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Facilities Council

Harwell Energy Tech Cluster



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Cluster Strategy 2022



Foreword

Over the years I have seen Harwell Campus flourish. Our Energy Tech Cluster was launched in May 2018 and has the mix of vibrant people, ground-breaking technologies, products and a scalability factor to create a platform for real commercial advantage. During this century there has been a growing recognition of, and momentum towards, addressing climate change, moving it to the forefront of Government policy. The UK was the first G7 nation to make a commitment to become carbon neutral by 2050, amending the Climate Change Act 2008. Technology is spearheading the UK's transition into a low carbon economy, creating new jobs and green growth. The UK has a great reputation for accessing the best available science and engineering analysis, finding ways to innovate technological solutions to meet this challenge. The Harwell Net Zero Living Laboratory is one of the initiatives that can bring innovative technical solutions more quickly to market, contributing to the green economy. I am particularly excited about the opportunity to harness the unique multidisciplinary base here at Harwell including the cross fertilisation of ideas between the Energy, Space, Health and Quantum Clusters.

The Energy Tech Cluster at Harwell is already a key national research and innovation hub with exceptional capabilities and partnerships, generating exciting new opportunities that will ultimately translate into economic and societal benefits. If you have never visited Harwell Campus, I urge you to do so and see for yourself how the Energy Tech Cluster can be of service to you.

Dr Barbara Ghinelli

Director, Harwell Campus Business Development and Clusters, Science and Technology Facilities Council



Our Vision:

We will push discovery boundaries and fast track the translation of innovative ideas into the tools, products and services that will help tackle global climate challenges and deliver significant benefits to society and the UK economy. Embracing collaboration and partnerships, whilst enabling access to innovation infrastructure, including the Harwell Net Zero Living Laboratory, to test, validate and expedite net zero technologies at scale.

Our Mission:

We will grow the Energy Tech Cluster to over 150 organisations at Harwell over the next 10 years, connecting its talented people to a wider network of more than 300 organisations and safeguarding 5,000 jobs across the energy sector. We will help business to grow and create internationally competitive, scalable innovations in zero carbon energy storage, battery technology, renewables, zero carbon fuels and digital solutions that drive the transition to net zero.

Executive Summary

Climate change is one of the biggest threats to society and our economy. To respond to this unprecedented challenge, the UK has set a world-leading net zero target and our government has put achieving net zero by 2050 at the core of an ambitious policy agenda to build back better and greener through innovation.

Harwell Campus is home to over 220 organisations. It supports a great breadth and depth of research on new and novel net zero technologies, often delivered collaboratively between the talented researchers, multidisciplinary facilities and the 80 innovative organisations that nucleate the Harwell Energy Tech Cluster.

To support the government's ambition to reach net zero carbon emissions, we will unleash the world leading capabilities of the Harwell Energy Tech Cluster, and the ground breaking science and technologies of its members and wider network across the UK, to deliver a step change in the way we visualise, manage and understand net zero technologies.

We will leverage the strengths of clustering, embracing co-location, collaboration and partnerships and to fast track the development and commercialisation of innovative technologies into whole systems, products and services. Supported by access to the skilled people, key research and innovation infrastructures and demonstration platforms that are crucial to scale up ideas and support business growth, including to Harwell Net Zero Living Laboratory,

Furthermore, the Energy Tech Cluster will draw on connections between its members, including the STFC multi-disciplinary science facilities, SME's and other organisations, to help identify and tackle emerging skills needs, reducing barriers to business growth and job creation in a key economic sector.

This strategy sets out our four main goals to deliver the step change needed to tackle the local, national and global challenge of transitioning to net zero and provides examples of how we will work with partners across the UK to deliver this ambition.

- 1. Build the Harwell Energy Tech Cluster to a scale large enough to have global impact.**
- 2. Champion Harwell Energy Tech Cluster capabilities, the Harwell Net Zero Living Lab and enabling infrastructure.**
- 3. Drive innovation and adoption at scale.**
- 4. Develop the skills for growth.**



Background on Harwell

Harwell has a 75-year history in energy and is home to a long list of science and innovation world-firsts in life and physical sciences, particle physics, nuclear physics, energy, astronomy and space science.

