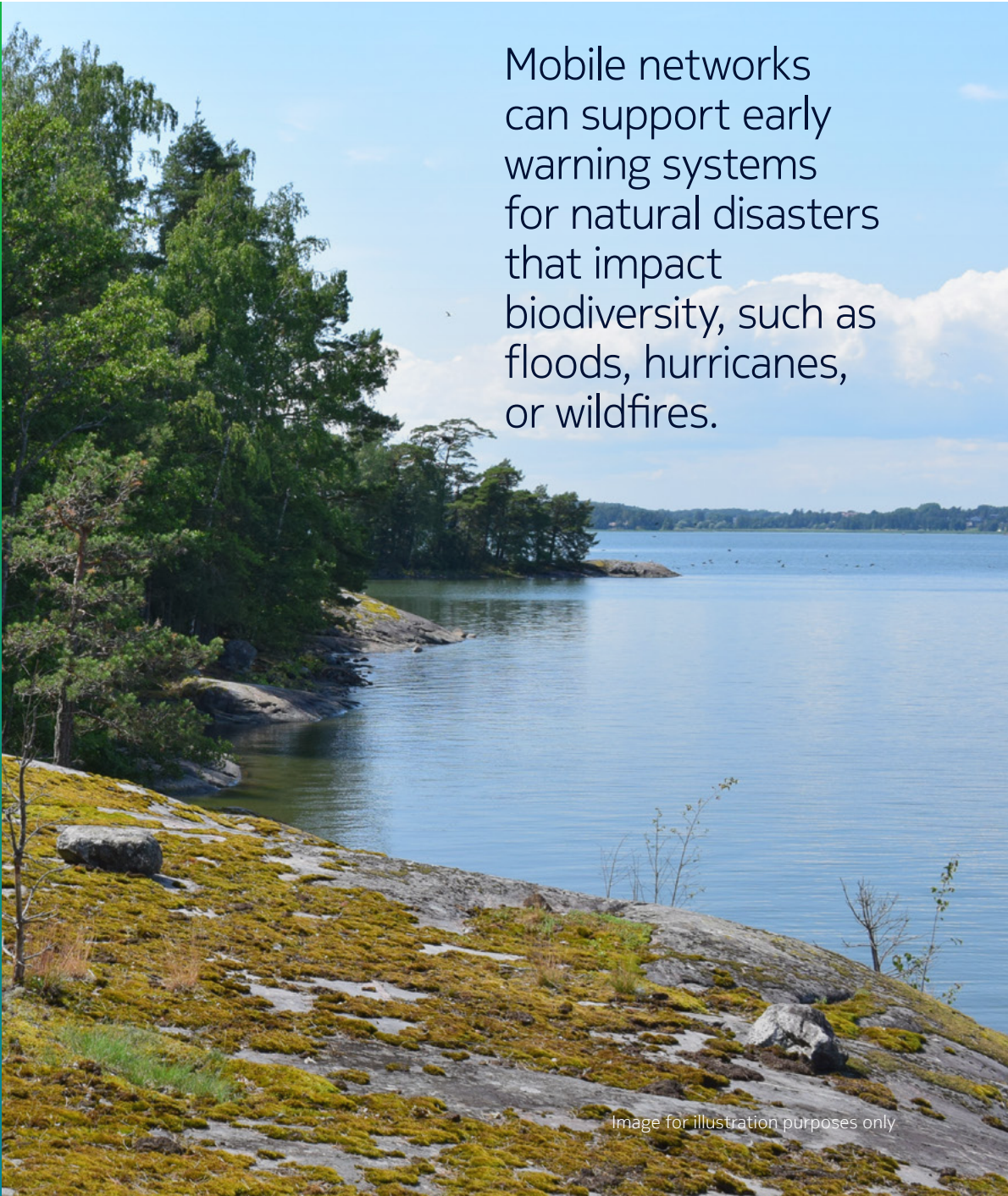
Mobile networks can support early warning systems for natural disasters that impact biodiversity, such as floods, hurricanes, or wildfires.

Image for illustration purposes only

2.4.2. Industrial automation

5G is the first generation of connectivity designed with industry needs in mind. Its ultra-low latency, consistent availability, low jitter and high data-transmission rates unlock a range of new industrial use cases.

Industry 4.0 and industrial automation
Industry 4.0, refers to the transformation of manufacturing and industrial processes in order to **enhance efficiency, productivity, flexibility and sustainability**. These enhancements are achieved through the integration of advanced technologies like AI/ML, the Internet of Things, automation…and robots.

Robots range from ultra-articulated arms that can assemble and weld complex machinery, to autonomous mobile robots, or AMRs, which move around a factory to carry out functions such as Just-in-Time "Pick and Drop" – where products or components are picked from storage and delivered **exactly where they're needed at the precise moment required** for production, without holding excess stock. This leads to faster production, **lower storage costs and less waste**.

These robots are found in many of the world's most state-of-the-art digitalized factories. For example, just one of **Mercedes' factories in Stuttgart, Germany, employs a fleet of 550 AMR**.

But even efficient technologies can be improved. So, we have been exploring how to apply our 5G private wireless technology to make these robots more efficient.

5G-driven robot efficiency
We have managed to remove the robot's onboard computer that controls its core functions, instead transferring that computing function to the local edge cloud – **making the robots "dumber" but more efficient.**

Wi-Fi vs.5G
Robots needed an onboard computer because they are run over a Wi-Fi network – a network that connects to a local router. But Wi-Fi networks can be unstable. As a result, a certain amount of compute power is often incorporated in the robot's hardware.

The game changer is using a 5G network instead. **5G is the first generation of connectivity designed with industry needs in mind**. Its ultra-low latency, consistent availability, low jitter and high data-transmission rates unlocks a range of new industrial use cases.

The power of 5G networks allowed us to get the robot's data processed at the "edge" of the cloud, close to where it's generated. This means **it's faster, uses less data and is more secure**.

In the context of AMRs (autonomous mobile robots), this means they can instantly process sensor data locally (at the "edge") to avoid obstacles without an onboard computer and without waiting for remote cloud instructions.

Tested with flying colors
There are three main benefits to our '5G driven robots' solution, compared to conventional mobile robots with onboard computing:

- **Reduced power consumption**, which can lead to lower operating costs and a smaller CO_2 footprint, particularly in high-volume deployments.
- **Improved performance and efficiency**, enabling either longer operating time or the use of smaller batteries without compromising endurance.
- **Lower hardware cost**, due to the removal of onboard computing components—reducing the need for raw materials, including key minerals and rare earth elements, and contributing to lower e-waste.

By aligning sustainability outcomes with operational efficiency, this innovation presents potential for broader application in large-scale operations—where cost and environmental performance are both critical considerations.

2.4.3. Sustainable energy management

Nokia's venture Enscryb is a digital toolset designed to optimize grid orchestration for a net-zero future. By simulating, validating, and deploying advanced energy solutions, Enscryb enhances flexibility, storage, generation, and consumption management for the energy grid. From grid operators to asset manufacturers, and from aggregators to consultants, its Sustainable Energy Management capabilities offer a highly flexible and scalable automated simulation solution for managing flexibility, storage, generation, and consumption through next-generation technology.

Enscryb enables customers to **better plan, operate, and invest in renewable energy infrastructure** by modelling electricity systems of any size and complexity. It provides forecasting capabilities for battery energy storage systems and solar hybrid assets, while integrating data from both market sources and customers' own infrastructure. This combination of market intelligence and technical simulation supports **more accurate and bankable financial models**, allowing renewable projects to be deployed with greater confidence, resilience, and cost efficiency.

Enscryb enhances flexibility, storage, generation, and consumption management for the energy grid.

We are working closely with a diverse set of partners to turn these capabilities into tangible sustainability outcomes.

With **NODES**, an energy trading platform, we are contributing to the growth of flexibility and congestion markets by enabling transactions between system operators, aggregators, and large industrial and commercial assets. These markets are key to unlocking distributed energy resources and balancing increasing renewable generation.

With **Smartecon**, a pan-Baltic renewable energy EPC, we are contributing to the deployment of utility-scale solar, battery, and hybrid power plants. Their expertise in grid compliance, technical design, and hands-on execution helps bring projects from concept to connection, accelerating clean energy adoption in the region.

Through these collaborations, we are not only advancing the technical capabilities of distributed energy orchestration but also directly supporting our customers' pathways to net-zero — strengthening grid resilience, reducing emissions, and enabling a more sustainable energy future.

"At Smartecon, we don't just build, we help clients make sense of complexity. Enscryb complements our approach by turning market and infrastructure data into actionable insights. With this partnership, we can deliver not only bankable energy systems but also smarter planning and better performance from day one."

