

Interim AI Adoption Plan: Clean Energy

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A report by Lucy Yu, AI Champion for the Clean Energy sector.

Introduction

This short note provides an update on the work currently being undertaken by the AI Champion for Clean Energy. It summarises the emerging picture of AI deployment across the energy system and draws on over 80 survey responses, 4 multi-stakeholder roundtables and more than 40 expert interviews conducted as part of the Champion's independent review of AI deployment in electricity networks, which will report later this Summer.

The opportunity for AI in the energy system

The pace of change in both the energy system and AI means that decisions taken over the next few years are likely to shape how the system operates for decades to come. The energy system is undergoing a structural shift. Increasing penetration of weather-dependent generation, the electrification of transport and heating, and the growing role of distributed assets are increasing both the complexity and uncertainty of system operation.

Artificial intelligence has the potential to play a significant role in addressing this challenge. Across the electricity system, AI is already being applied to improve forecasting, optimise asset performance, and support system planning. It can help operators respond more effectively to increasingly complex conditions, allowing decisions to be made with greater precision, speed and confidence.

But there is much more to do. The opportunity is not limited to improving existing processes: AI could fundamentally re-shape how the energy system functions. We could create the 'world's most experienced control room operator' by training AI models using data from real world grid operations and physics-based simulations including edge case scenarios, such as the Iberian Peninsula power outage. By creating digital representations of energy supply chains, we could use highly trained AI agents that can execute expert near real time decisions to turn our sometimes-fragile supply chains into always-aware, reactive and self-healing systems. With ever more homes being equipped with batteries, rooftop and plug-in solar, electric heating and electric vehicles, AI could manage every

neighbourhood as a virtual power plant, predicting when consumers need heat and power while managing volatile weather patterns, all at lower cost and with lower effort.

Over time, AI could enable significant transformations in how the energy system is operated including:

- **True probabilistic management:** allowing the system to operate based on risk-aware optimisation and planning, rather than deterministic rules
- **Greater decentralisation:** enabling more flexible and localised decision-making
- **Autonomy:** allowing certain grid operations or functions to be executed automatically within defined parameters and safety frameworks.

These capabilities depend on a further critical enabler: observability. This is not simply about increasing the volume of data, but about ensuring that data is available in a form that is timely, actionable and aligned to operational decision-making.

While each of these are already of interest to system operators globally; they are neither mature nor commonplace anywhere in the world today.

Getting this right and realising these new capabilities in the energy system should bring huge benefits to the UK. A more efficiently operated energy system means better utilising the assets we have and building fewer new assets. That will lower the system cost, reduce emissions, and ultimately cut bills for households and businesses. And if the UK moves quickly, there is a genuine opportunity for global leadership. The UK could aim to be the best place in the world to develop, test and deploy AI and frontier technologies in the future grid. Setting such an ambition and promoting and supporting UK based companies that develop next generation AI technologies for the energy system would crowd in investment and create exportable technologies, both benefits not only to the energy system but also to UK plc.

There are many important underpinning digitalisation initiatives and relevant AI activities already underway which we should continue to support and develop. From the National Energy System Operator's work on AI in the control room (Project Volta) to innovation funding for AI deployment in the energy networks. However, these initiatives alone will not be enough. Additional tools and approaches that unlock new possibilities across network management, business models, markets, and governance and regulatory frameworks are needed to support new operational paradigms.

Progress to realise these opportunities will require significant action over the coming years, not just in technical innovation but in creating the conditions for deployment and scaling. The Champion's review of AI deployment in the electricity networks, to be published later this summer, will set out a comprehensive set of recommendations for how this can be achieved (discussed further below).

Insights from engagement with the sector

As part of the review, the AI Champion has undertaken a programme of engagement across the sector, including:

- two national surveys on AI use cases as well as in-depth interviews and roundtables with different stakeholders, with the first survey focusing exclusively on technology providers and research organisations and the second working with utilities and network organisations. Around 80 unique submissions were received across both surveys.
- four multi-stakeholder roundtable discussions focused on issues including incentives for AI deployment, agentic grid management and other topics.
- over 40 bilateral discussions with expert stakeholders

The UK's position is generally viewed favourably. There are already examples of exportable AI-enabled capability in the sector (such as products from Open Climate Fix or Kraken) and a range of digitalisation and innovation initiatives are underway, including open data platforms, innovation funding mechanisms and regulatory sandboxes.

