bitkom

Position Paper

2025 November

Artificial intelligence and digitalisation for energy – An EU roadmap

Summary

The use of digital solutions is essential to enable the energy transition and efficiently manage the growing complexity of the energy system. We therefore strongly support the EU Commission's aim to unlock the potential of digitalisation and AI for energy. AI can be a powerful enabler of the energy transition – but only if its integration is backed by clear regulation, open and trusted data, robust digital infrastructure, and targeted research into energy-specific AI models. In this paper, we outline what we consider essential to ensure that AI is more widely deployed in the energy sector and can fully unfold its potential.

AI's Potential in the Energy Sector

AI can play a decisive role in making the energy system more efficient, flexible, and resilient – with particular value in the following areas:

- **More accurate forecasting of power generation and consumption** by analyzing large historical and current data sets enables better grid stability and optimized use of storage and flexibility options. This is crucial in the context of the energy transition and the increasing share of weather-dependent renewables (e.g. wind, solar).
- **Grid optimization:** AI enhances grid planning and operations by providing system operators with advanced insights, automation, and data-driven decision support, improving efficiency and reliability across the electricity network. It helps with the remediation of grid congestion and optimizes dispatching of intermittent renewables.
- **Automated control and integration** of decentralized, diverse energy sources and consumers – facilitating sector coupling across electricity, heating, and mobility.

64 %

of companies are currently planning or discussing the use of AI in energy management.

Source: Bitkom 2025

- **Efficiency gains** through optimized processes in generation, storage, and consumption (e.g. predictive maintenance, intelligent production systems).
- **Asset & Maintenance Management**: AI leverages digital twins, visual data, and predictive analytics to detect anomalies, optimize asset performance, and enable proactive maintenance. This reduces downtime, prevents costly failures and ensures safety and compliance. AI also assists in generating work plans, automating maintenance tasks, and ensuring compliance with safety and regulatory standards.
- **Regulatory Compliance**: AI helps energy companies navigate complex regulatory landscapes efficiently and streamlines regulatory filings by leveraging large language models (LLMs). This reduces the time and effort required for regulatory compliance, improves response accuracy, and minimizes errors.

Challenges: AI's Growing Energy Footprint

AI's own energy demand is rising sharply. In Germany, AI and high-performance computing currently account for 15 % of data center capacity, projected to reach about 40 % by 2030. This translates to a projected increase from around 3 TWh in 2024[1] to roughly 14 TWh by 2030[2].

To address this, many data center operators are investing in sustainable energy solutions. Currently, 74 % have green electricity contracts, 27 % purchase CO_2 certificates, and another 27 % generate renewable energy themselves[3]. Power Purchase Agreements (PPAs) are also becoming increasingly important. Targeted use of battery storage at data centers can lower peaks, shift demand for a few hours when needed, and free up capacity on existing lines. Studies indicate that limited, agreed curtailments combined with on-site storage can unlock significant network capacity without affecting service quality.

From 2027, German data centers will be legally required under the Energy Efficiency Act (EnEfG) to operate carbon-neutrally on a balance sheet basis. The energy transition, therefore, must accelerate so that data centers become carbon-neutral in practice, not only on paper. Achieving this will demand an expansion of renewable energy and power grids as well as more efficient hardware and software, ensuring that AI contributes to – rather than compromises – climate goals. Under the Energy Efficiency Directive, measures are currently being developed to position Europe as a climate-neutral hub for data centers.

Furthermore, Tiny AI and energy-efficient AI architecture are key levers for making AI models more climate-friendly. Studies show that approaches such as federated learning — training models across multiple devices instead of in a central location — as well as advances in hardware architecture can enable substantial energy savings of 65% and 31%, respectively[4]. AI training can cause fast changes in electricity use,

[1] Bitkom, 2024 Rechenzentren in Deutschland
[2] BMWK, 2025 Stand und Entwicklung des Rechenzentrumsstandorts Deutschland
[3] Bitkom, 2024: Rechenzentren: Deutschland verliert den Anschluss | Presseinformation | Bitkom e. V.
[4] Deutsche Energie-Agentur (Hrsg.) (dena, 2024): Studie: Energieeffiziente künstliche Intelligenz für eine klimafreundliche Zukunft. Neue Erkenntnisse über Energieeinsparpotenziale bei KI-Anwendungen.

sometimes by tens of megawatts within seconds. Battery storage smooths these swings and reduces the risk of flicker or stress on nearby generators.

