DIGITALEUROPE

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DIGITALEUROPE's roadmap for Europe's energy ecosystem digital transformation - *The time to transform is now*

Introduction

The war in Ukraine is a wake-up call for Europe to achieve independence as well as meet its climate targets. Digitalisation is key to enabling decarbonisation and addressing the existing energy crisis. DIGITALEUROPE calls for ambitious actions, large-scale public and private partnerships, overturning traditional models, and a sense of urgency and innovation.

Phasing out fossil-based energy sources to renewables and distributed assets creates challenges for the existing energy grid, with increased volatility, less predictability and less control of an increasingly complex energy ecosystem. This transformation requires a full value chain approach involving all actors in the ecosystem, where each step of the chain can be enabled by digital technologies.

A transformed energy ecosystem is a necessary step for other industrial sectors to become more resilient and energy-efficient through state-of-the-art technologies and services.

The European Commission's proposal on the digitalisation of the energy sector (DoEAP) rightly reaffirms the role of digital technologies in creating a climate-neutral and resource-efficient society. Digital technologies and the data insights they provide are helping various sectors, from buildings to transport, to farming and energy to radically improve their material and energy efficiency, cut waste and reduce emissions. By 2030, it is estimated that digital technologies can help resource-intensive industries reduce their global greenhouse gas emissions by 20%, saving ten times more emissions than they produce[1].

[1] The enablement effect; available at https://www.gsma.com/betterfuture/wp-content/uploads/2019/12/GSMA_Enablement_Effect.pdf

This paper consists of two main sections. The first outlines DIGITALEUROPE's overall position for the digitalisation of the energy ecosystem. The second includes two annexes that highlight challenges, opportunities, recommendations, potential KPIs, and examples of enabling digital solutions contributing to solving current and future energy crises.

Summary of proposed KPIs

1. Transforming Europe's energy ecosystem

- By 2025, the EU should capitalise on digital technologies to improve energy efficiency by 30%.
- By 2030, all Member States to set up digital building logbooks and to fully digitalise their building permit systems.
- By 2030, BIM required in all Member States for public tenders of infrastructures and buildings above 50 million euros.

2. Strengthening cyber resilience in the Energy system

- By 2025, an inclusive and transparent cybersecurity policy framework complementing existing cyber legislations (e.g., NIS II, draft CRA).

3. An EU Framework for data sharing

- By 2025, the data economy should represent 6% of the EU's economy.
- By 2025, data and APIs to be interoperable within the energy ecosystem and energy using industries such as EVs, buildings and industries.
- By 2025, EU to provide incentives and assurances respecting IPR for energy data across the ecosystem to be made available in a data space for training AI and developing next generation digital tools.

4. Promoting investment in the digital energy infrastructure

- By 2025, all EU cities to have gigabit connectivity coverage, building upon existing EU RRF funding.
- By 2025 increase investments in digital technologies (Cloud, AI, Machine Learning, IoT, Edge control and connectivity infrastructure), to achieve at least 30% of the 170 billion euros needed for investments in digitalisation of the energy system until 2030.
- Ensure 25% of national energy and climate plans (NECPs) policy and budgets dedicated to the digital transformation of the grid and ecosystem which will lead to an ROI in the medium term.
- By 2025, develop common smart grid indicators, including a new KPI to evaluate the maturity level of the digital twin of the grid.

5. Modernising the energy grid for resilience

- By 2025, monitor peer-to-peer trading projects in the EU and remove barriers for energy sharing for all consumers in Market Design reform.

6. Ensuring benefits for consumers: skills and empowerment

- By 2025, Member States, companies and utilities to complete retraining in digital and cyber skills for 20% of the workforce.
- By 2025, companies and utilities in the EU to provide ICT and cyber training to 70% of their employees.
- By 2025, mapping of EU jobs being created, transformed and lost in the transition to a digital energy ecosystem until 2030.

7. Energy consumption of the ICT sector

- By 2025, the EU should capitalise on digital technologies to help resource-intensive industries reduce 20% of their global GHG emissions.

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1. Transforming Europe's energy ecosystem

Europe's foreign energy dependency and the transition to a net zero future requires a coordinated EU-wide approach, aligning digital and green policies across industries and policy areas. To succeed in creating an enabling framework for the development of renewables and clean technologies, **the entire ecosystem needs to be involved in this work**, including Member States, energy utilities, ICT, transport and building sectors, but also energy-intensive European industries, and European consumers.

Creating synergies between legislation in energy and digital is crucial and priority should be given to the coherent implementation of existing provisions. This includes the revision of the Electricity Market Design Rules, the Green Deal Industrial Plan, the Net Zero Industry Act[2], REPowerEU, the Energy Efficiency Directive, the Digitalisation of Energy Action Plan (DoEAP), Data Act, and cybersecurity legislation. Doubling down on silicon chips production, securing strategic raw materials resilience is also essential.

