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Overcoming the UK Energy Hurdle to Win in AI

by Dominic Endicott

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About the Author

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About UKAI

UKAI is the UK's only trade association representing the entire AI sector, providing a unified voice for tech and non-tech businesses who are harnessing AI to drive economic growth. **UKAI** brings together a thriving eco-system of businesses, investors and government, driving collaboration to secure Britain's position as a global AI leader.

How to Overcome the UK's Energy Deficit to win in AI

Discover how the UK's AI sector can overcome the nation's energy cost disadvantage to remain a global leader in AI innovation. This paper explores actionable strategies, from energy optimisation to policy advocacy, empowering UK businesses to turn high electricity costs into a competitive advantage.

Economic Growth Depends on Access to Energy

The UK's economic progress since the Industrial Revolution has been closely linked to our ability to harness cheap and plentiful energy. In the Age of Artificial Intelligence (AI), access to cheap and plentiful energy to power the data centres that are becoming the 'AI Factories'[1] will be equally fundamental.

A recent quote by Micheal Liebreich, Editor of leading energy and environment publication BloombergNEF, captures the present moment:

> ***"The most powerful tech titans in the world have been humbled by the realization that their plans for world domination could be stymied by something as prosaic as electricity – and have embarked on a land grab for whatever sources of dispatchable power they can, triggering something of a gold rush"*** [2]

Two failed decades of British energy policy are today manifest in the UK having some of the highest electricity costs in the West, twice the rate paid by the US and four times the average cost rate in China.

1 https://finance.yahoo.com/news/era-robotics-ai-factories-powered-093000078.html

2 Michael Liebreich – Generative AI – The Power and the Glory, Dec 24, 2024 https://about.bnef.com/blog/liebreich-generative-ai-the-power-and-the-glory/

The AI economy is intertwined with the world of energy and electric power, to such a point that the data centres at its core are classified based on their power consumption levels. Every new generation of AI chips implies an increase in power density, with ever growing demands on the electric grid. A heavy premium on the price of electricity thus puts at risk the potential for the UK to retain its current position as the #3 AI epicenter[3].

Data centre electricity demand in the UK is estimated at around four Terawatt hours (TWh) in 2024, with potential demand in 2030 of as much as five times this amount[4]. As coal, oil and gas base load capacity is rapidly being eliminated, nuclear power is slow to turn-on, renewable remains unpredictable, and large-scale battery storage is at risk of becoming explosive[5], the ability of the UK network to meet the data centre demand is unclear. Growing data centre demand risks putting additional stress on the increasingly burdened UK grid[6], forcing the UK to ration electricity use or risk brownouts or blackouts.

> ***"We should turn the lemon of high electricity costs into the lemonade of global UK AI energy use leadership"***

3 The challenges of the UK's Climate Policy are detailed in Rupert Darwall's detailed analysis "The Folly of Climate Leadership Rupert Darwall DEC | 2023 Net zero and Britain's DISASTROUS ENERGY POLICIES" https://assets.realclear.com/files/2023/12/2321_2320_realclear-report-rupert-darwall-v7_1.pdf

4 https://www.neso.energy/document/246446/download

5 https://www.netzerowatch.com/all-papers/gridscale-batteries-fire-risk

6 https://www.telegraph.co.uk/business/2024/10/13/why-age-of-energy-rationing-is-looming-for-britain/

Constant and Growing Demand

The world is not standing still. US data center capacity is projected to more than double by 2030. China aims to surpass the US, as it has in many other fields. Across the Channel, France is aiming to capitalise on its nuclear network to become a European data centre and AI leader[7]. The Gulf Countries similarly aim to use cheap oil to become data centre and AI powers. Maintaining the UK's AI status with a stressed UK Grid will be a major challenge.

7 https://www.spglobal.com/commodity-insights/en/news-research/latest-news/electric-power/072624-frances-edf-sees-2024-french-nuclear-output-in-upper-range-of-forecast

UK businesses need to be aware of the UK's energy deficit and develop strategies to overcome this deficit. These include:

- Identifying business models that are less dependent on raw AI processing capability, and thus less sensitive to the high cost of electricity in the UK.
- Harnessing the waste-heat from AI data centres to feed into existing industrial, commercial or district heating systems, thus reducing the net cost of electricity.
- Using AI to optimise grid or electric usage, thus turning the high cost of electricity into a new business opportunity.
- Identifying low-cost opportunities for data processing, for example 'behind the meter' UK sources or by leveraging lower cost locations with more favourable energy pricing.
- Leveraging land assets to gain advantaged access to AI capability, when economically feasible.
- Harnessing advances in lower cost energy models, using the power of AI to speed the rate of innovation in materials, chips, engines, and processes.
- Advocating and lobbying for an AI-friendly UK energy policy.

