Energy Innovation Basecamp 2026
Problem Statement EIP153

energynetworks association

Application of AGI to Energy Networks – Consideration of a Shared Centre of Excellence

The following problem statement has been developed by the innovation teams within the UK's Gas and Electricity Networks for the 2026 Energy Innovation Basecamp.

Theme: Flexibility and Forecasting

Network Areas: Whole System

What is the problem?

Artificial intelligence and related technologies (e.g., machine learning) are advancing rapidly and can now solve very complex problems in other industries. For example, Protein Folding in Biochemistry. It seems likely that AI can solve a variety of issues in the energy industry. We have already made progress, and solutions that have been explored are summarised in Table 1 at the end of this document:

While some of these use cases are well developed, many projects and initiatives focus on specific niches. It is not possible to say that the regulated networks are engaged in a coordinated program of research and development leading to holistic, shared solutions.

As we move towards net-zero, the energy network is becoming much more complicated and distributed, combining highly dispersed renewable energy, nuclear and small nuclear reactors, and more traditional base-load generation. This requires a proliferation of supporting services, including energy storage and energy stability. This needs to be supported by a greatly expanded electricity transmission and distribution network. In addition, the gas network may need to be converted to support the transmission of Hydrogen across the UK, whether on a localised or national level. This is further complicated by a much more dynamic energy market, where customers are incentivised to manage consumption to balance the load better and reduce constraint costs. The question is whether we are designing and building the optimal energy system with assets in the right locations to achieve affordability and sustainability. Is this type of optimisation problem only solvable through Artificial (General) Intelligence, machine learning and high-powered computing

What are we looking for?

We are looking for proposals for a coordinated research program, or possibly **a dedicated research centre or centre of excellence**, to answer the question*: Can we use Artificial General Intelligence to better design, build, and manage the integrated energy system of the future?*

The AGI should be designed to analyse the problem and generate a set of network design options that minimise cost, minimise use of environmental capital, maximise energy efficiency, and maximise social utility.

How could this research program be coordinated across the entire UK energy network? What are the use cases and problems that should be solved in the journey to solve the problem of designing the most efficient energy network possible? We are interested in both national and regionalised solutions for the UK energy market.

This challenge is very ambitious, but very deliberately so. This is much more about the big picture optimisation of the UK network. The ambition is a well-funded R&D institute (like the HVDC Centre) but focused on AI applied to energy systems, funded and supported by the whole energy industry in the UK.

What are the constraints?

We are not looking for a single niche use case, but more for proposals that will explore the best way to set up a coordinated program of research and development, which will allow agile and rapid growth of new tools. The overall goal should be ambitious, to employ AGI to design the most efficient possible UK network that offers best value for the customer. While ambitious, we should examine how uses cases can be developed that bring more immediate benefits to the consumer while also working towards much mor ambitious tools. ambitious, we should examine how use cases can be developed that bring more immediate benefits to the consumer while also working towards much more

In this first phase of this project we would like to answer the question:

(1) Do we need a dedicated (well funded) and shared centre of excellence for the application AI (and other data analytic tools) in Energy Networks? What is the evidence for the recommendation.

(2) If the answer to (1) is, what are the options and models for setting up a centre of excellence? How should any centre of excellence be governed.

(3) Who should be involved in any proposed centre of excellence?

(4) What can we learn from other industries, and what would be best practice for agile use case development that can be shared and adopted by all energy networks in the UK?

(5) How can the UK benefit (in terms of general economic growth) from a dedicated centre of excellence?

(6) What level of funding is required to make a centre of excellence work?

Who are the key players?

The key players are all the regulated energy networks, energy developers, and experts in the application of AGI and Machine Learning, and in the use of high-powered computing. We are interested in collaborative proposals that involve partnerships among networks, academia, research institutes, and experts in AGI and high-performance computing. We would welcome proposals from private and public research institutes and consider part-funding a dedicated research program

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There is also a research consortium, mainly USA based under EPRI: *EPRI's Open Power AI Consortium (OPAI)—its mission, participants, capabilities, recent updates, and workstreams*: [msites.epri.com], [restservice.epri.com], [restservice.epri.com]. Proposals should consider how to best existing programs of research from around the world.

Does this problem statement build on existing or anticipated infrastructure, policy decisions, or previous innovation projects?

