Digital as a Key Enabler for Climate Action

The European Union and United Kingdom Perspective

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Introduction

As an addition to our global study "The Road to Sustainability: Digital Technologies as a Key Enabler for Climate Action," this **regional chapter** further explores how digital technologies can be leveraged to meet the challenge across the three pillars of climate action (Mitigation, Adaptation & Resilience, Setting Foundations). As one out of six regional deep dives, this chapter is intended to adapt global recommendations to the local context and distinct regional dynamics of **the European Union and the United Kingdom.**

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Climate Action in the European Union and United Kingdom – the current state

As the coming years will have the greatest influence on future climate stability, there is little time left to deploy and implement climate protection actions. One key component, though not sufficient on its own, is the reduction of greenhouse gases (GHG) (mitigation) to meet the Paris Agreement commitments to **limit overall global warming to 1.5 °C.**

The European Union, currently the world's 4th largest greenhouse gas emitter with **annual emissions amounting to 3.59 Gt CO2eq in 2022,**[1] (6.67% of total global GHG emissions), plays a significant role in addressing climate change. Germany, with its robust automotive industry, and France, a leader in the aviation sector, are the largest emissions contributors within the EU, with respectively 21.9% and 12.0% of the regions' emissions. Despite no longer belonging to the EU, the UK remains a significant economic partner in terms of trade and regulation implications and currently ranks as a close third.[2]

Balancing member state interests and addressing complexities such as potentially diverging interests between different stakeholder groups within the EU, complex decision-making processes, and social differences across Europe are key considerations for the EU in tackling climate change from a technological, political, and societal perspective. In addition to their role as sources of emissions, scientific projections highlight the climate-related risks facing ecosystems, economic sectors, and public health in Europe. This is particularly pressing given that the region has encountered a warming trend that is twice as intense as the global average over the last four decades,[3] with 2023 being the warmest year on record as temperatures reached 1.43 °C above the preindustrial average,[4] thereby underscoring the immediate need for climate mitigation measures.[5]

Climate KPIs EU

Measure	Unit
Climate Indicators[6]	
Expected rise in average surface temperatures in a business-as-usual scenario	SSP5-8.5: 4.1 to 8.5 °C
Expected rise in average surface temperatures if all NDCs are achieved	SSP1-2.6: projected warming of 1.2 to 3.4 °C
Activity Indicators	
Absolute emissions per year (CO_2e)	**2022** 3.59 Gt CO_2eq[7]
GHG per capita (CO_2e)	**2021** 7.77 metric tons[8]
Projected emissions in 2050 if all NDCs are achieved (CO_2e)	Goal: remaining GHG emissions no higher than 355 $MtCO_2e$[9]
Renewables in energy mix (%)	2021: 22% of energy consumed was generated from renewable sources[10]
CO_2 captured in carbon capture schemes (tCO_2e)	Target: EU annual injection capacity of at least 50 million tons of CO_2 by 2030[11]
Average yearly economic damage due to extreme weather (USD)	2011-2020 EUR 15.9 billion[12] (USD: ca. 16.75 billion) (16.10.23)

EU climate policies drive sustainability transformation by means of the **European Green Deal,** which aims for carbon neutrality by 2050 and 90%[13] and **55%[14] emissions reductions,** respectively, **by 2040 and 2030 as compared to 1990 levels,** while committing at least €1 trillion to sustainable investment and linking economic growth to climate targets. In laying the path for green transformation through the Green Deal, the EU defines three explicit opportunities:

