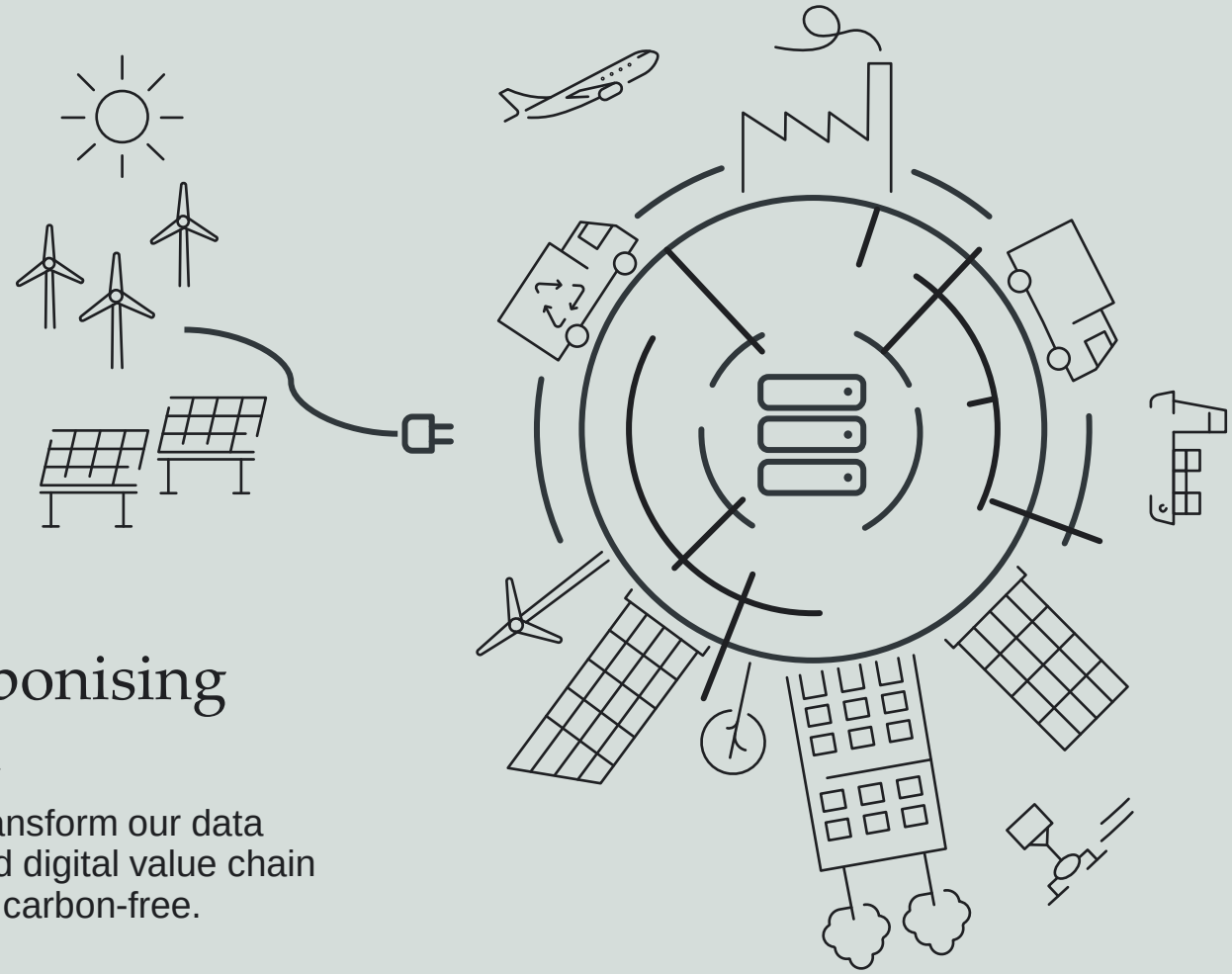
Digital decarbonisation in Belgium

How digital technologies enable decarbonisation across all sectors of our society

… and how we can decarbonise the digital value chain

October 2023

The Digital Decarbonisation report addresses two equally important priorities:



1. Digital decarbonisation

How digital technologies enable the transition to a net zero Belgian society.

2. Decarbonising digital

How we transform our data centres and digital value chain to become carbon-free.

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Summary

25-30% of the greenhouse gas reductions needed for Belgium to achieve net zero emissions in 2050 require digital enablement to work at scale and at socially acceptable cost

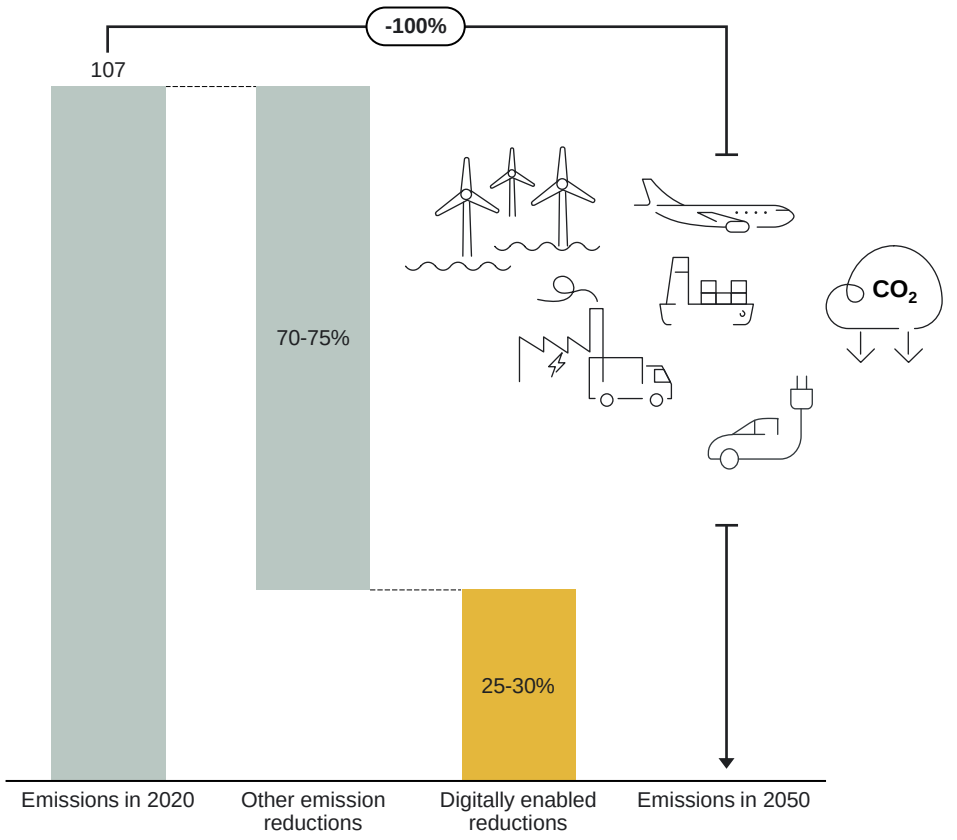
- Belgium has committed to achieving net zero emissions by 2050.
- Digital processes and new technologies are helping us to **save energy** and use it more efficiently, **use resources more sustainably**, **reduce travel** by using video conferencing instead of air travel or to work from home, and increase our use of **renewable electricity** with **intelligent power grids.**
- The **digital sector** is also on its own decarbonisation journey. Decarbonisation enabled via digital solutions will outweigh emissions from data centres and future gains are significant. Frontrunners in the sector are committing to 24/7 carbon-free energy as the most efficient way to progress towards a fully carbon-free digital sector.
- An Implement Economics analysis[1] showed that if all data centres in Europe achieved 100% hourly carbon-free energy (24/7 CFE), the EU will save **6-18 million tons of CO_2 in 2030**.

Belgium's **win-win approach** to competitiveness and the green energy transition should have two parallel tracks:

- **Digital decarbonisation**: Maximising the enabling role of digital technologies by accelerating already available digital solutions at scale.
- **Decarbonising digital**: Minimising the carbon emissions across the entire European digital value chain by decarbonising all operational electricity emissions, and addressing the emissions related to devices as well as servers and buildings etc.

The **digital decarbonisation** priority is about accelerating the uptake of digital solutions enabling climate change mitigation. This will require an enabling policy framework.

