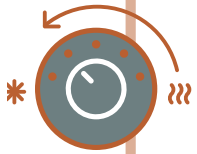
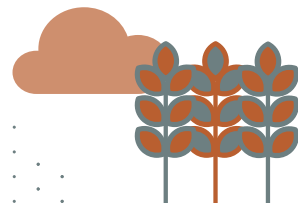
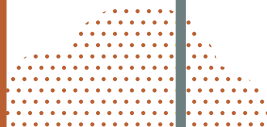
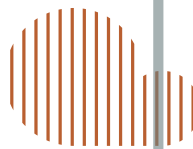
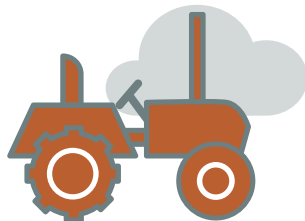
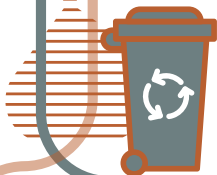
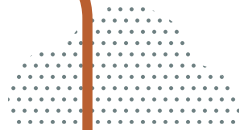
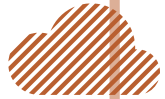




Llywodraeth Cymru
Welsh Government



Welsh Government Smart Living
Whole Systems & Hydrogen
Decarbonisation Innovation
SBRI Demonstrator Projects
Case Studies
2021 – 2023





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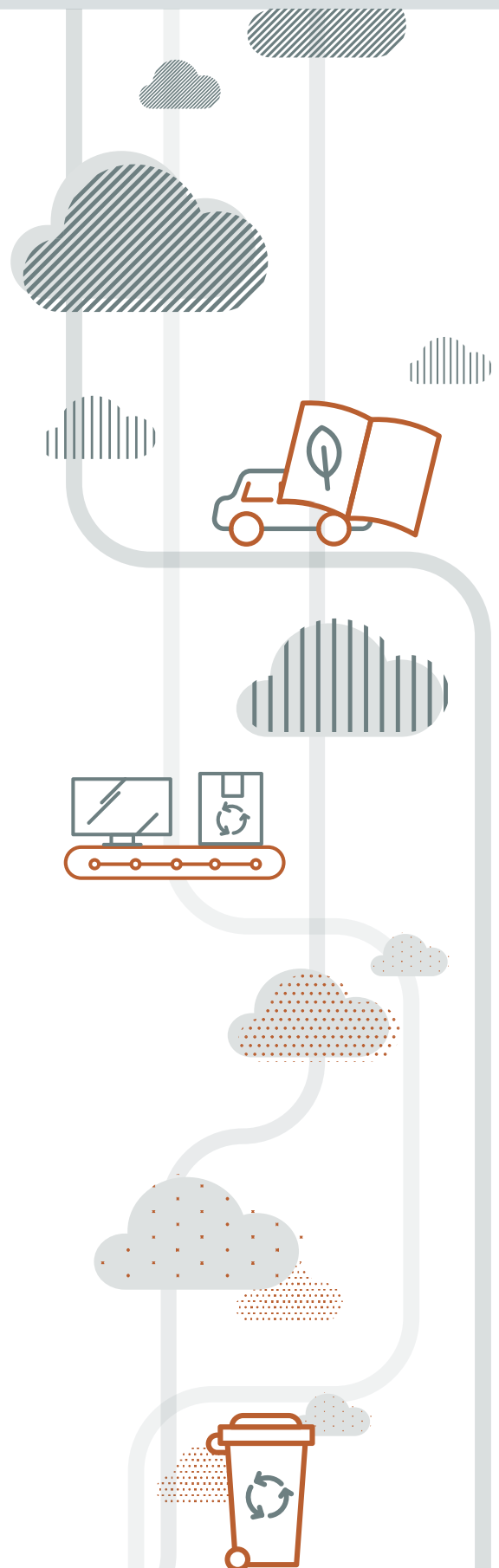


Foreword

I am delighted to share with you this collection of Smart Living demonstrator case studies that communicate the progress we are making supporting innovative decarbonisation across the country to deliver a Net Zero Wales by 2050. The prototyping and demonstrator studies in this brochure are drawn from 39 Smart Living funded SBRI projects covering a diverse range of sectors, suppliers, localities, technologies, models and applications, and innovation stages.