Over the past decade, more than £3bn of public and private investment has been made in the campus, creating a vibrant innovation ecosystem that is nucleated by a critical mass of world-class research, talented people, multidisciplinary facilities, high-quality research and innovation infrastructure, and a nationally significant cohort of enterprising start-up and scale-up businesses.

Harwell hosts over 6,000 skilled engineers, technicians and scientists, working inside over 220 organisations, including an academic network of over 30 universities. Its world-leading research and innovation environment drives innovation and supports collaboration between industry and the research base, leading to the development of advanced technologies and stimulating new business opportunities and growth of key industries and sectors that will shape the future of UK economy and society.

The Campus supports three thriving clusters in energy, space and health and an emerging cluster in Quantum. It is embedded in one of the most dynamic regions of the UK and Europe - the world-leading Oxford research and innovation ecosystem - further enhancing Harwell's position to address local, national and global challenges, attract high-impact investment and support new and established businesses to grow.

Harwell supports a great breadth and depth of research on new and renewable energy technologies, often undertaken collaboratively between academia and industry. The campus also hosts advanced imaging and analytical technologies, including X-rays, muons and neutrons, and operates multidisciplinary facilities and large-scale demonstration platforms that accelerate development and support adoption of new and novel net zero technologies and systems. These capabilities are underpinned by significant computational science capabilities and a wide array of business incubation and support services. A large network of specialist investors in the region support early and late stage research and innovation, development and adoption of technologies and help businesses grow and drive the transition to net zero.



Strategic Context

Climate change is one of the biggest threats to society and our economy. The Intergovernmental Panel on Climate Change (IPCC) 2021 Special Report - the world's leading authority on climate science - recently highlighted the impact human activity has had on the climate. It noted that long-term human-caused warming has resulted in global surface temperatures that are higher than any period on record, sea level rises, melting polar ice and glaciers, and extreme events, including heatwaves, floods and droughts.

To reduce the most significant climate-related risks to health, livelihoods, food security, water supply, human security and economic growth, a global framework - submitted under the Paris Agreement (2015) - was ratified to limit global warming to between 1.5°C to 2°C. This global target is underpinned by national policy measures that aim to achieve a balance between the amount of carbon emissions produced and the amount of greenhouse gases removed from the atmosphere, building a bridge to a net zero future.

COP26 marked a step forward in global efforts to address climate change. It raised global ambition on climate action, including a material increase in ambitions to reduce emissions across the world, finalisation of rules on reporting emissions and international carbon trading, and the launch of a range of new initiatives and sector deals, including the Glasgow Financial Alliance for Net Zero - \$130 trillion of private capital to accelerate transition to a net zero economy.

To respond to this unprecedented challenge, the UK has set a world-leading net zero target and its government has put achieving net zero by 2050 at the core of an ambitious policy agenda to build back better and greener through innovation. By 2030 it aims to reach at least 68% of this target (compared to 1990 levels) and achieve a 78% reduction in emissions by 2035. The UK Government's Energy White Paper: *Powering our Net Zero Future* (2020) sets out how the UK will harness the benefits of this transition to net zero by leading a green revolution that transforms the energy system, creates global trading opportunities for low-carbon technologies and the foundations for economic growth and job creation. This Ten Point Plan for a Green Industrial Revolution will bring together the public and private sector to help tackle the climate challenge, leveraging private sector investment and creating high quality jobs across key technologies such as hydrogen, offshore wind, nuclear, electric vehicles, heat and sustainable buildings.

Alongside this, the Government's Innovation Strategy: *Leading the future by creating it* (2021) and *Build Back Better: our plan for growth* (2021) focus on the pillars and wider innovation system that will act as the foundation for recovery, growth and job creation in the low-carbon economy and support levelling up. It also articulates the importance of collaboration between industry, science and government, infrastructure, people and skills to tackle the major challenges posed by climate change.

Reaching net zero requires extensive changes across the economy and society. Tackling the climate challenge must take into consideration a range of social and health related factors including reducing fuel poverty, increased wellbeing for communities, and provide opportunities for skilled employment.

Global Britain in a Competitive Age (2021): The Integrated Review of Security, Defence, Development and Foreign Policy looks at the UK's place in the world. It recognises that the UK can use its worldwide network of science and technology partnerships to tackle climate change, improve health, reduce inequality and drive economic growth.