Reduction of net greenhouse gas emissions toward 2050
$MtCO_2e$



Note: 1) Figures for data centre emissions were estimated by Implement Economics in connection with Digital decarbonisation, Implement Economics (2022)
Source: Implement Economics based on EEA

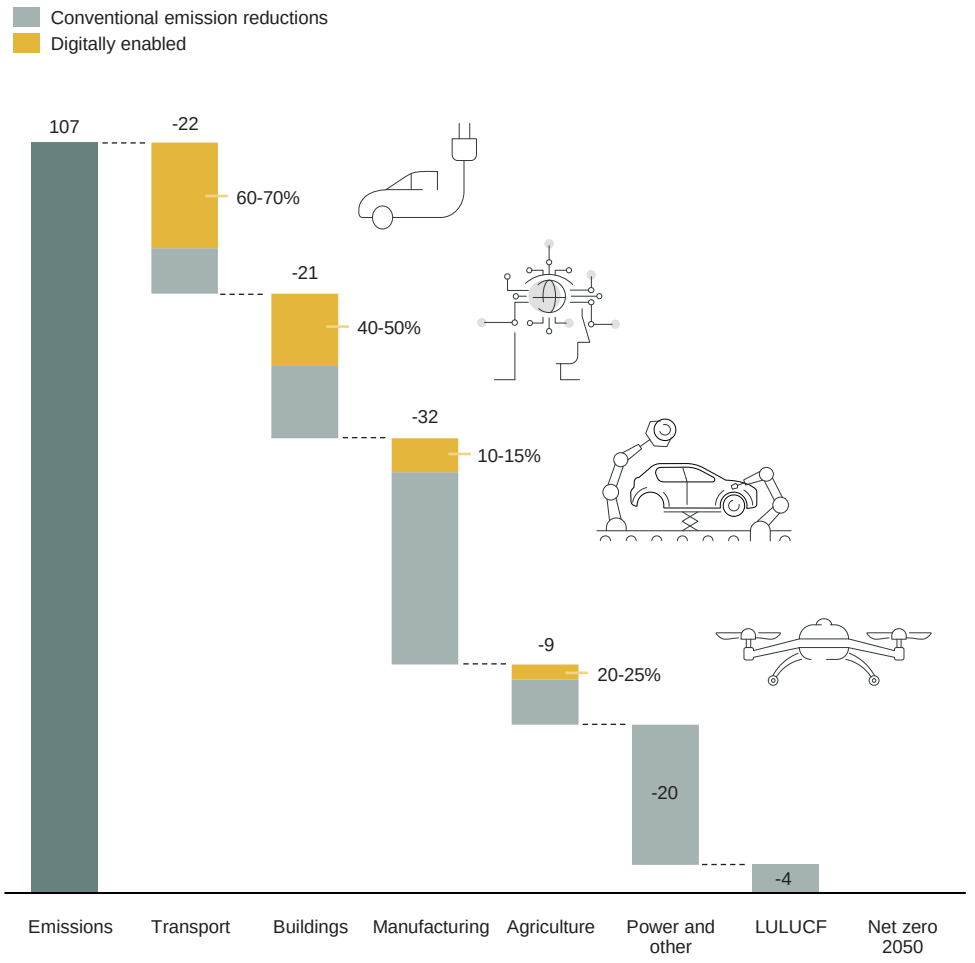
Summary

Digital technologies often work together with other technologies to make the green transition happen

- Belgium's **domestic transport** sector accounts for around 20% of total emissions. Around 60-70% of the reductions in transportation towards 2050 are expected to come from a switch to electric cars, trucks and buses, which will require a large degree of digital support and infrastructure. Smart charging apps, digitally integrated charging stations and a smart grid solution are already at work enabling this transformation. Digital technologies also reduce the need to travel, accelerating the modal shift to less polluting alternatives and making all modes of transport more energy efficient.
- The **manufacturing** sector is responsible for around 30% of total Belgian emissions. At least 10-15% of these emissions are to be reduced by improved energy efficiency and electrifying lighter industrial processes, which is being enabled by digital technologies such as predictive AI.
- Belgium's **agriculture** sector is responsible for around 11% of total emissions. Real-time data and algorithms for precision farming is used to making farming more climate-friendly and more accurate. Estimates suggest that 20-25% of the emission reductions in agriculture will require some degree of digital enablement.
- The **building sector** emits around 19% of total Belgian emissions. The heating of our homes and buildings is already being transformed by new building management systems using AI and machine learning. A big part of the decarbonisation journey is replacing gas and oil boilers with electric heat pumps. Digital solutions will help provide the needed flexibility and efficiency. Estimates indicate that 40-50% of emissions reductions from the building sector will require some degree of digital enablement.

The estimates and examples are not exhaustive, and there are numerous other ways in which digital solutions are already enabling the decarbonisation journey.

Reduction of net greenhouse gas emissions toward 2050 by sector
$MtCO_2e$

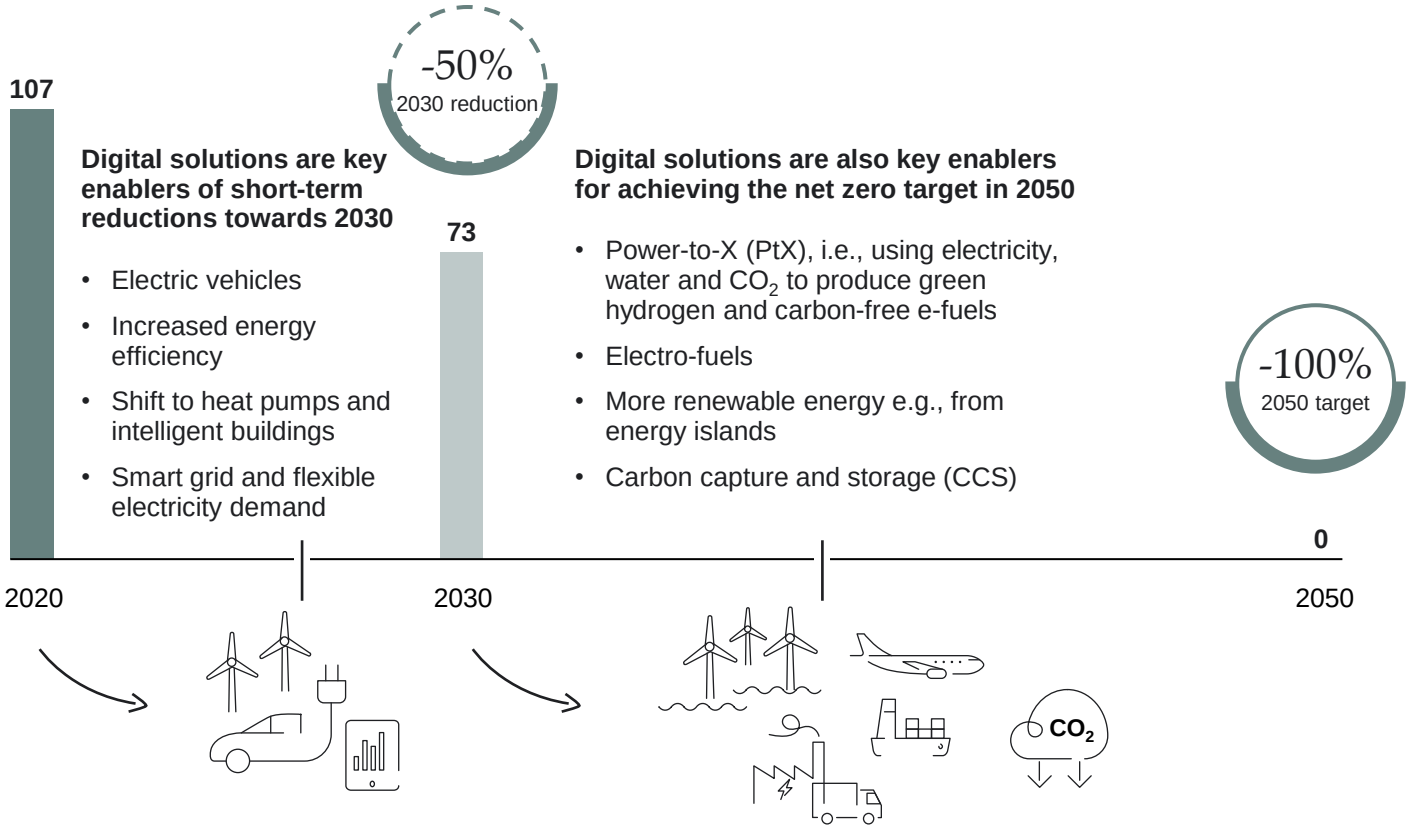


Source: Implement Economics based on EEA

Digital technologies are important enablers of the green transition

Belgium aims to become net zero by 2050. Digital innovation is seen as one of the driving forces to achieve a net zero economy. Digital technologies will play a role in decarbonising almost every corner of our society – hence, the grand idea of the twin green and digital transition.

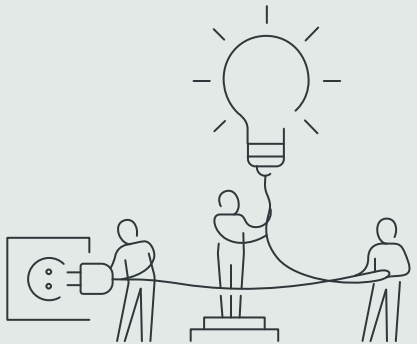
Belgium's net greenhouse gas emissions
$MtCO_2e$



Note: Emissions are defined as emissions from Belgian territory and thus do not include international transport. The Belgian governments are currently negotiating an updated emissions reduction target for 2030, which is expected to be around 50% relative to 2005. The previous target was 35% relative to 2005.
Source: Implement Economics based on the EEA and Climate.be.

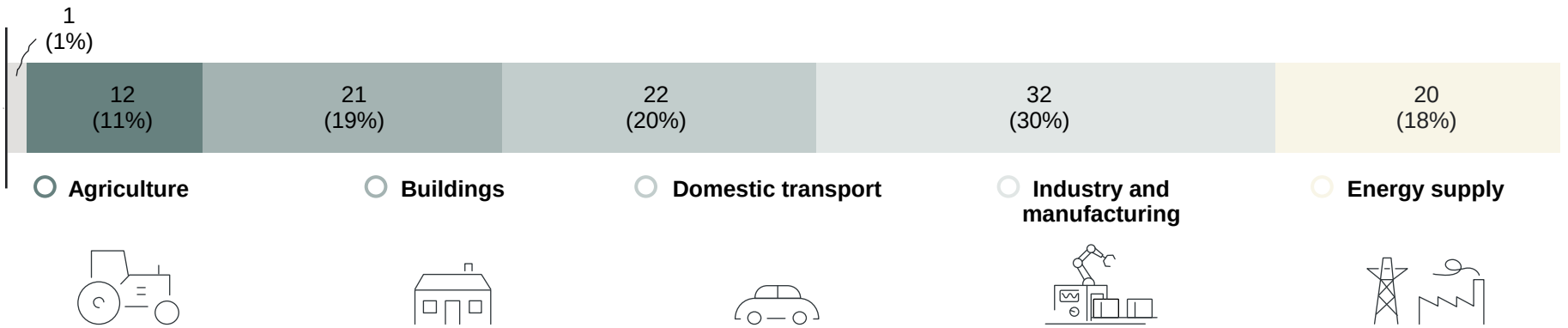
What is the twin transition?