Many niche AI and machine learning use cases are being developed. These can easily be found on the ENA Smarter Networks Portal or on the Networks own innovation web pages. However, we are not aware of a dedicated and well-funded program of research to design, build and manage the optimal energy network. There are also multiple research programs globally. Consideration should be given to collaboration with other research programs while also considering whether or not the UK and UK based companies and develop a competitive edge through unique capabilities available in the UK applied to specific case of the UK energy system.

What else do you need to know?

Please research the use of AI in networks, but focus on the general and ambitious problem of using AGI to design and build the most efficient energy network in the world.

Innovator submissions to this problem statement will be open on the Smarter Networks Portal from 4th February to the 13th March, but we encourage you to submit your response as early as possible, as networks will be able to review submissions as soon as they come in.

You can also use the virtual Q&A on the Smarter Networks Portal to ask for more information about this problem statement. Questions may be answered online or at the ENA Problem Statement Launch on 4th February 2026. More information on last year's Basecamp programme can be found on the Smarter Networks Portal.

***Table 1**: Comparison of AI use cases, benefits, and risks across energy segments (renewables, transmission grids, oil & gas, and utilities).* Each segment sees **tailored AI applications** – from weather forecasting for wind farms to anomaly detection in pipelines to smart meter analytics – yielding significant improvements in efficiency, reliability, and sustainability. However, all segments share common challenges around security, data governance, regulatory adaptation, and the need for human oversight to ensure AI is implemented in a safe and equitable manner

Energy Segment	AI & Analytics Use Cases	Key Benefits/Opportunities	Key Risks/Challenges
Renewable Energy	- Forecasting solar/wind output more accurately[i]- Predictive maintenance of turbines, panels[ii]- Optimising energy storage and hybrid systems[iii]- Automated control to maximise generation (e.g. panel tracking)[iv]	- **Higher efficiency & output:** Better forecasts and controls boost generation (e.g. +20% solar output)[v]- **Reduced downtime:** AI maintenance prevents failures (up to 35–70% downtime reduction noted)[vi vii]- **Grid integration:** Smoother handling of intermittency, enabling more renewables on the grid[viii]- **Cost savings:** Lower O&M costs and longer asset life from predictive repairs	- **Data & infra needs:** Requires high-quality weather and sensor data; many legacy wind/solar sites lack digital systems[ix].- **Initial costs:** Installing IoT sensors, computing for AI can be expensive for project developers[x].- **Trust/Adoption:** Operators must trust AI predictions for critical decisions (e.g. curtailment) – conservative culture can resist fully automated control.
Transmission Grid	- Load and generation forecasting (minutes to days)[xi]- Real-time grid balancing and automated control (AI-assisted dispatch)[xii]- Fault detection & outage prediction (anomaly detection on grid data)[xiii]- Dynamic line rating & network optimisation[xiv xv]- Coordination of distributed energy resources (VPPs, demand response)[xvi xvii]	- **Reliability & stability:** Fewer outages and blackouts via predictive grid management and faster response[xviii xix].- **Efficiency:** Optimising use of lines and generators defers new infrastructure and lowers operating costs[xx].- **Renewable uptake:** AI enables integrating more wind/solar by balancing variability in real-time[xxi].- **Resilience:** Better handling of extreme events (AI weather models pre-position crews, etc.) reducing recovery time[xxii].	- **Cybersecurity:** Grid AI systems become high-value targets for cyberattacks; a breach could disrupt power[xxiii xxiv].- **Black-box decisions:** Hard-to-verify AI outputs risk unforeseen grid interactions or failures[xxv], so operators are cautious about trust[xxvi].- **Regulatory approval:** Grid operations are tightly regulated; automated decision-making may face compliance hurdles and require new standards[xxvii].
Oil & Gas	- Seismic data interpretation for exploration (prospect identification)[xxviii xxix]- Drilling optimisation and automated control (real-time adjustments)- Reservoir modeling & production optimization (maximize extraction rates)[xxx]- Predictive maintenance of rigs, pipelines, refineries (sensor analytics)[xxxi xxxii]-	- **Cost reduction:** AI improves efficiency at each stage, potentially cutting O&G operational costs by 10–20%[xxxvii] (e.g. fewer dry wells, optimised maintenance).- **Higher output:** Better exploration success and enhanced recovery increase production from assets[xxxviii].- **Accident prevention:** Predictive safety and maintenance significantly reduce likelihood of	- **Integration with legacy:** Older rigs/refineries may not easily retrofit with sensors or connect to AI systems[xl].- **Skilled workforce gap:** Shortage of AI-literate engineers; cultural resistance in a traditionally conservative industry to adopting AI-driven processes[xli xlii].- **Cyber & IP risks:** Proprietary