As the UK continues to deal with the coronavirus pandemic and prepares to recover and rebuild from its aftermath it must forge a new identity and seize the opportunities that ensure everyone has the skills to get good jobs now and in the future. The UK government Skills for Jobs White Paper (2021): outlines how the government will to strengthen links between employers and further education providers, provide advanced technical skills in science, technology, engineering and maths. It commits to building the technical skills base the UK needs to deliver its ambitious net zero target, advance new cutting edge technologies and support green growth.



Introduction to the Harwell Energy Tech Cluster

The Harwell Energy Tech Cluster comprises 80 organisations employing more than 1,200 people on campus and directly links to a wider network of over 100 organisations across the UK. The Cluster is industry facing and helps to connect the significant science and innovation assets at Harwell to an innovative industrial ecosystem that spans the breadth of energy research, innovation and development and includes a cohort of high-growth SMEs. Furthermore, Harwell Energy Tech Cluster members work closely with the UK government and regulators on the design and implementation of policies, including incentives and environmental criteria. Informing consultations and providing strategic advice to diverse stakeholders on areas such as wind, storage, hydroelectric & solar PV, and sustainability best practice.

The Harwell Energy Tech Cluster provides a coherent focus for activities at Harwell that support the drive to net zero emissions. It plays a critical role in helping to deliver governments ambitions for growth and job creation in the low-carbon economy by bringing together UK public bodies, government, academia, finance and industry to share knowledge, risk and develop partnerships that help tackle net zero challenges. In 2018, the Faraday Institution - the UK's flagship research institute for electrochemical energy storage - headquartered at Harwell. The institute oversees an extensive battery research programme across 20 universities and 50 businesses, further strengthening connectivity between the Harwell Energy Tech Cluster and partners across the national research and innovation system.

By connecting different organisations, the Harwell Energy Tech Cluster supports development of cutting edge net zero technologies across renewables, battery research, zero carbon energy storage, zero carbon fuels, integrated energy systems, connected and autonomous travel solutions, and digital and data services. Strong links across the research and innovation system, in particular leveraging the capabilities of the Hartree National Centre for Digital Innovation (HNCDI) and STFC's Scientific Computing Department, enable organisations to apply multi-disciplinary and multi-scale modelling, data analytics, operational analysis (digital twins) and Artificial Intelligence to net zero challenges.

This development of new and disruptive net zero technologies leverages the dynamic research and innovation ecosystem at Harwell, which supports risk sharing and makes it easier to attract new investment. The enterprising culture and pool of highly skilled people on campus makes it an ideal environment to start-up and scale-up net zero businesses and for established companies to grow. Furthermore, access to multidisciplinary facilities, extensive capabilities and demonstration platforms enables innovative net zero technologies to gain economies of scale.



Overview of the Harwell Net Zero Living Laboratory

A living laboratory must, as far as possible, mimic the real-world environment. It should enable organisations to collaborate, test, develop and demonstrate technologies at scale and validate the performance of products and services in a real-world situation.

At 700 acres, Harwell is the size of a small town. It is a complex and 'live' community that is comparable to many public, industrial and commercial sites across the UK. Furthermore, it is home to unique facilities and a breadth and depth of knowledge and technical expertise that spans multiple disciplines. It's highly skilled and collaborative community of engineers, technicians and scientists develop new and novel technologies and accelerate innovations through to validated solutions that work in the real world. Harwell campus is therefore an ideal living lab, and partner, to help turn ideas into reality.

An example of this is the Darwin project which includes Telefonica/O2, the UK Space Agency and the European Space Agency. This ambitious four year trial programme is designed to pave the way for new generation connectivity solutions through connected autonomous vehicles. The aim is to test new technology and end-to-end connectivity solutions on site including 5G and satellite communications.

The Harwell Net Zero Living Laboratory is connected to the wider community and region through 'Living Oxford'. A regional-scale living lab that is laying groundwork to futureproof communities by 'putting citizens at the heart of science thinking' and helping them adapt to technological and environmental change.

The Harwell Energy Tech Cluster embraces Harwell as a Net Zero Living Laboratory and the opportunities it brings to support and accelerate the development and adoption of pioneering energy solutions and services, including connected and autonomous travel, green fuel solutions, and integrated energy systems.

