



Unlocking Green Opportunities: ICT's Role in Nordic Climate Action

Working with:



Contents

Unlocking Green Opportunities: ICT's Role in Nordic Climate Action	3
Priorities for decarbonisation	5
Opportunities to make gains	5
Energy and power	6
Decarbonisation challenges in energy and power	7
Opportunities in energy and power	7
Buildings	8
Decarbonisation challenges in buildings	8
Opportunities in buildings	9
Transport	10
Decarbonisation challenges in transport	10
Opportunities in transport	11
Manufacturing	12
Decarbonisation challenges in manufacturing	13
Opportunities in manufacturing	13
Summary and recommendations	14
How Telenor helps	14
Energy and power	14
Buildings	15
Transport	16
Manufacturing	16
About the Carbon Trust	17

Climate change poses a significant challenge, with urgent action needed to limit global warming to 1.5°C or 2°C above pre-industrial levels.

Telenor’s recent report delves into the crucial role of the ICT sector and digital solutions in achieving this goal. By reducing greenhouse gas (GHG) emissions and enabling the transition to a greener economy, ICT plays a pivotal role in helping the Nordics meet their ambitious climate targets. The synergy between green and digital transformations is evident, with the EU’s climate neutrality objective emphasizing the importance of net-zero technology and solutions. While the ICT sector currently contributes to global emissions, it also holds the potential to drive significant reductions through the deployment of innovative solutions, potentially cutting emissions by 15 – 20%.

this summary of the full report highlights the challenges and opportunities within each. These sectors collectively account for a large portion of global emissions and present complex challenges for decarbonization efforts. By prioritizing key opportunities aligned with policy incentives, market size, and emission reduction potential, the report identifies pathways for meaningful impact. For a more comprehensive overview, download the full report [here](#). In 2020, the energy and power sector accounted for 43% of global GHG emissions, with transport at 20%, manufacturing at 18% and buildings at 8%. As these sectors are the the biggest contributors to global emissions and some of the most difficult to stop, the report focuses on the challenges and oportunities within these sectors in the Nordics.

Focused on the energy and power, buildings, transport, and manufacturing sectors,

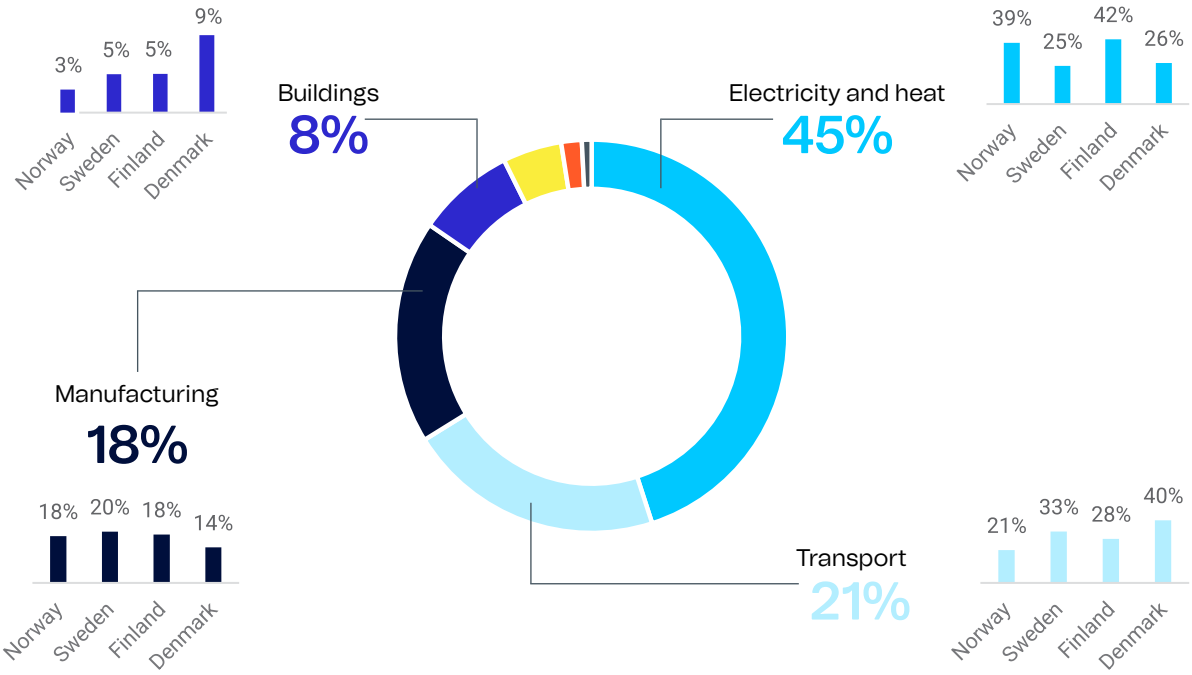


Figure 1. Global and country specific CO₂ emissions by sector¹

Table 1 outlines some of the main challenges faced in each of the four sectors and key opportunities that can address these challenges. It is important to note that the outlined savings can be achieved by the entire solution and are not solely due to the contribution of the ICT components of the solution. Most ICT solutions are combinations of several different ICT and non-ICT components and require collaboration between different stake-

holders to achieve expected carbon savings.