Responses to the AI Champion's survey highlight that AI is already being deployed across the energy system in several high-impact areas. These findings reflect current usage rather than an exhaustive list of future applications. The most prominent use cases areas include:

- **The use of AI tools to control and operate the grid in a smarter and more efficient way**, enabling a more decentralised approach and supporting increasingly complex power flows from the growing plurality of electric vehicles (EVs), batteries and renewable energy sources.
- **The application of AI to intelligently maintain grid infrastructure**, helping to extend the operational lifetime and resilience of critical energy assets through more proactive and predictive approaches.
- **The role of AI in supporting more effective grid planning and optimisation**, with the potential to accelerate the integration and upgrading of infrastructure required to unlock the UK's renewable energy ambitions at pace.
- **The use of AI to support effective market mechanisms** that help address affordability and equity challenges within the energy system, particularly in the context of ongoing cost-of-living pressures, while improving overall system efficiency and responsiveness.

Taken together, these uses suggest that AI is already beginning to shift how the system is planned and operated, but that its application remains partial rather than systemic.

These findings are consistent with wider analysis under the AI for Decarbonisation Virtual Centre of Excellence (ADVICE). The State of AI for Decarbonisation 2025 report shows

that AI is already beginning to deliver measurable impact across the UK economy, including in energy networks, where applications such as AI-enabled forecasting and flexibility management are supporting system operation at scale. At the same time, the report highlights that progress remains uneven, with many promising applications still at an early stage and further work required to move from innovation to widespread deployment.

Across this engagement, a consistent set of issues has emerged as the most immediate constraints on adoption today. These reflect the challenges the sector is facing now and are likely similar to the challenges faced across other sectors seeking to adopt existing AI technologies into ongoing operations:

- **Data and observability.** Access to high-quality, timely and interoperable data is a consistent constraint. In many areas, data exists but is not available in a form that supports operational use. Issues include fragmented ownership, inconsistent standards and challenges in accessing data at the speed and granularity required for system operation. As a result, many AI applications remain limited by the ability to observe and understand system conditions in real time. This challenge is also driving increasing interest in synthetic data as a potential enabler of AI adoption. Synthetic data offers a way to overcome data access issues by generating realistic datasets for training and testing, particularly in areas where real-world data is limited, sensitive or difficult to access. However, this is an emerging area, and unlocking its value will require clear standards for quality, validation and governance. The Department for Energy Security and Net Zero recently launched a Call for Evidence, supported by the AI Champion, on this topic and, following the closure of the Call, is looking to unlock high value data sets.
- **Routes to adoption and scale.** The UK has relatively strong mechanisms for supporting innovation and early-stage deployment. However, the transition from pilot to scaled, operational deployment remains a key challenge. In many cases, the benefits of AI are system-wide, while costs and risks are borne by individual organisations. This can limit incentives to invest. As a result, promising applications often remain in trial phases rather than becoming embedded in business-as-usual operations.
- **Governance, assurance and trust.** AI deployment in the electricity system raises important questions around safety, accountability and risk. The sector requires clear and proportionate approaches to assurance, including how AI systems are tested, validated and monitored over time. Uncertainty in these areas can slow adoption, particularly in safety-critical environments where reliability is essential. Without clear frameworks, organisations may default to risk-averse positions even where technologies are technically mature.

- **Capability, skills, institutions and system readiness.** The electricity system is not only a technical system. It also includes markets, institutions and governance structures. Current arrangements were designed for a more centralised and deterministic system. As a result, there are challenges around capability, organisational readiness and institutional alignment. Skills, leadership, and the ability to integrate AI into existing systems all play a role in determining whether adoption can scale. Taken together, these issues explain why adoption remains uneven and why there is still a gap between innovation and operational deployment. The challenge is not only technical, but systemic.

The Champion's review of AI opportunities in the electricity networks

In December 2025, the government commissioned the AI Champion to undertake a review of opportunities for AI in the electricity networks, due to report in Summer 2026. The objectives of the review are to:

- map current and emerging applications of AI across electricity networks
- identify barriers and enablers to deployment
- assess the potential system benefits and associated risks
- and provide recommendations to government, regulators and industry on safe and effective pathways to scale

The review is primarily focused on the potential to realise a system transformation, rather than solely near-term barriers facing the sector today. The electricity system is already operating in a new paradigm, shaped by increased complexity and uncertainty. However, many of the tools, institutions and frameworks used to operate the system were designed for a different set of conditions.

The review therefore considers how the system can evolve to support new operational capabilities over time. This includes the conditions required to enable probabilistic operation, more decentralised system management and, in some cases, increased levels of autonomy.

Critically, these capabilities cannot be developed in isolation. Progress in one area is dependent on progress in others. For example:

- improved forecasting without the ability to act on it will not deliver system value;
- decentralised control without sufficient observability can lead to suboptimal outcomes;
- and autonomy without appropriate safety and assurance frameworks introduces new risks

For this reason, the review will focus on how these capabilities interact and the conditions required to unlock them together.

Over the coming months the AI Champion will publish the review with a set of clear recommendations. Government intends to respond to this as part of a strategy for AI in Clean Energy, to be published before the end of the year, and continue working with the AI Champion to deliver the recommendations.