

Low Carbon Energy and Environment Research in Wales: a briefing for John Howells, Director for Climate Change, Energy and Planning at Welsh Government

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The last few years have seen a huge rise in interest in the environment globally. The fast-developing climate emergency (formally [recognized by the Welsh Government](#) in 2019) has resulted in ambitious commitments to decarbonize economies. A [green recovery](#) in Wales, contributing innovation beyond its borders and applying innovation at home, will be underpinned by research in this space.

This document has been laid out in response to three key questions directed toward to the Low Carbon Energy and Environment Research Network Wales by John Howells.

Q: What are the key policy actions for Wales?

We are happy to provide more policy advice after we speak if this is appropriate but we chose to highlight here the importance of investment in research more broadly.

Universities play a vital role in developing a high skilled workforce and providing the innovation to drive economic growth. Welsh Universities generate about £5bn a year and almost [50,000 jobs \(Universities Wales, 2020\)](#), and are [important catalysts for regional development](#).

There is real excellence in the low carbon energy and environment research space in Welsh Universities which attracts significant funding from UKRI. The EU has also been an important funding source (particularly valuable for building linkages between research and industry) but this is of course coming to an end.

The level of [R&D investment per capita in Wales \(£238 as of 2017\)](#) is lower than in other parts of the UK, at less than half that of England (£544), and approximately half of Scotland (£466). This may partially explain why Welsh Universities [receive a lower proportion of UKRI funding than the rest of the UK](#) as there is also [clear correlation](#) between the amount each nation in the UK invests in research funding and the amount of UK-wide research council funding that universities in that nation are able to secure in competitions.

Targeted investment by the Welsh Government can make a big difference. In the first phase of the Low Carbon Energy & Environment Research Network Wales (2013-2019), the £7 million investment in the by Welsh Government [leveraged an additional £33 million](#) for Welsh research institutions. The resulting research has important [industrial, economic and societal impacts](#). This investment also [brought talented researchers into Wales](#); demonstrating the role of Welsh Government funding in attracting and retaining excellent researchers to Wales, helping to build the research base.

Q: Where is the Low Carbon Energy and Environment Research Network Wales most likely to make ground?

Our mission is to support Wales' world-leading research in low carbon energy, nature-based solutions to environmental challenges, the bioeconomy, and sustainable food production. We aim to enhance and build on the excellent research capability in Wales, and to increase competitive funding secured

in Wales. Our vision is of world-leading research strength, contributing innovation internationally and economic strength domestically.

Short-term priorities: We have a limited budget for activities over the next two years, which with further funding could quickly be expanded to have a greater reach.

Showcase Welsh research and innovation

At COP26: We have submitted an EOI to showcase Welsh research and innovation at COP26 (title: Small Nation, Big Ideas)

Webinar series (Small Nation, Big Ideas): We plan to run a high-profile webinar series (ideally hosted by the Welsh Government) to showcase the excellent research happening in the low carbon energy and environment area within Wales. We will structure the webinar series around the relevant themes of the COP: Adaption and Resilience, Nature, Energy, Clean Transport, and Cities and Built Environment.

Media engagement: We plan to engage with the Welsh media and the media more broadly to find opportunities for Wales-based researchers to speak prominently thus raising the profile of research happening in Wales (contributing to grant capture and policy impact). COP26 and the run-up will offer many opportunities.

Make the case for funding Welsh research in this space (both within Wales and externally)

As Ministers seek ways to stimulate the economy in the wake of the pandemic, increasing capacity and creating jobs at Welsh research institutions will underpin a green recovery. The Low Carbon Energy and Environment Research Network Wales can highlight opportunities where Welsh Government funding could be especially influential (e.g. in providing matched funding or seed money to initiate projects with large potential).

UKRI has expressed interest in engaging with networks and clusters at high level, as highlighted during the Chief Executive's visit to Wales in March. As UKRI continue to [prioritise place-based funding strategies](#) in line with the UK R&D Place Strategy, it is vital that they are fully aware of Wales' research strengths and the opportunity that the highly connected Welsh research landscape has to offer. We will be a voice for Wales-based researchers in the low carbon energy and environment space to help ensure there are appropriate pots of money for them to bid into.

Support Wales-based researchers in grant capture

Where possible, the network will support researchers in Welsh institutions in making funding applications to UKRI and other significant funding sources. This support may take the form of 'sandpits' aimed at networking researchers interested in particular large calls, facilitating connections across Wales, and pulling together the appropriate information and background policies that can bolster their case for funding.