As a next step, ICT companies could evaluate and prioritise these opportunities by taking additional internal metrics, like business strategy, into consideration. Companies could then engage with relevant partners to develop and deploy any prioritised solutions.

Table 1. Overview of main challenges and opportunities for key sectors

Sector	Challenge	Opportunity
Energy and Power	Insufficient energy storage capacity	IoT connected battery energy storage solutions reducing emissions by enabling more renewable energy to be used Battery pooling and enabling more renewables
	Need for more renewable energy and diversification of energy sources	Increased renewable generation through forecasting and optimized operations Reduced maintenance from remote monitoring
	Increasing energy demand	Reduced electricity and gas consumption through residential smart meters Reduced electricity and gas consumption through commercial smart meters Reduced electricity consumption through water meters
	Power supply reliability	Virtual power plants allowing for better integration of renewable energy AI optimized power generation Reduced maintenance from remote monitoring
	Overloading of current grids with increased electrification	Smart grids allowing for peak load shifting and demand response
Buildings	Large share of global emissions	Digital solutions for construction sites reducing on site fuel and electricity use
	Energy performance gap	Reduced energy consumption through BMS
	Energy waste	Reduced energy waste through floor occupancy solutions
	Energy efficiency of existing building stock	Enabling connections into district heating, lowering emissions intensity for overall heating demand Digital twins allowing for better facility management and lower energy use

¹Excluding emissions from land-use change

Transport	Overwhelming reliance on fossil fuels & Long lifetimes of new vehicles	Fleet management and telematics solutions reducing fuel use EV charging
	Consumer demand for low price travel and shipping	Edge computing and IoT solutions for green shipping
	High cost for alternative fuel and alternative fuel vehicles	MaaS
Manufacturing	Supply chain complexity	Connected inventory management solutions reducing overall stock need
	Slow pace of the energy transition	IoT connected automation reducing energy waste through digitalisation
	High cost of decarbonising equipment and lack of funding	Additive manufacturing reducing energy use through automation and optimization
	Digital skills gap	Augmented reality, mixed reality and virtual reality technology improving manufacturing and training in the sector

Priorities for decarbonisation

As a key part of its environmental and business strategy, Telenor would like to ensure that it is developing connectivity and IoT solutions that enable the decarbonisation of other industries. Telenor wants to communicate the work it has performed in the area of avoided emissions and align its strategy with high-impact solutions and critical sectors in the future. As the avoided emissions topic is at an inflection point and new methodologies and standards are being developed, it is a key time for Telenor to evaluate its avoided emissions approach. Telecommunications service providers have the opportunity to identify solutions with the potential to avoid emissions and drive significant impact across other sectors and document this impact by providing accurate assessments.

In addition to the wide-ranging impacts of providing and connecting enabling technologies, it is important for Telenor to continue to reduce Scope 1 and 2

emissions. Telenor's Scope 1 and 2 emissions continuing to decrease will also mean customers' product footprints and Scope 3 emissions will also reduce.

Opportunities to make gains

The full report evaluates the potential for ICT solutions to support four key sectors in the Nordics; power and energy, buildings, transport and manufacturing to avoid emissions. The report identifies the main challenges in these sectors and the key opportunities for ICT companies to address these challenges.

The sector assessment encompasses a sectoral overview within the Nordic countries of Norway, Denmark, Sweden and Finland. The state of each sector is detailed, including expected growth projections, emissions reduction potential and needs for reduction in each sector, to identify potential opportunities and challenges for ICT solutions.

Energy and power

The transition towards zero-carbon energy production is necessary to limit global warming. Globally, energy and power had the largest increase in emissions in 2022 reaching an all-time high of 14.6 Gt. The Nordics are all leaders in the use of renewable energy and have some of the greenest grid energy mixes in the world. All four countries have set net-zero targets, intermediary targets for 2030 and targets for the greening of their electricity grids.

Digitalisation of the energy and power sector will not only be necessary to reduce sectoral emissions but will facilitate the decarbonisation of many other sectors as well. The primary drivers of decarbonization identified in the energy and power sector include IoT-enabled energy storage, connected renewable energy, energy efficiency solutions, connected power stations, and smart grids. Figure 2 highlights some specific solutions and potential carbon savings associated with them.

