Environmental Audit Committee:

Call for Evidence – Risks and opportunities to the sustainability of data centres in the UK

UCL's Policy Impact Unit provides professional policy engagement expertise across the Faculty of Engineering, collaborating with leading researchers to help incorporate evidence into the policy decisions.

Neuroware is an Innovation & Knowledge Centre (IKC) led by UCL, with a consortium of leading UK institutions.[1] Neuroware connects industry partners, researchers, investors, policymakers and networks nationally and globally to accelerate the development, commercialisation and adoption of neuromorphic hardware. Our consortium of experts makes us uniquely placed to contribute to this Call for Information. This submission will highlight the benefits of neuromorphic computing and prove it is an effective tool for enabling a more efficient and secure AI ecosystem.

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Consultation was undertaken with the following academic experts:

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- **Professor Steve Furber**, Professor Emeritus, Department of Computer Science, The University of Manchester

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What existing and emerging technologies can be used to minimise the environmental and climate change impact of data centres?

1. Neuromorphic computing is a novel, emerging technology inspired by biology, designed to mimic the neural systems found in the human brain. Neuromorphic chips operate in a fundamentally different way to the silicon chips found in traditional computers. In the brain, processing and memory functions are performed by neurons and synapses in a single location. Conventional computers that we use today have separate memory and

[1] Including Cambridge, King's College London, Imperial, Manchester, Oxford, Sheffield, Strathclyde, and the National Physical Laboratory

processing units. Neuromorphic computers will perform these tasks on one chip. This will remove the need to transfer data between memory and processing units, allowing for real-time processing and a significant reduction in energy consumption. Neuromorphic computing offers a major opportunity to positively transform the way in which we operate as a society – this includes helping to tackle the energy crisis and making data centres more sustainable.

2. Current government figures show that **data centres use about 2.5% of the UK's electricity and is projected to rise four-fold by 2030, with further advances in AI.**[2] In addition, according to the International Energy Agency (IEA), data centres could consume 3% of global electricity by 2030 – primarily due to the massive computational effort required to simulate neural networks.[3] The UK's Science Minister Lord Vallance recently acknowledged that "future computing paradigms [such as] neuromorphic computing, inspired by the brain's really remarkable energy efficiency, could fundamentally transform how AI operate" and could be key to tackling the huge consumption of energy by data centres in the UK.[4]

3. It's important to note two things. Firstly, with the advancement of neuromorphic computing, we **may not need to use data centres for everything that we currently use it for**. Secondly, while some data centres will still be necessary, **they will become far more energy-efficient and sustainable.**

4. Neuromorphic computer chips are a foundational technology that offers the UK an alternative pathway to grow and scale its AI capabilities without exponentially increasing energy consumption. **Neuromorphic computing will not replace AI; rather they will enable AI to run smarter, faster and more efficiently, much like how the human brain operates**.

How mature are these technologies and are they ready to be rolled out at the scale and pace required to match the potential expansion of data centres?

5. Neuromorphic systems are being delivered, and hardware capabilities are already in manufacture, however there is scope for wider adoption across the AI ecosystem. In terms of technical feasibility and timelines for deployment, large scale neuromorphic systems are already being deployed. For example, the University of Manchester has

[2] https://researchbriefings.files.parliament.uk/documents/CBP-10315/CBP-10315.pdf

[3] https://www.iea.org/reports/energy-and-ai/energy-demand-from-ai

[4] https://www.aston.ac.uk/latest-news/governments-science-minister-thinks-aston-university-led-neuromorphic-computing-could

been supporting an open service on its million-core SpiNNaker system since 2016,[5] and in 2025 SpiNNcloud Systems GmbH started shipping datacentre-scale SpiNNaker2 systems co-developed by Manchester and TU Dresden within the EU Flagship Human Brain Project.

6. Researchers at UCL have already built prototype neuromorphic chips – a major step in developing this new technology. In the next 3-5 years, researchers at UCL expect to be using their chips to increase the efficiency of conventional computers by creating 'hybrid' machines.

7. Neuromorphic computing is mainly being deployed at the edge,[6] which is where the first applications will be, however, we know that some large companies are looking at compute-in-memory,[7] which is a crucial stepping stone to get to neuromorphic computing. Even though neuromorphic computing will not initially tackle data centres, there is significant work in progress; timelines are heavily dependent on investment from government and large international companies such as Nvidia, Meta and Google. Importantly, **we do not see neuromorphic computing as replacing everything, rather it will work alongside existing technology** including – potentially – quantum.

8. One of the challenges with neuromorphic computing is that it's not yet capable of being delivered at scale to fully replace traditional technology. This is due to hardware limitations, computational cost, interconnectivity issues, standardisation and wider scalability barriers.[8][9] Therefore, it is very likely that more data centres will be needed in the immediate term. However, as this technology will approach maturity in the medium term, new data centre capacity should be planned in such a way that they can be repurposed in the future and care should be taken to avoid building more than we will need.

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[5] https://www.scieng.manchester.ac.uk/tomorrowlabs/spinnaker/

[6] "At the edge" refers to edge computing, where data is processed, analysed and stored locally on devices or local servers, rather than in a centralised cloud or distant data centre. https://azure.microsoft.com/en-us/resources/cloud-computing-dictionary/what-is-edge-computing

[7] "Compute-in-memory" (CIM), or in-memory computing, is a technique that performs data processing within memory units (such as RAM), rather than transferring data to a separate CPU/GPU, which, crucially, speeds up data processing. This leads to improved performance and lower power consumption. https://gsitechnology.com/compute-in-memory-computational-devices/

[8] https://kindatechnical.com/neuromorphic-computing-guide/scalability-challenges.html

[9] https://neuromorphiccore.ai/introduction-to-neuromorphic-computing-foundations-and-current-challenges/

9. Although the UK has strong expertise in neuromorphic computing, working more closely with our European partners would help the UK to build the level of sovereign capabilities to rival large powers, such as the USA and China. Neuromorphic technologies can dramatically reduce the need for large data centres, but developing these systems at scale is a big task, and not something the UK can – or should – do alone.

10. The recent UK-Netherlands Innovation Partnership[10] highlighted artificial intelligence and computing technologies as priority areas for deeper collaboration. Other countries, including the USA, Switzerland and Germany, have invested heavily and are accelerating progress. To stay competitive and unlock the full benefits of neuromorphic computing, the UK needs to leverage its relationships across Europe to speed up innovation and reduce our growing dependence on energy-intensive digital infrastructure.

11. The Neuroware IKC is a £12.8 million centre supported by funding from the UK Engineering & Physical Sciences Research Council (EPSRC) and Innovate UK, with a focus on commercialisation, photonics and scaling research for industry adoption. This will help to drive forward market ready neuromorphic technologies at pace and to minimise the need for large scale date centres in the future.

[10] https://www.gov.uk/government/publications/uk-netherlands-innovation-partnership/uk-netherlands-innovation-partnership