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A digital agenda for the Clean Industrial Deal: Powering Europe's energy transition

Executive summary

Energy lies at the heart of the Clean Industrial Deal (CID), and digitalisation, particularly the deployment of AI, plays a crucial role in achieving its twin goals of industrial decarbonisation and enhanced competitiveness. This paper outlines the vital contribution of digital technologies in driving energy efficiency, reducing costs and strengthening Europe's industrial competitiveness and resource efficiency.

To unlock the full potential of digitalisation, these technologies must be scaled sustainably and paired with an industrial strategy that supports the responsible deployment of digital infrastructure, notably energy- and resource-efficient data centres. The paper reviews current policy efforts to reduce emissions and energy use and highlights best practices already making an impact across Europe. It also explores the growing role of AI in driving down emissions through optimisation and innovation.

However, the path forward is not without challenges. Persistent barriers, including ageing grid infrastructure, slow permitting processes, limited financial incentives and a lack of digital and green skills, are slowing the uptake of digital and AI-driven solutions in the energy sector. This paper identifies these critical obstacles and offers targeted recommendations to address them. Overcoming these barriers is essential to enabling a competitive, clean and future-ready European economy.

Our key recommendations are to:

- **Accelerate electrification and digitalisation of the EU energy system:** To achieve this, it is essential to revise the Energy Taxation Directive to ensure equitable electricity-to-gas pricing and fully implement the Net Zero Industry Act to expedite clean and digital technologies. Additionally, leveraging electricity market mechanisms will promote the development of firm and flexible carbon-free resources, driving the transition towards a sustainable energy system.
- **Prioritise digitalisation in the European Grids Package:** This involves investing in digital infrastructure and international interconnectors, as well as introducing flexibility incentives to manage grid congestion. Public-private partnerships should be enabled to finance grid upgrades, whilst supporting smart grids and AI-driven energy management. Streamlining permitting processes and deploying generative AI solutions will enhance efficiency. Increasing transparency

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and regular reporting will foster accountability and drive progress towards Europe's decarbonisation and digitalisation goals.

- **Harmonise data standards and interoperability**: Grids still operate in national silos, lacking integration, standardisation and interoperability. This prevents economies of scale and the deployment of shared digital technologies. To address this, the EU should support harmonised data standards and interoperability across the energy system to reduce fragmentation, align EU legislation and accelerate the development of common energy data spaces.

- **Strengthen cybersecurity policies and standards**: Align EU cybersecurity frameworks, extend transition periods for compliance and promote global standards convergence. Establish a public-private threat-sharing platform under ENISA to support real-time cyber threat intelligence and coordinated response.

- **Upgrade the resilience of Europe's energy infrastructure**: Invest in dual-use technologies to protect critical energy assets through a mix of EU, national and private funds. Investments should encompass both cyber defences and physical infrastructure such as drones, satellites, and connectivity systems. The EU could take inspiration from efforts such as those in the US, where the US Administration's ICEYE initiative is advancing radar-based surveillance infrastructure for both security and defense.

- **Close the green and digital skills gap**: Equip the workforce to lead the energy transition by expanding public-private partnerships and targeted investments. Establish a European framework for green and digital sustainability roles and ensure alignment between skills initiatives and EU industrial and climate strategies. Prioritise demand-driven training programmes that match evolving industry needs and secure a future-ready, resilient labour force.

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How can digitalisation contribute to the Clean Industrial Deal goals?

Integrating digital technology into the implementation of the Clean Industrial Deal (CID) is not only a strategic move; it is necessary for achieving a sustainable, competitive and resilient industrial sector. By leveraging the power of digital tools, the European Union (EU) can drive significant progress towards decarbonisation and its climate goals, support small and medium-sized enterprises (SMEs), promote sustainability and efficiency and enhance resilience, innovation and overall competitiveness. This integration will ensure that the EU remains at the forefront of industrial modernisation and environmental stewardship.

Europe needs to reduce its dependency on imported energy. The only way is to decarbonise its industries, through increased electrification, and thus we will need more electricity, mainly from renewable assets. To be able to deploy the amount of renewables needed to meet the energy demand and achieve Europe's decarbonisation and energy cost reduction needs, the entire energy ecosystem needs to be digitalised, to minimise volatility and reduce power peaks and keep the energy system stable. Energy-related data needs to flow between users, distributors and producers, to be able to perform e.g. forecasting, grid management and flexibility solutions. Through the creation of a digital energy ecosystem, the long-term realisation of the European Energy Union is fully achievable.

Through clear political leadership and a focus on digitalisation in the energy system and across industries, the EU can create the much-needed innovation and take the pole position in the digitalised industry sector and a digital energy ecosystem.

Examples and case studies of companies deploying digitally-powered energy efficiency, showcasing the overlap and the rapid return-on-investment, can be found in the Annex of this paper.

Digitalisation as a driver of energy efficiency and affordability

As outlined in the Mario Draghi report,[1] EU competitiveness is bottlenecked by high energy prices, with EU industrial electricity prices roughly two and a half times higher than in the United States (US).

The cheapest and cleanest energy is the one which was never consumed at all, making electrification and energy efficiency the most cost-efficient, local and sustainable ways to power our economies, whilst simultaneously addressing high energy prices and energy security.