Decentralised resources like rooftop photovoltaic (PV) units, batteries within EVs and telecommunication network cell towers need to exchange real-time information with the grid operator. This requires high-quality, highly available, and secure dedicated communications networks covering urban and rural areas. Advanced capabilities, such as Artificial Intelligence (AI), interoperable network platforms, and Digital Twins will accelerate the pace of transition, enable large-scale flexibility trading, increase data insights, and enhance the cybersecurity of critical power sector infrastructure. Digital solutions deployed in the grid can also address challenges such as lack of visibility on network constraints, network losses and capacity management.

Both for new buildings and renovations, some of **the most impactful choices to reduce carbon emissions occur during the design phase of the project. Technologies like Building Information Modelling (BIM) enable project owners and** professionals to efficiently design and plan high-performance buildings, conduct energy analysis at key project stages, optimise HVAC system design and improve structural material efficiency. BIM is not only a critical tool for designing high energy performance buildings, but it is also the foundation needed to create a solid database that can be enriched and used by building owners, users, and public authorities. It will feed life-cycle assessment databases and passports such as the Buildings Digital Logbook and allow stakeholders to analyse and evaluate energy and resource consumption throughout all phases of a building's life cycle (design, construction, use, deconstruction).

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2 *Single Market Barriers continue to undermine Europe's competitiveness and green deal efforts*, DIGITALEUROPE,https://www.digitaleurope.org/news/single-market-barriers-continue-to-undermine-europes-competitiveness-and-green-deal-efforts/

The revision of the energy performance of buildings directive (EPBD) has the potential to drive the adoption of digital solutions to better assess, manage, and reduce the energy use of buildings from the early stages of their design across their whole life cycle, including operation and renovation[3]. The deployment of calculators and simulators in the construction and real estate sectors will create network effects to reduce the energy dependency of the EU.

Europe has a chance to lead the way on the clean energy transition and boost its competitiveness globally. The technology exists today in the form of renewables, digital technologies and software[4]. Now is time to deploy it!

2. Strengthening cyber resilience

The rapid digitalisation of the energy system is giving rise to new cyber risks, requiring critical infrastructure to be secured. DIGITALEUROPE endorses a security-by-design approach for hardware and software products, as well as appropriate cybersecurity risk-management measures, including reporting obligations, throughout the value chain[5], while enabling the emergence of new technologies and business models.

Security requirements must consider the specificity of the energy sector, which requires data and functional security. Cybersecurity is crucial for digital grid modernisation to make operations more reliable, resilient, and efficient. Investment in cybersecurity capacity building and skilling is particularly needed to improve overall cybersecurity resilience of critical energy infrastructure.

Due to increased threats from cyber-attacks, it is necessary to allocate adequate and usable frequency spectrum to the utility market for secure, dedicated regional or country-wide communication (in the lower frequency bands of 400 and 450 MHz, ideal for critical communication). This is required to run, manage and monitor the grid to ensure that the infrastructure has the appropriate level of resiliency for mission-critical networks and is secured from attacks by ensuring that no unauthorised devices are able to connect to these networks and exceptional events do not congest them. While most public networks are not built for mission-critical applications, there are non-mission-critical use cases (e.g., metering) where 5G networks can be utilised to prioritise utilities and the energy ecosystem through network slicing to obtain full bandwidth and quality of service.

[3] At the level of Technical Building Systems (TBS) the EPBD must support the deployment of IoT technology in the form of Building Automation and Control Systems (BACS) incorporated directly in TBS, e.g., a heat pumps, and at the building level through Building Management Systems (BMS). The EPBD's BACS installation requirements and the Smart Readiness Indicator should be mandatory for all building types, https://www.digitaleurope.org/resources/paving-the-way-towards-a-sustainable-and-digitalised-european-building-sector-digitaleuropes-views-on-the-revision-of-the-epbd/

[4] Such as Digital Twins, AI/ML, PoE, LTE Advanced/5G/fiber/satellites/cable, cloud, etc

[5] *Building blocks for a scalable Cyber Resilience Act*, DIGITALEUROPE, https://www.digitaleurope.org/resources/building-blocks-for-a-scalable-cyber-resilience-act/

The right legal framework has been established, including NIS I and NIS II, GDPR, the Cybersecurity Act and accompanying security certification framework, the Regulation on the Free Flow of Non-Personal Data, the Radio Equipment Directive Delegated Act, and the upcoming Cybersecurity Network Code (NCCS). However, we urge the Commission and Member States to avoid fragmentation across regulations, sectors and harmonise vulnerability and incident reporting requirements under the NCCS with NIS II and CRA frameworks, following the baseline horizontal NIS II framework, which already cover the energy and electricity sector.