The Cluster supports a diverse community of industry, entrepreneurs, academics, regulators and government to collaborate and utilise the living lab capabilities to develop, deploy, and validate novel megawatt-level-technologies that could shape the future of a net zero carbon economy. Whilst large energy companies may have access infrastructure to support these activities, the same is not true of the small and medium-sized energy technology businesses. In addition, without government support, it is challenging for industry to pull together the diverse partnerships needed to tackle large-scale net zero challenges, which we expect will be the greatest source of disruptive innovation.

By drawing on the strengths of its thriving Energy Tech Cluster and ambitions of the Net Zero Living Laboratory, Harwell is committed to supporting the UK in reaching its net zero carbon target by 2050. It will enable the adoption of clean energy solutions across and help business to create jobs and unlock sustainable green growth, strengthening the resilience of diverse communities across the UK.



The scale of the opportunity

The UK energy industry invests £13bn annually, delivers £31bn in gross value added on top of the £95bn in economic activity through its supply chain and interaction with other sectors, and supports 738,000 jobs across the UK.

In the first quarter of 2020, over 60% of all energy in the UK came from low carbon sources. However, to mitigate long-term temperature increases and reduce the risks of climate change we need to do more and reduce emissions from all energy production. We also need to meet wider net zero challenges, for example in infrastructure and transport, such as adapting building stock to deal with potential impacts, decarbonising heat supplies, provision and management of resilient transport systems. This adaptation will need to be underpinned by flexible services, resilient markets and regulation that supports the wider deployment and adoption of low carbon technologies and enables decarbonisation at a cost that is affordable all consumers.

By innovating to develop solutions that enable us to mitigate and adapt, UK businesses will be able to access a global net zero energy sector, which is expected to grow strongly with global estimates forecasting between \$1-4 trillion (World Bank) in annual revenue for zero carbon fuels and zero carbon energy storage.

The UK Government has outlined policies that will help ensure the UK is at the forefront of a Green Industrial Revolution. Taking action now the £12bn government investment is expected to create and support up to 250,000 green jobs help achieve our net zero emission targets. It seeks to position UK companies and our world class research base to seize business opportunities creating jobs and wealth for the country.

The Harwell Energy Tech Cluster will play a major role in driving the transition to next zero and supporting economic growth. It will deliver growth by enabling the development and adoption of core technologies, including: new and novel batteries, zero carbon fuels, zero carbon energy storage, renewables and digital net zero management systems. The Cluster will draw value from the diverse industries and research communities across Harwell – physics and engineering, digital and data analytics, materials science, satellite communications, quantum, space, health and environmental monitoring – and links to stakeholders in the wider ecosystem.



Delivering our ambition

Our approach has four main goals, which the Harwell Energy Tech Cluster will deliver by 2030. To deliver this ambition, we will work with partners across the research and innovation system and leverage the world-class research and innovation capabilities at Harwell and beyond to support the government's ambition to reach net zero carbon emissions.

By 2030, we will:

Build the Harwell Energy Tech Cluster to a scale large enough to have global impact.

Vibrant clusters draw on the geographical co-location of organisations, knowledge, skilled people and facilities to drive job creation and economic growth. The connected environment within our clusters encourages collaboration, attracts investment in people and ideas and can improve productivity. We will exploit this environment to achieve global impact and attract the skilled workforce required to deliver our mission. **We will strengthen connectivity and cohesion between the clusters' diverse membership of entrepreneurs, innovators, SME's, industry, researchers, regulators and government,** enabling synergies between different communities and growing the Harwell Energy Tech Cluster to over 150 organisations by 2030, in a coherent and managed way. **We will strengthen links between the cluster and investors to ensure emerging technologies and innovative organisations have the investment needed** to develop transformative technologies that support the transition to a net zero economy and drive economic growth.

Champion Harwell Energy Tech Cluster capabilities, the Harwell Net Zero Living Lab and enabling infrastructure.

Enabling access to key research infrastructure and capabilities and demonstration platforms at the right scale and at the right point in time is crucial to the success of start-up and scale-up businesses and for industry to grow.

We will work with our partners to **raise awareness of the funding, research facilities, skilled people, demonstration platforms, cutting edge net zero technologies** and wider capabilities of organisations and institutions in the Energy Tech Cluster.

We will coordinate efforts between cluster organisations that tackle grand challenges

We will support and champion the capabilities of the Harwell Net Zero Living Lab to test, develop and demonstrate net zero technologies at scale.