In the EU, it now takes half the energy to produce the same value added as 20 years ago[2] and manufacturing specifically produces 50 per cent more added value with 25 per cent less energy. Digitalisation is the lubricant that keeps these electrification and decarbonisation dynamics progressing. To achieve the CID targets, such as the 32 per cent electrification by 2030,[3] digitalisation of all industry sectors must be the cornerstone of the EU's industrial policy.

[1] Mario Draghi, *A competitiveness strategy for Europe (Part A),* available at https://commission.europa.eu/document/download/97e481fd-2dc3-412d-be4c-f152a8232961_en?filename=The%20future%20of%20European%20competitiveness%20_%20A%20competitiveness%20strategy%20for%20Europe.pdf.

[2] IEA, *Manufacturing energy consumption*, available at https://www.iea.org/data-and-statistics

[3] European Commission, *Clean Industrial Deal: A Joint Roadmap for Competitiveness and Decarbonisation*, COM (2025) 85 final, available at https://commission.europa.eu/topics/eu-competitiveness/clean-industrial-deal_en

AI and digital tools facilitate real-time monitoring and optimisation of energy consumption, leading to substantial energy savings and therefore reducing energy prices paid by citizens and industrial customers. By integrating building energy management systems and automation, users can optimise the usage of various components of a building, from heating, cooling and ventilation. By combining that with digital twins and the use of AI, building users and managers can address system deficiencies much faster and benefit from predictive maintenance tools to improve buildings' lifetime.

A strong regulatory framework can provide the push needed to ensure consistent support for digitalisation, modernisation and efficiency in industry, as well as financial and technical support needed.

In May 2025, the Iberian Peninsula faced a sudden blackout, requiring over 35,000 be rescued from trains and metros:[4] the full cost is still being estimated, but may be anywhere between €400 million to €1.5 billion.[5] This event is a stark reminder that the electricity grid is the backbone of the energy transition and that it needs to transform at the speed needed to keep up with other societal mega shifts, such as decarbonisation, electrification and digitalisation.

In an increasingly electrified society, where electricity will make up 60 per cent of all energy demand, compared with just 20 per cent today, upgrading and expanding grid capacity will be essential to guarantee Europe's energy resilience.[6] The full implementation of the EU Grid Action Plan and the upcoming Grids Package will be crucial, with a key focus on more streamlined permitting processes for grid infrastructure and the development of best practices for evaluating and planning for demand growth.

For that, grid investments in Europe will need to double by 2050,[7] but digitalisation can help modernise the grid to help avoid lengthy and costly expansion plans. Meeting the needs of a net-zero world purely with grid expansion would require 152-million kilometres of wire, enough to go from the Earth to the Sun.[8] Such a copper-intensive approach would strain our resources and our ability to complete our transition.

By using digital solutions and grid-enhancing technologies, grid operators can better use the physical grid's capacity today, identify where upgrades are the most useful and efficient. Digital flexibility management solutions can also forecast, evaluate and mitigate grid congestions, which makes grids more stable and resilient.

Digitalisation of the grid directly supports the grid, but consumption happens behind the meter. To understand how and when users are consuming electricity, free data flows are needed. Energy-related consumption data should flow between users, distributors and producers of electricity on a voluntary

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[4] Associated Press, 'Power outage affects parts of Spain and Portugal,' available at https://apnews.com/article/spain-portugal-power-outage-electicity-533832bb4ceae92eaa68c23dc0b5db18.

[5] See Brussels Times, 'Blackout cost Spain €400 million,' available at https://www.brusselstimes.com/1566479/blackout-cost-spain-e400-million, and BBC, 'How Spain powered back to life from unprecedented national blackout,' available at https://www.bbc.com/news/articles/c175ykvjxyeo.

[6] Eurelectric, *Grids for Speed report*, available at https://powersummit2024.eurelectric.org/wp-content/uploads/2024/05/Grids-for-Speed_Report.pdf.

[7] Eurelectric, *Double investments in power distribution or lose Europe's race to net-zero*, available at https://www.eurelectric.org/news/grid_investments_for_netzero/.

[8] BNEF, *A Power Grid Long Enough to Reach the Sun Is Key to the Climate Fight,* available at https://about.bnef.com/blog/a-power-grid-long-enough-to-reach-the-sun-is-key-to-the-climate-fight/.

contractual basis.[9] Digitalisation of downstream industry sectors will be crucial, unlocking energy management solutions improving predictability, frequency control and for those customers and industries capable of implementing such measures. Demand-response is the main form of flexibility: an energy asset responding to a signal. It can be as simple as an on/off instruction or as complex as an AI-optimised microgrid, but all flexibility is built upon devices receiving and reacting to digital signals.

Fully implementing existing legislation to ensure easy access to distributed digital assets in flexible energy markets could save consumers billions of euros each year. Moreover, increasing the use of demand-side flexibility by 2025 could reduce natural gas imports by 3.1 per cent, resulting in annual savings of €31.4 billion[10]. With increased digitalisation, more and more energy assets can become smart, unlocking the benefits of distributed energy, integrating more renewables into the energy mix and advancing the EU objectives to cut its dependencies on gas imports.