Hannes Aus,
Chief Development Officer and
Co-Founder, Smartecon

Enscryb
A Nokia Venture

Impact Report 2025
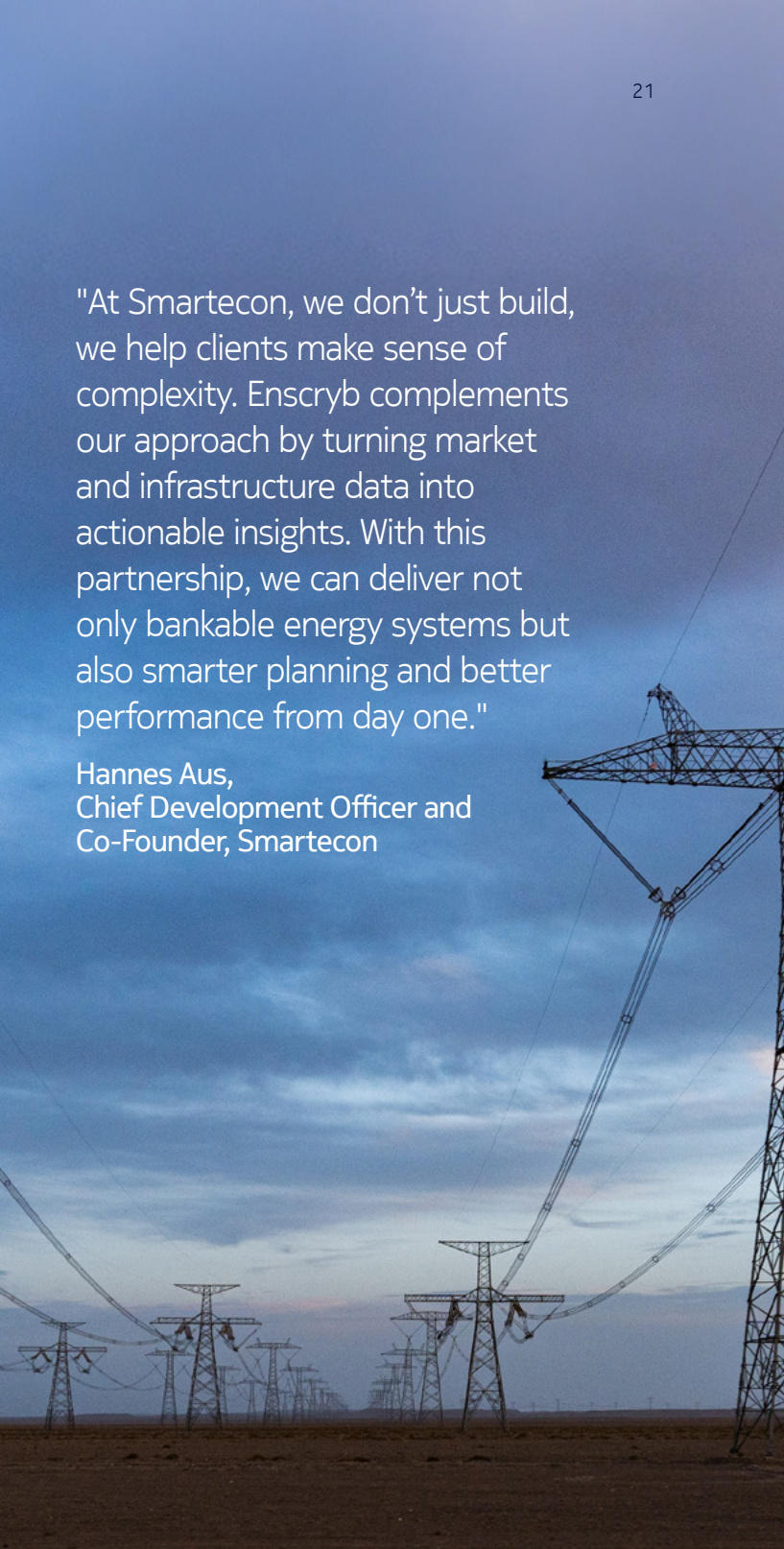
Nokia's Social Impact approach

Connectivity is a fundamentally social technology: it allows people to communicate with each other in their personal and professional lives. That is why providers of connectivity, including Nokia, have a unique role in **strengthening social bonds and building healthy, successful and productive communities.**

To guide us in our attempts to create meaningful social impact, we have identified three areas on which to focus. This will ensure we are aligned with the needs of the communities we serve. Through these focus areas, we aim to **contribute positively to society, foster sustainable development and enhance quality of life** for individuals and communities.

The three focus areas are:

3.1. Bridging the digital divide

3.2. Building a thriving workforce

3.3. Leveraging our relationships with suppliers to create a positive impact on communities

3.1. Bridging the digital divide

According to data from the International Telecommunications Union (ITU), **a third of the world's population, 2.6 billion people, lacked internet access in 2024. Of those 2.6 billion people, 1.8 billion lived in rural areas**.

The lack of connectivity experienced by many rural regions around the world, particularly but not exclusively in Sub-Saharan Africa, South Asia, and Latin America, is caused by a variety of factors including:

- **Sparse population densities**, meaning it is often not cost efficient for CSPs to connect the areas in question
- **High deployment and maintenance costs for traditional mobile networks**, as it is harder to install and maintain equipment in isolated places
- **Inadequate return on investment for telecom providers**, as there are not enough potential customers in the area in question, or there are enough potential customers but they do not have the spending power required to buy connectivity at a rate attractive to the network owner

Regardless of the reason or reasons behind individual cases, digital exclusion reinforces systemic inequalities, preventing rural populations from accessing education, healthcare, online governmental services, digitalized processes and economic opportunities as easily as people in more urban settings.

Through Nokia's Corporate Social Impact theme of 'Bridging the digital divide', **we seek to establish a robust and sustainable connection to the digital world for education and workforce development, in communities who otherwise might not have access to such a connection**. There are two major sub-themes, and at least one needs to be addressed through a Corporate Social impact initiative.

Nokia's recent achievements

349 million

new mobile broadband subscription were supported by Nokia Radio in 2024

39 million

Fiber to the home customers connected since the beginning of 2023

112,453

direct beneficiaries of our community initiatives since the beginning of 2023

There are two major sub-themes, and at least one needs to be addressed through a Corporate Social impact initiative

3.1.1. Connecting the unconnected

- **Reduce Coverage Gap:** Business as usual but focus on additional mobile broadband subscriptions serviced or connected Fiber to the home customers for underserved areas.
- **Reduce Usage Gap:**
  - Provide internet-enabled digital devices
  - Provide affordable access points

3.1.2. Enable the connected

- Provide Digital literacy skills according to relevance for communities
- End User Safety and Security awareness
- Advanced digital skills to underserved university / colleges

3.1.1.   Connecting the unconnected

Nokia's Rural Connect is a solution designed to extend reliable and affordable connectivity to remote, sparsely populated, and underserved rural regions.
It addresses one of the primary causes of digital divides – the high per-user cost required to bring connectivity to low-population areas. Through this initiative, Nokia directly addresses the digital divide by enabling operators and governments to cost-effectively connect communities with limited or no access to mobile broadband.

Nokia Rural Connect is a compact, energy-efficient, and cloud-managed solution that reduces the total cost of ownership for rural mobile broadband.

By reusing existing and refurbished radio access network (RAN) hardware, Rural Connect accelerates deployment. This approach maximizes hardware reuse, minimizing inventory and significantly lowering the costs associated with masts and towers. The solution integrates seamlessly with renewable energy systems, providing a secure and sustainable power supply, a critical factor in remote locations.

The impact of Rural Connect is already being felt. Deployments in Ethiopia, Egypt, Cameroon, and Mali are bringing 2G, 3G, and 4G connectivity to underserved communities, utilizing a variety of backhaul options to ensure reliable service. One example of use comes from a rural Cameroonian town, where the initial deployment of Rural Connect resulted in a fivefold increase in mobile users within two weeks. This demonstrates the power of sustainable innovation: leveraging existing equipment and a fully off-grid solar power solution to connect a community previously left behind.

The Peru Amazon connectivity project involves Nokia's deployment of a fiber network in the heart of the Amazon rainforest.
Delivered in collaboration with Global Fiber Peru, this initiative aims to reduce the digital divide by providing fiber connections to hundreds of communities in the region. The project connects localities such as Iquitos and Santa Rosa de Yaraví in Peru, Leticia in Colombia, and Tabatinga in Brazil, offering ultra-fast, multi-gigabit broadband services to over 500,000 people for the first time.

Key highlights of the project include:

- Deployment of a subaquatic optical, IP, and XGS-PON fiber broadband network
- Connection of 400 communities, enabling high-speed internet access
- Bridging the digital gap in remote areas previously inaccessible by traditional means
- Support for local businesses and community growth through improved connectivity

This project is significant for the region's development and quality of life, as it brings connectivity to areas isolated by dense jungle, making public services, information and financial products easier to access.

Nokia and Fibertime have partnered to expand broadband access across South Africa's underserved communities.
This initiative aims to provide affordable broadband coverage to five cities and 14 townships using Nokia's fiber solutions. Fibertime plans to connect 1.5 million customers using Nokia's Lightspan FX Optical Line Terminals (OLTs) and Wi-Fi 6 enabled Optical Network Terminals (ONTs). The project is designed to offer uncapped, unthrottled internet at a cost of R5 a day, making it accessible to low-income customers who are connecting for the first time.

Currently, less than 85% of South Africans have access to high-speed broadband, and many rely on expensive mobile plans. Nokia's fiber solution aims to provide affordable, reliable, pay-as-you-go broadband, empowering local communities with increased access to education, employment, and business opportunities. The deployment will initially cover Cape Town, Johannesburg, Gqeberha, Mangaung, and Stellenbosch, with plans to expand further.

3.1.2. Enable the connected

We believe that our products and services, as used by our customers and partners, support employment and entrepreneurship wherever they are rolled out. To supplement this, we also support social initiatives that drive further employment and entrepreneurship in individual markets or locations.