Understanding the Challenge and Exploring Solutions

In this paper we will delve into the sources of the UK's electricity cost disadvantage and explore some of the impacts on the UK economy and specifically its leadership in AI. We will then define a strategic response for UK businesses to address this barrier.

Our key message is that UK businesses need to be intensely aware of the headwinds they have in operating within the expensive UK energy market, and to overcompensate by deploying a comprehensive response to minimise the overall effect on their business. The silver lining in the UK energy cloud is that those that are effective in this strategy will be thus hardened to compete even better in the global market. We should turn the lemon of high electricity costs into the lemonade of global UK AI energy use leadership.

The UK's AI Own Goal

The UK's costs per kilowatt in 2024 averaged 42 cents, compared to 24 cents in France, 16 cents in the US and 8 cents in China[8]. With AI increasingly dependent on access to data centre capacity, and global data centre competitiveness heavily based on the cost of electricity, this creates a substantial barrier for UK AI leadership.

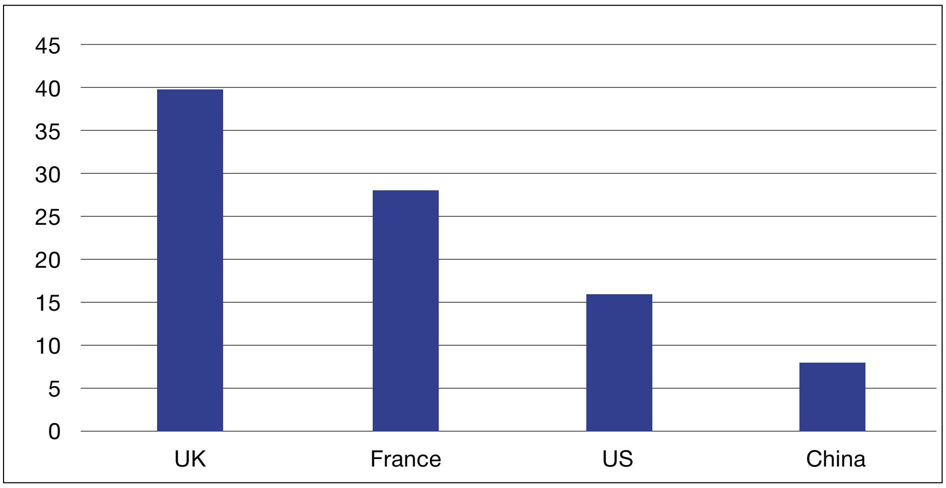

Figure 1 Cost of electricity per kilowatt hour, Selected Countries[9]

For those who question how harmful high energy costs have been for the UK, we have witnessed in 2024 the UK's giving up on an integrated steel industry[10], and the collapse in the past 12 months of UK electricity production, coal, oil and gas extraction, metals production, and nitrogen compounds production[11].

All this sacrifice has had a trace-level effect on global emissions. China has powered ahead in coal usage[12], pushing up global emissions and making the UK effectively hostage to a global adversary for key supply chain needs.

8 https://www.statista.com/statistics/263492/electricity-prices-in-selected-countries/

9 https://www.statista.com/statistics/263492/electricity-prices-in-selected-countries/

10 https://theconversation.com/the-past-present-and-uncertain-future-of-the-uks-steel-industry-235081

11 https://www.ibisworld.com/united-kingdom/industry-trends/fastest-declining-industries/

12 https://www.cnbc.com/2024/04/15/china-boosts-global-coal-power.html

Learnings From the Global Landscape

The UK is not alone. Other failed environmental champions such as Germany have replaced clean nuclear energy by burning more coal[13] and trees[14] (conveniently relabeled as 'biomass'), illustrating the failure of the European environmental policy. Germany has invested close to $500 billion in its energy policy[15]. Despite this investment or perhaps more because of it, Germany is now in the grip of accelerating de-industrialisation[16] and increased pollution.

Nor is the problem solely in Europe. Through similar policies, Australia has seen its cost of electricity double, and is on path for it to quadruple, going from a historically low-cost energy country to becoming a high-cost country[17].