Digitalisation as a booster of industrial competitiveness

The rapid deployment of digital technologies and the transformation of the EU industrial manufacturing base are essential to compete on equal terms with state-of-the-art and energy-efficient factories in other parts of the world. Adoption of digital technologies by companies is one of the EU's KPI for competitiveness, with a target of 75 per cent adoption by 2030; it currently sits at half that (38.9 per cent).[11]

Digital technologies such as automation and AI can also optimise manufacturing processes, reduce downtime and fuel consumption, and improve overall equipment efficiency. This, in turn, will bring down production costs through reduced energy consumption and resource use. Providing critical worker communication channels, including Push-to-Talk and Push-to-Video, improves communication and collaboration across industrial sites. This reduces the need for physical travel and enables quick responses to potential safety issues or machine malfunctions.

Combining the real and digital worlds via digital twins can have positive outcomes for product design (e.g. evaluate hundreds of product designs whilst building fewer prototypes), production (e.g. optimise energy productivity across machines and plants, use flexible energy mix, real time monitoring of air and water quality) and overall lifecycle (e.g. perform data-driven predictive maintenance). This interconnected digital thread extends beyond individual elements, reaching into supply chains and ecosystems.

Private wireless networks and mission-critical edge computing provide the high bandwidth and low latency needed to run these applications efficiently, unlocking their potential for more sustainable and optimised operations. A key to this successful transformation lies in supporting SMEs, notably through the future Multiannual Financial Framework (MFF). Whilst larger groups are already deeply committed to such transition, smaller European companies are lagging behind the world standard. It is estimated that EUR

[9] DIGITALEUROPE, *Executive brief: Removing regulatory burden for a more competitive and resilient Europe*, available at: https://www.digitaleurope.org/resources/executive-brief-removing-regulatory-burden-for-a-more-competitive-and-resilient-europe/.

[10] SmartEN, *DSF potential contribution to 2023 and 2025 gas reduction*, available at: https://smarten.eu/reports/report-l-dsf-potential-contribution-to-2023-and-2025-gas-reduction

[11] COM(2025) 26 final.

€100 billion would be necessary for Europe to catch up with the global standard for industrial modernisation.[12]

Digitalisation as enhancing resource efficiency

Digitalisation is the key accelerator for not only the productivity and efficiency of our industries, but also for its sustainability.

For example, water management can be addressed through digital solutions. Water loss in distribution networks is a key challenge for water and wastewater utilities, next to limited budgets, staff, time, pollution from sewers and decades-long asset lifecycle. Small leaks cause disproportionately high costs because they are very difficult to find. Industrial-grade AI and cloud solutions tailored to the specific needs of water utilities can help address these challenges by processing data from sensors providing information about flow, pressure, noise or tank levels. The results provide an excellent overview of events, including leaks, bursts, sewer blockages, pressure drops, equipment or sensor failures, investment and operational scenarios.

In addition, using digital solutions can contribute to the EU's circular economy goals. Not only can digitalisation help better secure critical infrastructure, prevent failures and enhance predictive maintenance to ensure extended product lifetimes, but it can also help trace materials and resources more effectively to promote re-use and recycling. The use of digital twins can also avoid the extensive use of materials for prototypes for new products.

Continuing the sustainable deployment of AI and clean technology

To fully realise the CID goals, digitalisation must not only support energy and resource efficiency, competitiveness, and grid resilience – it must also be scaled sustainably. This is particularly valid as the deployment of AI and advanced digital technologies across all sectors. AI, cloud services and other digital innovations are powerful enablers of industrial transformation, but their energy and infrastructure requirements are continuously growing.

At the heart of this digital backbone are data centres, which store and process the data necessary for AI models, digital twins, predictive maintenance, demand-side flexibility and smart manufacturing – all critical components of the CID. As these use cases expand, it is undeniable that data centre energy consumption is also increasing. Nevertheless, despite rapid growth, data centres remain a relatively small part of the overall power system, rising from about 1 per cent of global electricity generation today to 3 per cent in 2030, accounting for less than 1 per cent of total global CO_2 emissions.[13] Boosting digital technologies needs to be paired with an industrial strategy to sustainably deploy data centres.

Policy measures to reduce energy consumption and emissions to date

Recognising this challenge, DIGITALEUROPE fully supports the European Commission's efforts to make Europe climate-neutral by 2050. Today, data centres are leading sustainability efforts in Europe by

[12] COM (2025) 85 final.

[13] IEA, *Data Centres and Data Transmission Network*, available at https://www.iea.org/energy-system/buildings/data-centres-and-data-transmission-networks.

advancing their own decarbonisation and climate neutrality and supporting other industries to become more sustainable and digital.

Environmental reporting obligations for operators of EU-based data centres are addressed in different regulations. This includes the Energy Efficiency Directive (EED)[14] and its delegated act on the reporting scheme for data centres,[15] the Taxonomy Regulation, the European Performance of Buildings Directive[16] and the Corporate Sustainability Reporting Directive (CSRD).[17]

Under the EED's reporting scheme, data centres are required as of 15 September 2024 to report data on their energy performance and sustainability to the European Database.[18] Building on the sustainability indicators from the reporting, the Commission will propose a sustainability rating scheme for data centres to be finalised after 2025.