We achieve this by:

- **Making financial donations:** providing corporate donation funds to UN organizations and NGOs.
- **Connecting with communities:** We actively engage with communities to understand their needs and build relationships by being involved in the high-level project design
- **Leveraging technology:** We utilize our expertise in technology to bridge the digital divide by supporting projects with employee's engagements (skills, expertise, experience)
- **Facilitating collaboration:** We bring together diverse stakeholders to amplify impact, including Nokia's customers, governments, and NGOs, to work together on solutions.

Two major social impact programs have been funded by Nokia in 2024 towards Ethiopia and Ghana.

Ethiopia: The 'Digital Skills for Youth in Telco Work' project is designed to enhance the skill sets of young people in Ethiopia who want to develop careers in the telecommunications sector. The project, in collaboration with the skills-focused nonprofit Digital Opportunity Trust, combines peer-to-peer digital skills training with training in other skills relevant to the telecommunications sector, such as entrepreneurship. The objectives of this project are aligned with Nokia's CSR mission in Ethiopia, whereby underprivileged young people in Ethiopia have the skills and opportunities to secure and thrive in high-quality jobs in the telecommunications industry.

Ghana: The Digital Skills Center project aims to advance digital skills, taking advantage of the 5G deployment to foster innovation. We are building a dedicated space for the provision of digital skills training and mentorship, and we will provide that training and mentorship in order to boost confidence and increase engagement in the digital economy. The project seeks to empower the next generation, promote social inclusion, and encourage digital literacy **especially among girls and young people**. Collaboration among key stakeholders such as Nokia, Next Generation Infraco (NGIC), Plan International Finland, Plan International Ghana, three partner Universities and the Center for national Distance and Open Schooling (CENDLOS) will ensure that participants are job-ready and competitive in the labor market while proposing solutions to prevailing challenges to developing local contents. This project contributes to Ghana's Digital Agenda 2030, the African Union's Agenda 2063, and SDG 9, aligning with Plan International Ghana's focus on Inclusive Quality Education and Youth Economic Empowerment.

UNICEF: Empowering marginalized young people, particularly girls, in Morocco with digital, entrepreneurial and environmental skills

In 2021 Nokia, UNICEF and the Ministry of Youth began a multi-year project to empower young people with digital, entrepreneurial and environmental skills in Morocco. The project formed part of UNICEF's UPSHIFT program, which is designed to equip young people from 10-24 years old with the skills they need to thrive in an increasingly digital employment landscape. The program is featured as part of the World Bank's Solutions for Youth Employment portfolio.

The project helped young people to identify challenges in their communities, gain new skills and create entrepreneurial solutions to address them. Over 4000

young people gained life skills like critical thinking, problem solving, resilience and environmental skills. Groups were supported by trainings and mentorship to launch their youth-led initiatives. Nokia employees participated as mentors in providing this support.

The program achieved important outcomes also at national level as the Ministry of Youth committed to continue scaling the program and integrated the UPSHIFT program modules and curriculum to its national out-of-school-youth curriculum and other non-formal education, increasing the reach and the impact of the partnership further.

© UNICEF Morocco

Nokia and Christel House's initiative in India focuses on education, equity, and impact

Christel House, a nonprofit, provides comprehensive education to promote upward social mobility. Nokia enhances this by offering internships, mentoring, and employment to bridge the digital divide. The partnership, starting in 2019, has led to events such as "A Day at Nokia" in Bangalore, which engaged over 200 students with tech experiences and leadership talks, supported by over 100 Nokia volunteers. The

program includes mentorship for over 20 graduates, an internship-to-employment pipeline, and the provision of early STEM access. In 2025, the Nokia Innovation Lab was inaugurated, fostering skills and opportunities, symbolizing the transformative power of education.

Smartpur: Developing Digitally Enabled Ecosystems in Rural India

Is an initiative aimed at transforming rural Indian villages into smart communities, enhancing residents' access to technology-enabled services that boost economic activity and quality of life. The project focused on five key areas: education, governance, livelihood, financial inclusion, and healthcare. Implemented in collaboration with Bal Raksha Bharat and the Digital Empowerment Foundation (DEF), Smartpur is designed to meet the unique socio-economic needs of rural India.

Central to Smartpur is the empowerment of local entrepreneurs through digital innovation. The initiative featured:

• **Smartpur Centers:** These community hubs are managed by trained entrepreneurs who provide essential services across the five focus areas directly within villages.
• **Beneficiary Support:** Residents are equipped to use digital tools for skill-based training, livelihood generation, telemedicine, health services, digital literacy, technology education, digital banking, and access to government welfare schemes.

The ultimate aim was to simplify the integration of digital technology into the daily lives of remote communities in India.

Nokia-UN Women partnership

Nokia and UN Women have developed a collaborative program to enhance women's employability, entrepreneurship and agency in the world of technology. Tailored to national contexts, the program fosters women's participation and leadership in a sector where women are broadly under-represented. Nokia and UN Women provide professional development and training for women from underprivileged or vulnerable backgrounds, as well as leadership training and pathways to recruitment for women in tech.

The model was piloted in the Middle East & Africa in 2022 and scaled up globally in 2023 and 2024. The program leverages Nokia's and UN Women's respective knowledge of contexts, market needs and opportunities for tech solutions to accelerate achievement of gender equality and women's empowerment.

In 2024 the initiative was delivered in seven countries: Jordan, Tunisia, Türkiye, Argentina, South Africa, India and the Philippines.

In parallel, a separate workstream, Action for Transition to Workforce, was tailored to address the opportunity to increase the number of women working in tech roles within the technology industry. The concept was piloted in Saudi Arabia between 2022 and 2023, before being expanded in 2024 and applied to Kenya with the creation of an adapted Learnership program.

In total 357 women enrolled in the program, benefiting from the contributions of 222 global Nokia volunteers who invested approximately 5,500 hours.

A further collaboration program supported by UN Women is the Action for Leadership program. The program promotes women's participation and leadership in the tech sector within private sector companies in partnership with one of Nokia's strategically important customers. The program follows a three-pillar approach:

Acting together | how to collaborate effectively beyond company lines.

Sustainability challenge | introducing an urgent social responsibility or environmental topic to participants and providing them with in-depth knowledge about the selected area.

Business solutions | developing high-level business opportunities based on the sustainability challenge.

In 2024 a second cycle was finalized with Deutsche Telekom, followed by a cycle with du from the Middle East and Claro Brazil. In 2025 we have finalized a successful cycle with Telefonica Germany. Eighty female talents from Nokia and the participating customers have been through a four-month program cycle.

3.2. Building a thriving workforce

Our people remain our most potent asset. The research and development they conduct, the partnerships they develop and the passion they show for their work has allowed us to deliver the advanced connectivity necessary to improve productivity, efficiency and sustainability in multiple sectors. We want to make sure our people are supported as they deliver this work. Here are some examples of workforce-related policies and principles in place across Nokia.

Pay equity reporting and promotion transparency

Our pay practices are regularly reviewed to align pay with performance, experience and skills. We pay at least the minimum wage and comply with, and often exceed, all legal requirements for wages and benefits. Nokia policy is that part-time or temporary employees have access to employee benefit plans. We also have a range of employee reward and recognition programs.

We systematically analyze the fairness of our compensation practices and fund additional, focused salary increases to remediate unexplained, pay gaps. After the first investment to close the pay gap in 2019, we have repeated this analysis annually, and consistently investigate to ensure any reopening of that unexplained pay gap is identified and remediated. While we do not disclose global salary ratios, we are committed to equal pay for work that is of equal value (taking account of skills, responsibilities and other factors). This is applied without regard for an individual's personal characteristics such as gender, race, age, national origin, ethnicity, color, religion, sexual orientation, gender identity, gender characteristics or expression, disability, or entitlement to family leave.

Family-friendly policies

Nokia continues to promote employee well-being and work-life balance through a policy of Flexible Working applicable to all employees networkwide. When the nature of the role allows, flexible arrangements such as hybrid, remote, or home-based work are supported in compliance with local labor laws and working hour regulations. In addition to annual paid holidays, Nokia offers a wide range of leave options for significant life events, including maternity, paternity, parental, adoption, sick, and bereavement leave in line with local labor laws. Many of our policies exceed the minimum legally required. Nokia also continues to apply its Global Child Leave Policy which ensures all new parents, irrespective of gender, receive a minimum of three months' paid leave and the right to return to work within a year of the child's birth or adoption.

Our Global Child Leave Policy ensures all new parents, irrespective of gender, receive a minimum of 3 months paid leave.

Further, Nokia provides paid time off for volunteering each year. Finally, sabbatical leave is also available, subject to business needs and continuous service.

Embedding a sustainability mindset

Developing leadership and technical skills is crucial for Nokia's performance, innovation, and growth. Continuously upskilling employees, particularly leaders, through clear expectations and support, helps build a high-performing organization.

In 2024, we integrated AI-driven simulations into key development programs to deliver immersive, real-time learning experiences. These simulations replicate complex, real-world scenarios, such as leadership challenges and strategic decision-making, enabling individuals to practice critical thinking, explore different approaches, and receive immediate feedback in a safe, virtual environment.

Investing in the next generation

In 2024, Nokia hired over 2,500 trainees through global programs, offering hands-on learning that drew 30,000+ applications. Initiatives like the NextGEN Community helped early career professionals build skills and connections, while People Manager Enablement Training supported inclusive leadership across generations. These efforts contribute to stronger teams and more engaged communities.