Provide a link between Welsh science and Welsh policy

While not our primary role, we will contribute to ensuring that the world class low carbon energy and environment research in Wales feeds into high-quality evidence for Welsh Government and Natural Resources Wales. The [Environment Platform Wales](#) exists primarily to ensure effective flow of science into policy within Wales, but we work closely with them and also respond to direct requests from Welsh government.

Longer Term Aspirations: If we obtain funding past the current two years of WEFO funds, then we hope to do the following:

Run a returning fellows programme

We plan to run a Returning Fellowship Scheme to facilitate excellent researchers returning following long-term absence due to parental leave, health or caring reasons helping to avoid the loss of talent. Such fellowships also help address the gender imbalance that is present in all areas of STEM research, this has strong alignment with the Welsh Government cross cutting theme of Equal Opportunities and Gender Mainstreaming.

The Low Carbon Energy and Environment Research Network Wales [ran such a scheme](#) from 2013 to 2019. Ten Fellowships were awarded (all returning from maternity leave) and the recipients credit the awards with giving them the means and encouragement to develop their research, delivering high-quality publications and increased grant income.

Support PhD level training and research in Wales

PhD research programmes are recognised by the UK government for their [vital contribution towards economic performance](#) and producing highly skilled people who create opportunities, and of course a highly skilled work force attracts investors. We would like to bring together excellence from across Wales to train the next generation of innovators and thought-leaders in low carbon energy and environment research and development. This is particularly needed given that the [KESS 2 \(Knowledge, Economy and Skills\) programme](#) (funded by European Social Funds) is coming to an end in 2022. It is vital that there is a replacement for this important programme which has trained 645 PhD and MRES students to both ensure the continued supply of highly skilled researchers in Wales and replace the excellent applied research which was carried out under the programme.

Grant collaborative awards

Due to the relatively small size of the Welsh universities, collaboration between institutions will often be critical for developing truly competitive research bids. In the 1st phase of the Low Carbon Energy and Environment Research Network Wales we demonstrated the effectiveness of investing in research collaborations which bring together partners from across Welsh universities. We awarded funding for 8 Research Clusters. These ambitious multi-disciplinary teams delivered creative, excellent research pertinent to both national and international agendas, leveraged substantial research funding for Welsh institutions, produced high quality research outputs and recruited new researchers to Wales. The Chief Executive of UKRI highlighted recently, during her visit to Wales, that clustering is the ideal mechanism to create voices that have both the clout and the expertise to draw in significant investment. Investment in the Low Carbon Energy and Environment Research Network Wales would allow us to make highly impactful collaborative awards to leverage substantial further grant capture into Wales (as evidence by our performance in the previous phase).

Q: Where is Wales making a difference?

Low Carbon Energy

Marine Renewables: Wales is in a unique global position for marine renewable energy, as we have strong tidal currents, high tidal range, and energetic wave conditions, the research expertise, and strong links between academia and industry. There is complementary research expertise between Bangor, Swansea and Cardiff Universities tackling marine energy problems from the wider oceanographic and grid perspectives (Bangor), array-scale issues (Swansea) and device-scale issues (Cardiff). The NRN-LCEE Quotient project was one exemplar, with these three institutions working closely together across these scales, resulting in an additional £20M of grant capture. For over a decade, Bangor and Swansea (under the [SEACAMS/SEACAMS2](#) initiatives) have been filling knowledge gaps regarding ecological impacts of marine renewables that are a major obstacle to development of the sector. Two research vessels, the [Prince Madog](#) (Bangor) and the [Mary Anning](#) (Swansea) are used extensively by marine energy researchers and industry.

Hydrogen: The [Hydrogen Centre](#) at the University of South Wales (with funding from ERDF) is a focal point for new research, development and demonstration of hydrogen energy technology in Wales. The proximity of the Hydrogen Centre, [hydrogen research underway](#) at the Swansea University Energy Safety Research Centre as part of the [£9.2 million RICE project](#), innovative SMEs such as River Simple, vast hydrogen use and by-products at the Tata Port Talbot Steelworks, production and distribution at suppliers like BOC, and the South Wales Gas Pipeline all come together to create an incredible opportunity for a hydrogen cluster aligned with the recommendation made by the Energy Networks Association in their [2019 Pathways to Net Zero](#) report. The port of Milford Haven offers a similar industrial landscape which will now become part of the [£4.5 million Milford Haven Energy Kingdom](#) exploring the role hydrogen could play in a decarbonised energy future.