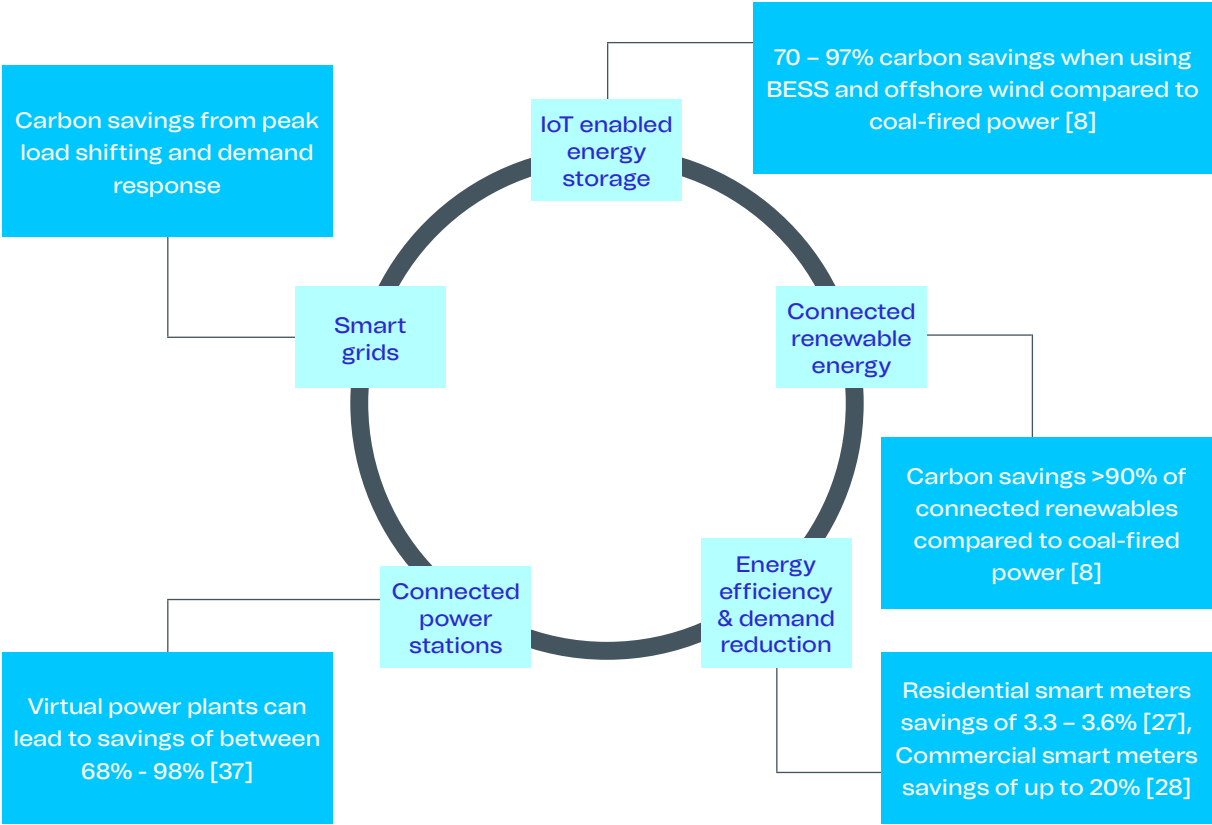


Figure 2. Potential carbon saving opportunities in the energy and power sector²

² Note: potential carbon savings are for the solution as a whole not only for the ICT component.

Decarbonisation challenges in energy and power

There are some variations in the energy and power sectors of the Nordics, with Norway being a large oil producer and Finland focused more on biofuels, for example. However, they all share ambitious decarbonization targets and are leaders in transitioning the power sector to sustainability. The focus on trying to reduce the environmental footprint of the energy mix as well as

increased electrification of different sectors has given rise to some challenges. Many of these challenges will also relate to other sectors such as buildings and transport as these are all somewhat intertwined. These challenges provide an opportunity for ICT companies to adopt IoT and connectivity solutions to positively impact the energy and power sector. Figure 3 summarises some of the major challenges that the sector is currently facing.