Health & wellbeing

In 2024, we expanded our well-being offerings with a focus on mental health, financial well-being, and navigating change. Thousands of employees participated in global and regional sessions, including the "Having Open Conversations" series, supported by the growing ShareTo Care Employee Resource Group (ERG). Our 24/7 Personal Support Service continues to provide confidential counseling to employees and their families worldwide. We also launched the Team Health Toolkit to strengthen psychological safety and enhance team performance and ultimately helping to unlock the full potential of our teams.

Impact Report 2025

Recognition and awards

In 2025, Nokia received multiple recognitions that reflect both our strong employee experience and responsible business practices. We were named a top employer by Randstad in Portugal and by Finders Seekers in Finland, where we ranked #1 for attracting international tech talent.

LinkedIn included Nokia in its 2025 Top Companies to grow your career across the U.S., Italy, Türkiye, the UK and Spain.

Nokia was ranked #37 on TIME's 2025 list of the World's Most Sustainable Companies. We were also proud to be named one of the World's Most Ethical Companies by Ethisphere and recognized as a Visionary in Gartner's 2025 Magic Quadrant™ for data center switching.

In 2024, Nokia sustained an overall Glassdoor rating of 4.07 (on a 5-point scale). Additionally, 83% of reviewers indicated they would recommend Nokia as a workplace.

Employee sentiment

In early 2025, Nokia launched its annual employee engagement survey utilizing an advanced AI-enabled platform, providing real-time insights into employee sentiment. The results show that employee engagement at Nokia remains significantly above global and industry benchmarks, with employees expressing strong pride in the company.

Hiring with community impact

At Nokia, inclusion shapes how we lead and grow—not just within the company, but in the communities we serve. Our approach blends structural and behavioral practices to embed inclusion into everyday culture and leadership.

Expanding representation | aiming for 25% women in our global workforce by 2030, where legally possible, helping build more equitable opportunities across regions.

Measuring culture | regular surveys show most employees feel treated fairly and experience a strong sense of belonging, contributing to healthier, more inclusive workplaces.

Elevating employee voice | our 14 global Employee Resource Groups help shape strategy and foster collaboration, extending the reach of inclusive practices beyond the company into the wider community.

"Great teams are not built because everybody has a unique skill, great teams are built because the complimentary skills of a collective team outperforms what any one individual could deliver."

Justin Hotard
President and CEO of Nokia

Read more →

3.3. Leveraging our relationships with suppliers

Nokia conducts business with around 9 300 suppliers in over 100 countries. We collaborate with our suppliers to raise standards in key sustainability areas such as the environment, labour rights, health and safety, and ethical behavior. Our sustainable sourcing program is built around four pillars based on materiality assessments and group sustainability priorities: supplier due diligence, climate, circularity, and responsible minerals sourcing. These programs are supported by supplier development, learning and industry collaboration in order to equip suppliers with the knowledge and insight they need to source responsibly. The results of the assessments are integrated into our Supplier Performance assessments and outstanding initiatives recognized as part of the annual Supplier Diamond Awards.

Supplier due-diligence

We expect our suppliers to adhere to our Third-Party Code of Conduct and we provide them with our supplier requirements, including the Responsible Business Alliance (RBA) Code of Conduct and additional, Nokia specific sustainability requirements. The requirements are periodically revisited and cover topics such as labor and human rights management, health, safety and security, privacy, risk management, environment, ethics, and anti-corruption. They are communicated to our suppliers and integrated into our contractual requirements, supplier qualification, auditing and supplier learning and capability building.

Our key supplier-related monitoring, assessment and auditing activities include an on-site corporate responsibility audit program, EcoVadis sustainability assessments, our in-house health and safety Supplier Maturity Assessment (SMA), the CDP Supply Chain Climate and Water Security assessments, Recycled Materials Content and Responsible Minerals Sourcing assessments. The results of supplier due-diligence assessments are integrated into our Supplier Performance Evaluation as a Sustainability Pillar.

We have set an target of having 80% of suppliers meeting sustainability satisfactory score by 2025, and by end of 2024, we met that at 78%.

We conduct hundreds of supplier audits and assessments annually to track progress. In 2024 alone we conducted 606 supplier audits and EcoVadis assessments. These included 101 in-depth corporate responsibility audits covering countries including China, India, Japan, Malaysia, Mexico, Singapore, Taiwan, Thailand, the Philippines and Vietnam. The number of findings per category in these audits and examples of some findings and corrective actions taken are disclosed on page 73 of Nokia 2024 Sustainability Statement.

As a result of the audits, 420 improvement recommendations were made. These were addressed through corrective action plans. Most of the recommendations aim to improve the working conditions for the value chain workers. All non-conformities identified were analysed by Nokia's experts in the sustainable supply chain team, and corrective actions were included in Nokia's training materials as a mechanism for systematic improvement.

Beyond in-depth audits, 469 online assessments with EcoVadis were also completed. In 2024, 84% of Nokia suppliers covered with valid EcoVadis assessment had a satisfactory score. All the suppliers with scores below expectations were addressed with improvement requests.

We also emphasize the importance of health and safety (H&S) in our supply chain, as many of our subcontractors work at height, with electricity, and they need to drive long distances as part of their work on our behalf. We have set stringent KPIs related to our health and safety Supplier Maturity Assessment (SMA), which is our in-house-developed assessment. This assessment helps to ensure that contractors know Nokia's health and safety

requirements and have the capabilities to deliver work safely on our behalf. It also helps ensure that projects have risk-mitigation procedures and controls in place. By the end of 2024, 98% of suppliers delivering high-risk activity had been assessed using our H&S Supplier Maturity Assessment process, and 98% of these assessed suppliers met H&S "Compliant" supplier status (scoring of 3 or more out of 5), and 16% of the suppliers met H&S "Preferred" supplier status (scoring of 4 or more out of 5).

We are continuously developing supplier maturity on health and safety. Our targets are that by 2030 all suppliers will meet the "Compliance" threshold, and 100% of suppliers delivering high risk activity will meet "H&S Recommended or Preferred supplier" status in our Health & Safety maturity assessment.

Supplier learning and capability building

Nokia invests in raising awareness among thousands of suppliers regarding effective and sustainable management of human resources, including health and safety practices. Our work with suppliers spans 100 countries, including regions where local standards fall short of industry best practices.

Through workshops, webinars, and one-on-one meetings help suppliers improve their awareness and practices regarding ethical recruitment and exits, labour contracts, remuneration, worker-management communication, health and safety, and more. This engagement is not Nokia-specific: we want it to raise local standards permanently, even if our active business involvement in the country or with the supplier ends. Nokia also collaborates with suppliers to address gaps in industry standards and Nokia's supplier requirements. These are typically identified through supplier audits and assessments and addressed through Corrective Action Plans. Nokia is very active in various industry forums around responsible sourcing and supply chains includes:

Responsible Business Alliance, EcoVadis, JAC, CDP, Public-Private Alliance for Responsible Minerals Trade etc.

Beyond auditors and supplier facing functions who meet the suppliers and conduct learning and development activities, Nokia also conducts Senior Leader Safety Tours to strengthen safety culture across our supply chain. In 2024, Nokia conducted 241 Senior Leader Safety Tours, exceeding our target and reinforcing leadership accountability.

Recognizing supplier achievements

Sustainability is an important category in our annual Supplier Diamond Awards alongside the Quality Award and the Innovation Award. The Supplier Diamond Awards are Nokia's annual recognition program to reward supplier excellence across several categories including sustainability. Suppliers present their cases in front of expert juries and are recognized at our annual supplier event, in the presence of Nokia top leadership.

The 2024 winners in the sustainability category include one of the leaders in sustainable semiconductor manufacturing – examining the decarbonization of its own operations, establishing a net-zero target for 2040 and collaborating with Nokia to reduce the emissions of our products.

Our work with suppliers spans 100 countries, including regions where local standards fall short of industry best practices.

Enablers of sustainable innovation

Sustainable Development Goal 9 - Industry, Innovation and Infrastructure - is an area in which Nokia can drive meaningful impact. A global technology leader, Nokia aims to embed sustainability-by-design into everything it does, including the development of next-generation connectivity. As highlighted elsewhere in this report, our approach drives improvements in many different fields of sustainability, including **increased productivity** and **efficiency**, **reduced emissions**, **enhanced worker safety** and **widespread upskilling**.

Our role goes beyond the provision of infrastructure that is itself efficient. We want to contribute to the roll out trusted, resilient and high-performing connectivity everywhere.

This will make it easier for communities to innovate, drive economic growth and provide public services in a more equitable way.

To meet future challenges, communication and other critical infrastructure must all be improved, not just in large cities and global north but **everywhere**.

This is a complex aim requiring a variety of approaches. Providers of connectivity and digitalization (such as Nokia) must build products that customers want to use. The groups driving industry standards must do so in a manner that encourages the broad uptake of digital technologies.

Universities and other academic institutions must pursue research projects that more commercial enterprises might find too long-term. Venture capital must be channeled towards promising ideas, empowering founders to make their ideas concrete.

This chapter explores how **we act as a catalyst** for sustainable innovation across industries and ecosystems. Through circular product design, lifecycle management, and collaboration with partners, academia, and startups, **we enable systemic change**. Among these efforts, we are continuously focused on building resource-efficient and low-energy-consuming communications networks. The network effect—where each connection amplifies the potential for transformation—is central to our approach.

We illustrate this through real-world cases from Brazilian agricultural company **Solis**, mining company **Vale**, global logistics leader **Maersk** and the city of **Chattanooga**, Tennessee - America's first "Gig City". These examples show how digitalization supports decarbonization, resilience, and inclusive growth. We also highlight our contributions to sustainability standardization, university partnerships, and the startup ecosystem via **Nokia Growth Partners** (NGP), demonstrating how innovation can scale responsibly and equitably. We are continuously focused on building resource-efficient and low-energy-consuming communications networks.