3. An EU framework for data sharing

Energy grids are becoming “smarter” and more resilient, through cutting-edge technologies, equipment, and controls that communicate and work together to deliver energy more reliably and efficiently. Grid operators depend on secure data transport for real-time monitoring, and remote operational modifications.

The transformation of the energy system, supported by digital technologies, while safeguarding privacy, security, and commercially sensitive information, will lead to an increased demand for harmonised data and new interfaces. Through electrification and the availability of highly distributed assets, the energy system is becoming more interlinked with other industry sectors (e.g., heavy-duty electrical trucks and buildings), requiring a holistic approach.

Data insights are essential to control, manage, and take decisions on assets in such an ecosystem. For utilities, this could mean optimising of energy flows across the grid, improving stability and avoiding outages. For industries and consumers, this could lead to more efficient transport routes, bi-directional charging of electrical transport, improving heating and use of buildings based on grid conditions, and facilitating flexibility trading.

To facilitate data sharing and interoperability, we urge the Commission to proactively **involve all relevant industry actors, including the ICT sector, in the work to create an EU-wide voluntary framework**, within the future Smart Energy Expert Group and the High-Level Group on Standardisation. Unless organisations can pool and categorise data in standardised ways, they will face obstacles extracting useful insights. This should be promoted through a voluntary approach, consensus-based, market-driven, fair, and transparent processes that build on existing industry standards and practices.

4. Promoting investments in digital energy infrastructure

Accelerating grid investments will be crucial to integrate renewables, as well as highly distributed energy resources such as battery backup systems or Virtual Power Plants (VPP), electric vehicles (EV), solar panels (PV) and small private home battery solutions. The digitalisation and smartification of the energy ecosystem must accompany traditional grid expansion to handle legacy power plants, volatile renewables, and a vast number of distributed assets. Existing grids have never been designed to deal with such a large, and variable, scale of power injection and consumption across the grid.

DIGITALEUROPE supports increased investments in the digitalisation of the energy system, particularly the **deployment of advanced grid software solutions and Digital Twins**. EU and national regulators should ensure that a suitable framework enables and encourages utilities and system operators to invest in software solutions for the faster deployment of smart grids and the digitalisation of the energy ecosystem. Moreover, existing R&I programmes, such as the EU's resilience and recovery funds (NextGenEU[6]) should be leveraged, while stakeholders should receive support by EU and national administrations to help them grasping available opportunities.

As a priority, the EU should present a **joint roadmap with industry to prioritise investments and incentives for the twin transition**, while addressing barriers hindering investments in the digitalisation of the energy sector, such as market fragmentation, complex and burdensome procedures, CAPEX focused investments and lack of a holistic approach[7]. Such a roadmap should include necessary investments to upgrade grids with a focus on digitalisation, orchestration and automation. By prioritising these areas, the energy sector can achieve massive efficiency gains.

To embrace opportunities, **basic connectivity infrastructure** needs to be considered. While most EU citizens have access to the internet through fixed or wireless solutions, a transformation of the energy ecosystem requires a broader coverage, including rural areas, transmission and distribution routes, and often increased capacity of existing networks. Therefore, it is crucial to accelerate and remove barriers to investments in basic digital infrastructure, such as mobile broadband and fibre solutions, as highlighted in the EU Digital Decade 2030 and the EU Gigabit Infrastructure Act.

5. Modernising the energy grid for resilience

Protection Automation and Control Systems (PACS) are central to utilities (TSOs and DSOs) to maintain the availability and stability of the grid. However, most of these systems rely on legacy communication technologies. Updating and replacing them is costly and complex, which hampers grid extensions and

[6] Which contributed to the national allocation of 20 billion EUR for the production of renewables, ca. 16 billion for the efficiency of the public sector, over 35 billion EUR for efficiency of buildings and 9 billion for energy networks and infrastructure, European Commission, State of the Energy Union 2022, https://energy.ec.europa.eu/state-energy-union-2022-snapshots-eu-country_en

[7] In traditional utility operations, investments in physical infrastructure (e.g., power plants or transmission lines) have a clear and measurable ROI, as they directly impact the generation and delivery of energy. However, digital solutions have more intangible benefits, such as improved efficiency, customer satisfaction, and reduced emissions. Incentive schemes should balance remuneration for OPEX in addition to those existing on capital expenses (CAPEX). Software solutions by nature are updated frequently and can introduce new advanced functionalities over time and tend to favour XaaS ("Anything as a service") business models.

the adoption of more renewables into the mix. Modern, fully digitalised PACS relying on Ethernet and IP technologies offer more agility to the grid to build better and smarter grid protection schemes. This will improve the grid availability (SAIDI), reduce power outages (SAIFI) and enable more flexible integration of renewable energy. **These systems enable utilities to build digital twins of their grid protection systems providing better insights for future planning and overcoming outages**.