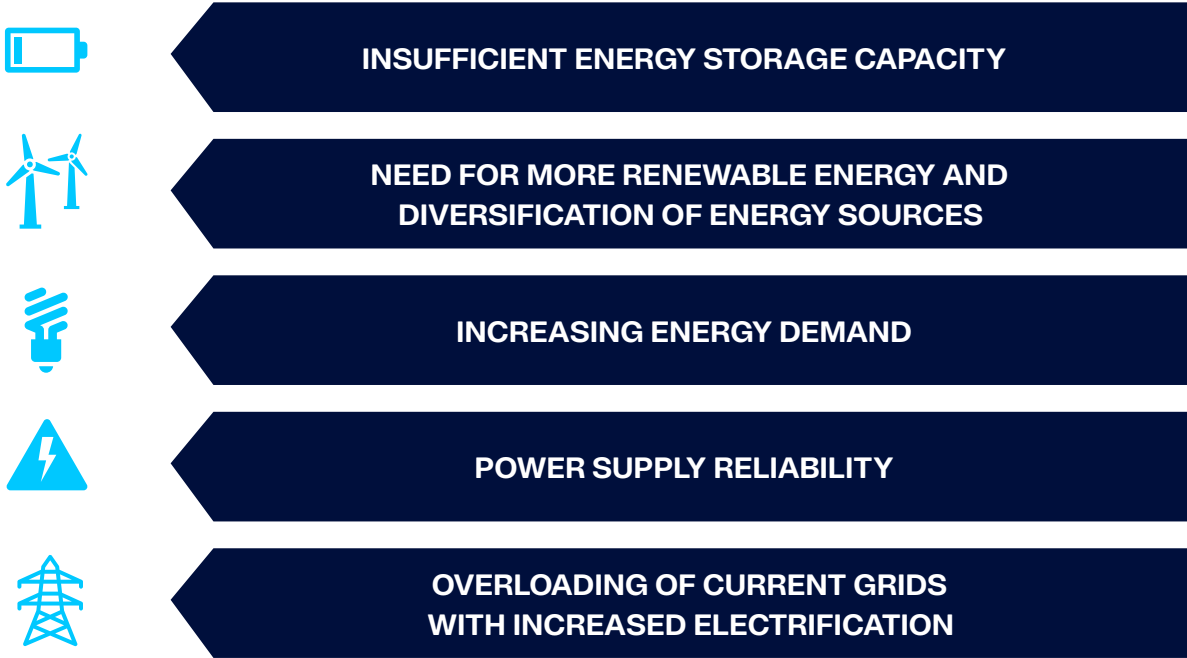


Figure 3. Main decarbonisation challenges in the energy and power sector

Opportunities in energy and power

The main opportunities that have been identified for the energy and power sector are IoT connected energy storage solutions, optimised renewable energy generation, energy efficiency and demand reduction solutions, connected power stations and smart grids. Some of the common challenges across these opportunities are that it is a relatively new field and therefore there is a lack of stand-

ardization and regulation for some of these technologies. In addition, most energy storage or grid solutions, have a high cost of installation associated with them. ICT companies facilitate the connectivity and optimization aspects of many of these solutions, enabling their effective implementation and maximizing their positive impacts.

Buildings

In Europe, the buildings sector constitutes about 40% of energy demand, making it one of the most energy intensive sectors. To reach net-zero targets it will be critical to reduce overall emissions and improve building energy performance. Policy in the Nordics and EU in general has been becoming more stringent with many new technologies being rolled out across the region. In the framework of the EU's climate policies, all non-residential buildings must be retrofitted with building

automation and control systems (BACS), and new buildings are required to be nearly-zero emission from 2030

The main carbon enabling solutions in the buildings sector include IoT solutions for construction, BMS, floor occupancy, connections into district heating and digital twins. Figure 4 highlights some specific solutions and potential avoided emissions associated with them.

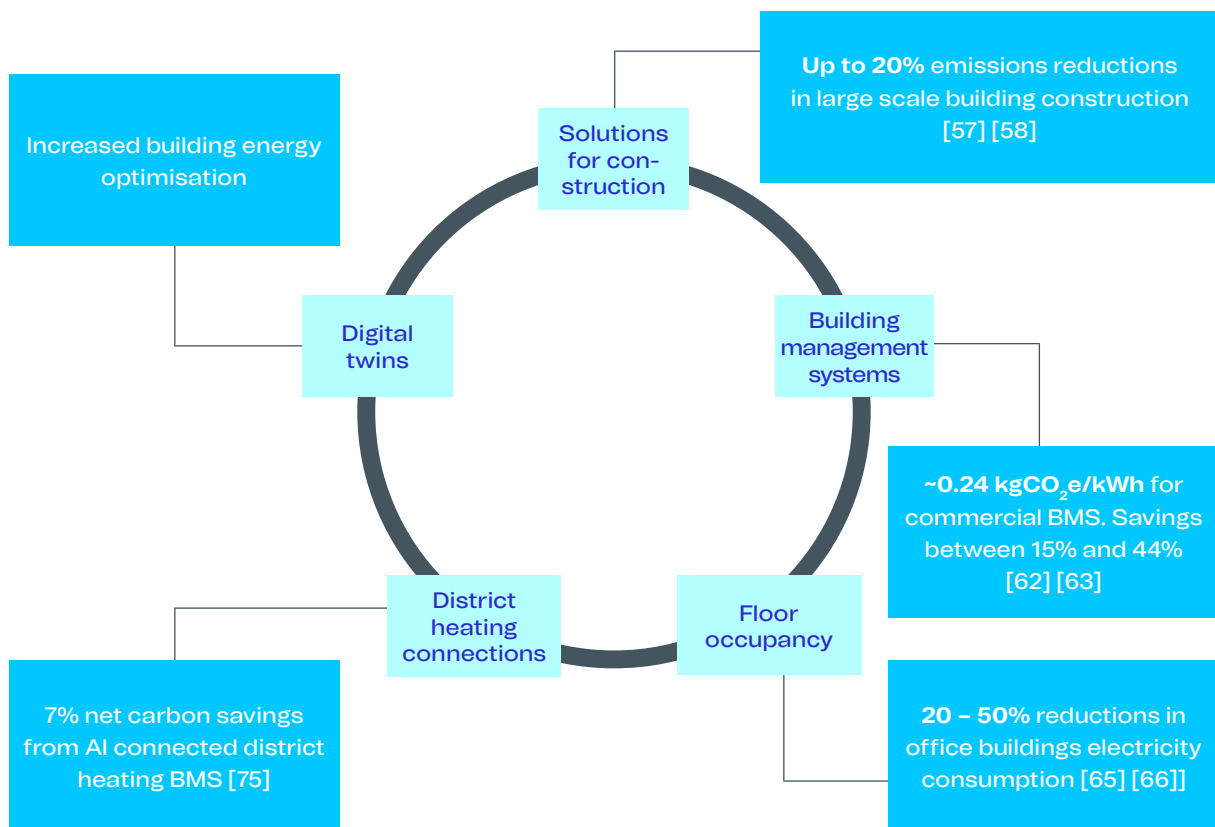


Figure 4. Potential carbon saving opportunities in the buildings sector³

Decarbonisation challenges in buildings

Decarbonising the building sector presents a complex array of challenges due to its substantial energy consumption and high carbon emissions. While the transition to renewable

energy sources is a critical component of reaching climate targets, existing buildings also need to be retrofitted with energy efficient technologies to reduce overall consumption.