The network effect—where each connection amplifies the potential for transformation—is central to our approach.

Image for illustration purposes only

4.1. Handprint of Nokia's technology on industries

Nokia's portfolio includes public and private 5G mobile networks, broadband, AI-powered network management tools, cybersecurity solutions, IP routing, and networking to, from and within data centers. These solutions help to embed resilient and high-performance connectivity in the world around us. They also provide powerful tools for commercial partners who are looking for ways to improve productivity, efficiency and worker safety.

Put another way, they enable our customers to achieve persistent competitive advantage which also benefits their customers and their customers' customers.

Our customers are primarily CSPs. Directly or indirectly we sell services to other customer types as well. In addition we are part of many sector-specific ecosystems, in which innovation leaders are testing new technologies with potentially transformative effects. As a result, our solutions are integrated into many industries which play a central role in people's everyday lives, such as agriculture, mining, shipping and the provision of power.

This report includes several case studies exploring how we work with partners in some of those industries. Each one begins with context about the sector in question before focusing on the specific solutions or pain points in question.

These case studies touch on only parts of our wide-ranging portfolio. But in each case, they demonstrate that Nokia can be the partner of choice when it comes to leveraging high-performance, resilient and commercially powerful connectivity that delivers measurable environmental and social impact.

Nokia can be your partner of choice when it comes to leveraging high-performance, resilient and commercially powerful connectivity that delivers measurable environmental and social impact.

Image for illustration purposes only

4.1.1.

Solis: Connecting Brazil's agribusiness

Why farming?
The environmental footprint of farming is considerable. Agricultural land occupies approximately 38% of the earth's land, and according to some estimates it is responsible for up to 12% of direct, and up to 37% of indirect, greenhouse gas emissions.

That footprint will probably increase. The global population is projected to reach 10 billion by 2050, and together with shifts in dietary patterns, increased resource use and food waste, it's estimated that by 2050 we'll need to increase food production by almost 60% compared to 2010 figures.

In that context it is vital to find ways of optimizing productivity and use of resources so humans don't need to use more land for farming.

Digitalization: lower costs, better efficiency, more food
This is where Agriculture 4.0 becomes relevant. For the first time, technological advancement in the sector is progressing without a corresponding rise in carbon emissions — in fact, the opposite is true. Through connectivity solutions such as the Internet of Things and advanced networks, farming machinery, sensors and people, can be linked to enable more efficient use of water, fuel and chemicals while optimizing harvesting and productivity.

Nokia Bell Labs predicts that even partial adoption of digital farming (25%) by 2030 could lead to yield increases of up to 300 million tons per year, a reduction in farming costs of up to US$100 billion per year and a reduction of wastewater by up to 150 billion m³ per year.

With this in mind, we have been working with Solis Tower Telecom do Brasil – a specialist in telecom solutions for Brazil's agribusiness – to use our private LTE network technology across more farms, helping farmers to save resources and improve efficiency.

In the spotlight: Vera Cruz do Xingu Farm
Vera Cruz do Xingu is a farm located in the west-central state of Mato Grosso, which is mostly covered by savanna plains, Amazon rainforest and wetlands, is one of the country's top agricultural producers.

The farm has a land area of 43,000 acres (nearly twice the size of Paris), 26,000 of which are preserved forest. The rest is used for farming cattle and growing soyabeans, corn, sesame and cotton.[4]

The problem that faced Vera Cruz do Xingu (like many other farms around the world) was the inability to monitor farming equipment in real time. With farm machinery isolated miles away from headquarters and an internet connection, it could take hours to bring faulty machinery back to headquarters, sort out the problem and send it back.

It was also difficult for staff to coordinate with each other or keep in touch with their lives and families, leading to lower retention rates.

The farm tried other technologies like satellite phones, but this wasn't financially viable, and Wi-Fi, with its limitations, couldn't deliver over the expanse of the farm's territory.

Then, agribusiness telco Solis and Nokia installed a private LTE network on the farm – 4G mobile technology but in the form of a dedicated wireless network. This reliable network connects people, machines and sensors seamlessly to provide detailed, real-time information and coordination.

Compared to pre-deployment conditions, the implementation of the private LTE network resulted in a **3–5%** reduction in fuel consumption, an **8–10%** reduction in the cost associated with the displacement of outsourced technicians for maintenance, a measurable decrease in unproductive time, and a notable reduction in employee turnover.

The sustainability impact also extends to the use of agrochemicals like fertilizers, pesticides and herbicides, which can be reduced with AI and edge processing for targeted, precision application.

Nokia Bell Labs predicts that even partial adoption of digital farming (25%) by 2030 could lead to **yield increases of up to 300 million tons per year**, a reduction in farming costs of up to **US$100 billion per year.**

Image for illustration purposes only

4.1.2.

VALE

Why mining?
The mining sector has a unique place in the conversation about sustainability.

On the one hand it is currently an emissions-heavy industry, responsible for up to 7% of the world's carbon emissions, and because mines are often located in remote regions local infrastructure must be built from scratch, adding to resource consumption.

On the other hand, the sector plays a crucial role in moving from fossil fuels to renewable energy. The green transition needs copper for electrification. It needs cobalt, graphite and lithium for batteries and electric vehicles. It needs aluminum, silver and zinc for solar panels. **According to the World Economic Forum, achieving net-zero emissions by 2050 will require 3 billion tons of metal – roughly the weight of 300,000 Eiffel Towers.** And because extensive infrastructure is often built close to mines in remote locations, mining can also bring economic opportunities and other benefits to otherwise excluded communities.

In summary, improved stewardship of metal resources and more responsible mining operations can minimize the negative impacts of the mining sector while accelerating its already considerable contribution to economic growth and the energy transition.

With mined materials travelling vast distances to ports, passing potentially hundreds of towns and villages on the way, **there are many opportunities to add social value and minimize environmental impact along the way.**

Digitalization: more efficiency, more vital minerals, more positive impact
Mines are complex sites holding complex operations. They are often remote, inaccessible and even dangerous, sometimes with very limited room for people and machines to operate. These difficulties lead to increased uncertainty, as there are many points at which operations could be disrupted. As a result, any route to **improving predictability and efficiency is highly attractive** and often leads to immediate and measurable improvements in productivity, efficiency and safety.

> Digitalization is already transforming mining operations. The industry has consistently led in adopting advanced technologies to enhance efficiency and reduce environmental impact. One notable example is its early and widespread use of autonomous vehicles, which now drive ultra-efficient haulers, loaders, and drills across mining sites.

Mining is ripe for digitalization because it produces huge amounts of data. Connected vehicles, machines and staff all generate huge amounts of information every day, about their own performance but also about the ever-changing physical environment of the mine. This **geospatial data is vital for optimizing the mine's performance**. But collecting the data is only half of the challenge. The other half is having the hardware, software and agility necessary to act on it.

That is why more mining companies are **embracing more advanced and potentially more transformative digital technologies**. These include pit-to-port private networking, digital twins and the real-time use of data.

In the spotlight: Carajás iron ore mine, in the state of Para in Northern Brazil, is the largest iron ore open pit mine in the world. It is **a huge site holding 7.2 billion metric tons of iron** ore in proven and probable reserves as well as deposits of ores for manganese, copper, aluminum and other minerals.[2] Operations are complex and often tricky to access – including one underground conveyor belt 10km long.

Vale, the mine's owner and operator, has already employed digital technologies across the mine, including automated mining vehicles from Caterpillar and Komatsu, both Nokia partners. But they felt that more gains were possible. In particular, they wanted their data to work harder.

The green transition needs copper for electrification. It needs cobalt, graphite and lithium for batteries and electric vehicles.

Image for illustration purposes only

After engaging with Vale to understand their specific pain points and expectations, **Nokia launched the Cognitive Digital Mine (CDM) project with a targeted focus on solving real-world mining challenges, using Vale's Carajás mine as a proving ground**. At the core of CDM is the Cognitive Monitoring Network service — a suite of AI agents and advanced connectivity devices that can run AI in the field to enable the creation of digital twins and intelligent supervision systems for critical mining functions. Operating over private networks, this solution is designed to significantly enhance performance, reliability, and safety across the site.

Digital twins use real-time data from sensors and devices to create **virtual replicas of a real-world systems**. All your equipment and assets in the real-word system also exist in the virtual world, meaning the system owner can monitor operational performance in real time, making data-driven decisions on maintenance, inventory tracking and worker safety, among many other fields. The virtual nature of a digital twin also means system owners can use it to perform 'what-if' analysis on planned changes to operations.

Ultimately, CDM aims to enhance mine performance, reliability, and safety. **The project's KPIs are ambitious, underscoring the transformative potential of digitalization. We are targeting up to a 25% increase in productivity across key critical areas monitored by the CDM's service; a significant reduction—or even elimination—of equipment outages caused by connectivity issues; and an 80% reduction in risk exposure for IT field teams by automating diagnostics, configuration, and survey tasks through the CDM platform**.The performance of the Cognitive Monitoring Network service has been strong enough that Nokia and Vale are already discussing how to expand CDM's cognitive services into critical operations across other Vale sites, including the S11D complex in Pará and key mines in Minas Gerais. The two businesses are already collaborating to develop these future systems, which will focus on the unique selling point of digitalization: simultaneous improvements in sustainability, safety and value creation.