The power grid is one of the biggest bottlenecks for the expansion of data centers. The establishment of new data centers should be supported by an active location policy that incentivizes settlement generally and particularly in areas with sufficient grid capacity and, ideally, in proximity to energy production sites. Such policy should also take into account other factors relevant to site selection, such as fiber-optic connectivity and the potential for waste heat utilization and should be closely consulted with the data center industry.

Recommendations

Create regulatory clarity

The introduction of AI is being slowed down by fragmented national regulations and the risk of overregulation. This hinders the development of new business models. A coordinated European approach is needed to avoid overlapping regulations at both the national and EU levels. Consistent implementation of European guidelines (such as the AI Act, Cyber Resilience Act or Data Act) is crucial.

In particular, Bitkom supports the EU Commission's goal of creating a clear and innovation-friendly framework for AI in Europe. Bitkom calls for practical simplifications to reduce legal uncertainty, including postponing the application of the most demanding requirements by at least 24 months, as the necessary technical standards will not be available before the end of 2026. In particular, the planned obligation for continuous open-ended risk searches in high-performance AI models would impose disproportionate burdens on companies without increasing safety. A practical regulatory framework requires clear differentiation between B2B and B2C applications. Industrial AI use cases rely on machine-generated data and require different regulatory tools than consumer-facing applications using personal data. To secure Europe's competitiveness, the AI Act must strike a balance between risk mitigation and innovation.

Furthermore, the EU must ensure that AI development is not hampered by unclear data regulations or OPEX funding. Instead, a clear regulatory framework is needed, for example through uniform communication standards and file formats, open interfaces, and effective data protection. Research and industry should work closely together across sectors to directly implement practical applications such as predictive maintenance and flexibility management.

Facilitate access to high-quality data

AI is only as powerful as the data it learns from. In Germany, access to high-quality energy data is particularly challenging due to the highly fragmented energy landscape with more than 800 distribution system operators. To unlock the full potential of AI, policymakers must significantly improve access to high-quality data within the scope of the existing laws and without introducing additional regulatory requirements. This requires coordinated efforts on several levels:

- **Laying robust technical foundations for data collection**: Harmonized European interfaces, open data standards and uniform regulations foster innovation, reduce barriers, and guarantee interoperability across different systems, platforms and borders. Such measures will enable energy companies to leverage diverse datasets for AI applications, enhancing the accuracy and effectiveness of AI models while promoting transparency, and collaboration among stakeholders. Standards like OPC UA, which enable secure and interoperable communication between devices, and the Asset Administration Shell (AAS), which provides a standardized data structure to harmonize data access and exchange of machinery including those used in the energy sector are key examples.
- **Building European energy data spaces**: Beyond single initiatives, Europe needs a coherent and scalable data infrastructure. Policymakers should connect and expand national and European projects to form a shared energy data space – analogous to the goal of creating an integrated European energy market. The focus must be on long-term stability, scalability, and practical usability for industry, regulators, and research alike. From the beginning, enhancing cross-sector interoperability between the Common European energy data space and other data spaces, such as those for climate, smart city or finance, must be a key goal.
- **Promoting data exchange**: Policymakers should promote the sharing of high-quality data among energy companies, researchers, and other stakeholders without introducing additional regulatory requirements. This can be achieved through incentives for data sharing and collaboration, as well as creating data repositories that are easily accessible. Ensuring that data is available in usable formats and is accompanied by metadata is important.
- **Creating clear and reliable legal frameworks for data use and exchange**: With the Data Act now applicable, it is essential to increase legal certainty on its scope as well as the responsibilities for data provision, storage and usage. Policymakers should provide concrete guidelines for infrastructure operators, administrators, and market actors in the energy sector in particular to ensure smooth and effective implementation of it.