13 https://www.reuters.com/business/energy/germany-approves-bringing-coal-fired-power-plants-back-online-this-winter-2023-10-04/

14 https://energytransition.org/2020/07/the-secret-burning-of-trees-the-often-overlooked-role-of-biomass/

15 https://hir.harvard.edu/germanys-energy-crisis-europes-leading-economy-is-falling-behind/

16 https://www.forbes.com/sites/tilakdoshi/2024/05/09/as-europe-deindustrializes-can-economic-suicide-be-avoided/

17 https://www.aer.gov.au/news/articles/news-releases/aer-releases-annual-review-electricity-and-gas-markets

In the US, New England is embarking on a similarly challenging course, with a set of policies estimated by one group to add $815 billion in costs by 2050[18]. A similar approach is pervasive across Blue States[19], likely contributing to the Democratic losses in 2024. The policies of the outgoing Biden Administration, if fully implemented, would have extended high grid costs to the rest of the country, and made the US dependent on its biggest geopolitical rival, China[20].

It is likely that the incoming Trump Administration will radically reverse course, with an aggressive "All of the Above" strategy that will seek to leverage all sources of energy[21]. The proposed picks to lead the Trump energy policy, Chris Wright and Doug Burgum, are equally comfortable in renewables, fracking and traditional oil and gas, so we are likely to see a pragmatic and less ideological approach. The US will almost certainly aim to use energy to win in AI and other critical industries vis-à-vis China.

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18 https://mainepolicy.org/research/the-staggering-costs-of-new-englands-green-energy-policies/

19 Why Electricity Prices Are Soaring in Blue States, Oct 2024, Heritage Foundation, https://www.heritage.org/sites/default/files/2024-10/BG3867.pdf

20 https://www.heritage.org/china/report/how-the-forced-energy-transition-and-reliance-china-will-harm-america

21 https://www.utilitydive.com/news/wright-burgum-all-of-the-above-energy-generation-nominations/733633/

The US and UK Divergence in Energy Costs

The gap between the US and the UK in energy is relatively new. Twenty years ago, the UK and US were at rough cost parity in the cost of electricity, with medium to large businesses in both countries paying in the range of seven cents per kilowatt hour (kwh). This reflects the legacy of the UK's robust energy strategy during the prior decades.

Since 2004 the two countries have diverged. The US embraced the potential of shale oil and gas[22]. Meanwhile the UK blocked these new technologies and followed up by shutting down traditional sources of baseload electricity such as coal and gas and replacing them with what some have said are unproven and unreliable power sources such as offshore wind, based on unsound models of cost efficiency and scale economies[23].

22 https://www.economist.com/special-report/2024/10/14/the-shale-revolution-helped-make-americas-economy-great

23 NetZero Watch, sponsored by a foundation set up by the late Lord Nigel Lawson, former Chancellor of the Exchequer, and architect of Margaret Thatcher's successful energy strategy, provides a number of detailed reports on the economic and strategic costs of the UK's Net Zero folly https://www.netzerowatch.com/recent-papers

We can see the differing outcomes in the graph below:

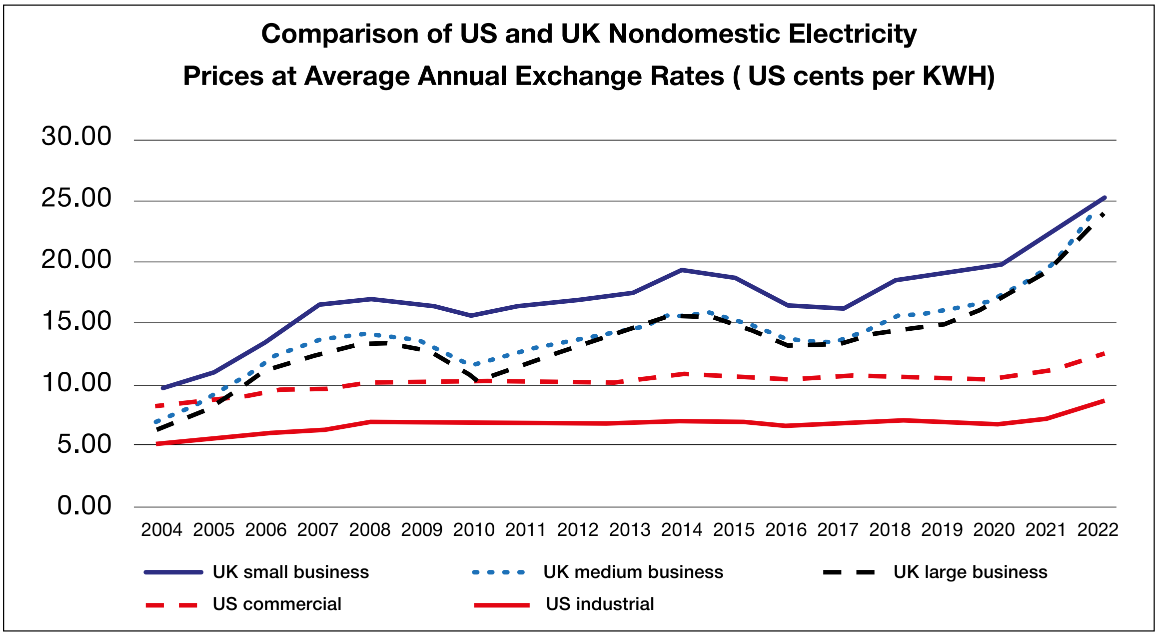

Figure 2 Divergence in UK and US Costs of Electricity

A fundamental problem is that the grid needs to be designed for peak utilisation, which renewables cannot guarantee, thus requiring massive overbuilding of capacity.

In the US, data centres currently consume five per cent of grid capacity and are projected to reach up to 12 per cent of capacity by 2028[24]. After decades of flat demand for electricity, AI driven demand on the US grid is projected to increase by 25 per cent by 2030[25], putting tremendous pressure on an unprepared system. Even in the US, weakness in the electric grid is becoming a key strategic issue. But it is a high-quality problem compared to what the UK and Europe are likely to face. History also suggests that the American system is very efficient at producing solutions. Many prior forecasts of grid collapse have failed to materialise.

24 https://www.newsweek.com/data-center-energy-demand-could-triple-2028-government-report-warns-2004468

25 https://www.promarket.org/2024/09/12/the-us-is-not-prepared-for-the-ai-electricity-demand-shock/

Choosing: Net Zero vs. Data Centres

While European nations have focused on environmental and industrial strategy, the US has powered ahead in innovation, data centres, and AI.

The effect of differing priorities can be seen in the global share of data centre capacity. As of March 2024, the US had 5,381 data centres, compared to 521 in Germany and 514 in the UK[26], out of a global total of around 8,000.

US dominance in data centres is likely to extend, with between 50 per cent and 75 per cent of new data centre capacity growth likely to be in the US. From 2025 to 2030, Blackstone predicts that the US alone will absorb $1 trillion in data centre investment, with another $1 trillion required for the rest of the world[27], implying 50 per cent for the US. The head of Bloomberg NEF estimates that "the majority of new AI data centre capacity will be built in the US", and quotes SemiAnalysis as estimating that out of 100 gigawatt (GW) of additional dispatchable data centre supply required globally by 2030, the US would absorb 74 GW of it, close to 75 per cent[28].

China will seek to leverage its formidable industrial strength and scale to challenge the US in data centres[29]. We are also seeing the emergence of new AI powers among some of the countries with ultra-low costs of electricity, such as the Gulf States. Both the UAE and Saudi Arabia are seeking to leverage their cheap oil and capital to become data centre behemoths[30].

> ***The UK and Europe will sooner or later be forced to address their Energy Challenges. UK businesses cannot wait"***

26 https://www.statista.com/statistics/1228433/data-centers-worldwide-by-country/
27 https://www.pehub.com/ai-drove-demand-for-data-center-deals-with-blackstone-among-the-bullish/
28 https://about.bnef.com/blog/liebreich-generative-ai-the-power-and-the-glory/
29 https://www.hinrichfoundation.com/research/wp/tech/china-quest-for-asymmetric-dominance-in-data-centers
30 https://www.mei.edu/publications/beyond-oil-googles-big-bet-saudi-arabias-ai-future

The Robotic Revolution will be built on AI and Data Centres

The bleeding edge of the AI revolution is increasingly happening in the physical world, in robots. A recent report by Citibank 'Rise of the AI Robots'[31], projects that there will be 1.3 billion robots globally by 2035 and four billion by 2050. The robotic economy will be modeled and managed from inside AI data centres. The physical embodiment of AI will be accelerating in 2025, thus further empowering those nations that have built strength in the core foundations. With China and the US competing for the leadership stakes in the robotic revolution[32], the risk that Europe and the UK get left behind is likely to accelerate.