The virtual nature of a digital twin also means system owners can use it to perform 'what-if' analysis on planned changes to operations.

Image for illustration purposes only

4.1.3.

MAERSK

Why shipping?
Roughly 90% of world trade, by volume, travels by sea.

Shipping is already the least environmentally damaging form of commercial transport. Transporting a ton of something by sea results in emissions of between 3 and 8 grams of CO_2 per kilometer, versus about 435 grams for travel in a 747-sized plane.

But there is always more to be done. The sheer scale of the shipping industry means that it emits roughly 1,000 Mt of CO_2 per year, or **3% of global CO_2 emissions.** And those emissions are rising, in part because of the increasing volumes of global trade. Some research estimates that without the greater use of sustainable technologies and processes throughout the sector, emissions from shipping will increase by up to 50% by 2050.

Every percentage gain in the efficiency of seaborne travel makes it **easier, cheaper and greener** to transport raw materials, food and consumer products from producers to buyers.

Digitalization: ship-shape intelligence for world trade
The maritime industry is digitalizing fast. Regulatory requirements from the EU and International Maritime Organization, for example, are pushing operators to improve their efficiency and sustainability. Shipping companies and port operators have also set **ambitious decarbonization targets**, based in part on the increasing cost of energy and fuel.

The current wave of digitalization is particularly suited to addressing inefficiencies in heavy physical industries. Shipping and logistics are excellent examples. GPS data, and data from connected devices, can be fed through AI applications in order to make sure vessels take the safest, most efficient routes. Navigation on huge container ships can be automated just as effectively as any other vehicle. Digital twins and other applications can monitor the performance and location of ships, containers and people. **The measurement and reporting of energy consumption and energy efficiency can be almost entirely automated.** And there are many more solutions being rolled out already.

Research has suggested measures to decarbonize shipping, including by reducing emissions from international and domestic marine transport through efficiency measures driven by digitalization among other methods, could result in emissions savings of roughly 2 gigatonnes per year by 2050.

Navigation on huge container ships can be automated just as effectively as any other vehicle. Digital twins and other applications can monitor the performance and location of ships, containers and people.

Image for illustration purposes only

There are also powerful social reasons why it is important to digitalize the shipping industry.

Life on a container ship can be repetitive and physically taxing. In addition, journeys routinely take several months, during which time the crew is away from friends and family. Container ships also tend to have shorter port stays, meaning less time on land to see other people. In this context, reliable connectivity becomes not just a business imperative but a social imperative. **Reliable private networking means crew members can talk to their families regardless of whether they are in a port**.

In the spotlight: Maersk
Maersk is one of the largest shipping and logistics companies in the world. It has over 100,000 employees spread across almost 130 countries (and the seas that separate them), plus 54 ports and terminals, almost 9 million square meters of warehouse capacity and hundreds of container vessels.

This wide distribution of assets brings huge advantages but also plenty of complexities. For example, **Maersk works with over 30,000 suppliers and service providers, generating vast quantities of data** that can be mined to optimize shipping routes and supply chains – but only if the right data is gathered, interpreted and acted on in a timely manner. That would be hard enough on one site, let alone if your assets are spread across land and sea.

Maersk is working with leading tech partners, including Nokia, to resolve this situation, connecting more assets to deliver higher-quality data and more actionable insight. **450 of Maersk's vessels will be equipped with industry-leading private wireless networks. The deployment is a vital part of Maersk's broader shift towards IoT connectivity, through which they will offer numerous benefits to its customers, including real-time cargo tracking, enhanced supply chain visibility, and improved operational efficiency**.

Private networks are nothing new. They have been driving improvements in efficiency, productivity and safety for some years. But a more recent development has been their ruggedness and flexibility, which makes them suitable for real-time asset tracking and positioning in harsh, exposed environments such as the middle of the ocean.

By adding private wireless networking to its technology stack, Maersk is transforming its infrastructure on board vessels it owns and vessels it charters. **The result is constant communication between numerous IoT devices and secure interoperability between private and public networks, ensuring Maersk's customers' cargo is reliably monitored at sea, port, or land. This is especially important for tracking parameters such as temperature and humidity for fruit and other perishables, as well as some pharmaceuticals**. It is easy to imagine a situation in which a container full of dairy products is spoilt due to a localized power failure on board a container ship, but if that ship had been equipped with a private network, then the failure could have been tracked down and fixed by the crew almost instantly. The result is less waste, happier customers and a more efficient supply chain.

Connecting more assets to deliver higher-quality data and more actionable insight.

Image for illustration purposes only

4.1.4.

Chattanooga

An unlikely candidate for Gig City

Back in 2008, no one would have guessed that the mid-sized city of Chattanooga, Tennessee, would become the first in the US to offer 25 Gbps internet. But within two years, the city was launching **America's first 1 Gbps internet, then up to 10 and finally up to 25 Gbps.**

Throughout this transformation, Nokia has partnered with the city-owned utility EPB to provide a high-speed, 100% fiber optic network with symmetrical upload/download speeds for all commercial and residential customers, enabled by Nokia's unique XGS/25G PON technology.

> For context, typical speeds today range from 100 Mbps to 1 Gbps for most households and businesses. But with the increase in the quantity and quality of streaming, remote working, cloud, AI and the Internet of Things, global data traffic has more than doubled since 2020 and is expected to more than double again in the next five years.

A 25 Gbps network can support the massive data loads generated by data centers for high-performance applications that make Smart Cities sustainable such as energy efficient grids and buildings, industrial automation, renewable energy, waste management, traffic optimization, electric vehicle charging, disaster detection and recovery, or air and water quality monitoring.

Chattanooga's fiber network is used by EPB's Smart Grid – an advanced electricity grid that improves energy efficiency and reduces disruptions using a digital network for two-way communication combined with 1,200 switches and smart meters on every premise to create America's most automated, interactive and self-healing electric distribution system.

Impact Report 2025

The network links all the electrical infrastructure and the more than 170,000 homes and businesses, transforming Chattanooga into a Gig City attracting a host of businesses and investments, and into a platform for cutting-edge research and innovation. **Chattanooga has become a test bed for new power usage real-world applications – with 170,000 meter readings every 15 minutes, EPB has the richest data set of this kind in the United States**.

The environmental upshot; renewable energy and reduced emissions

As well as providing energy and cost savings for Chattanooga's residents and businesses, this network is **supporting renewable energy sources like solar and wind generation**, which vary unpredictably, by equipping solar installations with on-site storage and other equipment to turn them as independent micro-grids that can expand or contract based on conditions. This can help utilities across the US better manage unpredictable, renewable power generation.

The Smart Grid also allows many processes that once required site visits to now be handled automatically or remotely, reducing EPB's carbon footprint in 2023 by 250,000 truck miles, with a reduction of 3.6 million lbs of CO_2 emissions and 915,889 lbs of waste diverted from landfill.

Reduced power outages and environmental damage

Perhaps the biggest impact of the Smart Grid has been the **reduction of power outages by 50%** during severe weather events, **saving customers $55 million per year** but also protecting the environment from bushfires. –

When posts fall and power lines go down, outages can be detected in microseconds by the Smart Grid's fiber network detection mechanisms so lines can be turned off remotely, thereby avoding bushfires caused by fallen live electricity lines (as seen in recent years with the Los Angeles fires). Moreover, the Smart Grid is automated to act instantly as the first line of defense in rerouting power to reduce the number of customers who experience lasting outages.

We saw the impact of this in July of 2012 when **the grid saved $1.4M from the damage of a summer storm**, and during Winter Storm Heather in January 2024 or the tornados in spring of the same year that brought significant damage to the power grid. Easter Sunday, more than 106,000 EPB customers lost power, which the Smart Grid restored almost instantly for 44,0000, saving them from outages that could have lasted hours or days.

Gig City = Smart City = Sustainable City

Smart Cities are increasingly evolving into Gig Cities with Smart Grids, as these infrastructures enable the digital and energy capabilities needed to support greener urban systems.

For their work turning Chattanooga into a Gig City, in 2024 EPB and Nokia received the Network X Award for Leading PON-Based Smart City Service – an award that recognizes outstanding achievements in networking technology and smart city infrastructure, celebrating innovative, high-impact projects that use cutting-edge network solutions to enhance city services, infrastructure and urban living.

Global data traffic has more than doubled since 2020 and is expected to more than double again in the next five years.

Image for illustration purposes only

4.2. Sustainability and standardization

Future generations of technology and ICT innovation must ensure that sustainability is a defining principle in order to create new business models and opportunities. Products must embed sustainability in their design and adhere to standards and methodologies that ensure products and processes support sustainable lifecycles and minimize their adverse environmental impact.

Let's consider the next generation of mobile technology, 6G, intended to be a leapfrog from today's 5G– expectations are high that it will be a sustainable technology and enable other industries to become more sustainable. Compared with 5G, 6G is expected to deliver a 10 to 20 fold capacity increase at peak load, help to reduce overall energy consumption by 50% and improve bit/joule metric by five to ten times at peak load. To minimize its potential adverse environmental impact, 6G should reduce overall energy consumption and GHG emissions across the whole lifecycle (raw materials, production, use and end of life) and this will encourage site, infrastructure and resource sharing. 6G infrastructure should have the capability to adapt to sudden environmental changes and socio-economic shifts, but also be guided by user-centric and value-driven requirements to ensure broad access and drive greater inclusion.