Optimising efficiency: The [Energy Safety Research Institute](#) (led by Sêr Cymru chair Barron) covers sustainable resources, waste recovery, carbon dioxide sequestration and next generation of energy distribution. The [Gas Turbine Research Centre](#) at Cardiff is improving the efficiency of gas turbines (which underpin much of the UK's energy generation and the global aviation industry). The £24 million WEFO-funded [FLEXIS](#) project has built capacity and collaboration in these areas across Swansea, South Wales and Cardiff (together with industry partners).

Environment

Sustainable food production: Aberystwyth, Bangor and UKCEH have important strengths in reducing emissions from farmland. The NRN-funded projects [Cleaner Cows](#) and [Multi-land](#) were influential in building cross-institution collaboration. Research farms at Aberystwyth (Trawscoed, [Pwllpeiran](#)) and Bangor ([Henfaes](#)) allow landscape-scale study and experimentation. There is growing expertise in the development of more sustainable protein sources (including lab meats, plant-based proteins, insect and fungal proteins) and more efficient production systems. The [National Plant Phenomics Centre](#) at Aberystwyth and the Innovate-UK [Genomic Selection](#) project at Bangor are breeding crop varieties more resilient to likely conditions of the future. Both aquaculture and marine fisheries are strengths at [Bangor](#), Aberystwyth and [Swansea](#), with a focus on low-carbon food production systems through shellfish aquaculture with strong industry partnerships (e.g. the [Bluefish](#) project). Land use and marine food production are linked for example through catchment research by Bangor and UKCEH, looking at viral/bacterial contamination affecting shellfish production areas.

Nature-based solutions to climate change: Land and water management play a significant role in both climate change mitigation and adaptation. There is real strength in Swansea, Bangor and UKCEH in the role of peatland and forest management in carbon sequestration (with Bangor and UKCEH's soil science expertise particularly influential). Cutting-edge research in Wales has shown how land management can contribute to both reducing coastal (eg NRN-funded [Resilicoast](#)) and surface water flooding (NRN-funded [Multi-land](#)), while the [Cardiff Water Research Institute](#) leads in multidisciplinary catchment research. Cardiff hosts the £5m ESRC [CAST Centre](#) on climate and social transformations, and the [first Welsh UKRI Future Leaders fellow](#) on resilience in water stressed cities. The EU-funded [PONDERFUL](#) project looks at the role of ponds in climate change mitigation and adaptation. Bangor University has particular strengths supporting equitable strategies for sequester carbon through agro-forestry and forest management in low-income countries.

Earth observation: World-class research at Aberystwyth (supported by the appointment of Sêr Cymru chair Lucas) is feeding into national (e.g. through [Living Wales](#)) and international (e.g. through the European Space Agency [Biomass project](#)) policy and science. Welsh institutions are also running world-leading projects using earth observation to support adaptation to global challenges such as water scarcity in Africa (e.g. the EU-funded Cardiff-led [Down2Earth](#) project).

Biodiversity science and conservation: Cardiff co-leads the [NERC Omics Centre](#) which is applying cutting-edge molecular tools. For example the Bangor-led [LOFRESH](#) project is advancing the use of environmental DNA (eDNA) for tracking species in freshwater. Cardiff are a lead-partner in the [CryoArks](#) project (animal biobanking for research and conservation). The [National Botanic Garden](#) has internationally-recognized expertise in genetic barcoding. There are also real strengths in Wales in conservation science particularly in Bangor and Swansea; for example exploring the resilience that large marine reserves provide in the face of over-exploitation and climate change.

Novel products from nature: There is innovative research across Wales in the area of biorefining. The WEFO-funded [BEACON](#) project (Aberystwyth, Bangor, Swansea and South Wales) works across diverse areas including agrochemicals, biofuels and pharmaceuticals, reducing waste and adding value to agricultural residues. The [Centre for Environmental Biotechnology](#) at Bangor (co-funded by ERDF), focuses on the discovery and industrial application of novel enzymes to replace chemical catalysts in industrial processes. University of South Wales (led by a [Royal Academy of Engineering Chair in Emerging Technologies](#)) also has substantial expertise in developing microbial bio-electrochemical systems for waste treatment and resource recovery to make industrial processes more efficient.