Drive innovation and adoption at scale.

Collaboration and partnerships between researchers, innovative businesses, facilities, entrepreneurial people and government play an important role in driving innovation and tackling global challenges.

We will identify two projects a year that could have a global impact on addressing climate change.

We will support the cluster to tackle these challenges, bringing the public and private sector together to develop and demonstrate innovative technologies and understand the regulatory barriers to deliver change across energy, the environment and transportation.

Develop the skills for growth.

It is widely recognised that there is a national shortage of skilled technicians and engineers, especially working in the energy and transportation sectors.

We will work with the STFC multi-disciplinary science facilities, SME's and other organisations in the cluster to identify the critical and emerging skills needs that are barriers to growth.

We will work with UKRI and other partners across the UK to identify training programmes and people movement opportunities to address skills gaps, helping to give businesses in the cluster confidence they can attract and retain the talent they need to invest and grow.

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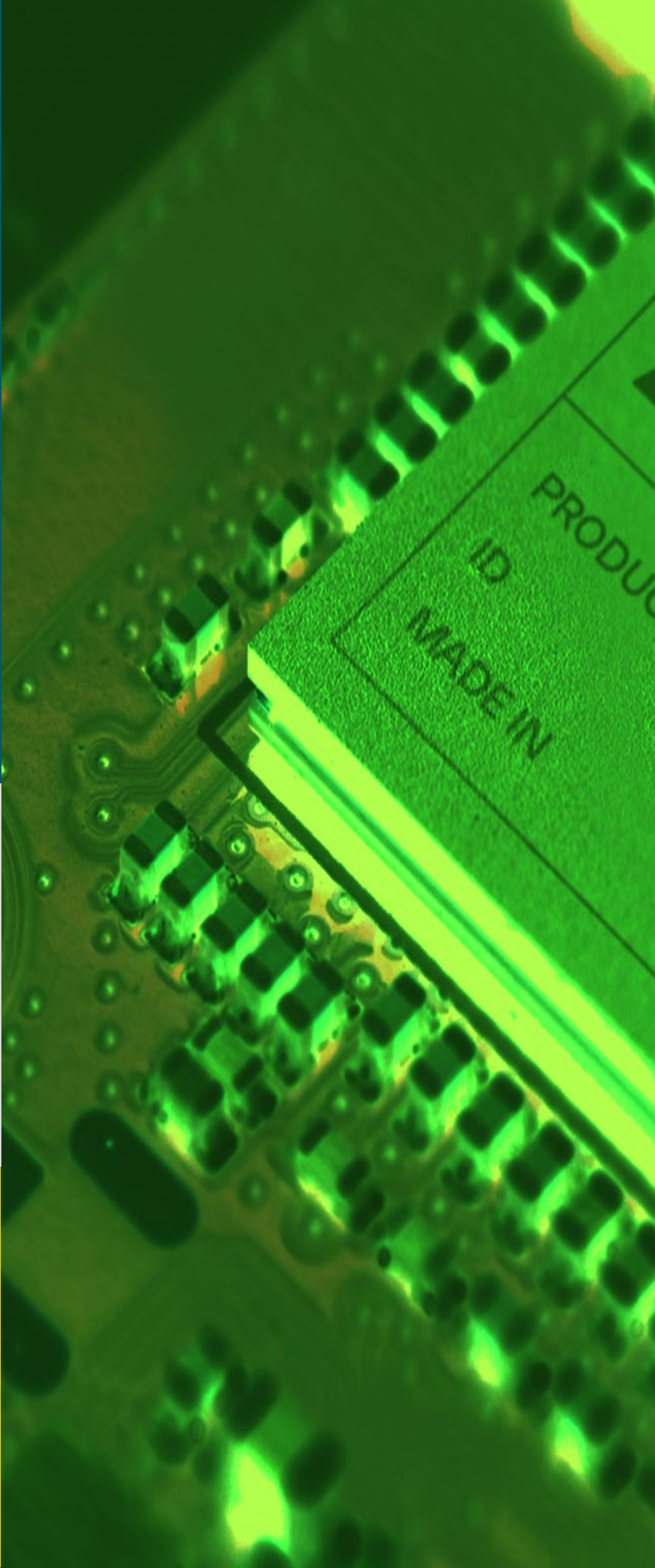
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