Such a proposal, if designed well, has the potential to significantly enhance transparency and accountability in the sector's sustainability performance. If designed correctly, a future-proof and proportionate rating mechanism that ensures a level playing field for data centres across the EU could support customers, operators, and investors in making informed decisions and identifying opportunities for improved ratings.

As the data from the first reporting cycle is incomplete (only 40 per cent of data centres reported their data to the Commission's database in 2024, with no data reported in six Member States)[19], the Commission should consider reviewing reliable and comprehensive data from at least two complete EED reporting cycles. In this context, DIGITALEUROPE is not in favour of the introduction of individual minimum performance standards as these do not account for the complex interdependencies between energy efficiency, water use and heat reuse potential, as well as the vast variety of operational controls across the sector.[20] Thus, to reflect this complexity in the context of the development of data centre rating scheme, DIGITALEUROPE has drawn attention to the diverse operational requirements across different types of data centre facilities, encouraging early adoption of cutting-edge solutions that can accelerate Europe's transition to net-zero and has urged the Commission to stick to a more holistic approach within the rating scheme.

The key performance indicators proposed by the industry promote the adoption of energy-efficient design, operation and management practices for data centres, whilst being based on well-established international technical standards - power usage effectiveness (PUE), water usage effectiveness (WUE), renewable energy factor (REF) and IT capacity metrics with bonus key performance indicators that reward advanced sustainability initiatives.[21]

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[14] Directive (EU) 2023/1791.

[15] Commission Delegated Regulation (EU) 2024/1364.

[16] Directive (EU) 2024/1275.

[17] Directive (EU) 2022/2464.

[18] Commission Delegated Regulation (EU) 2024/1364.

[19] EUDCEAR Workshop (May 2025), available at: https://www.borderstep.org/wp-content/uploads/sites/2/2025/02/DG-ENER_EUDCEAR_Workshop-3_Shared-with-Stakeholders.pdf

[20] DIGITALEUROPE, *Proposal for the draft EU sustainability rating scheme for data centres*, available at: https://www.digitaleurope.org/resources/proposal-for-the-draft-eu-sustainability-rating-scheme-for-data-centres/

[21] Ibid.

Overall, to reduce fragmentation, we advocate for existing regulatory and voluntary frameworks to align with the EED and the forthcoming rating scheme for data centres. This ensures consistent recognition of data centre performance across the single market and avoids duplicative or contradictory regional and local schemes. For instance, the Water Resilience Strategy[22] and its potential sectoral follow-up initiatives should be aligned with current reporting requirements and rating schemes, such as those outlined in the EED. This will prevent overlapping obligations and promote a more efficient regulatory environment.

Finally, it is important to align the rating scheme with the objectives of the upcoming AI, cloud (e.g. Cloud and AI Development Act, Apply AI Strategy) and quantum (Quantum Act) initiatives to ensure coherence with Commission initiatives aimed at fostering innovation, competitiveness and sustainability across the digital sector.

Continuing to lead in energy and resource and resource-efficient data centres

These policy developments are essential to setting a common framework, but it is the industry's proactive efforts that are already delivering real-world impact. Data centres are leading with innovation, investment and collaboration to drive energy efficiency and decarbonisation.

Despite exponential growth in data traffic, an 80-fold increase between 2007 and 2023, the electricity consumption of the ICT sector has only risen 1.4 times, thanks to sustained efficiency gains across the digital value chain.[23] This shows that energy use is not directly proportional to increased data usage, thanks to efficiency gains brought about by hardware-to-software solutions across the data value chain.

Data centres have also been driving further deployment and uptake of cleaner sources of energy by financing the additional connection of clean power to electricity grids. Through Power Purchase Agreements (PPAs), data centres are helping the addition of new clean energy capacity to the grid and reducing fossil fuel use. Since 2018, data centres have added 11.6 GW of clean energy in the EU through PPAs and other mechanisms to match their energy consumption.[24]

In addition to securing PPAs, many solutions exist to help data centres continue contributing to improving energy efficiency:

- **Innovative cooling solutions:** AI-optimised and liquid cooling solutions in data centres can enhance energy and water efficiency, contributing to reduced environmental impact. For example, some data centres employ AI-powered recommendation systems on a project basis, achieving consistent energy savings of roughly 30 per cent.[25]

[22] European Commission, *European Water Resilience Strategy*, COM (2025) 280, available at: https://environment.ec.europa.eu/publications/european-water-resilience-strategy_en

[23] Ericsson, *Rethinking ICT energy: networks, data centers*, available at:https://www.ericsson.com/en/reports-and-papers/white-papers/ict-energy-evolution-telecom-data-centers-and-ai

[24] RE-Source, *PPA deal tracker*, available at https://resource-platform.eu/buyers-toolkit2/ppa-deal-tracker/

[25] DIGITALEUROPE, *Digitalisation as a key enabler for resilient and sustainable energy ecosystem*, available at https://cdn.digitaleurope.org/uploads/2023/02/Digitalisation-as-an-enabler-for-an-independent-and-sustainable-energy-system-4.pdf