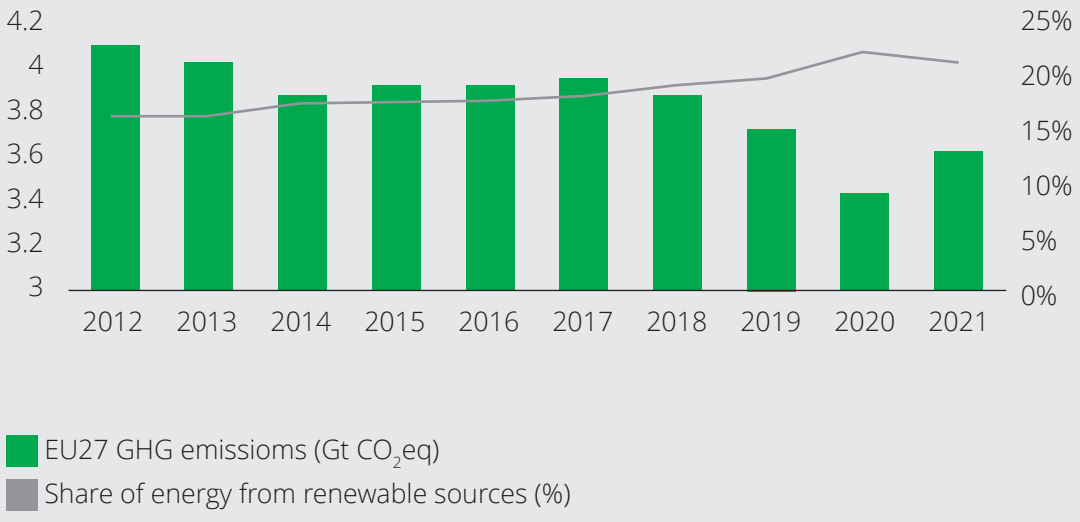
Economic growth | Markets and jobs | Technological development

While the opportunity for technological development is already at the heart of the Green Deal, the potential for digital technologies to act as a key enabler of climate action is highlighted separately in the declaration on the "green and digital transformation of the EU" signed by 26 member states plus Norway and Iceland.[15] While both the green and digital transformations have independently already been given high priority within EU policy, the EU recognizes the high synergistic potential of both transformations and is calling for a **twin green and digital transition.[16]**

With a 32% reduction between 1990 and 2020, there is a clear trend towards reducing GHG in the EU, especially now that this goal is driven by the EU Green Deal. One key lever for this is increasing the share of renewable energies, which at the same time contributes to Europe's efforts to become more energy independent.

Table 1 EU-27 development GHG emissions and share of energy from renewable sources[17/18]

EU-27 2012-2021
development GHG emissioms and share of energy from renwable sources



Digital Transformation and Innovation

In the European Union, there is a collective effort to embrace and adapt to digital technologies with a goal of increasing the proportion of people with basic digital skills from 54% in 2021 to 80% by 2030. The EU is also focusing on accelerating digital transformation, especially for small and medium-sized businesses and public sector organizations, through initiatives like the European Digital Innovation Hubs and investments in 5G and fiber infrastructure.

Positive impact results from the ability to better **connect and communicate,** enabling better monitoring and tracking, providing software that can **analyze, optimize, and predict,** and offering support through **augmentation and autonomation.** The European Joint Research Center has estimated that today's digital technologies, if well optimized and widely implemented, could reduce total emissions by up to 20%.[19] In particular, the EU has highlighted six areas of application for digital technologies to become climate neutral: Energy network, precision farming, mobility & transportation, smart buildings, green data space, and the power of data.[20] The creation of digital twins is particularly promising to identify reduction possibilities, increase efficiency, and improve simulations.

AI in particular shows great potential in the field of **hazard forecasting** and thus contributes to climate adaptation and resilience. Benefits include predicting regional trends in extreme weather events, the development of early warning systems, and vulnerability and exposure management. Within the EU, nearly 50 million people have been affected by natural threats between 1980 and 2020, with this figure expected to rise in coming years.[23] Monitoring and early warning systems based on detailed scientific data increase the safety and security of European society and help to anticipate risks, provide needed resources, and warn people in danger. Given the increasing amount of data relevant to environmental hazards, digital technologies are essential for real-time monitoring, analysis, and prediction of climate events. Moreover, digital technologies can be used for training purposes, nudging society regarding climate-friendly decisions, and to help **meet new regulatory requirements.** For instance, digital tools can facilitate the provision of transparent, verifiable, and standardized data on carbon emissions along the value chain that companies need to comply with the Corporate Sustainability Reporting Directive (CSRD) in Europe.

Digital technologies potential for emissions reduction in the EU[21]

According to the Implement Consulting Group Study commissioned by Google, **20-25% of the GHG reductions needed for a net zero EU economy will require some degree of digital** enablement. This corresponds to approximately GHG reductions of 700-900 Mt CO_2. Electrification is a key decarbonization pathway and accounts for about half of GHG reduction potential (350-450 Mt CO_2), followed by energy efficiency (250-300 Mt CO_2). Interestingly, **decarbonization happens faster in the most digitalized economies of the EU,** with Europe's most advanced digital economies having reduced their GHG by 25% and grown their GDP by 30% between 2003 and 2019 while the least digitally advanced economies in the EU only reduced their GHG by 18% (18% GDP growth) over the same time period.