Twin transition refers to the interplay between digital and green transitions. Digital technologies will help economies reduce carbon emissions. Similarly, the green transition of our energy system will help the digital sector reduce its operational emissions.



Manufacturing and domestic transport account for half of Belgium's greenhouse gas emissions

Belgium's net greenhouse gas emissions, 2020
$MtCO_2e$



Decarbonisation initiatives in main sectors
(non-exhaustive)

- Efficiency improvements from precision farming
- Reduced food waste
- Changes in land-use
- Green fuels based on PtX for heavy machinery

- Smart buildings
- Transition to heat pumps
- Improved energy efficiency
- Sustainable building materials

- Electric cars, vans, busses and small trucks
- Efficient and eco-friendly driving
- Reduced travel by use of digital tools (work-from-home and video-conferences)
- Green fuels based on PtX for ships, aircraft and heavy vehicles

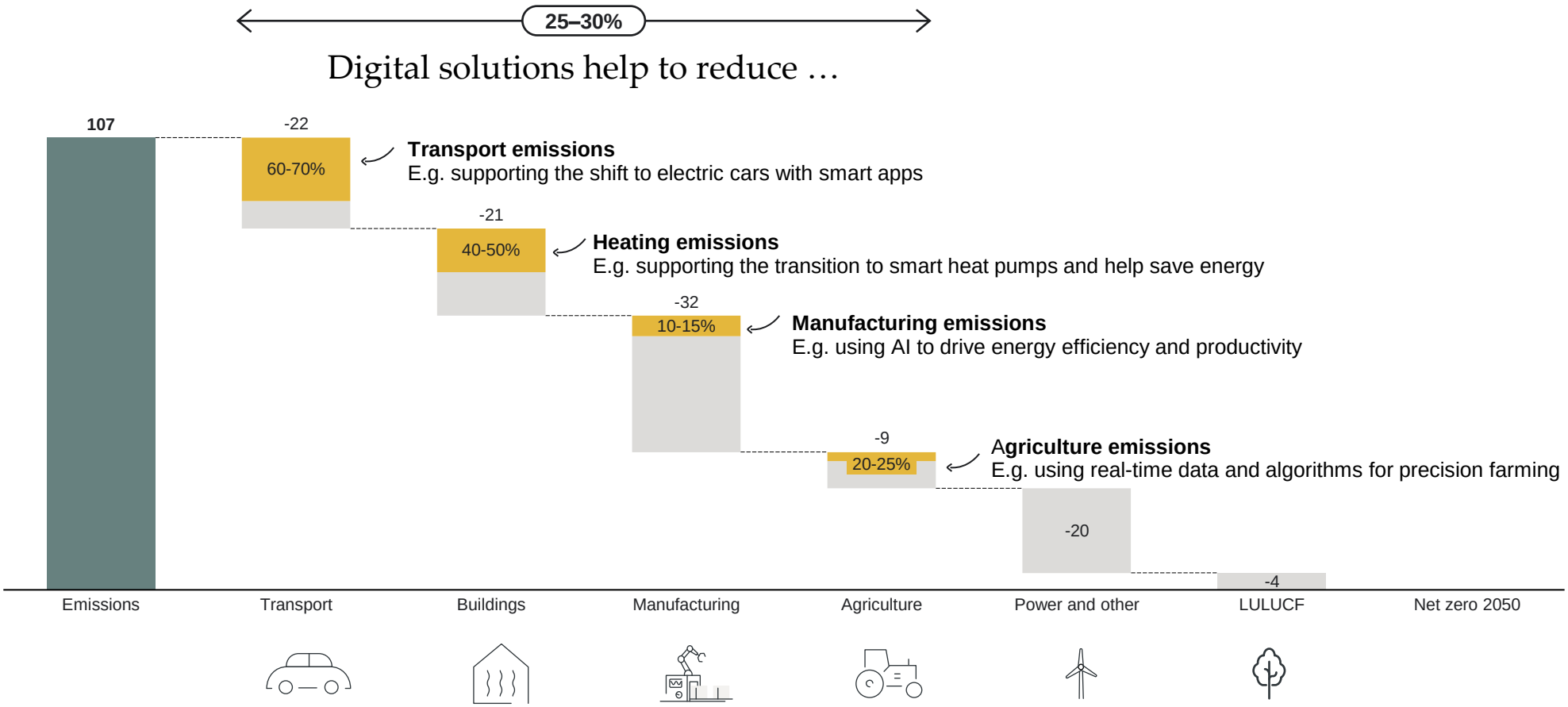
- Smart factory with AI systems
- Efficiency improvements
- Electrification of lighter processes
- Green fuels from PtX for heavy processes

- Expansion of renewable energy
- Electrification
- Smart grid
- Flexible electricity demand

Note: Data on net greenhouse gas emissions and removals, sent by countries to UNFCCC and the EU Greenhouse Gas Monitoring Mechanism (EU Member States). This data set reflects the GHG inventory data for 2022 as reported under the United Nations Framework Convention for Climate Change. CRF inventory categories: Energy supply: CRF 1A1 (energy industries) + 1B (fugitives); Industry and manufacturing: CRF 1A2 (manufacturing industries and construction) + CRF 2 (industrial processes and product use); Domestic transport: CRF 1.A.3; Residential and commercial: CRF 1A4a (commercial) + CRF 1A4b (residential); Agriculture: CRF 1A4c (agriculture, forestry and fishing) + CRF 3 (agriculture); Waste: CRF 5 (waste); Land Use, Land-Use Change and Forestry (LULUCF): CRF 4 (LULUCF); Other combustion (CRF1A5a + CRF1A5b + CRF indirect CO2).
Due to rounding, components may not sum to totals
Source: Implement Economics based on the EEA.

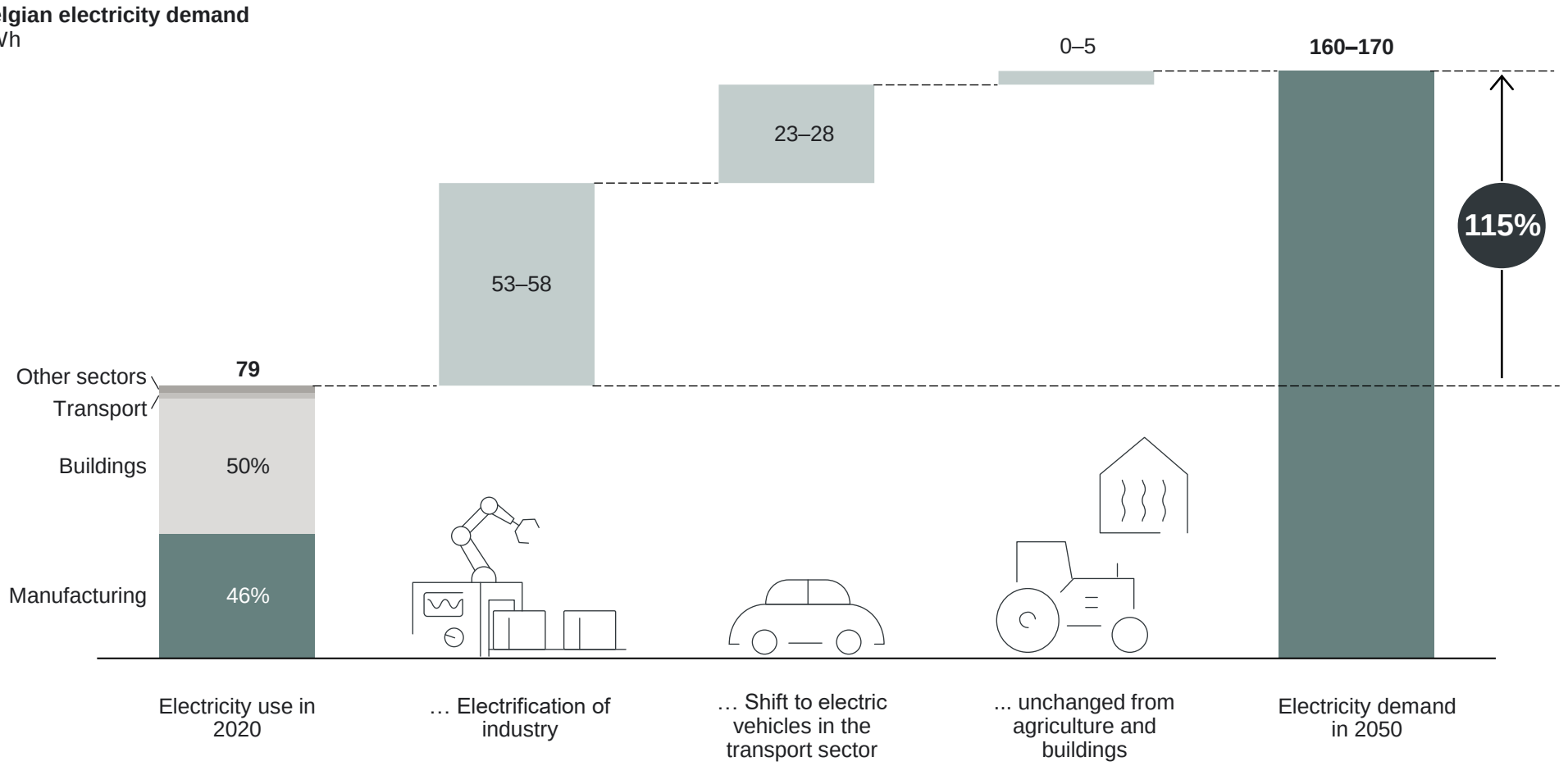
25-30% of the reductions needed for Belgium's net zero target require some degree of digital enablement

Belgium's net greenhouse gas emissions, 2020
$MtCO_2e$



Note: 'Buildings' include both commercial and residential buildings. Increased digitalisation via smart thermostats in individual homes and advanced AI-powered building management systems play an active role in saving energy and providing demand flexibility.
'Manufacturing' includes negative contributions carbon capture storage (BECCS) of magnitude 4 MtCO2e.
'Agriculture' includes emissions from agriculture and LULUCF. 'Other' includes emissions from waste.
Source: Implement Economics based on EEA, Climat.be and Aalborg University.