31 Rise of the AI Robots, Citibank, Dec 4 2024 https://ir.citi.com/gps/H558-XNr_iTlGa7Qq7H9AYb5ZT2W851WZdFgPNEDsBtSeTgp7JcaTdS_uBfLVLpwfMQYeB5O5TwV9YcIDGuGOMjE2luzQprf

32 https://www.all-about-industries.com/artificial-intelligence-race-china-usa-a-7b8ea8fa99381c869c03c8cff1bc5c46/

How Should UK Businesses Respond?

UK businesses that want to win in AI must deploy clever strategies to overcome the energy cost hurdle, while the entire UK AI ecosystem must advocate for a return to a more rational energy policy. Elegant coping strategies include maxing out on data-centre waste-heat reuse and becoming leaders at energy optimisation.

> *"Long-term success requires getting the UK back to below 10 cents per kwh[33]"*

33 Per Darwall "The Folly of Climate Leadership Rupert Darwall DEC | 2023 Net zero and Britain's DISASTROUS ENERGY POLICIES" https://assets.realclear.com/files/2023/12/2321_2320_realclear-report-rupert-darwall-v7_1.pdf

Below we categorise some examples of potential coping strategies. We offer more detailed examples in the Appendix:

Energy Efficiency and Optimisation

Use energy-efficient hardware (e.g., ASICs) and advanced cooling technologies to reduce power use.

Energy-Saving Strategies

Harness the waste-heat from AI data centres to feed into existing industrial, commercial or district heating systems, thus reducing the net cost of electricity.

Collaborative Cloud Strategies

Partner with local cloud providers offering competitive energy pricing or renewable integration.

Edge Computing and Decentralisation

Reduce reliance on centralised data centres by processing data locally via edge computing setups.

International Co-operation

Partner with global energy-efficient firms for distributed AI computing and resource sharing.

AI Efficiency Innovations

Optimise AI models to reduce computational needs (e.g., through better algorithms or smaller models).

New Business Opportunities

Use AI to optimise grid or electric usage, thus turning the high cost of electricity into a new business opportunity.

Getting Ahead of Robotic AI

UK businesses need to rapidly jump into the opportunities of robotic AI, which will place ever higher stress on the UK grid network, especially in the edge of the network.

2025 Priorities for UK Businesses

We recommend that **UKAI** members treat the cost and reliability of energy as a top priority in 2025. We would specifically recommend the following set of actions:

1. ***Determine the impact of UK electricity costs on your competitive position.***
2. ***Identify assets in the business that could be used to mitigate the effect of high costs.***
3. ***Evaluate potential adaptations to your business model to reduce the effect.***
4. ***Define potential new business opportunities by overcoming high energy costs.***

Conclusion

The UK stands at a crossroads in the global AI economy, where its potential to lead is hampered by two decades of short-sighted energy policies that have created some of the highest electricity costs among advanced economies. This energy cost disadvantage poses a direct threat to the competitiveness of UK AI businesses, particularly as global rivals such as the US, China, and even emerging Gulf States leverage cheaper and more reliable energy sources to dominate the AI and Data Centre industries.

However, the resilience and ingenuity of the UK AI sector offer a path forward. By adopting innovative coping strategies – such as energy efficiency, waste-heat utilisation, AI model optimisation, and international partnerships – UK businesses can mitigate the challenges posed by high electricity costs. Furthermore, advocating for a more rational and AI-friendly energy policy is essential to unlocking the sector's full potential and ensuring its long-term viability.

The silver lining is clear: those UK businesses that successfully adapt to this challenging environment will not only survive but thrive, leveraging their experience to compete more effectively in the global AI market. The lessons learned and innovations developed to address these challenges will position the UK AI sector as a leader in energy-efficient and sustainable AI operations.

In an era defined by fierce competition in AI and robotics, the UK cannot afford to lose its foothold. By focusing on adaptation, innovation, and advocacy, UK businesses can transform the energy disadvantage into an opportunity to lead in the development of smart, sustainable AI solutions. The UK's AI journey may be fraught with challenges, but it is one that can culminate in global leadership – provided that its stakeholders rise to meet this critical moment.