- **Using well-established metrics:** Metrics like PUE, WUE, ERF and IT capacity metrics promote the adoption of energy-efficient design, operation and management practices for data centres. Helping to identify where energy and water are being used inefficiently. Guiding improvements in cooling, power distribution and resource use, all contributing to lower consumption and more sustainable operations.
- **Waste heat re-use for local communities (hospitals, educational facilities, etc.):** Where local infrastructure allows, data centres are finding opportunities to capture and reuse their heat for nearby buildings and industries, including schools, swimming pools and residential areas. For waste heat re-use to be a success, this must be considered from the design phase, local infrastructure must be suitable, and willing partners must be available. Supportive policy frameworks, incentives and financing schemes can further help data centres and municipalities seize the opportunities of deploying waste heat reuse for their communities.[26]
- **Supporting grid stability:** Data centres are not set up to provide traditional load flexibility (i.e., shifting demand up or down on command). However, their advanced energy-management systems in some cases can still bolster grid reliability in other ways.
- **Future-proofing energy efficiency and improving operational efficiency:** Data centres are increasingly adopting a range of solutions to future-proof their energy efficiency and improve day-to-day operational performance. Using smart sensors, automation and systems like fault managed power to optimise energy and water use in real time. Looking ahead, many are investing in next-generation solutions, including alternative refrigerants, green backup systems like hydrogen and sustainable construction materials to reduce environmental impact and ensure long-term energy resilience.

AI innovations will continue to bring down emissions

The relationship between data centres and AI is inherently symbiotic: whilst AI increases infrastructure demand, it also offers powerful tools to further improve sustainability. AI is not just an energy user – it is also a key driver of energy savings and optimisation across sectors. Not only will AI models continue to become more efficient, thereby reducing energy consumption, but further digitalisation of energy and industrial sectors will continue to generate significant emissions savings, partly counterbalancing the expected rise in energy consumption.

AI can support energy consumption optimisation, whilst maintaining state-of-the-art service delivery to end consumers. For example, AI can use network traffic analysis to assess and forecast when network demands will be lower and power down equipment, or route traffic through network nodes which are served by lower carbon intensity electricity (e.g. through countries with a higher proportion of renewable energy for multi-country networks).[27]

Several key innovations are helping to significantly improve the efficiency of AI:

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[26] DIGITALEUROPE, *The Download – Data Centres: A powerful enabler of Europe's twin transition*, available at https://www.digitaleurope.org/resources/the-download-data-centres-a-powerful-enabler-of-europes-twin-transition/

[27] Analysys Mason, *AI for Connectivity: How policymakers can help digitalization*, available at https://www.analysysmason.com/contentassets/5e398864686247e59396354ffd6875e2/analysys_mason_ai_connectivity_policy_digitalisation_full_report_mar2025.pdf.

- **Algorithmic innovations**: Different strategies are being deployed to reduce the computational intensity of inference, for example, by using mixture of experts (MoE) models. At inference time, MoE models selectively activate only the parts of the model most pertinent to solving the query in question, thereby saving on computation and hence energy costs whilst preserving model performance.[28]
- **Optimisation of resource usage for model training** has improved. Solutions such as batching can maximise the parallel processing power of GPUs by grouping tasks and running them together rather than sequentially, in order to save computing capacity.
- **Hardware efficiencies**: According to the International Energy Agency (IEA), the efficiency of AI-related chips has doubled every three years. Per unit of computation, the cost of a GPU has decreased by more than 99% when comparing current chips to 2006. Hence, it is highly probable that both servers and AI GPUs will advance with more efficient processors entering the market before 2030.[29]
- **System-wide energy savings outweigh consumption:** The widespread adoption of existing AI applications could lead to emissions reductions that are far larger than emissions from data centres, meaning AI can deliver a net reduction in global energy use.[30] For instance, in the electricity sector, AI can enhance grid efficiency, demand forecasting and energy storage. The IEA estimates this could free up 175 GW of transmission capacity and generate annual savings of up to $110 billion by 2035 without any new lines being built.[31]
- **AI-generated progress**: AI can continue to enable reductions in the energy sector. The IEA states that despite data centres potentially generating 500 MT of CO2 by 2035, AI-enabled reductions could reach from 1000 to nearly 1500 MtCO_2 of emissions savings.[32]

In short, AI is both a beneficiary of sustainable digital infrastructure and a driver of further environmental gains. As data centres become more resource-efficient and AI becomes more energy-aware, the combined impact can significantly advance the EU's climate and energy goals.

What is needed to accelerate the digital twin transition?

To unlock these benefits at scale, the EU must urgently incentivise and accelerate the deployment of digital technologies. Now is the time for the EU to accelerate investing in its future by focusing support, incentives and investment on critical and cutting-edge technologies for Europe's clean and digital transition. European industries must make a double technological leap in a short time to ensure they remain competitive on the global stage. The EU needs to invest where it can still be ahead globally, as in batteries, technologies for electrification, electrolysers and in digital in AI, cloud technology, quantum and connectivity. In 2023, China accounted for 80 per cent of average investments in the manufacturing of key clean technologies (versus 20 per cent for the EU and US combined). In digital, Europe is lagging in seven of eight critical

[28] IEA, *Energy and AI*, available at https://www.iea.org/reports/energy-and-ai/.

[29] Ibid.

[30] Ibid.