Electrification of industry and transportation will double Belgium's electricity use by 2050

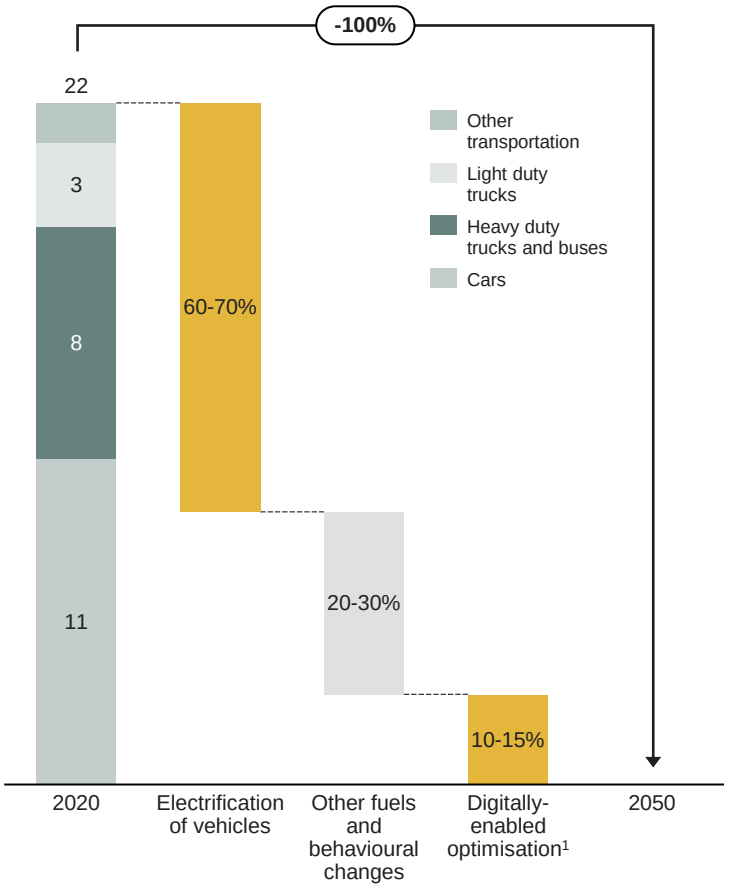


Note: Modest increases in the electricity use for buildings are due to large expected energy efficiency improvements due to switch to smart heat pumps and advanced building management systems. Increases in electricity use from industry are higher than expected by the Federal Belgian agency Climat.be.
Source: Implement Economics based on Statbel and McKinsey & Co.

Transport

Digital technologies are key enablers of the transition to carbon-free transportation

Net greenhouse gas emissions from Belgium's domestic transport
$MtCO_2e$



Decarbonising transport emissions requires ....

01. Change how we fuel our travel

Do different
Digital technologies enable the transition to non-polluting transportation alternatives

02. Change the way we travel

Use less
Digital technologies enable the reduction in use of resources through human action, or automatically reduce the use

03. Change how much we travel

Stop using
Digital technologies provide digital alternatives to transport of goods and people

Digital solutions can help this transition alongside other initiatives by …

- Digital solutions optimise EV charging and ensure that green hydrogen and e-fuels from PtX give drivers carbon-free alternatives to fossil fuels.
  → *See Monta case.*

- Digital ride-sharing platforms contribute to lower emissions by enabling higher utilisation of vehicles.
- Digital solutions for public transport improves passenger experience and ease the transition to low-emissions options like trains and buses, as for example in the city of Namur.[2]
- AI and Eco-routing software helping drivers and freight transport choose the most energy efficient route together with digital solutions optimising traffic lighting and mobility.
  → *See Toqua case.*

- Video-conferencing and work-from-home saves transportation emissions

60-70%

of the emission reductions in domestic transportation towards 2050 is expected to come from electrification, which in turn requires digital solutions to happen at scale and at acceptable social cost.

Note: Assuming the digitally enabled share of reductions in Belgium is the same as at the EU level.
1) Includes virtualisation, traffic control optimisation and smart logistics.
2) STI Namur is the first Intelligent Transport System of Wallonia for citizens, which provides real-time information of the best itineraries for citizens to travel in or to the city, cycling infrastructure, bus timetables, car sharing, parking spots, city bikes, cf. Digital4Climate report by Agoria. Real-time reliable information provided by IoT sensors like cameras, air quality sensors, parking spot availability and data from Cambio about e.g., bus delays and traffic movements is intended to ease the use of public transport.
Source: Implement Economics based on the EEA, Agoria and Climat.be.

CASE | Artificial Intelligence helps decarbonise shipping by unlocking the 10% fuel-saving potential of sensor data

Toqua has developed an accurate vessel performance model using artificial intelligence (AI) on ship sensor data to unlock fuel-saving potential.

Technology

Toqua's ship performance model, Ship Kernels, employs AI on ship sensor data to accurately estimate the impact of factors like wind, waves, currents, and speed on vessel performance.

The model seamlessly integrates with ship operators' existing route optimisation tools, providing enhanced vessel performance data. This improved data foundation is used to calculate more precise cost estimates for route optimisation.

Leading companies in the industry, such as Euronav and Vroon, are already benefiting from this solution. For example, Euronav has found that Toqua's solution can double its fuel savings compared to traditional ship performance models.

Toqua's solution has the ability to double the reductions achieved by traditional ship performance models.

Effect

The solution enables ship operators to reduce their carbon footprint by selecting the route with the lowest fuel consumption, while also saving costs on the fuel saved.

Toqua estimates that fuel savings can range from 2-15%, depending on ship type, operating profile and data quality.

Decarbonisation potential

Toqua aims to achieve a 10% reduction in fuel consumption for 6,500 ships by 2026.

If they fulfill this ambition, it will result in a reduction of ~22 million tonnes of CO_2e globally, equivalent to removing all emissions from domestic transport in Belgium.

Source: Implement Economics based on Toqua.

IM_

TOQUA

Sector

- Transportation

Type

- Use less

Objectives

- Decarbonise shipping

Technology

- AI, machine learning

CASE | Software enabling flexible charging of electric vehicle eases the transition to electric mobility

Monta has developed a smart operating platform powering the electric vehicle (EV) charging ecosystem serving drivers, companies, cities, and the electricity grid. Their mission is to provide the best technology solutions for the entire EV charging ecosystem.

Technology

Monta's solution makes it easier for EV drivers to charge anywhere and for charge point operators to manage, monitor and optimise EV charging.

The solution enables EV owners to reduce their carbon footprint by enabling them to charge when the CO_2 intensity in the grid is low while also saving costs by avoiding peak demand on the grid.

On the road, the solution provides access to over 450,000 charge points, soon covering the majority of charging stations in and outside Europe.

It also gives charge point owners the opportunity to make their charge point public with customised time schedules and prices.

The software offers full transparency over individual usage, consumption and pricing and is compatible with over 350 charge point models.

At workplaces, it enables smart charging including optimising EV fleet charging. By utilising digital technologies, the solution makes it possible to meet the growing charging demand by optimising the utilisation rate.

Effect

Monta simplifies EV charging and makes it more reliable, easing the transition to EVs. Further, the different features of Monta's solution aids in preventing costly unnecessary grid expansions by utilising the existing grid efficiently.

Decarbonisation potential

Road transport has an outsized impact on the environment, accounting for 20% of EU27's GHG emissions and 16% of Belgium's GHG emissions.

EVs are a key component in achieving net zero transportation, and solutions like Monta that ease the shift to greener cars are essential in the transition.

Source: Implement Economics based on Monta and the EEA.