Digital solutions can help to achieve maximum self-sustainability and alleviate pressure on the grid through the **adoption of microgrids**. Smartly managed renewables within a microgrid are making an impact on many industrial applications by offering energy cost savings and supplying energy security to industrial campuses. Despite their size, microgrids are complex systems with many elements which need software solutions, reliable communications, and control solutions to manage the supply and demand balance that is normally the responsibility of the utility provider.

In addition to help managing fluctuating costs of energy through self-generation via solar panels, small turbines and battery storage, microgrids may also help balance the regional grid during high demand or low generation periods. The optimisation of voltage levels across the grid requires direct control and load balancing between different sources and loads.

6. Ensuring benefits for consumers: skills and empowerment

To power the twin transition and address the challenges of IT/OT convergence, **green and digital skills** are crucial. DIGITALEUROPE recognises the importance of providing in-demand industry skills to help individuals from all backgrounds upskill and participate in the economy of the future.

Recording and reporting jobs depends on the ability to collect, manage, and aggregate data from multiple sources. Developing a clearer picture of skills and labour gaps will require a common taxonomy and framework. We recommend a collaborative approach involving private sector, government, and the education sector to define a skills and competencies framework to shape education and training curricula on digital and sustainability jobs.

Training and education providers must work closely with companies and industry associations to develop and continually update curricula and trainings. This work must start with the development of new learning materials that can be used both in person and online. Furthermore, higher education institutions will need to strengthen and expand their undergraduate and graduate sustainability programs, while VET curricula will need to embed green skills with a sectoral approach, and educators need to be equipped for creating real-world interdisciplinary learning opportunities.

Changing behaviours and educating consumers on better-saving energy is key. Therefore, the EU should focus on "sustainability competencies" interlinking knowledge, skills, attitudes, and values enabling an effective response to real-world sustainability problems, challenges, and opportunities[8] from the perspective of lifelong learning training programmes.

7. Energy consumption of the ICT sector

To achieve digitalisation in the energy sector it is essential to design products in an increasingly sustainable and energy-efficient way. Therefore, **embedding sustainability in product-design remains a key priority for the ICT sector**. Although there has been a debate on the impact of increased digitalisation on overall energy, research shows that the entire ICT industry (including networks, devices and data centres) only accounts for approximately 4% of the world's electricity consumption and represents 1.4% of the GHG emissions.[9]

Over time, both the telecoms and digital sectors have become more energy efficient by leveraging AI and data analytics. This has resulted in a reduction of their global carbon footprint over the past decade, even as data traffic and service usage has increased. It is important to note that a reduction in energy consumption also generates reductions in network-driven CO2 emissions[10].

Acknowledging the enabling role of digital solutions to enable the reduction of carbon emissions across industries, the EU should not only develop KPIs to measure their impact but also **build upon the work of the European Green Digital Coalition (EGDC) when developing energy and climate policies**.

Networks

International Energy Agency (IEA) data shows that transmission networks have become significantly more efficient[11]. During the COVID-19 pandemic, while data in networks increased by 50%, electricity use for telecom operators remained constant according to GSMA data. Operational data for European telecom operators between 2015-2018 shows that **electricity consumption increased about 1% despite a data traffic increase of around 300%**.[12]

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[8] These have also been highlighted in the GreenComp reference framework for sustainability competences developed by the Joint Research Center of the European Commission.

[9] Malmodin, Jens & Lundén, Dag. (2018). The Energy and Carbon Footprint of the Global ICT and E&M Sectors 2010–2015. Sustainability, https://www.ericsson.com/en/reports-and-papers/research-papers/the-future-carbon-footprint-of-the-ict-and-em-sectors

[10] GSMA, "The Enablement effect", https://www.gsma.com/betterfuture/wp-content/uploads/2019/12/GSMA_Enablement_Effect.pdf, 2020.

[11] IEA, "Data Centres and Data Transmission Networks", Sept 2022, https://www.iea.org/reports/data-centres-and-data-transmission-networks

[12] Lundén et. al., Electricity Consumption and Operational Carbon Emissions of European Telecom Network Operators. Sustainability 2022, 14, 2637.

Although data traffic has risen significantly in recent decades, energy consumption has not increased at the same rate. Previously assumed correlations between data traffic and electricity usage have led to exaggerated forecasts. Hence, **the expected data growth due to increased digitalisation does not mean a sharp increase in future electricity consumption**.

Advancements in technology and a focus on sustainability and energy performance have enabled the fixed and wireless communication industry to deliver increased bandwidth using the same or less power. Continuous network modernizations are further improving the overall energy performance of cellular networks. For example, 4G networks are 5 times more energy efficient than 3G networks, and 50 times more efficient than 2G[13]. Hence, modern 5G networks are currently the most energy efficient generation of cellular communication, with up to 70% lower energy consumption than 4G networks.[14]

Data Centres

The International Energy Agency (IEA) estimates that 0.9 -1.3% of total global electricity is used by data centres. The industry has made consistent efforts to decrease resource usage, such as using lower-power servers, liquid cooling, microgrid technology, air cooling, or reusing waste heat. These efforts will continue supporting the European Commission's goal for "climate neutral data centres" by 2030.