Since 2021 our Climate Change Smart Living scheme has piloted several rounds of Small Business Research Initiative (SBRI) or Contracts for Innovation funding programmes to stimulate before-the-market whole systems and hydrogen-based solutions delivering the principles of the Carbon Budget 2 Net Zero Wales Plan and the Wales Innovation Strategy. The use of agile procurement approaches like Contracts for Innovation has the potential to attract substantial and lasting commercial investment and funding to help transform the economy and maintain the vitality of places and our communities.

The WBRID and HYBRID SBRI programmes covered by these studies were pilots exploring what works to realise our strategic aspirations for decarbonisation and innovation. They draw out the many positives and opportunities of working collaboratively with people and communities - encouraging people the take-up of more joined up approaches to problems, and reducing demands on pressurised services through transforming business models. These studies also show us just how we can boost the greening of the economy by engaging with innovative companies to turn their bright ideas into commercially viable products.



Leveraging substantial new research and development into Wales was a strong focus of these SBRI projects, supporting our strategy by identifying sectoral focused challenges across the nation to maintain people's wellbeing, deliver behavioural change and nurture a truly Just Transition.

In my mind innovation is about taking risks to create value, getting to grips with learning and failure, and making an effort to do things better and make a positive difference. Anyone can be innovative and we should all have the opportunity to be entrepreneurial and access its benefits, to innovate in ways that work for us. The ways we innovate also matter - the 'How' is indeed often as important as the 'What' and collaborating yields more than pure competition. Drawing together multiple stakeholders from public sector bodies and different organisations, disciplines and sectors is a really robust basis for rooting lasting co-creation.

These case studies provide ample opportunities for you to share in the experiences and learning informing development of new opportunities for decarbonising Wales. The wide range of practices sponsored by both the WBRID and HYBRID has recently been evaluated by DG:Cities and we are planning further regular application of the Contracts for Innovation framework by the Smart Living scheme – including the Whole Systems Research and Innovation for Decarbonisation (WSRID) SBRI programme, which starts this autumn.

I look forward to seeing further development and uptake of these tested solutions, and other future new exciting demonstrators providing novel practical and commercial solutions addressing urgent decarbonisation and green growth across Wales.



Ken Skates MS

Cabinet Secretary for the Economy,
Transport & North Wales



Introduction

These Welsh Government Smart Living initiative SBRI project case studies present a snapshot of innovative decarbonisation demonstrator projects across Wales and how they have developed over the period from 2021 to 2023.

The case-studies are categorised by end-use, sector, type and geographic area.

They capture the experiences and words of the partners, suppliers and other stakeholders involved and are based on extensive research and interviews carried out by Freshwater Media on behalf of Smart Living. These are all named and listed with each case study for you to contact and engage with further to find out more.

These cases studies are designed to give you the confidence, practical advice and models of successful decarbonisation projects you can scale up and deploy where you are.

Smart Living

The Smart Living scheme has been in existence since 2015, helping to realise the [Wellbeing of Future Generations Act \(2015\)](#) and the goals and policies of our [Net Zero Wales Carbon Budget 2](#) and its successors through supporting innovative decarbonisation projects.

These projects supply place-based and needs-led decarbonisation solutions for trialling in the real world, that can be mainstreamed and rolled out at scale. Smart Living also promotes the development of a whole energy systems approach specific to Wales.

These projects are usually delivered in partnership with Welsh local government and other public sector bodies. They also link into later-stage Welsh Government decarbonisation initiatives and other public and private investment in this important area.

Smart Living's mission fits within the Welsh Government's innovation strategy – [Wales Innovates: Creating a Stronger, Fairer, Greener Wales](#), (February 2023) and its accompanying implementation plan and goals paralleling Innovate UK's own strategy. This all-Wales innovation strategic plan will guide Welsh Government research, development and innovation interventions and support over the next 5 years.