Nokia works with multiple telecoms and non-telecoms standardization organizations and industry fora to ensure that future technologies are based on consistent standards and research methodologies for climate action, circularity and biodiversity – three key pillars of environmental sustainability.

For example, we work with 3GPP and the International Telecommunication Union Telecommunication (ITU-T) Standardization Sector and the European Telecommunications Standards Institute (ETSI) and focus on energy consumption and energy efficiency, circularity, lifecycle assessment (LCA) and biodiversity standards and methodologies. We also work with the International Organization for Standardization (ISO), CEN (the European Committee for Standardization) and CENELEC (the European Committee for Electrotechnical Standardization) on AI Governance.

In addition to our standards work, Nokia has identified five sustainability-by-design (SbD) principles that acknowledge the range of environmental sustainability challenges and identify a linked technology strategy that will lead to sustainable 6G outcomes and commercial success.

- Energy efficiency and GHG reduction enables net reductions in energy use and generation of GHG emissions across the lifecycle of networks and UE.
- AI sustainability ensures trustworthiness and compliance readiness of AI processes, resources and datasets.
- Hardware efficiency means that minimal hardware is used, its usage is maximized, it is shared where possible and its lifetime is extended through repair and reuse.
- Resilience and climate change adaptation means that infrastructure can adapt to extreme climate conditions and variability in the energy supply, but equally it ensures that in times of economic or social crisis it will help to minimize market volatility and social exclusion.
- Value-oriented design and operations – deliver technology enablers to support use cases that extend coverage to remote areas, improve performance in high density areas and provide enhanced services to industries such as agriculture, energy and healthcare.

We are also working with existing standards to propose frameworks and tools related to the sustainability of the ICT sector. For example, At Nokia, we have come up with what we believe is the most comprehensive framework to transparently assess the environmental impact of AI systems, thus helping people, companies and governments make informed sustainable decisions about which AI tools are the least energy-hungry. Our framework relies on existing ISO and ITU standards and therefore can be adopted across different industries and regions as a globally recognized way to assess the environmental impact of AI systems. It can be used in AI systems tens of billions of parameters in size, or in basic shopping list recommenders.

Sustainability must permeate every aspect of the global economy if we want it to thrive and ICT and digital services play a pivotal enabling role.

It starts with the technology design and standards that create a broad ecosystem of partners, as well as a common language and measures. This will extend the scale of positive impacts across supply chains, help to reduce duplication and waste, as well as foster responsible business approaches.

Sustainability-by-design principles for 6G
Key to achieve net-zero targets in the coming decades

Energy efficiency & GHG reduction	Reduce net GHG emissions & energy consumption for networks and devices
AI sustainability	Ensure AI-native in a responsible way. including governance and resources
Hardware efficiency	Promote hardware efficiency through flexibility and adaptability, including resources sharing
Resilience and climate change adaptation	Make networks resilient to growing adversarial events and risks of disasters
Value-oriented design and operations	Deliver technology enablers that benefit industries, people and the planet through ubiquitous access and digital inclusion

4.3. University Donations Program for a sustainable future

At Nokia, we believe **technology's power extends far beyond connectivity**; it's a catalyst for positive change. Our University Donations Program reflects this belief, funding groundbreaking research that addresses critical Environmental, Social, and Governance (ESG) challenges.

This collaborative journey is fueled by a shared commitment to innovation and impact. Our donations support research initiatives designed to not only advance technological frontiers but also directly contribute to Nokia's ESG goals. We envision a future where technology empowers everyone, respects ethical boundaries, and safeguards our planet. This program builds on Nokia's long-standing academic partnerships. Through the Distinguished Academic Partners program and strategic university collaborations, Nokia Bell Labs and Nokia Standards drive breakthrough innovation and nurture future technology leaders.

In 2023, Nokia contributed approximately USD 1.5 million, followed by an additional USD 1 million in 2024, to support 34 university projects as part of its effort to build strategic partnerships with leading universities across Europe, the USA, and Asia uniting diverse minds to develop solutions for a more sustainable and equitable future.

In 2024 alone, received funding for ESG-related research focused on five strategic pillars:

1. **Sustainable and Energy-Efficient Computing**:
   The digital world's ever-growing energy footprint demands a radical shift. We're funding research into low-power hardware, energy-efficient 6G networks, and software optimizations to minimize the environmental impact of our technology, paving the way for a greener digital future.

2. **Climate Intelligence and Environmental Stewardship**:
   Climate change demands innovative solutions. Our support for research leveraging AI, satellite imagery, and drone technology aims to create powerful tools for comprehensive climate and ecosystem monitoring. By developing sophisticated algorithms to interpret environmental data, we aim to provide predictive insights that inform global climate strategies and enhance environmental protection efforts.

3. **Digital Inclusion and Accessibility**:
   Technology should be a bridge, not a barrier. We're committed to ensuring accessibility for all, regardless of ability, background, or location. Our funded research explores user-centered design, innovative distribution models, and solutions to bridge the digital divide, connecting underserved communities and empowering individuals through technology.

4. **AI Ethics and Governance**:
   As AI becomes increasingly pervasive, ethical considerations are paramount. We're funding research that establishes best practices for responsible AI development and deployment. This includes focusing on privacy protection, bias mitigation, transparency, and fairness, ensuring AI systems are used ethically and beneficially.

5. **Explainable AI (XAI)**:
   Building trust in AI requires transparency. Our support for XAI research focuses on making AI decision-making processes more understandable and interpretable. This crucial work fosters accountability and builds confidence in the responsible use of AI technologies.

Through this University Donations Program, Nokia is not just funding research; we're fostering a collaborative ecosystem dedicated to creating a more sustainable, inclusive, and ethical technological landscape. We believe that by working together, we can harness the transformative power of technology to build a better future for all.

In 2023, Nokia contributed approximately USD 1.5 million, followed by an additional USD 1 million in 2024, to support 34 university projects.

Sønderborg – Denmark - Sustainable Data Centers

As part of Nokia's commitment to sustainability and innovation, we supported the Southern University of Denmark in **advancing next-generation green data center technologies**. The research led to the development and simulation of a fully off-grid energy system that integrates solar photovoltaic panels, hydrogen electrolysis, PEM fuel cells, battery storage, and a heat recovery system for district heating. The system achieved an impressive 118.5% useful efficiency under normal conditions, thanks to its effective reuse of waste heat from the data center and energy components. It also demonstrated resilience under extreme conditions with no solar input, highlighting the robustness of hybrid storage using both hydrogen and batteries. The project addresses major industry challenges in energy efficiency and carbon footprint reduction, offering a viable alternative to diesel generators in remote data center operations. Beyond technical innovation, the research supports Nokia's Environmental, Social, and Governance (ESG) goals by showcasing how renewable energy and thermal integration can significantly cut emissions, up to 60% compared to diesel, while also contributing to local community heating solutions. The findings have been submitted to the high-impact journal Applied Energy, and future work aims to apply reinforcement learning for further optimization, moving toward a fully closed-loop, net-zero green data center model.

University of Jyväskylä (Finland)

Nokia is supporting the University of Jyväskylä in **advancing biodiversity footprint assessments for organizations**. This collaboration, aligned with Nokia's Environmental, Social, and Governance (ESG) strategy and broader sustainability commitments, addresses the urgent need to tackle both climate change and biodiversity loss simultaneously. Currently, while carbon footprint assessments are commonplace, comparable tools for measuring biodiversity impacts are scarce. The University of Jyväskylä, a leader in biodiversity footprint research, will leverage this support to enhance its existing work and establish a tenure-track professorship dedicated to this critical area.

This initiative is crucial because understanding an organization's biodiversity impact—pinpointing activities causing the most significant loss and quantifying the overall footprint—is the first step towards developing effective reduction strategies. While general accounting principles and tools are under development, comprehensive standards suitable for diverse organizations and industries are still lacking. Nokia's contribution complements funding from the Finnish Innovation Fund Sitra, which is supporting a related University of Jyväskylä project focused on overcoming obstacles to establishing an international standard for biodiversity footprint measurement. This project aims to create a common language among existing metrics, enabling convertibility between different measurement approaches and accounting for diverse biodiversity impacts across various global ecosystems. The combined efforts of Nokia, the University of Jyväskylä, and Sitra represent a significant step towards creating the tools and frameworks necessary for organizations to effectively measure and mitigate their impact on biodiversity.

Purdue University (USA)

Nokia's donation to Purdue University's research on **low-energy Ambient IoT (A-IoT) for precision agriculture** reflects our strong commitment to sustainable and energy-efficient technologies. This groundbreaking work has the potential to transform farming by introducing battery-free, low-cost, energy-harvesting soil sensors—reducing agriculture's environmental footprint while boosting productivity and increasing efficiency/yield. The integration of advanced multiple access and positioning techniques, along with explainable AI for transparent and automated decision-making in areas such as irrigation and fertilization, will further strengthen the scalability and reliability of A-IoT. Together, these innovations lay the foundation for broader adoption and a more resilient, sustainable food system. This joint research was recently published in the prestigious IEEE Communications Magazine.

Aalto University (Finland)

Through our partnership with Aalto University, we're developing **power-efficient, backscattered wearable devices for gesture and activity recognition using body-worn reflective surfaces**. By developing power-efficient, backscattered wearable devices we are advancing human-computer interaction while minimizing energy consumption and carbon emissions. This research has the potential to create more accessible and inclusive technologies for diverse populations, empowering individuals through innovative and sustainable solutions.

4.4 Partnering with the startup ecosystem for sustainable transformation

NGP Capital is a global venture capital firm founded by Nokia in 2005.