Digital technologies potential for emissions reduction in the UK

The results of **Deloitte's Tech for Impact Study** illustrate the extent of **emissions reduction potential of digital technologies** in the **UK.** According to the Department of Business, Energy and Industrial Strategy (BEIS) estimates, the UK's total GHG emissions will fall by 48 Mt CO_2e between 2019 and 2030. Of this reduction, an **estimated 15% can be attributed to digital technologies.** The breakdown by sector predicts the greatest potential savings from the application of smart grids to energy networks (52%), followed by using Industry 4.0 in manufacturing (24%). The remaining savings can be attributed to the use of precision agriculture to reduce livestock related emissions (12%), urban emissions reduction using intelligent traffic systems (9%), and smart buildings technology (3%).[22]

Climate Forward Government

Governments can effectively handle risks and challenges in environmental action by **setting goals and creating a flexible framework to achieve them**. As a first step, comprehending regional barriers and complexities is key, so that policymakers can tailor their strategies to effectively address them, enabling the acceleration of digital tech-driven climate action.

Barriers to Digital Climate Solutions

Globally, two main overarching barriers to harnessing the potential of digital technologies for climate action have been identified: insufficient innovation and insufficient engagement. Because innovation and engagement levels tend to be rather mature in Europe, the main challenge in this region involves the **implementation and scaling of existing innovations, which is hampered by different underlying barriers.** These include a degree of policy uncertainty due to the diverse nature of member states, as well as insufficient access to data and regulation of data usage. In addition, resource scarcity in terms of capital and knowledge leads to missed investment opportunities and knowledge gaps, while a lack of expert collaboration causes knowledge silos and a shortage of common use cases. Furthermore, there is still a certain skepticism within society regarding digital technologies and a lack of awareness of the potential they can offer for all three pillars of climate protection.

Policy Goals

To overcome the existing barriers hindering the use of digital technologies for climate action, European policymakers could aim to facilitate the implementation and scaling up these technologies. This overarching goal should be pursued through four sub-goals that align with current EU and UK objectives, enhanced by insights from expert interviews.

Single market for data

First, the goal of policy within the EU and UK needs to be to build a single market for data as a foundation for developing, adapting, and deploying digital solutions across country and sectoral borders. This includes access to data, appropriate digital infrastructure, and the provision of privacy and data security.[26]

Advancing education and cross-sector cooperation

The second goal is to advance education and cross-stakeholder, sector, and country cooperation at the intersection of climate sustainability and digital technologies. The aim is to adopt a holistic approach and address consumers, companies, and governments in equal measure.

Drive implementation and scale up solutions

Third, policymakers consider promoting the use of digital technologies through financial and regulatory incentives and the reduction of bureaucratic processes to drive the implementation and scaling of digital solutions for climate action in practice.

Encourage positive climate behavior and action

Finally, governments might consider encouraging behaviors that have a positive impact on climate change. Data visualization of behavior and reduction potential of digital technologies are a starting point for policymakers to proactively engage and advocate to society to build trust and coherence.

Case Study

Artificial intelligence and predicting extreme weather events in the EU

With increasingly extreme weather and climate, both adaptation & resilience and mitigation policies as well as disaster risk management need to evolve. The growing availability of data, e.g. Copernicus Climate Change Service, increasingly supports climate services and underlines their relevance for strategic decisions. To evaluate the full potential of this data, climate services can build on artificial intelligence (AI) capabilities. One example of specific implementation is the EU-funded project CLINT, which aims to support climate science by optimizing the detection, causation, and attribution of extreme events by processing large available climate datasets using an AI framework with integrated machine learning (ML) techniques and algorithms. In addition, the project addresses the quantification of the impact of extreme events on different socio-economic sectors across Europe. The AI framework will specifically facilitate (1) the identification of patterns and trends in climatological fields relevant to extreme weather, (2) the validation of physically-based causality previously identified by ML algorithms, and (3) capture the attribution of extreme events to human-induced influences.[24]

Digital Tech Policy

In presenting the potential policy measures for achieving these goals, the Digital Sprinters Framework by Google offers a structured approach. This framework defines four primary categories: Infrastructure, People, Market Environment and Tech Innovation. Each category addresses specific policy aspects that can facilitate sustainable and inclusive economic growth while harnessing the power of digital transformation.