Smart Living complements other areas of activity within the Welsh Government Climate Change and other ministerial portfolios, including the development of Local Area Energy Plans, shaping a smart and flexible future energy system across Wales, and effective and sustained local action to tackle climate change.



Small Business Research Initiative (SBRI) or “Contracts for Innovation”

Since 2021 Smart Living has piloted five consecutive Contracts for Innovation¹ or Small Business Research Initiative (SBRI) programmes for whole system (WBRID) and hydrogen-led (HYBRID) decarbonisation, integrated to its broader mission. “Contracts for Innovation”, called SBRI until May 2024, is the UK public sector’s leading **pre-commercial procurement vehicle** using the procurement of research and development to support the creation of new products and solutions for unmet needs. Contracts for Innovation offers organisations and businesses in Wales² a unique opportunity to work directly with the public sector to develop new technologies and processes, helping to meet efficiency targets and improving public services.

Contracts for Innovation is also not limited to small businesses and is in fact open to any organisation, regardless of size or previous experience of working in a specific sector.

Smart Living’s SBRI programmes encouraged:

- › Working collaboratively with people and communities to take a more joined up approach to prevent and resolve problems, while reducing demands on already pressurised services and transforming current business models.
- › Boosting the economy by engaging with innovative companies to turn bright ideas into commercially viable products. This is likely to create and safeguard jobs.
- › Leveraging substantial new research and development into Wales.
- › Supporting Welsh Government strategy by driving innovation and technology to resolve focused sectoral challenges across Wales.



SBRI Government challenges.
Ideas from business.
Innovative solutions.

1 [Contracts for Innovation \(May 2024\)](#)

2 Wales SBRI Centre of Excellence <https://sbriwales.co.uk/>

SBRI Case Studies

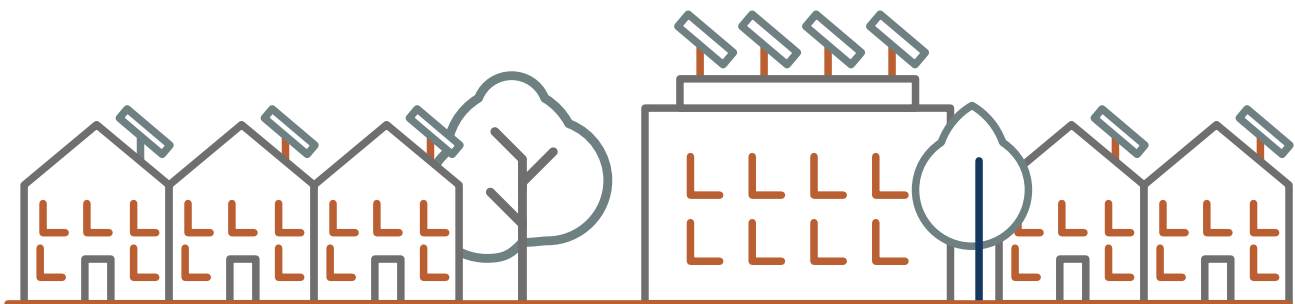
1. WBRID Whole Systems Business Research & Innovation for Decarbonisation Programme SBRI (2021 – 2023) Demonstrator Case Studies

These case studies were part of the Whole Systems Business Research & Innovation for Decarbonisation (WBRID) SBRI. This was a Smart Living and Local Authorities' initiative developing whole system innovation for net zero decarbonisation. During 2021 – 2023 Smart Living funded four Welsh Local Authorities to run WBRID SBRI “challenges”.

In the Phase 1 Feasibility (spring 2021) Smart Living supported four challenges by up to £200,000 each, and up to a further £500,000 challenge for subsequent Phase 2 Demonstrators (June 2021 – March 2022). The focus of the WBRID challenges was on developing whole system concepts to address key barriers and issues previously identified such as heating public buildings and insulating homes, and empowering homeowners and businesses in rural areas to decarbonise.