³Note: potential carbon savings are for the solution as a whole not only for the ICT component.



Figure 5. Challenges for buildings

Opportunities in buildings

The key opportunities that have been identified in the buildings sector are solutions for heavy machinery on construction sites, BMS, floor occupancy solutions, connecting new sources to district heating networks, and digital twins. As commercial buildings are subject to stricter EU regulations around energy reduction requirements, there are more opportunities for energy-saving IoT applications in this sub-sector. Telenor’s existing solutions in the sector focus on heavy machinery connectivity, water leak

detection, and AI-powered heating controls. The main risks to consider include the high initial investment required and challenges in interoperability with legacy equipment already present in many buildings. Installing new building management platforms will also lead to increased maintenance costs, which must be offset by cost savings provided by the solutions themselves to remain appealing to clients. Connecting previously offline systems to the Internet also poses a challenge in terms of data privacy and cybersecurity.

Transport

The transport sector is responsible for approximately 21% of all greenhouse gas emissions, however in the Nordics, the sector is a much larger contributor, representing around 40% of the regions total. Whilst the exact split of emissions across sub-sectors varies between countries, across the Nordic region it is typically dominated by passenger road transport and road freight. Alongside its existing emissions impact, the sector has decarbonisation challenges such as reliance on fossil fuels; the long lifetimes of vehicles; and the overwhelming demand for cheap service provision in trans-

port sub-sectors such as freight or aviation. Alongside the countries' individual targets and policies, there are established co-operative decarbonisation initiatives in the sector under Nordic Vision 2030.

The main opportunities for ICT companies identified in the transport sector include fleet management and telematics, EV charging, green shipping and (Mobility as a Service) MaaS. Figure 6 highlights some specific solutions within the opportunities and potential emissions abatement associated with them.