Research has shown that despite a dramatic increase in compute output, the data centre industry's energy consumption has largely remained flat since 2010. Between 2010-2018, global data centre energy consumption increased by only 6%, while compute workloads increased by 550%. In the same period, installed storage capacity rose 25x and data centre IP traffic rose 10x, while the installed base of physical servers rose only 0.3x. Energy intensity of the data centre industry dropped by around 20% per year between 2010-2018. This efficiency improvement rate is much greater than rates observed in other key sectors of the global economy over the same period.[15]

In Europe, data centres operators support new and unsubsidised renewable capacity and continue to lead the way on sustainable corporate power procurement, by helping decarbonising electricity use through matching demand to carbon-free supply. Data centre operators also provide grid stabilisation services that can replace services from retiring thermal generation when conditions allow, providing low carbon heat for other applications, like

[13] IEA, "Data Centres and Data Transmission Networks", Sept 2022, https://www.iea.org/reports/data-centres-and-data-transmission-networks

[14] Frenger et al. More Capacity and Less Power: How 5G NR Can Reduce Network Energy Consumption | IEEE Conference Publication | IEEE Xplore, available at www.ieeexplore.ieee.org/document/8746600

[15] E. MASANET, A. SHEHABI, N. LEI, S. SMITH, and J. KOOMEY, « Recalibrating global data center energy-use estimates », 28 Feb 2020, https://science.sciencemag.org/content/367/6481/984

heating residential areas. On the other hand, cloud solutions are already delivering significant sustainability benefits and offering an opportunity for business and society to reduce the carbon footprint associated with computing.

We recommend the adoption of **harmonised sustainability requirements on the energy efficiency of data centres** to avoid diverging approaches at Member States level. In particular, **labelling requirements should be easy to implement and developed in the context of the Energy Efficiency Directive (EED)**.

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Annex I: Challenges, opportunities, recommendations and KPIs

Chapter	Challenges	Opportunities	Recommendations	KPIs
1. Transforming Europe's energy ecosystem	- Digital absent from Green Deal Industrial Plan - Conflicting methodologies and KPIs - Grasping of recovery funds - Risk of conflict and overlaps of various initiatives - Supply chain issues (e.g., access to chips and raw materials)	- Digitalisation will power the clean energy transition - European Green Digital Coalition (EGDC) to open membership to industry verticals - R&I and RRF available - Revision of the energy performance of building directive (EPBD) - EU Chips Act and Critical Raw Materials Act to respond to industries' needs	- Continue recognising digital as an enabler of the green and clean energy transition - Leverage work of the EGDC (e.g., KPIs, calculators) - Leverage existing funding and avoid global subsidies race - Create synergies between initiatives/legislation such as the EMD, Green Deal Industrial Plan, Net Zero Industry Act, REPowerEU, EED, DoEAP, Data Act, Cybersecurity legislation, Chips Act and Critical Raw Materials Act - Support deployment of calculators and simulators in the construction and real estate sector, incl. deployment of IoT (BACS)	**By 2025, the EU should capitalise on digital technologies to improve energy efficiency by 30%.** **By 2030, all Member States to set up digital building logbooks and to fully digitalise their building permit systems.** **By 2030, BIM required in all Member States for public tenders of infrastructures and buildings above 50 million euros.**
2.Strengthening Cyber resilience in the energy system	- Increased cyber threats - Geopolitically insecure world increases cyber-attacks from state sponsored actors - Availability of dedicated mobile spectrum hindering deployment of secure networks	- Trustworthy and secure grid solutions would enable uptake of digitalisation by utilities.	- Investment in secure dedicated networks for utilities, TSOs and DSOs - Harmonise reporting and risk management requirements for energy sector operators and their ICT suppliers	**By 2025, an inclusive and transparent cybersecurity policy framework complementing existing cyber legislations (e.g., NIS II, draft CRA).**

3.EU Framework for Data sharing	- Increased demand for harmonised data and new interfaces - Interoperability of data, data models	- Voluntary and industry driven approach to pooling and categorising data to support decision-making for controlling and managing assets in the ecosystem - Interoperability between industry sectors and energy system to achieve digitalisation, electrification and phasing out fossil fuels	- Provide support to "Data for Energy" (D4E) expert group to develop portfolio of high-level use cases for the energy sector	**By 2025, the data economy should represent 6% of the EU's economy[16].** **By 2025, data and APIs to be interoperable within the energy ecosystem and energy using industries such as EVs, buildings and industries.** **By 2025, EU to provide incentives and assurances respecting IPR for energy data across the ecosystem to be made available in a data space for training AI and developing next generation digital tools.**
4.Promoting investments in the digital	- Grid investments lagging due to difficulties in grasping available funding	- Development of Digital Twins to speed up the transition and the transparency of investments made in the energy system	- Ensure access to incentive schemes and EU funding for utilities for faster deployment of digital solutions	**By 2025, all EU cities to have gigabit connectivity coverage,**