BioFactory anaerobic digester demonstrator at Coleg Llysfasi farm (WBRID Net Zero Farm Challenge).



Bridgend Village Creates Local Energy Network To Power Net Zero Homes



Challoch Energy and NuVision Energy team with local councillor and resident of South Cornelly during home installation of solar panels.

Low carbon energy consultant, Challoch Energy, in collaboration with Bridgend County Borough Council (BCBC), created a concept for a totally self-contained energy network in a small village, where homes can be powered by renewables, with surplus energy ‘traded’ within the village. The project was supported by Welsh Government Smart Living’s Whole Systems Innovation Research for Decarbonisation (WBRID) SBRI programme, as a local authority-funded demonstration project to set up a local energy market (LEM), trading in locally produced and consumed renewable energy for the benefits of residents.

The innovative approach involved creating a ‘digital twin’ of the local electricity grid and all the homes connected to it, which was used to explore different energy generation and distribution scenarios. There are now 21 homes in South Cornelly running on either solar-powered electricity or solar powered ventilation systems. The aim is to decarbonise the village and with a parallel project, the potential to connect to a local energy centre

with the ability to supply hydrogen, also produced from renewable sources, as a low-carbon solution for heating and domestic appliances.

The South Cornelly Low Carbon Village project at-a-glance

The project has created a blueprint concept for a ‘decarbonised village’ – a network of domestic properties, fed by their own roof-based solar panels and connected via an innovative energy management system. Properties are also benefiting from solar powered ventilation systems that improve air quality within the homes, many of which are sited close to an operational quarry.

Phase One and Two proposals

Phase One: Challoch Energy led one of a number of scoping studies, designed to identify individual communities that could effectively host local energy networks, powered by renewable sources and with the potential to



trade in excess energy for the benefit of the residents.

Phase Two: as one of six successful projects, Challoch applied for phase two demonstrator funding for additional feasibility studies and to build a business case for the project. This involved detailed development and testing of the technology, extensive engagement with existing network operators, stakeholders and the local community, the development of necessary legal and regulatory frameworks, as well as work on metering and transaction management.

Stakeholder and community engagement

Effective communication and engagement were essential to the success of the project, both in terms of generating sufficient interest from households and ensuring all the relevant stakeholders and suppliers

were on board with the project. The local authority developed a distinct “Low Carbon Communities” brand identity, which was used in all project communications, while Challoch Energy, supported by NuVision Energy (Wales), produced a webpage, hosted by BCBC and a suite of printed materials on the project, prepared briefings for local media and held a series of presentations and drop-in days for residents.

The effectiveness of engagement activity resulted in a waiting list of households that expressed an interest in joining the network. Towards the end of phase two, Challoch Energy oversaw the creation of a Community Interest Company (CIC), set up to take on the ownership of the physical assets and handle the ongoing management of the local energy network.



Challoch Energy and NuVision Energy teams holding public information session on the village green in South Cornelly, 2021.

Why South Cornelly?

There are a number of reasons the village was selected for an initial feasibility study and was considered highly suitable for the local energy market project. South Cornelly is a relatively discreet community of around 200 privately-owned homes, many with the right orientation for solar installations and all supplied by a single electricity substation. The village was also of a manageable size for a demonstration project of this nature.

Benefits

The South Cornelly Solar Village project offers a range of benefits for the community, local businesses and public sector organisations, including:

- › **Access to low-cost energy:** Project funding enabled participating households to benefit from free installation of solar panels and a future supply of low-cost energy.
- › **Boost to energy security:** The ability to produce and store electricity within a local energy system provides a reliable supply of electricity all year round and protects households from fluctuations in energy prices.
- › **Public sector innovation:** The project serves as a model for public sector organisations, demonstrating how to design and implement local markets, using energy from renewable sources, for the benefit of local residents.
- › **Air quality improvements:** Integrating air quality monitoring and solar-powered ventilation systems within the project to deliver measurable improvements in air quality.
- › **Environmental sustainability:** The project has the potential to reduce the barriers to adopting renewable energy by delivering systems at a community level and helping Wales to hit its net zero target by 2050.