All recommendations listed are intended to promote achieving at least one of the four aforementioned overarching objectives and at the same time to reduce the barriers that currently exist.

Infrastructure

- **Expansion of digital infrastructure** within the EU and the UK to ensure the widespread use of current digital technology solutions, for instance for data collection and analysis, to prepare for the development of a single market for data.
- Incentives and support for **improving digital infrastructure** within the EU and UK in line with available digital solutions. Of particular importance is comprehensive internet coverage with 5G to build a coherent and reliable technology ecosystem for a future single market for data.
- Further use of digital technologies in day-to-day government work to **facilitate the implementation of digital** innovation (e.g., automate approval procedures for renewable energy systems), **reduce own emissions,** and drive implementation within government institutions.
- **Enable and simplify data availability and sharing:** New or adjusted regulations are needed that simplify data sharing and data availability in general, while maintaining data privacy (guidelines and legislation). Establishing a single market for data with anonymized data might be one approach. One interesting application in this regard is the use of smart meters.

Lisbon Smart City[27]
The city of Lisbon has recognized the potential of digital technologies and is placing the needs of its citizens at the center of its infrastructure planning. Under its Smart City strategy, in 2017 the city commissioned NEC, their Cloud City Operation Center, to link both government-managed services (e.g., garbage collection) and external services (e.g., fire department) to the management of partner organizations. This created a centrally coordinated management capability. The system uses artificial intelligence, Internet of Things technology, and real-time data analytics to enable city services to respond to situations as they arise. This is possible due to the ability of digital technologies to monitor and track data and operations.

People

- **Education in digital technologies and sustainability** should be integrated into general education and professional training. Additionally, companies could be incentivized to train employees to understand their own touchpoints within daily work towards these two areas of interest.
- **Establishing trust and visibility** in digital technologies for industries and individuals is important. Governments may become early adopters themselves or create touchpoints for industries and digital technology solutions through public events to drive implementation and upscaling.
- **Awareness creation through visualization:** Governments might explore ways to go beyond presenting data, by showcasing how concrete global warming is and demonstrating how digital technologies can tackle climate action through impact measurement. Data alone can be intangible, while visualizations are extremely powerful for encouraging positive climate behavior.
- **Nudging consumers towards** environmentally-friendly behavior by providing them with tools that enable them to make informed decisions.

Market environment

- Implementation of adequate **data standards** to ensure the **interoperability** of different technologies and coherence between member states through guideline setting or a certification of collected data to prepare for a single market of data.
- Policymakers could consider **pursuing and communicating a clear green digital strategy** to create certainty for investments in the transition to new digital technologies.
- Legislation must **keep pace with the development of digital technologies** in order to drive implementation in day-to-day business activities. A lack of clear legislation on the use of new digital technologies can lead to delays in their use.
- Clear guidelines are needed to **regulate data ownership in digital technology solutions and ensure data privacy** to strengthen confidence in the implementation of new solutions.

Digital Product Passport[28]

The need to ensure sustainable purchasing decisions is growing among consumers and companies. However, data gaps in supply chains that obscure the footprint of products make for distorted and uninformed decision-making. This is where the **Digital Product Passport (DPP), introduced by the European Commission,** comes into play, providing transparency along the supply chain and empowering customers to make informed decisions The goal is to be able to exchange data along the entire value chain, including data on raw material extraction, production, recycling, etc., and thus drive circular economy in the long term. Digital technologies enable the exchange of all this information across production steps and stakeholders by **connecting and communicating.**

UK's new data sharing laws[29]

Access to data is the foundation for digital technologies. The UK has taken a step forward with its Data Protection and Digital Information No. 2 (DPDI) Bill, **enacting smart data legislation** that will enable **easier data sharing for the private sector** across the UK economy. It is expected to spur competition and innovation in the marketplace while enabling better outcomes for **consumers.**

Tech Innovation

- Channel strategic **public investments** into digital solutions that support climate action and assist companies in minimizing their digital technology implementation risk. In this context, access to capital can be created via green financing or low-interest loans.
- Encourage **private capital** (especially VCs) as a bridge for financing high-risk innovation by utilizing tools such as a guaranteed minimum return, or **encouraging cross-collaboration between climate- and digital-focused VCs** on investments through climate incubation programs to address the need for high investment before proof of concept.
- Accelerate the **dissemination** of new, credible, and usable **digital technology solutions** by giving these solutions a stage on which to be showcased. At the same time, provision of **best practice recommendations** is needed for the use of digital technologies as well as for compliance with EU regulations such as the Corporate Sustainability Reporting Directive.
- Supporting and actively inviting **cross-stakeholder and sector collaboration to connect issues with fitting digital technologies:** Building an experimental ecosystem to develop, test, and validate solutions that can turn into best practices.