While independently managed, it is backed by Nokia and plays a strategic role in identifying and supporting high-growth startups that align with Nokia's long-term innovation and sustainability goals. Through this partnership, Nokia gains early insight into emerging technologies while supporting scalable solutions that contribute to its broader ESG ambitions.

NGP Capital shares Nokia's view that embedding environmental, social, and governance principles into products and strategies can provide a competitive advantage, as well as being a responsible choice. Below are examples of companies within NGP Capital's portfolio, arranged by their alignment to the most relevant SDGs.

Lime is the leading global micromobility provider with a strong commitment to operating an environmentally conscious business. In 2020 Lime committed to reaching net-zero emissions by 2030. They are well on their way as compared to their 2019 baseline. To date, they have reduced their emissions by 60% by committing to fully electric fleets and powering warehouses with renewable energy.

Shippeo is a multimodal transportation logistics provider. Shippeo's product suite includes a carbon visibility tracking tool to help major shippers and carriers measure their carbon emissions and create actionable reduction plans. Shippeo has also shown itself to be a leader in company governance, setting aggressive and actionable targets and goals across all three pillars of ESG for 2024.

ANYbotics is a leading provider of autonomous robotic inspection solutions designed to enhance safety and efficiency in industrial environments. Their legged robots operate in hazardous and hard-to-reach areas, reducing the need for human exposure to dangerous conditions. By enabling predictive maintenance and continuous monitoring, ANYbotics helps industrial sites minimize downtime, optimize energy use, and reduce environmental impact. Their technology supports a safer, smarter, and more sustainable future for heavy industries.

NGP Capital aligns it's portfolio with the UN Sustainable development goals

8 DECENT WORK AND ECONOMIC GROWTH	9 INDUSTRY, INNOVATION AND INFRASTRUCTURE	3 GOOD HEALTH AND WELL-BEING	11 SUSTAINABLE CITIES AND COMMUNITIES
shadowfax	NOVA	Lifesum	shadowfax
GET YOUR GUIDE	SENSORO	Clue	Zūm
OBSERVE-AI	ANYbotics	vida	Lime
美菜	Daedalus	E G Y M	哈啰出行
Juvo	zinier	OnShift	Zoomcar

Glossary

5G (Fifth Generation Mobile Communications): The next major phase of mobile telecommunications standards. 5G is a complete redesign of network architecture with the flexibility and agility to support upcoming service opportunities. It delivers higher speeds, higher capacity, extremely low latency and greater reliability.

6G (Sixth Generation Mobile Communications): The cellular industry introduces a new generation about every ten years. The next generation of technology is expected to be introduced by 2030 and is generally referred to as 6G.

Ambient IoT (A-IoT): A class of ultra-low-power, battery-free or low-energy Internet of Things (IoT) devices that harvest ambient energy—such as light, heat, motion, or radio waves—to operate without the need for battery charging or replacement.

Artificial Intelligence (AI): Autonomous and adaptive intelligence of machines, where machines have the ability to perform tasks in complex environments without constant guidance by a user and have the ability to improve performance by learning from experience.

Biodiversity footprint: The measure of an organization's impact on biodiversity across its value chain.

CDP: Formerly the Carbon Disclosure Project, a global disclosure system for managing environmental impacts.

Circularity: A model of production and consumption that emphasizes reuse, refurbishment, recycling, and minimizing waste throughout the product lifecycle.

CSPs (Communications Service Providers): One of Nokia's customer segments.

Digital Twin: virtual replicas of physical assets, systems and processes that use real-time data and other sources to enable learning, reasoning and dynamic recalibration for improved decision-making.

EcoVadis: A sustainability rating platform that evaluates companies across environmental, social, and governance (ESG) criteria.

Explainable Artificial Intelligence (XAI): AI models that provide human-understandable explanations for their decisions.

FP5 (Fifth-Generation Network Processor): A high-performance network processor which enables scalable, secure, and energy-efficient IP routing for service providers.

FPcx (Compact Routing Silicon): A compact, programmable routing silicon optimized for IP access, aggregation, and edge networks.

ICE7 (Infinite Capacity Engine): Seventh-generation coherent optical engine.

PSE-6s (Photonic Service Engine 6s): Sixth-generation coherent optical engine for high-capacity optical transport.

Quillion: A custom-designed broadband access chipset that power Nokia's fiber and copper solutions.

ReefShark: A custom System-on-Chip (SoC) technology used in its AirScale radio and baseband solutions.

RE100: A global initiative bringing together world leading businesses committed to sourcing 100% renewable electricity for their operations. The initiative aims to accelerate transition towards zero carbon grids at scale.

Scope 1 emissions: Direct emissions, from sources owned or controlled by the company.

Scope 2 emissions: Indirect emissions, from the consumption of purchased electricity, heat, and/or steam (location-based and market-based).

Scope 3 emissions: Indirect emissions, as a consequence of the activities of the company, but from sources not owned or controlled by the company.

SDGs (Sustainable Development Goals): A set of 17 global goals adopted by the UN in 2015 under the 2030 Agenda to address key global challenges such as poverty, inequality, climate change, environmental degradation, peace, and justice.

Smart Grid: A digitally enabled electricity network that can monitor, automate, and manage energy flow.

Sustainability-by-design: A strategic approach that embeds sustainability principles into the design of products, services, and workspaces to reduce environmental impact and improve resource efficiency across their entire lifecycle.

Private Wireless Network: Private wireless is a standalone network focused on industrial operational assets and users. A private wireless network provides broadband connectivity, similar to a public wireless network, but is owned and controlled by the organization that built or purchased it.

SBTi (Science Based Targets initiative): A partnership between CDP, the United Nations Global Compact, World Resources Institute (WRI) and the World Wide Fund for Nature (WWF) is a global body that validates corporate climate targets against scientific benchmarks.

Industry 4.0 (the fourth industrial revolution): Enables enterprises, governments and public sector agencies to use innovative digital technologies, smart automation and advanced analytics to transform their operating processes. This blending of technologies creates a convergence of the physical and digital worlds, enabling an era of massive industry improvements and positive impacts for societies.

RAN (Radio Access Network): A mobile telecommunications system consisting of radio base stations and transmission equipment.

XGS-PON (10Gbps Symmetrical Passive Optical Network): A high-speed optical network technology that enables both upstream and downstream gigabit and multigigabit services. Its adoption is accelerating, helping operators improve competitiveness, revenue, and network efficiency, while meeting the growing demand for bandwidth from video, online gaming, and emerging applications like virtual reality.

References

Page	Reference	Source
4	ITU (2.6 billion offline, 2% GHG, 5% electricity)	Measuring the Emissions and Energy Footprint of the ICT Sector: Implications for Climate Action and Measuring the Emission & Energy Footprint of the ICT Sector
5	TIME's World's Most Sustainable Companies	World's Most Sustainable Companies of 2025 | TIME
5	Corporate Knights Global 100 rankings	Global 100 | Corporate Knights
5	ABI Research's Telco Scope 3 Emissions Management ranking	Which Telcos Are the Most Successful at Reducing Scope 3 Emissions?
7	SBTi (Science Based Targets initiative)	Target dashboard - Science Based Targets Initiative
12	Lightspan portfolio (optical line terminals)	Lightspan DF Fiber Access Nodes
12	Sustainable Aviation Fuel (SAF)	Decarbonizing the Air Transportation Sector
12	IATA's SAF accounting framework	IATA Sustainable Aviation Fuel (SAF) Accounting & Reporting Methodology
14	Intel Xeon processors, Nokia's cloud-native 5G Core	Nokia utilizes Intel technology to drive greater 5G network energy savings through software innovations and new chips
17	One Circle pilot	A dynamic duo for circular innovation – Nokia and DSV's partnership in One Circle, About One Circle project and Environmental And Social Management Plan (ESMP), see section 3
19	World Bank poaching tracking devices	Savannah Tracking Devices
19	UNECE Forest Information Systems	Trends in Digitalization of the Forest Sector
19	GSMA Disaster Response	Business Continuity Management: Planning for disaster resilience in mobile networks
20	Mercedes Stuttgart AMR robots	Safelog: 550 mobile transport robots for Factory 56 from Mercedes-Benz

Page	Reference	Source
24	Nokia and ISAT Africa (Liberia)	Nokia and iSAT Africa to enhance rural coverage in Liberia
24	Peru Amazon connectivity project	Nokia deploys fiber network in the heart of the Amazon rainforest with Global Fiber Peru
24	Nokia and Fibertime (South Africa)	Nokia and Fibertime expand broadband access across South Africa's underserved communities
27	Nokia-UN Women partnership	Empowering communities through a unique partnership between Nokia and UN Women
29	Telcomagazine: Nokia CEO Justin Hotard	The Future of Nokia with its New CEO: Justin Hotard
34	Nokia Bell Labs (digital farming)	Smart agriculture - The fight to feed 10 billion
40	Nokia 6G sustainability asset	The path to 6G with unparalleled energy savings
40	Nokia AI sustainability framework blog	A transparent and methodical framework to assess the sustainability impact of AI
42	IEEE Communications Magazine (Purdue)	Ambient IoT: Communications Enabling Precision Agriculture
45	Nokia website	nokia.com

Other standard Nokia disclosures that were supporting documents:

- Nokia Annual Sustainability Statement 2024
- Nokia Climate Transition Plan
- Nokia Modern Slavery Statement 2024

NOKIA

www.nokia.com