Appendix: Coping Strategies

Energy Efficiency and Optimisation (In Data Centres or Adjacent Systems)

Category	Example	Description	Impact
Data centres	Dynamic Server Allocation	Dynamically adjusting server usage based on real-time demand to avoid idle power consumption.	Reduces unnecessary energy use during low demand.
	Liquid Cooling Systems	Using liquid cooling instead of air cooling for servers to enhance heat dissipation efficiency.	Lowers cooling-related energy costs by 30-40 per cent.
AI Model Training	Model Pruning	Removing redundant parts of neural networks without reducing performance.	Reduces computational power needed for training.
	Mixed Precision Training	Using lower-precision computations (e.g., FP16 instead of FP32) for AI model training.	Speeds up training while cutting power usage.
Industrial Processes	Variable Frequency Drives (VFDs)	Adjusting motor speeds to match the specific load requirements in industrial systems.	Saves up to 50 per cent of energy in motor-driven systems.
	Combined Heat and Power (CHP)	Capturing waste heat from industrial processes to produce electricity or heating.	Boosts overall energy efficiency by 20-30 per cent.
Office Buildings	Smart Thermostats	Automatically adjusting temperature based on occupancy and weather conditions.	Reduces heating, ventilation, and air conditioning (HVAC) energy costs by up to 20 per cent.
	LED Lighting	Replacing traditional lighting with LEDs for higher efficiency.	Cuts lighting energy use by up to 75 per cent.
Manufacturing	Predictive Maintenance	Using AI to anticipate equipment failures and optimise maintenance schedules.	Avoids downtime and reduces energy waste.
	Heat Recovery Systems	Recovering waste heat for reuse in heating or production processes.	Improves energy efficiency by up to 30 per cent.

Waste Heat Optimisation – Both in Data Centres and More Broadly in Other Uses

Example	Description	Impact
District Heating Integration	Using the waste heat from data centres to supply heating for nearby residential or commercial buildings.	Reduces heating costs for communities and improves data centre energy efficiency.
Aquaponic Farms	Redirecting waste heat to maintain optimal temperatures for fish farming or plant growth in aquaponic systems.	Supports sustainable agriculture while reusing heat efficiently.
Greenhouse Heating	Using waste heat to maintain temperatures in agricultural greenhouses.	Cuts heating costs for growers and reduces reliance on fossil fuels.
Water Heating Systems	Using data centre waste heat to warm water for municipal or industrial use.	Lowers energy requirements for water heating in nearby facilities.
Absorption Chillers	Using waste heat to drive absorption cooling systems to cool the data centre itself or nearby buildings.	Enhances cooling efficiency, reducing the need for additional electricity.
Heat Reuse for Indoor Pools	Supplying waste heat to maintain the temperature of indoor swimming pools.	Cuts operational costs for recreational facilities.
Industrial Processes Heating	Redirecting waste heat to support nearby industrial processes requiring low-grade heat.	Reduces energy costs for nearby industries and utilises waste heat effectively.
Urban Heat Networks	Feeding waste heat into city-wide heating networks to serve multiple buildings.	Supports large-scale urban sustainability goals and increases heat utilisation.
Office Heating in Multi-Tenant Complexes	Providing waste heat to heat office spaces in shared complexes where the data centre is located.	Cuts heating costs and improves the energy balance of the entire complex.
Energy Recovery for Water Desalination	Using waste heat to preheat water in desalination processes, reducing energy consumption.	Supports clean water initiatives while repurposing excess heat.

Collaborative Cloud Strategies

Example	Description	Impact
Partnership with Renewable-Focused Providers	Collaborating with cloud providers (e.g., Google Cloud, AWS) offering services powered by 100 per cent renewable energy.	Ensures operations align with sustainability goals and reduces carbon footprint.
Cloud Providers with Energy-Efficient Infrastructure	Partnering with providers that use liquid cooling and optimised data centre designs.	Minimises energy consumption and lowers operational expenses.
Flexible Cloud Workload Allocation	Using cloud services with dynamic workload allocation to regions with lower energy costs or excess renewable supply.	Takes advantage of time-based energy pricing to optimise costs.
Carbon-Neutral Cloud Services	Leveraging providers offering carbon offsets or credits for energy consumption (e.g., Microsoft Azure).	Supports climate-positive business goals while maintaining cloud scalability.
Private Cloud on Renewable Power	Setting up private cloud infrastructure co-located with renewable energy farms.	Combines control over data with sustainability benefits.
Collaborating with Local Providers	Partnering with regional cloud providers with lower operational costs due to local renewable energy availability.	Reduces latency while benefiting from lower-cost energy solutions.
Using Edge Computing Resources	Working with providers to deploy edge computing facilities near renewable energy sites.	Reduces data transmission energy and improves latency for end-users.
Green Energy-Powered AI Training Services	Utilising AI-specific cloud solutions powered by renewable energy for energy-intensive training tasks.	Cuts costs and carbon emissions associated with large-scale AI training.
Shared Renewable Cloud Solutions	Co-developing a renewable-powered cloud infrastructure with other companies in the same sector.	Shares costs and accelerates access to sustainable computing resources.