[31] Ibid.

[32] Ibid.

technologies.[33] Whilst the focus of the EU is rightly on defence for the next MFF, energy security and securing critical infrastructure remain amongst the top priorities of NATO and should be considered as well during the negotiations.[34]

Obstacles to further digitalisation

- **Ageing infrastructure:** By 2030, the average age of transmission and distribution networks in the EU will be more than 40 years.[35] Many competing regions, such as China, the US and India, have successfully deployed 5G Standalone networks, whilst Europe still hasn't. This needs to be taken into consideration in the review of the EU Merger Guidelines, to increase the healthy return of capital of telecommunication network operators and increase the ability to invest in European network infrastructure. A huge amount of investment will have to go into upgrading and expanding current infrastructure to help the economy digitalise.
- **Accelerating grid permitting:** Inadequate transmission infrastructure remains a major barrier to power system development, electrification, and energy security. Slow progression transmission lines development is caused by a series of issues, including supply chain stress, workforce shortages, and permitting bottlenecks. Nevertheless, permitting remains the primary cause of delays, especially in advanced economies, whilst shortages of cables, transformers and other components further hinder progress. To encourage full commitment to grid development, there should be increased accountability of Member States to boost grid development.
- **Digitalising permitting procedures:** Digitalising some parts of permitting processes that are similar to all EU Member States can help create a level playing field and avoid making some countries more attractive for investments than others.
- **Data silos:** Voluntary data sharing, as detailed in our data package paper[36], is fundamental to achieving the ambitions in the CID, to decarbonise Europe and create innovation across industries. To reap the benefits of wide-scale digitalisation, grid components, networks, electrical products and industry software need to speak a common data language. Interoperability is crucial and harmonising data protocols and access is therefore key to making infrastructure, products and software interoperable.
- **Lack of transparency on network planning**: The more grid operators are transparent on their infrastructure plans and network development needs, the easier it is for solution providers to propose scalable and cost-efficient digital products. Many Member States have different levels of transparency when it comes to their development needs, which hinders the scalability of

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[33] DIGITALEUROPE, *The EU's critical gap: Rethinking economic security to put Europe back on the map*, available at https://cdn.digitaleurope.org/uploads/2024/07/DIGITALEUROPE-CRITICAL-TECHNOLOGIES-REPORT-FINAL_JULY_WEB.pdf.

[34] NATO, Energy security, available at https://www.nato.int/cps/en/natohq/topics_49208.htm.

[35] BCG, *Delivering the Energy Transition Will Come Down to the Wires*, available at https://www.bcg.com/publications/2025/delivering-energy-transition.

[36] DIGITALEUROPE, *Removing regulatory burden for a more competitive and resilient Europe,* available at https://www.digitaleurope.org/resources/executive-brief-removing-regulatory-burden-for-a-more-competitive-and-resilient-europe/.

digitalisation. The wider the information, the bigger the economies of scale, the lower the costs for users.

- **Missing financial incentives to digitalise infrastructure**: Custodians of infrastructure, like grid utilities, are regulated monopolies whose primary income is the tariffs their regulator allows them to levy on users. If regulators only recognise capital expenditures as valid expenses, this forces utilities to solve problems inefficiently with large projects and physical infrastructure instead of through constant efficiency and upgrades, which require software and services. It is therefore essential that regulators take a total expenditure approach (ToTEX), giving utilities both the room and the imperative to modernise.
- **Digital skills upgrade**: To drive the energy transition, we need a workforce equipped with the right IT and OT skills. Digital and sustainability skills are interconnected, requiring a common approach to closing the skills gap. Technology partners, educational institutions, and industry leaders must collaborate to develop specialised training programs for green and digital technologies.

1. Put digitalisation, AI and advanced connectivity at the core of implementing the Clean Industrial Deal

Though the CID acknowledges the potential of digitalisation of the energy sector, it falls short of fully integrating green and digital transitions.

- Ensure cross-service cooperation across DG ENVI, DG CONNECT and DG GROW, to maximise the CID's competitiveness and sustainability potential.
- Design sustainability policy, when implementing the CID, to both support the positive impact of technology (handprint) and address the business operational impact to strengthen responsibility over the negative impact (footprint).
- Reinforce the CID's commitment to EU climate goals by embedding digitalisation and connectivity as enablers of decarbonisation.

2. Accelerate the electrification and digitalisation of the EU energy system

Implementation of existing frameworks:

- Finalise the revision of the Energy Taxation Directive[37] and encourage Member States to maintain an equitable electricity-to-gas price ratio in their taxation systems.
- Ensure full implementation of the Net Zero Industry Act[38] to accelerate permitting and scale up clean and digital technologies.
- Implement electricity market mechanisms under the Electricity Market Design[39] to incentivise the development of more firm and flexible carbon-free resources.

[37] Directive (EU) 2003/96.

[38] Regulation (EU) 2018/1724.

[39] Directive EU/2024/1711.