Strengthen digital infrastructure

Targeted investments in digital infrastructure, especially cloud and edge technologies, are necessary to enable scalable, data-intensive AI applications. Cloud technologies are central to the digital energy transition because they enable the scalable processing of large amounts of data and support applications such as smart grids, virtual power plants, predictive maintenance, and energy trading. When designing cloud and edge solutions, the focus should be on real-time capability, cyber security, and hybrid architectures (e.g. for critical control functions). Further research and testing are needed, particularly at the interface between cloud, edge computing, and the energy sector.

Embedding Cybersecurity- and Privacy-by-Design
All AI systems in critical energy infrastructure must implement mandatory security-by-design and privacy-by-design principles, in full compliance with Member State–level requirements set by relevant national authorities. Specific support programmes should be established for SMEs and municipal utility companies to meet these standards, recognising that smaller operators may face disproportionate compliance costs.

Political initiatives should specifically promote the interface between AI, energy management, and cloud, to mobilise investment and establish standards. A key lever to support digital investments is the adoption of a TOTEX approach, treating CAPEX and OPEX equally. This enables grid operators to select innovative and cost-effective digital solutions such as AI-based software without regulatory bias.

Enable Economically Viable, Energy- and Resource-Efficient AI

AI in the energy sector must contribute to Europe's digital and climate goals without creating unnecessary energy or computational burdens. Tiny AI, neuromorphic chips, photonic processing and federated learning are key levers for reducing both the energy consumption and the computational requirements of AI models. Efficient models should not only lower carbon emissions but also meaningfully reduce compute costs and capacity demands, making them economically attractive for operators and suppliers and helping to avoid infrastructure bottlenecks.

To be adopted at scale, these solutions must be technically feasible *and* economically viable for companies. Policymakers should therefore pair R&D and standards work with measures that improve the business case for green AI: co-funded pilot projects in real grid environments, procurement schemes that favor energy-efficient solutions, TOTEX-friendly regulation that values operational savings, and SME-targeted vouchers or tax incentives that lower upfront adoption costs. Sustainability KPIs for EU-funded AI projects should include not only carbon and energy metrics but also computational resource usage and cost-savings estimates, so that funded innovations demonstrably improve both environmental and economic performance. Open standards, interoperable toolchains, and shared testbeds will reduce development costs and make efficient AI models easier and cheaper to integrate across companies and sectors.

Promote research and testing

Generative AI models ('foundational models') do not yet offer the necessary depth for specialised applications in critical infrastructure such as grid operation. There is therefore a need for research into grid foundational models that can derive structural information from large, diverse data sets and support complex tasks such as grid planning, operational management, and energy flow forecasting. In particular, the intelligent linking of GIS data, real-time sensor data, and digital twins holds potential for risk assessment and robust infrastructure planning.

Regulatory sandboxes and experimental spaces for data-based innovations should be promoted. The implementation of the AI Act (Art. 57) can enable real-world laboratories. To better assess digitalization expenditures, performance-based Smart Grid KPIs should be introduced. These help justify OPEX investments by measuring efficiency gains such as grid capacity, connection times, or flexibility provision.

Bitkom represents more than 2,200 companies from the digital economy. They generate an annual turnover of 200 billion euros in Germany and employ more than 2 million people. Among the members are 1,000 small and medium-sized businesses, over 500 start-ups and almost all global players. These companies provide services in software, IT, telecommunications or the internet, produce hardware and consumer electronics, work in digital media, create content, operate platforms or are in other ways affiliated with the digital economy. 82 percent of the members' headquarters are in Germany, 8 percent in the rest of the EU and 7 percent in the US. 3 percent are from other regions of the world. Bitkom promotes and drives the digital transformation of the German economy and advocates for citizens to participate in and benefit from digitalisation. At the heart of Bitkom's concerns are ensuring a strong European digital policy and a fully integrated digital single market, as well as making Germany a key driver of digital change in Europe and the world.

Published by
Bitkom e.V.
Albrechtstr. 10 | 10117 Berlin

Contact person
Emilie Hansmeyer | Policy Officer Energy & Smart Grids
P +49 30 27576-334 | e.hansmeyer@bitkom.org

Lucy Czachwoski | Policy Officer AI & Cloud
P +49 3027576-320| l.czachowski@bitkom.org

Responsible Bitkom committee
WG Smart Grids & Artificial Intelligence