Edge Computing and Decentralisation

Example	Description	Impact
Local Data Processing with Edge Devices	Deploying edge devices (e.g., sensors, gateways) to process data locally instead of sending it to the cloud.	Reduces latency, saves bandwidth, and minimises energy use for data transmission.
Regional Micro Data Centres	Establishing small, decentralised data centres closer to users to reduce energy-intensive data transmission.	Decreases operational costs and improves user experience with lower latency.
Edge AI Inference	Running AI inference (e.g., facial recognition, object detection) on edge devices like smartphones or IoT.	Minimises cloud dependence and improves privacy while saving energy.
Smart City Edge Networks	Using edge servers to process data from sensors and IoT devices in smart cities for real-time applications.	Optimises resource usage and reduces centralised processing energy.
Content Delivery Networks (CDNs	Hosting frequently accessed data closer to end-users through regional CDNs.	Saves energy by reducing data centre loads and improves content delivery speed.
5G and Edge Integration	Combining 5G networks with edge computing to enable real-time processing for IoT and mobile applications.	Reduces energy and improves response times for critical applications.
Decentralised Renewable Energy Control	Using edge devices to manage renewable energy systems like solar panels or wind farms in distributed grids.	Enhances efficiency and stability of localised energy systems.
Industrial IoT (IIoT) Edge Computing	Processing manufacturing data on-site with edge devices to optimise operations in real-time.	Reduces reliance on central servers and increases energy efficiency.
Healthcare Edge Solutions	Processing medical imaging or patient data locally on edge devices within hospitals.	Ensures data security while reducing energy for data transfer and storage.
Remote Monitoring with Edge Devices	Using edge computing for monitoring remote infrastructure (e.g., pipelines, power grids).	Reduces energy by avoiding constant data streaming to the cloud.

International Co-operation and Data Centre Diplomacy

Example	Description	Impact
Collaborative AI Development Programmes	Partnering with international AI research hubs to co-develop models and algorithms.	Reduces R&D costs and accelerates innovation by leveraging shared expertise.
Distributed AI Training with Global Partners	Sharing training workloads with international partners in regions with lower electricity costs.	Balances energy costs and optimises resource use across borders.
Green Energy-Powered Cloud Partnerships	Using renewable-powered data centres in other countries for energy-intensive operations.	Reduces carbon footprint and operational costs while supporting green energy.
Cross-Border Data Centres	Establishing shared data centres near renewable energy resources in neighboring countries.	Benefits from economies of scale and reduced electricity costs.
Joint Renewable Energy Investments	Co-investing in renewable energy projects (e.g., solar or wind farms) with international firms.	Increases access to renewable energy while sharing financial risks.
International AI Ethics and Sustainability Consortiums	Participating in global initiatives to set ethical standards and promote sustainable AI practices.	Enhances global reputation and ensures adherence to sustainable development goals.
Collaborative Renewable Supply Chains	Building partnerships for shared renewable energy supply chains across regions.	Reduces costs and increases availability of renewable energy technologies.
Global Innovation Challenges	Participating in international competitions to solve energy efficiency challenges in AI.	Drives innovation and showcases leadership in energy-efficient AI development.
Knowledge Sharing Platforms	Joining international forums to share best practices for integrating renewable energy in AI.	Encourages faster adoption of sustainable practices across industries.
Cross-National Talent Development	Developing AI and energy efficiency training programmes with international universities and institutions.	Builds a globally competitive workforce and fosters innovation.