The European Grids Package must place digitalisation at its core to:

- **Boost investment in digital infrastructure:**
  - Introduce flexibility incentives to reward variable consumption patterns and reduce grid congestion. This will, in turn, encourage industrial players to invest in digital solutions to help manage and predict grid capacity.
  - Enable public-private partnerships to finance grid upgrades and digital infrastructure, such as public 5G Standalone and Mission Critical Networks, ensuring resilient and secure high-speed connectivity.
  - Establish market-based measures to support smart grids, AI-driven energy management, and demand-side flexibility solutions.
- **Facilitate permitting, grid modernisation and expansion:**
  - Streamline permitting processes for grid infrastructure across EU jurisdictions, including mobilising the Trans-European Networks for Energy framework[40] to issue EU guidelines and establish priority "electrification acceleration zones" for early deployment of grid infrastructure projects.
  - Deploy generative AI-based solutions to enhance the productivity of companies and licensing experts going through regulatory and permitting processes. For example, assisting with drafting documents using previously available data for human review and improvement.
  - Extend the permitting acceleration measures, introduced in the revised Renewable Energy Directive[41] in 2023, to grid infrastructure through an amendment to the directive. Applying the same principles to grid permitting, for both demand and generation projects, would ensure consistency and coherence across the energy system. This includes establishing clear and enforceable timelines, as well as creating "one-stop-shops" within competent authorities to streamline decision-making processes. Such alignment is essential to accelerate grid development and support Europe's broader decarbonisation and digitalisation goals.
- **Increase transparency of planning and processes:**
  - Improve transparency of grid development plans and promote best practices to support long-term scalability and industrial planning.
  - Amend the Regulation on the Governance of the Energy Union[42] to introduce regular reporting of Member States' grid investment, planning and development in their National Energy and Climate Plans (NECPs) to foster accountability, enable anticipatory investments and drive progress.

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[40] Regulation (EU) 2022/869.

[41] Directive (EU) 2009/28.

[42] Regulation (EU) 2018/1999.

- **Electrification Action Plan to facilitate access to affordable energy:**
  - Support the 32 per cent electrification target with sector-specific KPIs.
  - Accelerate permitting for renewables and other carbon-free energy sources whilst upgrading infrastructure to ensure resilience and flexibility.
  - Focus on energy efficiency and flexibility for industrial electrification, as they can bring about short-term costs and emissions savings.
  - Support industry electrification through counter-guarantees.
  - Promote a fair and competitive market for PPAs in Europe by providing the best practices that offer numerous benefits for both buyers and sellers of electricity, primarily by providing long-term price stability and security.

3. Promote investment in advanced clean energy technologies

Creating demand for digital solutions:

- Channel public and private funding to both reduce the environmental impact of existing technologies (consumption efficiency, footprint) and enable innovative, resource-efficient solutions.
- Refocus procurement on non-price criteria to give sustainability-enabling digital technologies a competitive edge, as supported by the Industrial Decarbonisation Accelerator Act.
- Lead by example, EU institutions and national governments should leverage the purchasing power of the public sector by increasing the adoption of energy-efficient digital technologies, building trust and confidence in these solutions, and reaping the benefits of lower energy costs.
- Mobilise investments via the Clean Industrial State Aid Framework and Clean Energy Investment Strategy to scale up broadband, AI, computing, and semiconductor technologies, including for SMEs. This can take the form of tax deductions for capital expenditure in new energy efficiency investments.
- Set up a one-stop shop to access EU funding processes, to bring more clarity to businesses on how public funds will be disbursed and which projects could be eligible.
- Include energy efficiency technologies and telecommunication networks, such as 5G networks, in the Climate Delegated Act of the EU Taxonomy to unlock sustainable investment in digital infrastructure.

4. Harmonise data standards and interoperability

- Support harmonised data standards and interoperability across all electricity-using sectors: grids, markets, buildings, industries and electric vehicles.
- Reduce fragmentation by aligning standards across EU legislation and accelerating work on common energy data spaces.

- Facilitate industry-wide collaboration and investment in interoperable systems to enable AI-driven energy optimisation and digitalisation at scale.

5. Strengthen Europe's cyber and infrastructure resilience through harmonised rules, threat-sharing, and dual-use tech investment

- Harmonise cybersecurity requirements by aligning definitions, taxonomies, and reporting obligations across EU frameworks (e.g. CRA, RED Delegated Act, NIS2).
- Allow longer transition periods for compliance to ensure supply chain-wide adaptation across suppliers, integrators, and end users.
- Promote convergence between European and international security standards to facilitate global market access.
- Establish a public-private threat-sharing platform under ENISA, modelled on the US ISACs, to enable real-time cyber threat intelligence and coordinated incident response.
- Launch a large-scale investment programme aimed at deploying dual-use technologies that protect critical infrastructure, including the energy sector. This initiative should be supported by the MFF, and combine joint EU and national investments, coordinated pilot deployments, and alignment of key instruments such as aligned with the SAFE Regulation, the EDF, the European Defence Industry Programme, Digital Europe, and Horizon Europe, and supported by the Connecting Europe Facility, EIB TechEU and private sector co-investment.

6. Close the green and digital skills gap with continued public-private partnerships and extra investment by enhancing collaboration between governments, educational institutions and the private sector

- Develop a European framework and job taxonomy for digital sustainability roles, including certification schemes to better match training with industry needs.
- Scale up existing skills initiatives and align them with EU strategies such as Sector Skills Alliances and the European Data Space for Skills.
- Strengthen collaboration between governments, industry, and educational institutions through targeted public-private investment to future-proof the EU workforce.