IM_

MONTA

Sector

- Transportation

Type

- Do different

Objectives

- Optimise EV charging

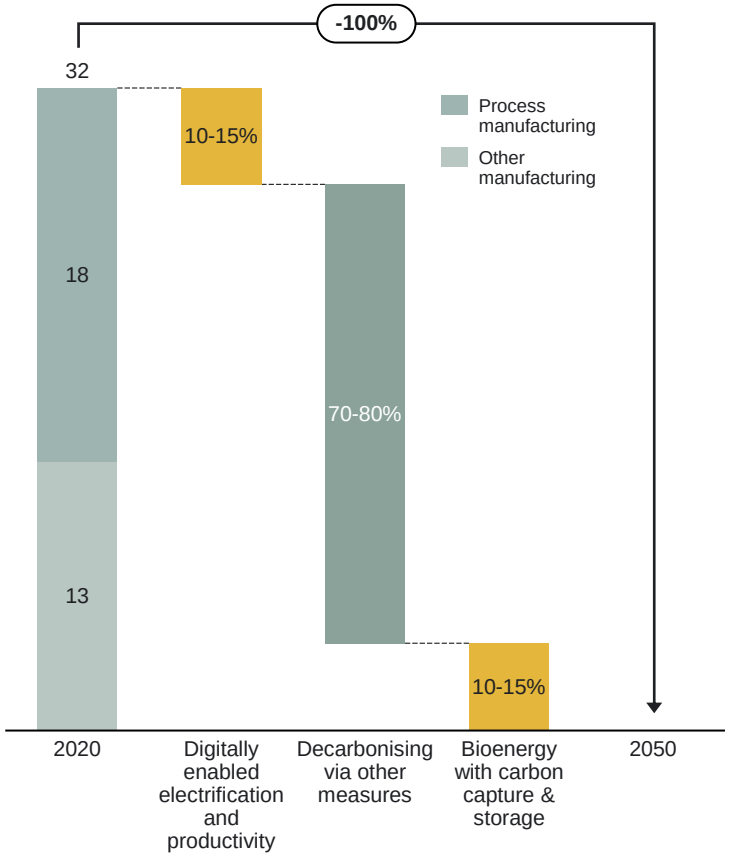
Technology

- Cloud technology, machine learning, AI, IoT

Manufacturing

Digital solutions are helping to improve manufacturing energy efficiency, supporting electrification and reduce over-production

Net greenhouse gas emissions from Belgium's manufacturing sector
$MtCO_2e$



Decarbonising manufacturing emissions requires ....

01. Change production processes

Do different
Digital technologies enable the transition to cleaner production processes

Digital solutions can help this transition alongside other initiatives by …

- Digital solutions are used to optimise production processes at the factory floor and in the supply chain and is increasingly used for energy efficiency purposes
  → *See Renault case.*
- Digital twin allows fewer production processes by virtual simulation

02. Change how we fuel our plants

Stop using
Transition to heat pumps with digitally enabled smart grids

- Smart factory transformations are changing how plants are fueled and optimised, which requires digital enablement
  → *See Arcelor Mittal case.*

03. Change how we forecast demand

Produce less
Reducing overproduction with digitally enabled demand forecasting

- AI and machine learning can help to better forecast demand in e.g., food production or clothing, leading to less overproduction and hence less energy use. A study of the global fashion industry suggests emissions could be reduced by 3-6% in 2030 using demand forecasting.

10-15%

of the emission reductions in manufacturing towards 2050 will require some degree of digital enablement

Note: Projections of emissions from the manufacturing sector in 2050, e.g., in Climat.be, vary with the projected degree of carbon capture and storage.
Source: Implement Economics based on EEA, GFA & McKinsey, and Climat.be.

CASE | Sensor technology advances carbon neutral steelmaking

ArcelorMittal, one of the world's leading steel producers, uses digital technologies at its plant in Ghent to be among Europe's most efficient and lowest emissions integrated steelworks.

Technology

ArcelorMittal's plant in Ghent employs sensor technology to efficiently manage its operations.

The large amount of data collected from the sensors is analysed using big data technology to identify potential savings related to energy, water, and wear and tear on machinery.

Effect

The use of sensor technology provides ArcelorMittal with real-time insights into its plant's performance, energy consumption and the health-status of its assets.

These insights help them improve the efficiency of their operations and detect maintenance needs and issues at an early stage, allowing them to intervene before the problem becomes severe.

Decarbonisation potential

In Belgium, steel and iron production accounts for 13% of emissions within the industry and manufacturing sector.

To achieve a net zero manufacturing sector, it is essential to make steel and iron production carbon neutral. Sensor technology, together with other technologies, can help accelerate the pathway to carbon neutral steelmaking.

ArcelorMittal

Sector

- Manufacturing

Type

- Use less

Objectives

- Smart steel, energy efficiency, industry 4.0

Technology

- Sensor technology, big data

Source: Implement Economiccs based on ArcelorMittal and the EEA.

CASE | Cloud solutions are used to build the smart factory of the future

Renault, the French car manufacturer, uses Google Cloud solutions to build the smart factory of the future that is more efficient and consumes less energy.

Technology

Google Cloud's solutions are used to digitalise Renault's production facilities and supply-chain.

Big data and machine learning analyse over half a billion data points from Renault's factories every day, transforming them into actionable and easily understood information. This enables fine-grained monitoring and proactive detection of irregular behavior.

A custom energy consumption dashboard keeps track of energy usage and suggests actions to reduce it, resulting in a 10-20% reduction in overall energy use.

Effect

The digitalisation of Renault's production facilities and supply-chain enables proactive maintenance, extending the lifetime of assets and resulting in more efficient resource usage, while also reducing energy consumption and carbon emissions.

Decarbonisation potential

Manufacturing generates 21% and 30% of carbon emissions in the EU27 and Belgium, respectively. Making factories smart by utilising digital solutions will be key to reducing the sector's emissions and ultimately reaching net zero.

Source: Implement Economics based on Google Cloud and the EEA.

IM_

RENAULT

Sector

- Manufacturing

Type

- Do different

Objectives

- Energy saving, smart factory

Technology

- IoT, AI, cloud technology, big data, digital twin

Decarbonising digital

Decarbonisation enabled via digital solutions will outweigh emissions from data centers and future gains are significant

	Transport (21%)	Buildings (13%)	Manufacturing (21%)	Agri (13%)	Data centres (~0.5%)[1]
Share of total EU emissions in 2020					
Reductions will happen via:	A. Electric vehicles B. Alternative fuels C. Energy efficiency D. Reduced passenger transportation E. Reduced freight transportation	A. Insulation B. Energy efficiency C. District heating D. Heat pumps E. Alternative energy sources	A. Energy efficiency B. Processes efficiency C. Reduced waste	A. Grow sustainably B. Reduce consumption of livestock and other carbon-intensive products C. Increase efficiency of crops	A. Energy efficiency B. 24/7 CFE C. net zero supply chain
Digital tech crucial to this:	› **Smart charging apps** › **Artificial intelligence and machine learning** › **Mobility as a service (MaaS) platforms** › **Videoconferencing and online collaboration tools**	› **Managing supply and demand of heating through grid control** › **Artificial intelligence and machine learning** › **Smart thermostats**	› **Artificial intelligence and machine learning** › **Internet of Things (IoT)**	› **Sensors** › **Satellite data** › **Drones** › **Artificial intelligence and machine learning** › **IoT**	

In Belgian context

”Net carbon reduction potential of digital technologies is 4.7 times larger than the total footprint of digital technologies by 2030.”

Agoria, Digital4Climate report

Note: 1) Figures for data centre emissions were estimated by Implement Economics in connection with Digital decarbonisation, Implement Economics (2022)
Source: Implement Economics based on the EEA, the IEA and Agoria.

24/7 carbon-free energy is the most efficient way to progress towards a fully carbon-free digital sector

This part of the report focuses on the energy use and carbon emissions related to the operation of data centres. Although they are only responsible for part of the total footprint of the digital sector, data centres are a segment of the digital sector under the direct control of tech companies, and where tech companies can act – and have acted – to minimise their environmental impact.

24/7 Carbon-free Energy

24/7 Carbon-free Energy (CFE) means that every kilowatt-hour of electricity consumption is met with carbon-free electricity sources, every hour of every day, everywhere.

Source: UN 24/7 Carbon-free Energy Compact

The tech sector was among the first to acquire additional carbon-free energy through power purchase agreements (PPAs) and has been responsible for 45 percent of new carbon-free energy deployed through PPAs between 2010-2020, according to the International Energy Agency (IEA).

Many are going even further. After meeting its goal to match 100 percent of its electricity consumption with carbon-free energy on an annual basis, Google became the first major company to commit to operating on 24/7 carbon-free energy (CFE), which it aims to do at all in of its data centres and office campuses across the world by 2030.

Other companies such as Microsoft and Iron Mountain are also on this journey. A new global effort has been created under Sustainable Energy for All and UN-Energy to coordinate among companies, governments, and non-governmental organisations to develop new solutions to this challenge.

Google has set a goal to run on 24/7 carbon-free energy (CFE) on every grid where they operate by 2030

Google's decarbonisation journey in Belgium

In Belgium, Google acquired 23.8 megawatts of renewable energy from Luminus, provided by four dedicated, new-to-the-grid onshore wind projects. This adds to the 92 MW power purchase agreement with Engie from 2019 for the offshore wind farm Norther in the North Sea. Google projects that these PPA's will help keeping its Belgium data centers and offices at or near 80% carbon-free energy in 2024, when measured on an hourly local basis.