AI Efficiency and Optimisations

Example	Description	Impact
Model Pruning	Removing redundant parameters in AI models without compromising accuracy.	Reduces computational requirements and energy consumption during inference.
Quantisation	Converting model weights and activations to lower-precision formats (e.g., FP16 or INT8).	Decreases model size and speeds up computations, lowering energy costs.
Knowledge Distillation	Training a smaller 'student' model to mimic the outputs of a larger 'teacher' model.	Maintains performance while significantly reducing computational demands.
Sparse Neural Networks	Using sparsity techniques to eliminate unnecessary connections in neural networks.	Optimises storage and computation, leading to faster and more energy-efficient models.
Hardware-Aware Neural Architecture Search (NAS)	Automatically designing AI models optimised for specific hardware platforms (e.g., GPUs, TPUs).	Ensures models are computationally efficient and tailored to energy-efficient hardware.
Adaptive Inference	Dynamically adjusting the depth or complexity of a model during runtime based on task requirements.	Reduces energy consumption for simpler tasks without compromising performance.
Efficient Transformers	Developing transformer architectures with lower memory and computational requirements.	Enables training and inference of large language models with reduced energy usage.
Low-Rank Matrix Factorisation	Approximating large weight matrices with lower-rank alternatives.	Reduces computational overhead and energy consumption in model training.
Federated Learning	Training AI models locally on edge devices and aggregating updates instead of transferring raw data.	Reduces communication overhead and energy for cloud-based AI training.
Algorithmic Optimisation	Using advanced optimisation techniques (e.g., gradient-free methods) to accelerate training.	Minimises iterations, saving energy and time in training processes.

Grid AI Based Optimisation

Example	Description	Impact
Demand Response Optimisation	AI predicts peak usage times and automatically adjusts grid load by reducing non-critical energy use.	Reduces stress on the grid and creates opportunities for businesses offering demand management services.
Energy Trading Platforms	AI-enabled platforms optimise the buying and selling of surplus energy between grid operators and consumers.	Creates a new market for peer-to-peer energy trading and maximises resource utilisation.
Predictive Maintenance for Grid Assets	AI analyses grid equipment performance data to predict failures and optimise maintenance schedules.	Extends asset lifespan, reduces downtime, and provides predictive maintenance as a service.
Renewable Energy Integration	AI manages the integration of intermittent renewable sources like solar and wind into the grid.	Ensures grid stability and opens opportunities for renewable energy forecasting services.
Virtual Power Plants (VPPs)	AI aggregates distributed energy resources (e.g., batteries, EVs) to act as a single power plant.	Creates a new business model for energy aggregators and improves grid flexibility.
Real-Time Grid Monitoring	AI systems provide real-time insights into grid performance and energy flows.	Improves operational efficiency and enables energy advisory services for utilities.
Dynamic Energy Pricing	AI dynamically adjusts energy prices based on supply and demand forecasts.	Allows businesses to offer time-sensitive energy pricing plans to customers.
EV Charging Optimisation	AI balances grid demand by scheduling EV charging during off-peak hours.	Enables new services for EV fleet management and demand balancing.
Energy Storage Optimisation	AI predicts optimal charge/discharge cycles for batteries to align with grid demand.	Maximises energy storage efficiency and creates opportunities for battery-as-a-service models.
Grid Resilience Modeling	AI simulates grid behavior under various stress scenarios to improve resilience.	Supports consulting services for utilities to enhance disaster preparedness.

Getting Ready for Robotic AI

Example	Description
Optimise Energy Usage and Shift to Efficient Models	Refine algorithms, schedule processes during off-peak hours.
Adopt Renewable and Decentralised Energy Sources	Install on-site solar/wind, use battery storage systems.
Enhance Collaboration with Data Centres	Partner with energy-efficient data centres, utilise edge computing.
Transition to Distributed Computing	Use distributed AI models to reduce central processing load.
Policy and Subsidy Advocacy	Advocate for subsidies or reduced tariffs for energy-efficient practices.
Adopt AI in Energy Management	Utilise AI for energy optimisation and predictive maintenance.
Leverage Carbon Capture and Clean Energy Innovations	Explore carbon capture and hydrogen-based energy innovations.
Build Long-Term Energy Security	Participate in Power Purchase Agreements (PPAs) for low-cost energy.
Develop Regional Energy Strategies	Collaborate with regional suppliers for grid upgrades and energy hubs.

Join the Conversation

UKAI will be further exploring what the UK needs to do to build the social and physical infrastructure to lead the world in AI.

Join **UKAI** and get involved in the conversation.

www.ukai.co/membership

Let us know what you think by interacting with our posts on Linkedin or come along to one of our events.

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