Annex

AI-powered energy efficiency in buildings

Member: Schneider Electric

Description: From 2020 to 2024, Schneider Electric implemented an AI-powered heating, ventilation and air conditioning (HVAC) optimisation system in 87 public schools in Stockholm, using existing infrastructure and thereby minimising capital expenditure. By optimising the HVAC of educational buildings, Schneider Electric has enabled €1.3 million in annual savings and 250 tonnes of CO_2 reductions across all 87 schools.

The system achieved energy savings for heating (597 MWh) and electricity (881.75 MWh), resulting in total energy savings of 1,478.75 MWh/year.

The environmental impact was also substantial; the AI optimisation helped avoid 109.87 tCO_2 from district heating and 149.30 tCO_2 from electricity consumption, totalling a 250.65 tCO_2 annual reduction in emissions.

The AI-powered HVAC solution is highly scalable and replicable across various building types and sectors. The global potential of these technologies is up to 30 per cent energy savings in commercial buildings.

Digitally-enabled grid planning

Member: Siemens

Description: Hardware savings: Through the RomeFlex project, Areti an Italian local distribution network operator is projected to optimise its hardware investments by 45 per cent, saving €420 million of over the next 8 years, thanks to strategic flexibility management. This result highlights the enormous potential of combining flexibility management with traditional grid planning and operations to create a future-ready, resilient energy infrastructure.

Outage prevention: Elvia, Norway's largest power grid operator, uses Siemens' software to develop a Digital Twin of the low-voltage grid, providing reliable data-driven insights and real-time transparency for multiple departments. This way, Elvia is optimising grid topology and utilising controllable distributed energy resources (DERs) to prevent constraint violations and manage demand during peak hours. Moreover, the Norwegian DSO is enhancing its usable grid capacity and reducing outage times by up to 30 per cent through the automated prediction of outage location and impact.

Creating a virtualised view of the electricity grid

Member: Google

Description: Tapestry, a part of X, Alphabet's moonshot factory, is creating a single virtualised view of the electricity system through AI-powered tools that can predict and simulate what might happen on the grid from milliseconds to decades into the future. Tapestry worked with Google DeepMind to improve the grid planning process by applying and enhancing GraphCast, an AI model designed for fast and accurate global weather forecasting. Tapestry and GraphCast's collaborative model outperformed the state-of-the-art model, the European Centre for Medium-Range Weather Forecasts' high-resolution forecast, by up to 15 per cent. These highly accurate wind forecast insights have already aided wind prediction in Chile and can give grid operators worldwide higher confidence in relying on variable renewable energy to power their network.

Digitally enabled integration of wind farms into the grid

Member: Nokia

Description: Connectivity facilitates seamless integration of renewable energy (e.g., solar, wind) into the grid, ensuring a stable and reliable energy supply and reducing energy waste. Our high-performance wireless broadband networks, especially in the context of renewable energy installations like wind farms, have been pivotal for global ESG goals. These networks enhance worker safety, collaboration and productivity, and unlock operational benefits of Industry 4.0 automation and predictive maintenance. The private wireless solutions provided by Nokia for wind farms, for example, ensure mission-critical reliability and low-latency broadband connectivity, essential for connecting workers, sensors, cameras and turbines in challenging environments.

In 2024, Nokia further advanced in embracing Industry 4.0 for optimizing wind farm operations. The incorporation of IEC 61850 standards in our mission-critical WAN solutions for power utilities highlights our commitment to sustainable and efficient energy management. This standard facilitates effective communication within electrical substations and across distributed energy resources, enhancing the overall efficiency and reliability of power systems.

Leveraging AI for carbon-free energy permitting

Member: Microsoft

Description: AI for permitting with customers that have worked to accelerate permitting procedures across different sectors. Microsoft's Generative AI for Permitting capabilities leverage Azure Open AI to enhance the productivity of customers' permitting operations, reducing the cost and time to permit new clean energy projects, turbocharging the rollout of clean energy globally, with a projection of saving between 255 per cent to 75 per cent of time in the application processes for nuclear permitting. Lloyd's Register, the UK-based classification society and professional advisory service, is using generative AI for permitting capabilities to bridge the gap between terrestrial and maritime applications. These capabilities are designed to enhance the regulatory process for nuclear technology and will be used by Lloyd's Register to advance the deployment of nuclear in maritime applications.

Leveraging digital technologies and IT/OT observability in factories

Member: Cisco

Description: Splunk (now a Cisco company) offers a big data platform that helps users with a range of tasks, including cybersecurity, observability, and network operations. Splunk provides users with granular, unified and real-time visibility across applications and hardware devices. In the manufacturing sector, this capability empowers companies with a unified view of key technical and business metrics across their operations to optimise at scale. Splunk partnered with Bosh Rexroth to help optimise energy efficiency, energy cost and carbon footprint across their production facilities. Through the partnership, Splunk was able to support Bosch's approach to environmental sustainability reporting whilst also optimising performance with digital solutions.

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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. Our membership represents over 45,000 businesses who operate and invest in Europe. It includes corporations which are global leaders in their field of activity, as well as national trade associations from across Europe.

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