[16] A STRONGER DIGITAL EUROPE – our call to action towards 2025: https://www.digitaleurope.org/policies/strongerdigitaleurope/

electricity infrastructure	- Remuneration of system operators does not incentivise investments in innovation and digitisation (OpEx) but focuses on CapEx - Need to improve coverage in rural areas by increasing the capacity of existing networks and expanding transmission and distribution routes. - Barriers to broadband roll out - Dedicated networks not expected to generate revenue but should serve population as 'not-for-profit' service	- Digital Decade Targets 2030 and Gigabit Infrastructure Act to remove barriers to connectivity	- Remove barriers for investments in basic digital infrastructure (mobile broadband and fibre solutions) - Ensure appropriate high speed/high-capacity coverage for urban and rural areas in the EU - Prioritise the definition of harmonised smart grid indicators	**building upon existing EU RRF funding.** **By 2025, increase investments in digital technologies (Cloud, AI, Machine Learning, IoT, Edge control and connectivity infrastructure), to achieve at least 30% of the 170 billion euros needed for investments in digitalisation of the energy system until 2030.** **Ensure 25% of national energy and climate plans (NECPs) policy and budgets are dedicated to the digital transformation of the grid and ecosystem which will lead to an ROI in the medium term.** **By 2025, develop smart grid indicator, including a new KPI to evaluate the 'maturity level' of the digital twin of the grid.**

5.Modernising the energy grid for resiliency	- PACS rely on legacy communication technologies, hindering high uptake of renewables and distributed assets - Rules on self-generation/consumption - Managing flexibility - Difficulties to scale peer-to-peer trading initiatives	- Invest in modern communication technologies to increase rate of renewables and create fully digitalised energy system - Regulatory framework enabling the development of prosumers and active participation in the energy system, including flexibility - Flexibility trading on a larger scale can impact demand/response through lowered power peaks, reduced energy prices and better grid balancing - Including industrial users in flexibility trading creates larger pool of energy available for grid balancing	- Create incentives for utilities, TSOs and DSOs to upgrade communication technology systems - Regulatory framework should enable system operators to invest in the digitalisation of the grid	**By 2025, monitor peer-to-peer trading projects in the EU and remove barriers for energy sharing for all consumers in Market Design reform.**
6.Ensuring benefits for consumers: Skills, empowerment	- Talent gap growing: 4/10 adults and 1/3 person who works in Europe lack basic digital skills	- 2023 EU Year of Skills package to promote reskilling and upskilling, boost EU industry competitiveness, create quality jobs and respond to the twin transition.	- Need for shared understanding on jobs, knowledge and skills - Companies, industry associations and training/education providers to jointly develop and update curricula and trainings - Develop sustainability competencies, building upon the work of the European Commission's JRC (GreenComp reference framework)	**By 2025, Member States, companies and utilities to complete retraining in digital and cyber skills for 20% of the workforce[17].** **By 2025, companies and utilities in the EU should be providing ICT and cyber training to 70% of their employees.** **By 2025, mapping of EU jobs being created, transformed and lost in the transition to a digital energy ecosystem until 2030.**

[17] A STRONGER DIGITAL EUROPE – our call to action towards 2025: https://www.digitaleurope.org/policies/strongerdigitaleurope/

7.Energy Consumption of the ICT sector (Networks / Data Centres) -	- Perception that the ICT industry consumes high amounts of electricity - Perception that electricity consumption will increase with increased transmission of data and the digitalisation of society	- Through advancements in technology, focus on sustainability and energy performance, industry can deliver increased bandwidth using the same or less power. Continuous network modernisations are further improving the energy performance of cellular networks - Assess current scientific analyses: data transmission and energy use are not correlated, and digitalisation of society at large does not mean higher energy consumption of the ICT sector - Harmonisation of energy efficiency requirements of data centres	- Avoid regulatory fragmentation of the ICT sector and data centres in particular. Define harmonised requirements on the sustainability reporting of Data centres (Energy Efficiency Directive). - New labelling or indicators should be easy to implement, accessible for DC operators and based on existing standards - Labelling directed to consumers should only include information that is strictly needed to inform their choices - Align with existing sustainability reporting regulations (i.e., CSRD, ESRS Standards)	**By 2025, the EU should capitalise on digital technologies to help resource-intensive industries reduce 20% of their global GHG emissions.**

Annex II: Solutions and use cases

As highlighted in DIGITALEUROPE's Thought-Leadership Report on the Digitalisation of the Energy Ecosystem[18], the energy sector needs to become a continued and efficient adopter of digital technologies and solutions. While these have the potential to help resource-intensive industries reducing their global GHG emissions by 20% by 2030, the EU needs more use cases demonstrating their tangible effect on the EU's ability to be resilient in the face of the energy crisis, and how they can help the EU reach its green targets. Examples of technologies that are driving the digitalisation of the energy ecosystem are provided below.