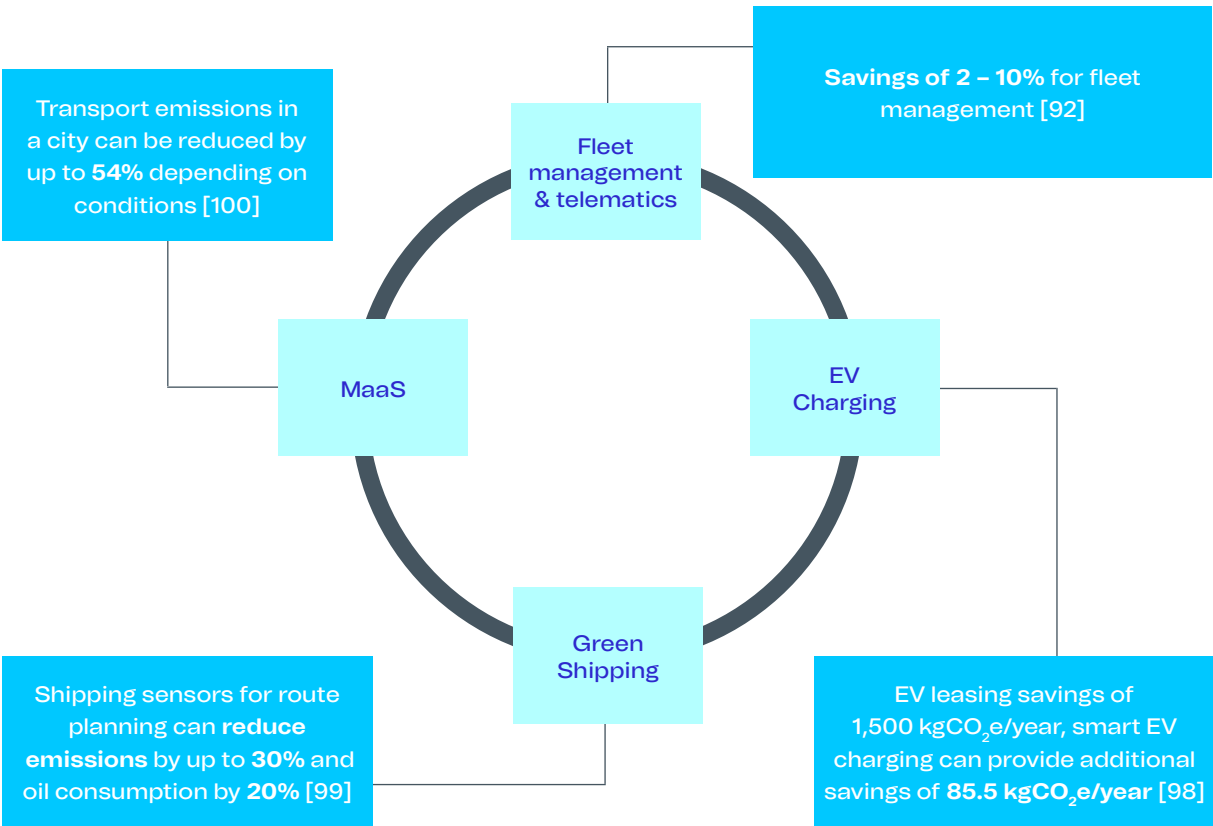


Figure 6. Potential carbon saving opportunities in the transport sector⁴

Decarbonisation challenges in transport

Transportation has in the last 5 -10 years seen rapid developments in terms of technology

and consumer preferences however, there are still many gains to be made.

⁴Note: potential carbon savings are for the solution as a whole not only the ICT component.



Figure 7. Summary of decarbonisation challenges in the transport sector

Opportunities in transport

The key opportunities identified include fleet management and telematics; and IoT connected shipping focused on fuel efficiency, connected EV charging targeting electrification, and mobility-as-a-service (MaaS) aiming to give individuals more opportunity to choose the most climate-friendly and efficient transport option for their needs. Telenor is one

of many ICT companies making an impact in the transport sector through their managed connectivity services such as Scania and Astrata's fleet management solutions; Charge Node's connected EV chargers; connectivity for Giken mobility; connectivity for PEOPLE and CIMC's shipping containers and collaboration on Smartere Transport Bodø.

Manufacturing

Manufacturing as a sector is diverse, with sub-sectors ranging from the production of paper, plastic and raw metals to the manufacturing of complex machinery. As such the decarbonisation opportunities and challenges are also varied and diverse. The sector is one which requires significant decarbonisation, with the sector responsible for roughly 20% of global GHG emissions, second only to the energy sector in terms of climate impact on a global scale.

The main opportunities for ICT companies identified in the manufacturing sector include connected inventory management, IoT connected automation, AR/MR/VR and IoT additive manufacturing. Figure 8 highlights some specific solutions and potential avoided emissions associated with them.

