IEA Activities on Energy and AI, 2025-2026

Introduction and Context

Artificial intelligence (AI) is emerging as one of the most consequential technologies of today and has major implications for the energy sector. On the one hand, AI is energy intensive and is driving a rapid increase in electricity consumption from data centres. On the other, AI applications can be deployed to save energy, increase competitiveness, mitigate externalities, improve energy security, and accelerate innovation. None of this is a given, however. There are major barriers to both the expansion of data centres necessary to power AI, and to the uptake of AI-related applications in the energy sector.

Recent IEA Work on AI and Energy

The International Energy Agency (IEA) has been working on issues related to energy and digitalisation for some time. In 2017, the IEA published a special report on Digitalisation and Energy, which included first-of-its-kind projections for electricity consumption from data centres. In 2024, the agency launched a major set of activities to address important gaps in the understanding of the implications of AI for the energy sector and contribute to an evidence base for appropriate policy responses.

- In **December 2024**, the IEA hosted the Global Conference on Energy and AI, which brought together high-level representatives from government, the energy sector, tech, and finance. More than 500 attendees contributed to setting out an agenda for future work on this critical topic.
- In **February 2025**, the IEA participated at the leadership level of the AI Action Summit, co-hosted by the leaders of France and India.
- In **April 2025**, the IEA published its special report Energy and AI, which provided first-of-its-kind analysis and projections of the electricity consumption of data centres in the age of AI, the implications for the electricity sector, and the potential of AI-related solutions to optimise energy systems and drive innovation in novel technologies.
- In **June 2025**, the IEA launched its Energy and AI Observatory. This novel data platform brings together the latest data on the pipeline of data centres around the world and their electricity consumption and power needs. It also brings together a set of carefully curated case studies for the application of different AI-related solutions in the energy sector, many of which come from G7 economies. These case studies were gathered from industry partners in the energy and tech sectors and synthesised by the IEA.
- **Since** April **2025**, the IEA has also been co-hosting a series of industry-government dialogues with the Canadian G7 Presidency to help inform the development of a G7 workplan on AI and energy, as tasked by G7 Leaders at the Kananaskis Summit in June 2025.

Looking forward to the next 12 months: IEA activities on Energy and AI

Pillar 1: AI and energy security

Problem statement: Large numbers of increasingly power-hungry data centres are seeking connections in electricity systems that are often already under strain. Data centres are often spatially concentrated and can be developed rapidly in comparison to more sluggish development times for other energy infrastructure. Supply chain constraints for key inputs, such as gas turbines, transformers, and critical minerals and metals such as copper, may also create challenges to data centre expansion and have implications for energy security. While data on the pipeline for data centres and their operational characteristics remains patchy and connection queues are often convoluted, numerous policy and market innovations are occurring around the world to address these emerging issues. These include: legislation to reform data centre connection processes and enhance demand response from them; new utility agreements between hyperscalers (large-scale cloud service providers) and utilities leveraging demand response from data centres; and partnerships to drive reconductoring (cable replacement on existing transmission lines) to increase capacity. Deepening the understanding of the technical and market outlook for AI is critical to help the energy sector evaluate the mid- to long-term outlook for data centre electricity demand. AI may exacerbate cybersecurity risks in the energy sector, while also providing tools to defend against attacks.

Outputs:

- **Energy and AI Observatory:** The IEA will continue to gather, analyse and provide the latest data regarding data centre project pipelines and their projected power draws and energy consumption. The IEA will also increase the granularity of the data it provides on the Energy and AI Observatory.
- **Special report:** The IEA will publish a comprehensive special report in 2026 on *AI and Energy Security*. Working with partners in the tech and energy sectors, this report will identify strategies to facilitate data centre integration into electricity systems in a secure and timely way. It will explore the challenge and solutions, including connection processes and permitting, data centre efficiency and flexibility, grid modernisation and expansion, and the role of novel technologies and contracting arrangements to supply data centres. The report will also provide an overview of cost-effective and scalable approaches to power artificial intelligence through new and diverse supply and demand side solutions for data centres. It will provide policymakers with a proven toolkit of solutions to meet this challenge. It will also analyse and provide data on supply chains for powering data centres, and emerging issues such as AI and cybersecurity in energy systems.