Digital Twins

The digital twin of the electrical grid and advanced grid software solutions can support the integration of new generation and loads and accelerate the energy transition to support EU's security of supply and climate targets for 2030. The potential of the technology is recognised: it is expected to grow more than six-fold between 2020 and 2026, with the US being the largest market[19].

Digital twins enable utilities and system operators to manage planning, operations and maintenance processes efficiently, while handling complex and expanding data volumes. However, data is still handled in a very siloed way, with different sources and formats for each process. Beyond being a digitalised model of the physical world, the digital twin offers a single source of truth, providing all the date needed for different processes across a single company.

To track progress on the digitalisation of the grid, a new KPI could be introduced to evaluate the "maturity level" of the "digital grid twin". This assessment could measure the share of High Voltage, Medium Voltage, and Low Voltage grid nodes digitally represented and included in a network model and made available across planning, operations, maintenance processes. This KPI could be included in the ongoing discussion on smart grid indicators, per article 59.1 (I) of the Electricity Directive.

Use case: Siemens' **digital twin of the electrical grid to develop clean power sources**: https://www.siemens.com/global/en/company/stories/infrastructure/2018/digital-twin-fingrid.html

[18] https://www.digitaleurope.org/news/digitalisation-of-the-energy-system-experts-urge-the-eu-to-ramp-up-collaboration-between-the-digital-and-energy-sectors/

[19] https://reports.valuates.com/market-reports/QYRE-Auto-15L1177/global-electrical-digital-twin

Peer-to-peer trading and local energy markets

There are already several peer-to-peer trading projects taking place in the EU, such as the pebbles project (in Germany. This project has established the first local marketplace for optimised electricity trading which takes grid constraints into account and incentivises flexibility. Beyond engaging prosumers, it also presents concrete alternatives to reduce the need for grid expansion.

However, small scale energy trading faces several challenges, including diverse semantics, lack of interoperability, and poor asset-based data quality. This hinders the expansion and scaling of local initiatives. Additionally, the current energy market design and regulatory framework do not provide appropriate means to small and mid-sized consumers, prosumers, and producers to directly buy and sell electricity and to provide flexibility to increase grid utilisation.

Connectivity and digitalisation are essential for the success of DoEAP initiatives and the transformation to renewable and fossil free energy production. Network management solutions play a crucial role in enhancing distribution efficiency, increasing resilience, lowering costs, transitioning to smart grids and providing effective operation management and platform-based customer services.

Use case: Siemens and regional utility Allgäuer Überlandwerk (AÜW), **Electricity trading based on blockchain**, https://press.siemens.com/global/en/pressrelease/electricity-trading-based-blockchain-launches-german-municipality

Sustainable Networks

High speed connectivity is essential to facilitate the twin transition as it is a critical enabler for digital technologies that cannot be fully deployed or reach their transformative potential without it. Telecommunication technologies are vital in delivering real-time value across the ecosystem and sustainability gains.

For example, new **antenna-integrated radio solutions** for mobile communications allow for the faster deployment of mid-band 5G networks. This leads to improved network performance, lower inter-cell interference and support for high-order spatial multiplexing and multi-user MIMO (MU-MIMO), as well as full radio resource utilisation in vertical and horizontal beamforming. **These technologies could help decrease energy consumption by up to 43% compared to the previous-generation radios and up to 55% during off-peak times**.

Use case: Ericsson and Vodafone, **Powering Network Efficiency** https://www.ericsson.com/4ae1be/assets/local/about-ericsson/sustainability-and-corporate-responsibility/environment/07122021-ericsson-vodafone-4page-web_fin.pdf

Telecommunication networks enabling grid resilience

Several EU countries have recognised that improving the resilience and security of their telecommunications infrastructure is critical to ensuring the resiliency of their electricity grid and enabling its digitalisation to edge.

Power utilities, water utilities, gas and heat distribution providers are increasingly using the 450 frequency spectrum bands to support cellular connectivity solutions with broad coverage. This strategy improves their operations' efficiency and allows for the consistent integration of renewables into their grids while ensuring a level of resiliency needed during major power outages. Ultimately, this will lead to the achievement of integrated and secure European utilities markets.