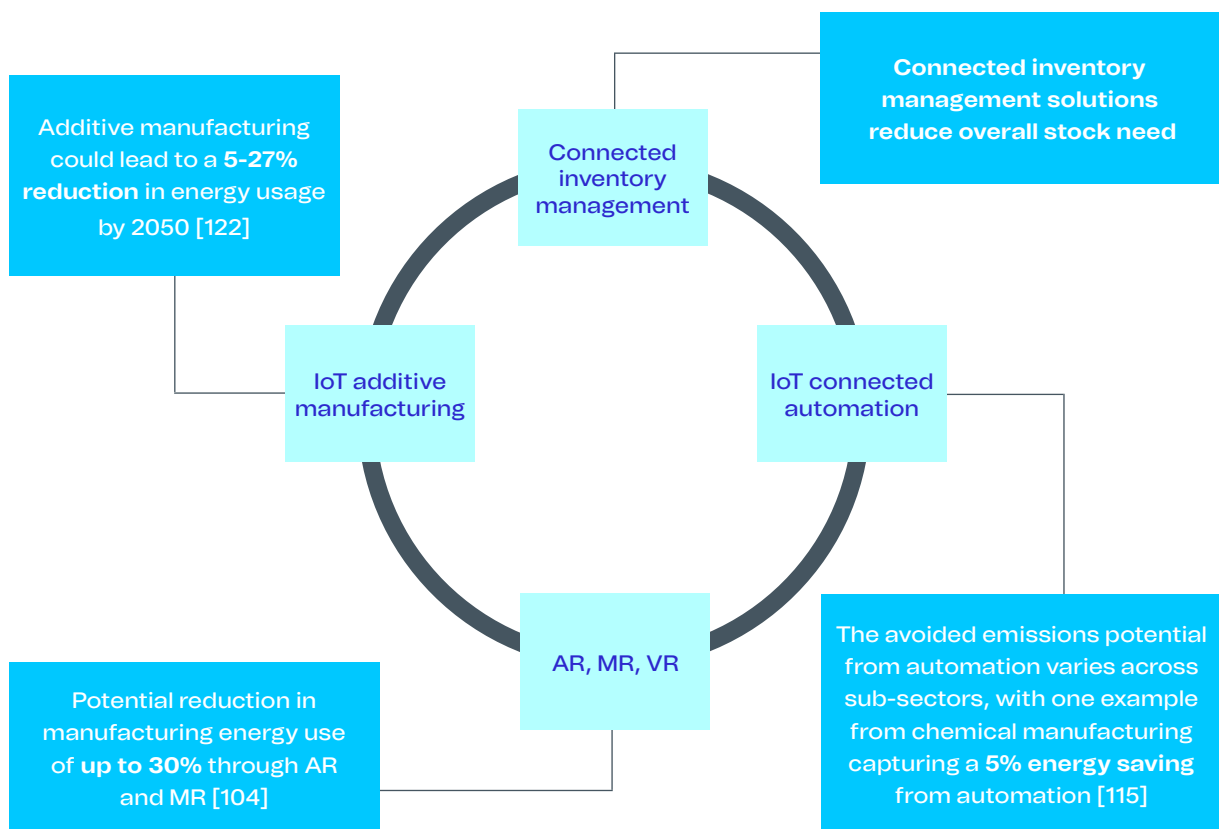


Figure 8. Potential carbon saving opportunities in the manufacturing sector

Decarbonisation challenges in manufacturing

The manufacturing sector is particularly diverse and whilst there are undoubtedly some common challenges, different sub-sectors will face different decarbonisation challenges. This diversity also means that the impact of the same solution can have a significantly different impact in different contexts and sub-sectors, and also needs

to be assessed separately. Key manufacturing sub-sectors in the Nordics include metal manufacturing and processing; vehicle manufacturing; machinery and industrial technology manufacturing; pharmaceutical products; and pulp, paper and forestry products.

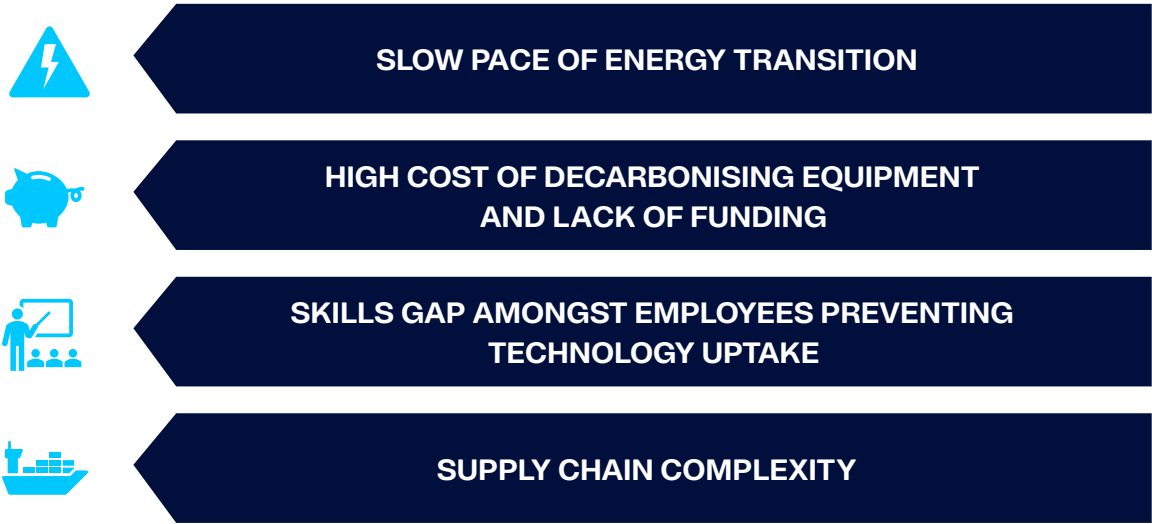


Figure 9. Manufacturing decarbonisation challenges

Opportunities in manufacturing

Manufacturing is a crucial sector economically for many Nordic nations, and as such, many of the Nordic governments play an active role in encouraging the decarbonisation and modernisation of the sector. Alongside this, the region is known for its innovative approach to manufacturing and in its leading role in the uptake of industry 4.0. This appetite for innovation highlights the potential impact of identified opportunities, namely connected inventory management; manufacturing automation; AR, MR and VR in manufacturing; and additivemanufacturing.

Despite the appetite for decarbonisation and innovation in the Nordic region, the sector is not without its decarbonisation challenges. Whilst the sector is very diverse, with different challenges presenting themselves to different sub-sectors, there are some common challenges across the whole sector. These include the slow pace of the renewable energy transition; the high cost of capital associated with upgrading or replacing existing manufacturing equipment; funding for decarbonisation initiatives; skills shortages and associated upskilling costs; and supply chain complexity presenting common barriers.

Summary and recommendations




Decarbonising and digitalisation are fully intertwined and the decarbonisation pathway of the four key sectors addressed in this report will rely on large scale digitalisation. ICT solutions support the decarbonisation of these key sectors by providing solutions that enable remote monitoring, optimisation, and automation, as well as allowing for key decarbonising solutions to be more efficiently implemented and rolled out through connectivity.

As ICT companies are working towards achieving their direct emissions reductions targets, there are a number of steps that can be taken to maximize the potential impact of

the solutions they provide to their customers. Firstly, ICT companies should assess in detail which solutions to invest in and incorporate into the product portfolio. In addition to the metrics evaluated in this report, which include the avoided emissions potential, potential market size and policy landscape for solutions, a number of company specific metrics should be evaluated. These metrics include; understanding the potential customer base, alignment with internal business strategy, technological feasibility, availability of partners and ease of working together to develop solutions and case studies with partners.