80%

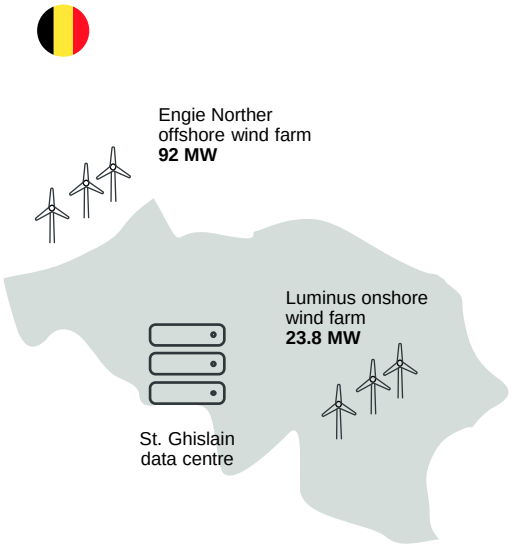
CFE-score for Google's operations in Belgium in 2022

Source: Environmental Report 2023

116 MW

Renewable energy projects in Belgium supported by Google's agreements with Engie and Luminus

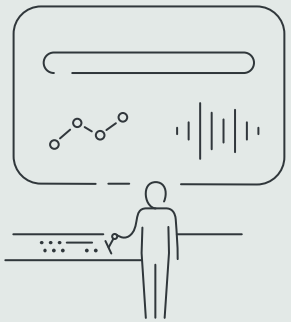
Source: Google blogpost



Note: Carbon-free energy is any type of electricity generation that does not directly emit carbon dioxide, including (but not limited to) solar, wind, geothermal, hydropower, and nuclear. Sustainable biomass and carbon capture and storage (CCS) are special cases considered on a case-by-case basis, but are often also considered carbon-free energy sources. The **carbon-free energy score** (CFE Score) measures the degree to which each hour of electricity consumption on a given regional grid is matched with carbon-free energy. An overview of Google's 24/7 energy is available at https://sustainability.google/progress/energy/. Details on Google's approach to 24/7 carbon-free energy are available at https://www.gstatic.com/gumdrop/sustainability/24-7-explainer.pdf and at https://www.gstatic.com/gumdrop/sustainability/24x7-carbon-free-energy-methodologies-metrics.pdf.

A fully decarbonised data centre industry will enable the full potential of digital decarbonisation

Decarbonising digital means minimising the carbon emissions across the entire digital value chain by decarbonising all operational electricity emissions (emissions occurring during use), as well as addressing the embodied emissions (emissions occurring during production)

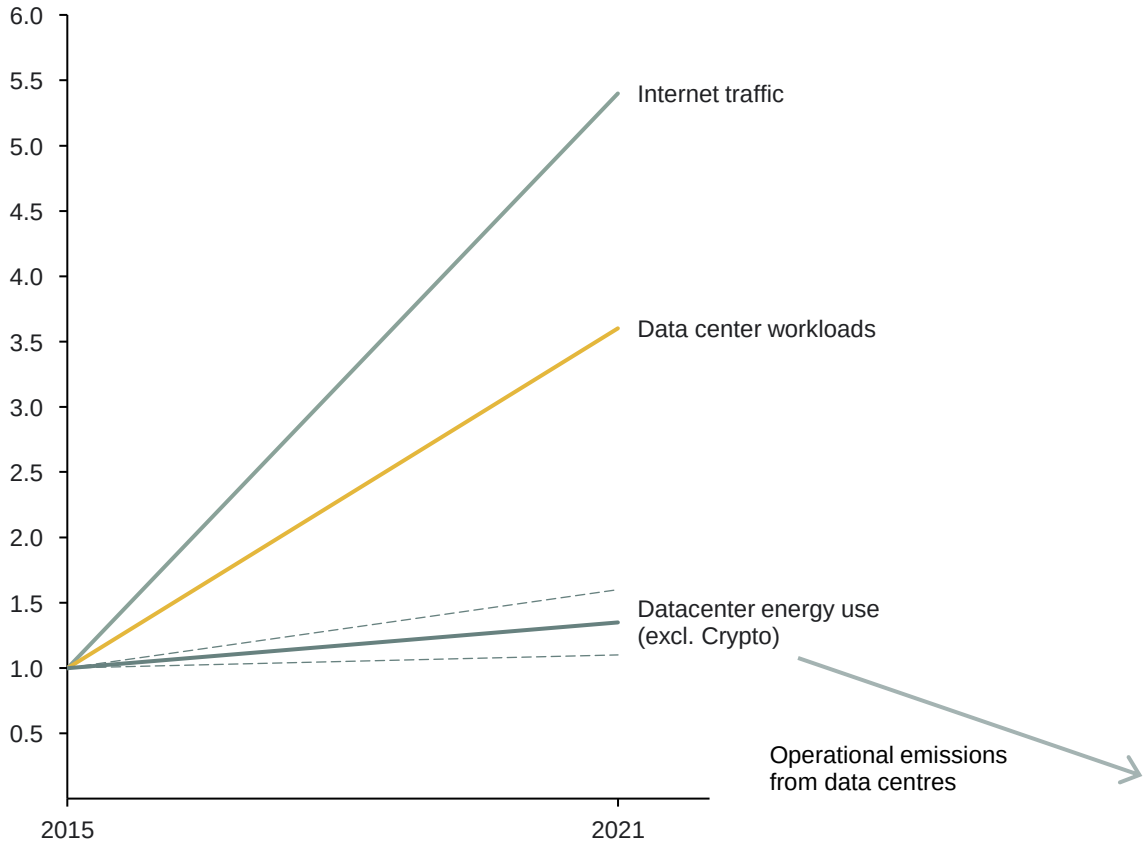


	Data centres	Networks	Devices
Operational emissions[1] *(scope 2)*	24/7 carbon-free electricity portfolios such as Google's *CFE Manager*[2] would be the most effective approach.	24/7 carbon-free energy deals, but networks do not have the same load-shifting possibilities as data centres.	Improved energy efficiency of devices plus decarbonisation of the general power supply.
Actions to make it happen:	• Accelerate carbon-free technology deployment • Provide companies and consumers with a better measurement of real decarbonisation		
Embodied emissions *(scope 3)*	Data centres should be working with their suppliers to bring down scope 3 emissions.	Network operators should be working with their suppliers to bring down scope 3 emissions.	Device manufactures should reduce operational footprint and improve circularity of products.
Actions to make it happen:	• Improved circularity in the digital sector through recycling, reusing, refurbishing, and maintaining • Improving efficiency of EU climate policies through e.g. the proposed cross-border adjustment mechanism		

Note: 1) The International Energy Agency (IEA) estimates global data centre energy use at 240-340 TWh in 2022 and global data transmission network energy use at 260-340 TWh in the same year.
2) A Carbon Free Energy Manager is an energy service provider that an energy buyer tasks with assembling a portfolio of CFE projects.

Decarbonising Europe's data centres with 24/7 carbon-free energy will save **6-18 million** tons of CO_2 in 2030

Global internet traffic, data centre workloads and energy use
Index (2015 = 1)

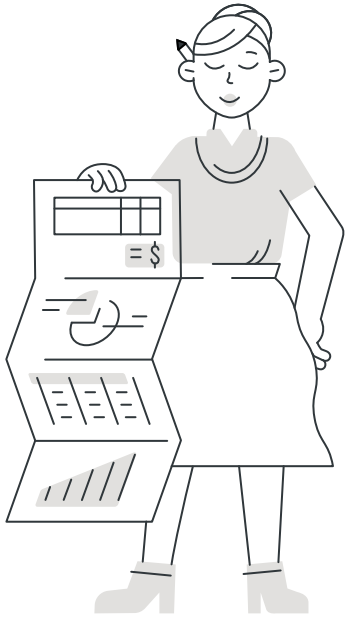


If all data centres in Europe achieve 100% hourly carbon-free energy (24/7 CFE), we will save **6-18 million tons of CO_2 in 2030**

– this is more than Belgium's agriculture emissions.

Decabornising digital towards 2030

Carbon-emissions will fall if all EU data centres meet 24/7 carbon-free energy goals such as those set by the frontrunners



Source: Implement Economics based on IEA..

Policy recommendations

Make the 2020s the decade of massive decarbonisation

The technologies for achieving the necessary emissions reductions by 2030 exist.
To achieve the net zero target by 2050 requires immediate and massive deployment of digital technologies.
Digital technologies will play an important enabling role in that transition.

A "new industrial deal" for Europe

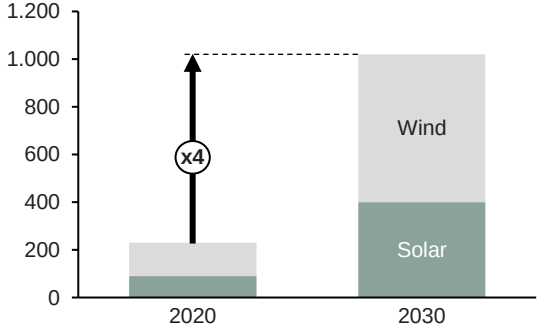
The Belgian Government has expressed the need for a "new industrial deal" to decarbonize the European economy, including green chemistry (such as Solvay), green steel (such as Arcelor Mittal) and green pharma (such as UCB).

This ambition needs to work together with the planned 120-Gigawatt renewable power sources from the North Sea and the build-out of solar energy.

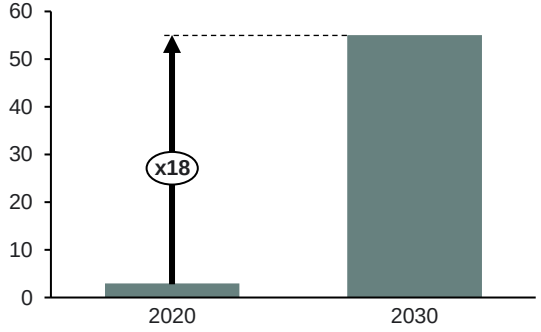
The transition calls for major increases in all sources of flexibility: batteries, demand response and low-carbon flexible power plants, supported by smarter and more digital electricity networks.

Digital solutions with real-time data (perhaps even down to the minute) and predictive AI will be important enablers of those solutions.

Global solar photovoltaic and wind capacity additions
GW



Global electric car sales
Millions



Priority actions for governments from the international energy agency (IEA)

01. **Digitalisation of networks**

- Governments need to digitalise the grid to support more flexible grid operations, better management of variable renewables and more efficient demand response.