Use case: Nokia enables '450connect' **LTE450 critical infrastructure network**
https://www.nokia.com/about-us/news/releases/2022/02/14/nokia-chosen-by-450connect-to-supply-network-technology-for-lte450-critical-infrastructure-network-in-germany/

AI for Energy efficient Data centres

Where telecommunication networks are the rails, data centres are the engine of the digital transformation train and this train cannot run effectively nor efficiently without both. They constitute two pieces of critical infrastructure that are a must-have if the EU is to reach its green goals. Crucially, data centres allow for big data processing in a safe and secure environment, in the most sustainable way. Machine learning and artificial intelligence hold significant promises for advancing the efficient use of energy across a number of domains. For example, Google has developed a Cloud-based, AI-powered recommendation system that can improve the energy efficiency in data centres and deliver consistent energy savings of around 30% on average. As data center electricity demand grows, the adoption of similar tools by others in the industry can lead to significant energy savings across the industry.

Use case: Google, **Safety-first AI for autonomous data center cooling and industrial control,**
https://www.blog.google/inside-google/infrastructure/safety-first-ai-autonomous-data-center-cooling-and-industrial-control/

Datacentre batteries supporting growth of renewables on the power grid

With more variable renewable energy in the grid, grid frequency is becoming more volatile. Data centers have batteries on site which can be activated in fractions of seconds to ensure an uninterrupted supply of energy to their servers (UPS) before other emergency energy supplies are activated. Developed functionalities can provide grid stabilisation to the grid by activating the UPS with secure communication between the datacenter and the utility.

Eirgrid, the Irish transmission system operator, runs a market for grid services that prioritizes non-carbon-emitting solutions. Microsoft is participating in this market through Enel X, that aggregates industrial and commercial energy consumers into virtual power plants. The long-term vision is to turn the datacenter assets into something that can provide social benefit outside of their operations.

Use case, Microsoft-Eaton, **Grid-interactive data centers: enabling decarbonization and system stability**, https://www.eaton.com/gb/en-gb/markets/data-centers/transform-your-power/energy-aware/eaton-microsoft-grid-interactive-data-center-whitepaper.html / https://news.microsoft.com/source/features/sustainability/ireland-wind-farm-datacenter-ups/

Cloud Computing

The cloud has the ability to support multiple products simultaneously, making it an efficient way to distribute resources among many users. This means that we can accomplish more tasks using less energy, which is beneficial for both individuals and businesses. In 2013, a study conducted by Lawrence Berkeley National Laboratory found that if all office workers in the United State were to use the cloud, it could reduce the energy used by information technology by up to 87%[20].

However, **despite the opportunities presented by the cloud, including green cloud, only 41 % of EU enterprises used cloud computing in 2021, mostly for e-mail and storage of files[21].**

Use case: VMware and UK Power Networks**, Cloud computing solution transforming energy grids to deliver environmentally clean power,** https://innovation.ukpowernetworks.co.uk/projects/constellation/

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[20] Berkeley Lab, "**Berkeley Lab Study Finds Moving Select Computer Services to the Cloud Promises Significant Energy Savings", 2013,** https://newscenter.lbl.gov/2013/06/11/berkeley-lab-study-finds-moving-select-computer-services-to-the-cloud-promises-significant-energy-savings/

[21] Eurostat, Cloud computing - statistics on the use by enterprises, 2021, https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Cloud_computing_-_statistics_on_the_use_by_enterprises

Power over Ethernet

Next generation Power over Ethernet (PoE) technology is a game changer, particularly in smart buildings, as it allows enterprises to connect everything inside the building to the ethernet cable instead of the traditional power cable. PoE technology that operates over DC power **has the potential to help Europeans reduce up to 45% energy waste, saving energy and reducing operating costs[22].** PoE provides the ability for the switch infrastructure to supply power over a copper Ethernet cable to an endpoint device. Typically, it used to power up devices such as Access points, IP Cameras and IP Phones connected to the device's Ethernet ports.

Use case: Cisco and VINCI, **L'Archipel: A smart and unified building for VINCI in Paris,** https://video.cisco.com/detail/videos/latest-videos/video/6314133517112?autoStart=true

[22] CSA Group, "DC Microgrids in Buildings", March 2019, https://www.csagroup.org/article/research/dc-microgrids-in-buildings/

About DIGITALEUROPE

DIGITALEUROPE is the leading trade association representing digitally transforming industries in Europe. We stand for a regulatory environment that enables European businesses and citizens to prosper from digital technologies. We wish Europe to grow, attract, and sustain the world's best digital talents and technology companies. Together with our members, we shape the industry policy positions on all relevant legislative matters and contribute to the development and implementation of relevant EU policies, as well as international policies that have an impact on Europe's digital economy. Our membership represents over 45,000 businesses who operate and invest in Europe. It includes 102 corporations which are global leaders in their field of activity, as well as 41 national trade associations from across Europe.

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