European Green Digital Coalition (EGDC)[30]

Supported by the European Commission and the European Parliament, the EGDC is an **initiative from companies** with the main objective of **maximizing the sustainability benefits of digital technologies to reduce emissions.** All participating companies engage in this exchange with the aim of becoming active in the following concrete areas:

- Investing in the **development and implementation** of green digital solutions to increase energy and material efficiency.
- Developing methods and tools to **measure the impact** of green digital technologies.
- Co-creating **recommendations, best practices, and guidelines** for different sectors for the green digital transformation together with representatives across sectors.

Industry perspectives

Having identified what to do, and how to do it, the next question is where to start. Based on current emission levels and the expertise of interview partners, a special focus on implementing digital technologies leveraging climate action should be placed on the following four key industries: **Energy, Industry, Transportation and Agriculture.**

Industry	Recommendation[31]	Specific action	Priority
Energy	Building an intelligent, flexible and interactive energy system	Create a regulatory, technical, and financial system to utilize urban spaces for clean energy generation through digital solutions aimed at decentralized energy production	Medium
	Consumer participation in energy markets	Leverage easy-to-use digital technology solutions to empower consumers to participate in the energy markets (e.g. energy sharing and peer-to-peer exchanges) and to enable them to better control their energy use and bills (e.g. rollout of smart meters)	High
Industry	Digitalization of circular infrastructure	Create circular industrial zones with digital infrastructure to optimize circularity between occupants and encourage smart manufacturing practices	Medium
Transportation	Legal framework for digital tools in transportation	Implementation of an appropriate legal framework as a key driver for digital technologies for climate action is needed, for example through an effective pollution regulation, autonomous driving regulations and certification, and other digitally-enabled solutions	Medium
	Raising people's awareness of digital tools in transportation	Proactively engage society to change people's transportation behavior. Citizens need to adapt to these new technologies and business models, making convenience and ease of use essential for successful adaptation	High
Agriculture	Workforce digital literacy	Enable sharing of best practices of modern digital agriculture technologies that enable improved crop, water, and livestock management	Medium
	Sustainable farming techniques	Incentivize digital tools that can contribute to sustainable farming techniques, improve resilience and reduce both chemical inputs and greenhouse gas emissions	Medium

Conclusion

In the face of climate change, policy action is essential to mitigating its impacts, adapting to new challenges, and creating a foundation for collective action, with digital technologies offering the potential to enhance connectivity, monitoring, analysis, and support, although mitigating their own negative impacts is crucial. For both the EU and UK, the question of how to leverage the potential of these digital technologies to pursue climate action is mostly a **challenge of implementation rather than innovation.** Therefore, it would be beneficial for policymakers in this region to pursue the overarching goal of **becoming enablers of the twin green and digital transformation.** Considering the five barriers within the EU and UK (System Complexity, Resource Constraints, Societal Reservations, Data Access & Regulations, Lack of Cooperation) that currently impede this development, the focus of policy actions should be on meeting four objectives to drive implementation and upscale digital technology usage:

- Building a **single market for data**
- **Promoting education and collaboration** at the intersection of climate sustainability and digital technologies
- Incentivizing the **implementation and scaling of digital solutions** for climate action in practice
- Influencing **behavioral changes in society and establishing a positive narrative**

By addressing these objectives, this report highlights a set of 16 concrete action areas for policymakers in the EU and UK and groups them under four specific policy fields (Infrastructure, People, Public Policy, and Technological Innovation) that can facilitate sustainable and inclusive economic growth while harnessing the power of digital transformation.

This report showcases practical examples of how digital technologies can be leveraged for climate action through policymaking, emphasizing the positive impact achieved through the interaction of different digital technologies. It also notes the need to monitor emerging technologies, like quantum computing, for their potential in climate solutions, ultimately requiring bold and collaborative efforts by policymakers to harness the full potential of these tools.

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31. For the full industries policy recommendations please review the global study "The Road to Sustainability: Digital Technologies as a Key Enabler for Climate Action"

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