02. **Incentives for flexible electricity system**

- Governments need to create markets for investment in batteries, digital solutions and electricity grids that reward flexibility and enable adequate and reliable supplies of electricity.

03. **Safe and secure networks**

- The resilience of electricity systems to cyber attacks and other emerging threats needs to be enhanced.

04. **Social acceptance of digital solutions**

- Measures should be put in place to ensure social acceptance of the digitalisation of electric vehicles and other digital solutions, for example controlling the heating system in people's homes.

Note: GW is gigawatt installed capacity.
Source: Implement Economics based on the International Energy Agency (IEA) and speech by Prime Minister De Croo at UN Assembly September 2023.

Policies at EU and national level can help advance the digital and green transformation in Belgium

Digital decarbonisation

How might we **maximise the enabling role of digital technologies** by accelerating already available digital solutions at scale within the key sectors of the Belgian economy?

Accelerate the digital transition

- **Strengthen EU policy** framework by giving **incentives to invest in cost-effective digital climate solutions**
- Ensure **efficient movement of capital** into the most effective digital climate solutions
- Creating **sector plans in partnerships**
- Strengthening **coherence** between EU and national policy initiatives
- Further strengthening the digital and green element in **EU's external trade policy**

Decarbonising digital

How might we **minimise the carbon emissions across the entire digital value chain** by decarbonising all operational electricity emissions, and addressing the embodied emissions?

Reduce operational and embodied emissions

- Accelerating carbon-free **energy deployment**
- Providing companies and consumers with a **better measurement** of real decarbonisation (e.g 24/7 carbon free energy)
- Improving **circularity** in the digital sector through recycling, reusing, refurbishing, and maintaining

For more details, please see the full report on *Digital Decarbonisation*

Digital skills and digital businesses can help unlock digital decarbonisation in Belgium … and policies from digital frontrunners can serve as inspiration

Digital skills

A digitally skilled workforce

Digital compass

Frontrunners

- **Target 1:** Minimum 80% of individuals aged 16-74 have basic digital skills

- **Target 2:** 20 million ICT specialists in the EU

Digital business transformation

Digitally empowered businesses

Digital compass

Frontrunners

- **Target 3:** 75% of companies in the EU have taken up cloud computing, big data and AI

Cloud

Big data

AI

- **Target 4:** Doubling the number of EU unicorns

- **Target 5:** More than 90% of EU SMEs reach at least a basic level of digital intensity

Policy ideas from frontrunners

The frontrunners are applying a wide range of policies to increase digital skills - and the approach is becoming more and more targeted

A digitally skilled workforce

Digital Compass Target 1
More people having basic digital skills

Digital Compass Target 2
More ICT specialists

Building skills

Pre-school, primary, secondary

- Digital literacy a new learning area in primary and secondary education
- More women in ICT.
  Initiative example: Unicorn Squad (private funding)
- Teachers must implement technology in their teaching
  Initiative example: Cross-curricular Technology and Innovation
- Interest in IT from a young age.
  Initiative example: ProgeTiger
- Introduce pupils to coding in primary school

Tertiary

- New type of coding education based on project-based learning
  Initiative example: Kood/Jõhvi (private funding)
- An action plan to meet the growing demand for ICT professionals
  Initiative example: HCA ICT

Life-long learning

- New training models for adults to support lifelong learning
  Initiative example: The Digital Age Skills Programme
- Bootcamps to increase the number of software developers
  Initiative example: CHOOSE IT
- Reducing skills mismatch by training immigrants
  Initiative example: Integrify
- Short specialist courses for lifelong learning
- Subsidy scheme to ensure digital inclusion
  Initiative example: Count on Skills
- Guidance and help with the use of devices of services
  Initiative example: Digital support in using web services and devices

Attracting and retaining skills

- Special taxation of foreign specialists (‘green card’)
- Visa systems for foreign specialists
- Active recruiting campaigns
- Branding and marketing

Frontrunners are applying a range of policies to digitally empower businesses – and still searching for an effective policy approach

Digitally empowered businesses

Digital Compass Target 3
More companies take up cloud computing, big data and AI

Digital Compass Target 4
More unicorns

Digital Compass Target 5
More SME's reach at least a basic level of digital intensity

Governance

- Position Denmark to fully leverage the opportunities of AI
  Initiative example: National Strategy for Artificial Intelligence
- Roadmap to an ethical and human-centric design and governance of AI
  Initiative example: A National Artificial Intelligence Strategy for Ireland

Financial support

- A digital transformation and e-commerce scheme for SMEs
  Initiative example: SME:Digital
- Funding and network for SMEs
  Initiative example: SME initiative (OP)
- One of the largest data analytics centres in Europe
  Initiative example: Insight

AI enablers and other incentives

- Increase organisations' understanding of how to better utilize data, machine learning and AI
  Initiative example: First Artificial Intelligence Accelerator
- Free online courses on AI
  Initiative example: The Finnish Center for Artificial Intelligence
- Public funding to digital technology start-ups
  Initiative example: The National Digital Research Centre
- Public-private partnership to further develop the use of Big Data
  Initiative example: Commit2Data
- Greater use of satellite-based data in higher education
  Initiative example: Strategy for Denmark's Digital Growth
- Boost awareness about digitalization and the opportunities for SMEs
  Initiative example: Digitaliseringslyftet

Guidance and regulation

- National regulation on automated decision-making
- Public-Private partnership to accelerate the development and application of AI
  Initiative example: NL AIC
- Automated business reporting – digital business processes for all companies

Note: Framework is adapted from OECD.AI (2021).

Annex 1
Initiative examples - Digitally skilled workforce

Early stage education | Frontrunners continue to invest in their population's digital skills to maintain their position

Target 1

Digital literacy a new learning area in primary and secondary education

- Area: New Educations
- Initiative name: N/A
- Period: 2020
- Budget: N/A

The curriculum is designed in collaboration between the government, schools, umbrella organisations, content experts and ICT professionals. The collaboration also has the goal to support teachers in their work through targeted use of digital tools.

PROPOSAL

Target 2

Interest in IT from a young age

- Area: New Educations
- Initiative name: ProgeTiger
- Period: 2012-
- Budget: N/A

The programme's objective is to encourage the use of technology in teaching from preschool to high school and vocational school to spark interest in IT and improve technological literacy and digital competencies. The program includes courses in programming, robotics and 3D technology. The focus is on three major areas engineering sciences, information technology, and design & technology.

Target 2

Teachers must implement technology in their teaching

- Area: New Educations
- Initiative name: Cross-curricular 'Technology and Innovation'
- Period: 2013-
- Budget: N/A

All teachers in primary school must include technology in their teaching. This means that teachers regardless of which subject they teach in has to integrate technology as part of their teaching. It is not specified in the cross-curricular what to use or how to use technology in teaching. The objective is to introduce and educate children in technology from a very young age.

Target 2

More women in ICT

- Area: New Educations
- Initiative name: Unicorn Squad
- Period: 2019-
- Budget: N/A

The Unicorn Squad movement started in 2019 and offers girls aged 8-12 to get hands-on experience with robotics and tech. Today, there are more than 130 clubs around Estonia and more than 1600 members.

PRIVATELY FUNDED

Target 2

Introduce pupils for coding in primary school

- Area: New Educations
- Initiative name: N/A
- Period: 2016-
- Budget: N/A

Coding is a cross-curricular activity from the first year of school. It is not a subject on its own but must be integrated as a part of teaching in other subjects to develop pupils computational thinking skills.

Tertiary education | Frontrunners are investing in new types of education to build the next generation of ICT specialists

Target 2

New type of coding education based on project-based learning

- Area: New Educations
- Initiative name: Kood/Jõhvi
- Period: 2021-
- Budget: N/A

Kood/Jõhvi is a new type of coding education in Estonia. The education is a 2-year full-time study and students will develop the most valuable skills for the IT industry. After finalising the study students will be ready to start a career as software engineer.

PRIVATELY FUNDED

Target 2

An action plan to meet the growing demand for ICT professionals

- Area: Knowledge transfer and public networks
- Initiative name: The Human Capital Agenda ICT (HCA ICT)
- Period: N/A
- Budget: N/A

The Human Capital Agenda ICT is a action plan to meet the growing demand for ICT professionals. HCA ICT supports the supply of ICT professionals by:

- Encouraging and support regional cooperation between businesses and education to ensure that education is better linked to the local labour market
- Inspire and inform students in secondary school about the opportunities the labour market offers to ICT professionals
- Promote knowledge transfer of new technologies to ensure that the Dutch workforce has sufficient basic digital skills. This is done by stimulating cooperation between the business community and education and by increase the number of ICT centres in vocational and higher education.

Life-long learning | Frontrunners are seeking more and more targeted initiatives to build digital skills - also by investing in marginal groups

Target 2

Bootcamps to increase the number of software developers

- Area: New educations
- Initiative name: CHOOSE IT
- Period: N/A
- Budget: N/A

‘Choose it’ is an adult bootcamp with the objective to provide participants with basic software development skills. The bootcamp consist of 6 weeks full-time study, followed by 8 weeks internship in a company.

Target 1

New training models for adults to support lifelong learning

- Area: New educations
- Initiative name: The Digital Age Skills Programme
- Period: start 2018
- Budget: N/A

A national programme supporting lifelong learning by funding new educational programmes, courses and training models that are focused on improving and strengthening the digital skills of adults.

Target 2

Reducing skills mismatch by training immigrants

- Area: New educations
- Initiative name: Integrify
- Period: start 2016
- Budget: N/A

Integrify is a programming school for immigrants. The objective is to integrate immigrants into the workforce by training them as software developers and at the same time reduce the mismatch between the skills in the labor force and the demanded skills by the employers.