How Telenor helps




Energy and power

COMPANY	SOLUTION	ABATEMENT MECHANISM
	Grundfos offers connected water pumps and water-as-a-service, for which Telenor provides the IoT connectivity. This has enabled Grundfos to provide condition monitoring, energy management and water management offerings.	Energy savings through remote monitoring, efficiency increases, reduced downtime for maintenance.
	Kamstrup develops and sells monitoring meters for water, district heating, and electricity globally. They also have a smart metering project with DONG Energy, one of the largest smart metering rollouts in Denmark.	Smart metering allows customers to track energy and water use and shift behavior towards reduced energy usage.
	Skagerak Energy provides sensors for water flow detection that are coupled with Telenor IoT connection for more efficient operation of hydropower plants.	Provides signals on when there is a strong or weaker flow of water allowing for better optimisation on how to operate a hydropower plant and increase electricity generation.



Buildings

COMPANY	SOLUTION	ABATEMENT MECHANISM
	<p>IoT solution for better heating control and management. Learning AI that continually gathers data on, e.g., heat retention, weather forecasts and the property's location and with the aid of this data, Wattinen decides how to adjust the heating in each room to optimise both residents' comfort and the property's heating energy consumption. The AI accurately predicts and controls the property's heating room by room.</p>	<p>This solution can enable savings of 10–30% on the energy used in heating.</p>
	<p>Telenor helped develop a water leak detection system (water sensor and fault switch) for Länsförsäkringar insurance to prevent water damage in homes. Research shows that carbon dioxide emissions from a bathroom renovation amount to just over 3.5 tons.</p>	<p>Provides signals on when there is a strong or weaker flow of water allowing for better optimisation on how to operate a hydropower plant and increase electricity generation.</p>
	<p>Home energy management, Eliq is based on achieving more sustainable home living. Telenor Connexion was involved from the very beginning, supporting Exibea with their competence and experience. This included both engineering and hardware integration, ensuring that the energy data could be captured and communicated to the cloud, and building a specific application for visualization and management of data in the energy display.</p>	<p>Reducing energy use by enabling customers to control their consumption via an app connected to the smart meter.</p>

Transport

COMPANY	SOLUTION	ABATEMENT MECHANISM
	<p>Telenor provides connectivity to real time data from truck fleets to address specific customer needs such as predictive maintenance or reduced fuel consumption.</p>	<p>Reducing fuel consumption through optimisation (e.g. route planning).</p>
	<p>Visilion asset tracking and supply chain visibility solution developed by Sony Network Communications Europe. The solution allows the tracking of assets in the supply chain in real time through LTE-M connectivity enabled by Telenor, contributing to improved efficiency and an ability to reduce costs by optimising transport times, inventory and delivery.</p>	<p>Optimising supply chain efficiency can contribute to reduced fuel consumption.</p>
	<p>Telenor Connexion provide managed connectivity to Astrata's VanLinc. The solution provides Realtime GPS tracking of all fleet vehicles, along with performance monitoring. This helps fleet operators boost productivity, efficiency and increase capacity for work globally.</p>	<p>By boosting efficiency for LGV fleets, fuel consumption can be reduced and driver behaviour can be improved.</p>

Manufacturing

COMPANY	SOLUTION	ABATEMENT MECHANISM
	<p>Commercial refrigeration monitoring using Telenor Connexion's managed connectivity. This allows ISA to monitor and control the most critical components of their products and continuously collect data from the refrigerators.</p>	<p>Reduces the energy consumed by commercial refrigeration equipment. Which in turn reduces emissions associated with that energy.</p>
	<p>A manufacturer of machines for gourmet gelato, Telenor provide connectivity to monitor the lifecycle of the machine based on use, optimizing the maintenance of machines based on their actual usage, reducing downtime.</p>	<p>Connected remote monitoring and optimized maintenance reduces unnecessary maintenance of machines, reducing fuel usage related to maintenance (travel and shipping).</p>

About the Carbon Trust

Our mission is to accelerate the move to a decarbonised future. We have been climate pioneers for more than 20 years, partnering with leading businesses, governments and financial institutions globally. From strategic planning and target setting to activation and communication - we are your expert guide to turn your climate ambition into impact.

We are one global network of 400 experts with offices in the UK, the Netherlands, South Africa, China, Singapore and Mexico. To date, we have helped set 200+ science-based targets and guided 3,000+ organisations in 70 countries on their route to Net Zero.



The Carbon Trust's mission is to accelerate the move to a decarbonised future."

- The Carbon Trust

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Telenor Connexion

Telenor IoT is the portfolio of IoT solutions from Telenor Group, one of the world's major mobile operators. With more than 20 years' experience of providing global IoT connectivity, cloud services and expert support to companies of all sizes, Telenor is one of the world's most advanced IoT solution providers. Telenor IoT manages international IoT deployments for global customers in some 200 countries and today operates more than 20 million connected devices to enterprises such as Volvo, Scania, Hitachi, Verisure Securitas Direct and Husqvarna. The IoT solutions are offered to national customers in the Nordics through the local Telenor operations in each country, and on a global level through Telenor Connexion, Telenor's specialized unit that provides IoT solutions for large, international enterprises who need a customized offer with advanced support.

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