	Safety monitoring (hazard detection, leak/spill detection)[xxxiii]- Market analytics (demand and price forecasting)[xxxiv]- Supply chain logistics optimisation (inventory, scheduling)[xxxv xxxvi]	catastrophic failures (blowouts, spills)[xxxix].- **Faster decisions:** Automation and AI analytics speed up decision cycles (drilling, trading) in a historically slow industry, giving competitive advantage.	exploration data and operational tech could be hacked, with severe safety/environment consequences; recent years saw attempts to breach oil/gas control systems[xliii].- **Regulatory compliance:** AI must still ensure operations meet environmental and safety regs (flaring limits, pipeline standards); any AI errors here could lead to non-compliance fines[xliv].
Utilities & Retail	- Smart meter data analytics (usage patterns, theft detection)[xlv]- Load forecasting at neighbourhood level and demand response (incl. smart EV charging)[xlvi]- Outage management (predictive restoration, crew optimisation)- Customer service chatbots and personalised recommendations- Distributed resource management (integrating rooftop solar, home batteries into grid)[xlvii xlviii]- Energy trading and pricing optimisation (for retailers in markets)	- **Customer benefits:** More reliable service (quicker outage fixes) and tailored energy-saving advice. Consumers gain tools (apps, smart thermostats) to cut bills and participate in programs[xlix].- **Efficiency & loss reduction:** AI cuts non-technical losses (theft) recovering revenue[l], and optimises grid operations to reduce wasted energy in distribution.- **New services & revenue:** Utilities can offer value-added services (like usage insights, home automation) leveraging AI analytics, improving customer satisfaction and retention.- **Grid flexibility:** Managing EVs and home solar with AI avoids overloads and improves local grid resilience, enabling greener energy adoption without sacrificing quality[1].	- **Data privacy:** Handling detailed household consumption data raises privacy concerns – strict data protection is required to maintain trust[li].- **Cyber threats to IoT:** Smart meters and home devices could be entry points for hackers if not well-secured, potentially compromising grid control or customer data[lii].- **Fairness and inclusion:** Need to ensure AI-driven programs (like demand response or preferential rates) are accessible and fair to all customers, including those less tech-savvy or in lower-income brackets, to avoid creating an energy "digital divide"[2].- **Regulatory oversight:** Utilities often need regulatory approval for new billing schemes or demand response programs; AI-driven dynamic pricing, for example, must comply with consumer protection rules and requires transparent justification of rates.

[1]https://www.europeanfutureenergyforum.com/ai-powered-demand-response-optimizing-energy-consumption-and-grid-balancing/

[2]https://acropolium.com/blog/artificial-intelligence-and-renewable-energy-a-guide-to-tech-sustainability/

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[i] https://acropolium.com/blog/artificial-intelligence-and-renewable-energy-a-guide-to-tech-sustainability/

[ii] https://globaltechnosol.com/case_studies/ai-for-predictive-maintenance-in-renewable-energy/

[iii] https://acropolium.com/blog/artificial-intelligence-and-renewable-energy-a-guide-to-tech-sustainability/

[iv] https://acropolium.com/blog/artificial-intelligence-and-renewable-energy-a-guide-to-tech-sustainability/

[v] https://acropolium.com/blog/artificial-intelligence-and-renewable-energy-a-guide-to-tech-sustainability/

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[viii] https://acropolium.com/blog/artificial-intelligence-and-renewable-energy-a-guide-to-tech-sustainability/

[ix] https://www.bcg.com/publications/2025/ai-in-energy-new-strategic-playbook

[x] https://acropolium.com/blog/artificial-intelligence-and-renewable-energy-a-guide-to-tech-sustainability/

[xi] https://www.csis.org/analysis/ai-grid-opportunities-risks-and-safeguards

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