- **Cybersecurity for the energy sector**: The IEA will continue to monitor the issue of AI and energy-related cybersecurity and may expand its analysis on this, subject to the views of IEA Member countries.

Pillar 2: Optimising energy systems with AI

Problem statement: energy systems are growing increasingly complex, dynamic and digitalised. AI offers several opportunities to help optimise energy systems. These include: supporting decision making by power system operators and planners; shortening product lifecycles, boosting innovation, and driving manufacturing productivity and competitiveness. Supporting resource assessment and exploration in critical minerals mining; and monitoring critical infrastructure for energy security are also possible. However, numerous barriers inhibit a broader uptake of AI-related solutions, including missing digital infrastructure; inadequate data and data privacy concerns; concerns of risk and liability; and missing skills in the energy sector.

Outputs:

- **Survey and case studies:** To reduce hesitancy in the adoption of AI solutions for energy system optimisation and to support their uptake, the IEA will deepen its analysis and data collection on AI-related applications in the energy sector: their potential benefits, enabling conditions, and barriers. To provide policymakers with a comprehensive and data-driven perspective, in 2026 the IEA will conduct, in collaboration with industry, a comprehensive survey on *AI Uptake in the Energy Sector.* This will feed impactful case studies of AI-related applications in the energy sector into the IEA's Energy and AI Observatory.
- **Skill gaps:** The IEA will use its ongoing work on energy employment to deepen understanding of the skills gap for AI-related roles in the energy sector.

Pillar 3: Using AI to accelerate innovation in energy-related technologies

Problem statement: Innovation is critical to energy-related policy goals, such as energy security, climate change mitigation, competitiveness and economic growth. AI is becoming increasingly integral to scientific discovery, as AI models enable scientists to analyse vast quantities of experimental data, integrate statistical analysis with known physical laws, and predict the behaviour of new molecules, enzymes, chemistries or materials. Recent AI-driven advances of relevance to the energy sector include: novel and highly efficient carbon capture materials; novel candidates for battery chemistries that don't use critical minerals and use less lithium; and a novel superconducting material. However, obstacles exist that limit the potential of AI to accelerate energy-related innovation such as the lack of comprehensive, robust, and experimentally-validated data on which to train models; long-standing barriers to taking innovations out of the lab and towards demonstration and commercialisation

in complex, competitive and often highly regulated industrial supply chains. Other challenges include the lack of skills and infrastructure, and issues of co-ordination and prioritisation of the most impactful research challenges. Accelerating progress at the discovery phase may also require innovations from regulators and policymakers to facilitate concurrent advances in the demonstration phase – as is starting to appear in medicine, for example.

Outputs:

- **Industry-government dialogue:** The IEA will continue to use its convening power through tools such as the Energy Innovation Forum to provide opportunities for innovators, policymakers and energy technology end users to enhance their dialogue on AI and energy innovation.
- **Innovation report series:** The IEA will continue to use its reports, such as the State of Energy Innovation report series, to track trends in AI-related energy innovation (startups, venture capital, patents, research findings); and identify bottlenecks and opportunities.

Pillar 4: Convening and dialogue

Problem statement: As the buildout of AI-dedicated data centres – as well as the rollout of AI applications for the energy sector – are evolving quickly, there is still a significant gap in the shared understanding of opportunities, risks, and barriers between key stakeholders. Structured dialogue between governments, regulators, industry and civil society is essential to facilitate a smoother rollout of data centres while minimising adverse consequences, and enhancing use of AI capabilities towards energy system optimisation and innovation. Structured dialogues can build trust, transparency and legitimacy, plug information gaps, and share data and best practices.

Outputs:

- **IEA government-industry dialogues:** The IEA will convene regular dialogues with key government and industry stakeholders to discuss and highlight emerging issues at the intersection of energy and AI. The objectives will be for participants to flag emerging risks and opportunities, and for the IEA to receive feedback on its various analytical outputs from the participants.
- **Engaging with multilateral fora:** The IEA will continue to engage with international and multilateral fora including G7 and other international initiatives. The IEA will provide the presidencies and convenors of these fora with analytical insights and stakeholder dialogue opportunities.