Target 2

Short specialist courses for lifelong learning

- Area: New educations
- Initiative name: N/A
- Period: 2018-
- Budget: 10 million per year in 2018 and 2019.

The Swedish Government has assigned Vinnova to produce short university courses at the advanced level for working specialists. When developing the courses the needs of SMEs and LEs are taken into account.

Target 1

A network to promote digital participation and opportunities for people to advance their digital skills

- Area: New Network
- Initiative name: Digidel
- Period: 2013-
- Budget: N/A

The objective of the Digidel network is to increase digital participation and accessibility to digital services in Sweden.

Life-long learning | Substantial funding and awareness campaigns are also initiated to improve digital skills

Target 1

Guidance and help with the use of devices of services

- Area: Public awareness
- Initiative name: Digital support in using web services and devices
- Period: start 2019
- Budget: N/A

The Finish government has a large focus on increasing digital skills in the population outside the labor force. The objective of this programme is to help elderly with the use of devices of services such as mobile phone, computer etc.

The support includes courses on the use of devices, guidance events and one-on-one help if needed.

Target 1

Subsidy scheme for life-long learning

- Area: Subsidy/funding
- Initiative name: STAP
- Period: 2022-
- Budget: EUR 200 million annually

STAP is a subsidy scheme introduced by the Dutch Government to support lifelong learning and development. The purpose of STAP is to allow anyone connected to the Dutch labour market to keep their skills up-to date. Anyone who are connected to the labor market can apply to receive training.

Annex 2
Initiative examples - Digitally empowered businesses

Governance | Examples of national strategies

Target 3.c

Roadmap to an ethical and human-centric design and governance of AI

- Area: National strategies, agendas and plans
- Initiative name: A National Artificial Intelligence Strategy for Ireland
- Period: 2021-
- Budget: N/A

The objective of Ireland's National AI strategy is to ensure that Ireland can unleash the potential that AI can provide.

The strategy sets out a high-level direction for the implementation of AI in Ireland.

The strategy contains a number of initiatives including:

- Promote and expand courses which educate the general public about AI
- Consider how AI can be incorporated into future policy for digital learning
- Developing an AI programme for enterprise of targeted funding and advisory measures for AI adoption
- Establish an AI Innovation hub to increase AI adoption by Irish enterprises

Target 3.c

Position Denmark to fully leverage the opportunities of AI

- Area: National strategies, agendas and plans
- Initiative name: National Strategy for Artificial Intelligence
- Period: 2019-
- Budget: EUR 9,2 million for 2019-2027

The strategy contains 24 initiatives including:

- In collaboration with the business and research communities the Government will identify five public data sets that will be made available to contribute to the development of AI.
- Create a digital hub for public-private partnerships that among other things will improve life-science companies' ability to do research using AI on Danish health data.
- Provide adult education and continuing training to strengthen the digital competencies in the workforce and ensure that the needs of the labor market are met.

Financial support | Frontrunners are turning their attention from high-level strategies to real action to fund next level digitisation

Target 5

Funding and network for SMEs

- Area: Grants for business R&D and innovation
- Initiative name: Business Finland funding
- Period: N/A
- Budget: N/A

Business Finland is the finish government organization for innovation funding and trade. Business Finland have several funding schemes which are targeted towards SMEs. One of their focus areas is digitisation and besides funding they offer companies a strong network, support and seminars about the latest global digital trends.

Target 5

A digital transformation and e-commerce scheme for SMEs

- Area: Grants for business R&D and innovation
- Initiative name: SME:Digital
- Period: 2018-2023
- Budget: 23.5 mDKK (from 2021-23)

The objective of the scheme is to help SMEs up the digital ladder. SMEs can apply for grants for purchase of private counselling, innovative sprint courses, competence courses, sparring and networking as well as guidance on regulation and competitive conditions.

Target 3.b

One of the largest data analytics centres in Europe

- Area: Project grants for public research
- Initiative name: Insight - SFI Research Centre for Data Analytics
- Period:
- Budget: EUR 150 million

Insight seeks to derive value from Big Data and provide innovative technology solutions for industry and society by supporting 450 researchers that conduct research within areas like data science, machine learning and AI.

AI enablers and other incentives | Networks and partnerships are in focus in several frontrunners

Target 5

Public funding to digital technology start-ups

- Area: Networking and collaborative platforms
- Initiative name: The Technology Centre Programme
- Period: N/A
- Budget: N/A

The Technology Centre programme is a joint initiative between Enterprise Ireland and IDA Ireland. It allows Irish companies and multinationals to work together on market focused strategic R&D projects in collaboration with research institutions.

There are 8 different technology centres in the programme among others:

- CeADAR Technology Centre which are the National Centre for Applied AI
- MCCI Technology Centre which focus on carrying out microelectronic circuit research for the benefit of industry
- Learnovate which is one of the leading research and innovation centres in learning technologies. The centre offers strategic research and innovation services to individual companies that develop learning technologies; and companies that acquire and use learning technologies

Target 3.b

Public-private partnership to further develop the use of Big Data

- Area: AI/Big data specific skills and education
- Initiative name: Commit2Data
- Period: 2014-
- Budget: EUR 154 million (until 2020)

Commit2Data is a long-term national research and innovation programme. The programme is a public-private partnership that has been created to bring researchers and entrepreneurs together to explore new Big Data business models and opportunities.

The objective of the program is to maintain and strengthen the Netherlands knowledge and position in big data. The programme will expand the knowledge about big data and at the same time contribute to regional anchor points for valorisation and dissemination of big data.

Target 3.c

Free online courses on AI

- Area: Knowledge transfers and business advisory services
- Initiative name: The Finnish Center for Artificial Intelligence (FCAI)
- Period: start 2018
- Budget: N/A

FCAI offers different courses in AI for free. The objective is to make AI more accessible and strengthen the digital skills of the labor force.

Target 3.c

Increase organisations' understanding of how to better utilize data, machine learning and AI

- Area: AI/Big data specific skills and education
- Initiative name: First Artificial Intelligence Accelerator (FAIA)
- Period: start 2018
- Budget: N/A

The FAIA helps Finnish organisations deploy artificial intelligence (AI).

They facilitate 2-3 months long AI training programs where organisations learn the basics of AI and what it takes to succeed with AI-driven products.

AI enablers and other incentives | Raising awareness and creating dialogue across sectors is an integrated part of frontrunner initiatives

Target 5

Boost awareness about digitalization and the opportunities for SMEs

- Area: Knowledge transfers and business advisory services
- Initiative name: Digitaliseringslyftet (Kickstart)
- Period: 2016-2020
- Budget: EUR 7,7 million

The objective is to strengthen the digitalisation in firms with special focus on SMEs in the manufacturing sector. Through coaching and workshops digitalisation is de-dramatize and opportunities is identified while lowering the threshold for firms to get started. The Initiative is a part of the Swedish digitalisation strategy of businesses called “Smart Industry”.

Target 3.b

Greater use of satellite-based data in higher education

- Area: National strategies, agendas and plans
- Initiative name: Strategy for Denmark’s Digital Growth
- Period: 2018-
- Budget: N/A

The Danish Government will initiate a dialogue with education institutions to identify relevant courses in which satellite data can be used. The initiative will enhance the digitalisation of higher educations and at the same time support the development of skills to apply and use big data in the labour force

Guidance and regulation | The regulatory aspects of digital transformation is an emerging area of attention – more to come

Target 3.c

National regulation on automated decision-making

- Area: Emerging regulation
- Initiative name: N/A
- Period: 2020-
- Budget: N/A

In Finland, the Ministry of Justice and the Ministry of Finance are currently examining national regulation on automated decision-making.

The objective is to improve the regulatory environment and governance in order to encourage digitalization.

Target 3.c

Public-Private partnership to accelerate the development and application of AI

- Area: Networking and collaborative platforms
- Initiative name: The Netherlands AI Coalition (NL AIC)
- Period: 2019
- Budget: More than EUR 500 million per year

The NL AIC was set up to substantiate and stimulate AI activities in the Netherlands. The NL AIC is a public-private partnership in which the government, the business sector, educational and research institutions, as well as civil society organisations collaborate to accelerate and connect AI developments and initiatives. Today there are more than 400 organisations in the programme.

NL AIC works as the catalyst for AI applications in the Netherlands and has implemented several initiatives:

- The AiNed Programme aims to accelerate the development and application of AI. The programme focus on stimulating innovative AI applications in companies, increase AI knowledge and the capacity for AI training in the labor market, develop AI ethics and make data available for AI in a safe and responsible manner.
- A platform for the participants to knowledge transfer and collaborate to accelerate and connect AI developments and initiatives.

Guidance and regulation | Accelerating business digitisation – also for SMEs

Target 5

Automated business reporting – digital business processes for all companies

- Area: Emerging regulation
- Initiative name: Automated Business Reporting
- Period: Not yet implemented
- Budget: N/A

The Danish government has identified a great potential in automating bookkeeping and accounting through digital accounting systems. Today, Danish SME's use €4.4 billion yearly in labor costs related to invoice handling, bookkeeping and financial reporting.

The Danish Government plans to introduce regulation that will require the vast majority of Danish companies to use digital accounting systems in order to reap benefits for both the individual companies, authorities and the general economy. This will also support the digitation of businesses.

By introducing digital and automated bookkeeping processes, it minimizes heavy manual processes, administrative burdens and frees resources in the companies to solve the company's core tasks.

Automated Business Reporting also provides clear benefits for the authorities both through potential efficiency savings but also through more targeted auditing and financial monitoring.