Next Steps

The goal of the project is to transform the whole of South Cornelly into a low carbon village, where every household can benefit from low-cost electricity generated from renewable sources, with excess power traded within the village. Challoch Energy is currently working with a team from Cardiff University on the software platform that will effectively handle the management of energy and with village residents to set up a Community Interest Company to take forward the next stage of the project. Meanwhile, an associated project funded by the Welsh Government's HYBRID SBRI programme is progressing the introduction of green hydrogen into the local energy network that has been developed in South Cornelly.

Once agreed and operational, the South Cornelly project will provide a blueprint for similar projects in local authorities across Wales to generate low cost, clean energy in local energy networks, for the benefit of the local community.



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Bridgend County Borough Council (Paul Smith): Paul.Smith2@bridgend.gov.uk

NuVision Energy (Wales) Ltd
(Robert Francis): robert.francis@nuvisionenergywales.co.uk

Powering Progress: Blaenau Gwent's Bold Leap Towards Net-Zero With Innovative Energy Solutions



Roseheyworth Business Park, Abertillery.

Blaenau Gwent County Borough Council (BGCBC) embarked on an ambitious project funded under the Welsh Government’s Smart Living Whole System Business Research Innovation for Decarbonisation (WBRID) SBRI Challenge. This initiative, aimed at developing a Smart Industrial and Commercial Energy Platform Model, highlighted the critical role of collaboration between local government, innovative suppliers, such as StorTera and BankEnergi and sustainable businesses embedded in the community in driving net-zero energy solutions within business parks.

The Blaenau Gwent CBC project at-a-glance

Blaenau Gwent CBC sought innovative solutions to reach net-zero carbon emissions for its business parks, as part of its response to Smart Living’s WBRID challenge. With Welsh Government funding, the council engaged with suppliers in two phases, eventually narrowing down to two main consortia of suppliers for Phase Two: StorTera and the BankEnergi BlaZE.

Between July 2021 and July 2022, the solutions offered by both organisations underwent rigorous testing and pilot trials, with the goal of advancing the council and local businesses significantly towards optimising energy efficiency and sustainability and achieving their decarbonisation ambitions.



StorTera batteries in shipping containers to store solar energy generated on site.

Phase One and Two projects

The initiative kicked off with four suppliers in phase one, focusing on the feasibility of diverse energy solutions. It then narrowed down to two for detailed pilot testing in the demonstrator phase two, each supported by £250,000 of Welsh Government funding. Both aimed to demonstrate the viability of sustainable energy transitions in business parks, focusing on solar energy, energy storage and energy trading to foster low-carbon business environments.

StorTera, an Edinburgh-based energy storage innovator, took the lead in a consortium piloting an energy storage solution complemented by ground-mounted solar at Roseheyworth Business Park. This project aimed to demonstrate a smart local energy system for business parks, focusing on energy generation for business supply and grid support. Not only did this solution seek to reduce energy bills, it also aimed to showcase the financial viability of switching from gas to electric heating systems, thereby reducing carbon emissions related to business energy use.

StorTera used local Welsh sub-contractors to carry out individual aspects of the project.



Solar panels being installed on site at Roseheyworth Business Park.



Worker on the finishing line at Cotech Sensitising Ltd on-site making filter screens for the film industry, benefiting from the BankEnergi BlaZE scheme.

They included: Energy Local (Ynni Lleol), SolarCentric, Cardiff University and Asbri Planning.

BankEnergi BlaZE, a consortium consisting of Consortio, CarbonTRACK UK, Wales and West Utilities and BankEnergi, explored energy trading options and the potential for microgrids by sharing existing and new assets between businesses in Blaenau Gwent. The project aimed at creating low or zero carbon energy business parks, optimising energy usage through innovative solutions like shared solar PV production and considering hydrogen as a future fuel.

Why Blaenau Gwent?

Blaenau Gwent was an ideal location for such an ambitious decarbonisation initiative, aligning with the Welsh Government's 2050 net-zero targets.

Amy Taylor, Team Manager for Regeneration Opportunities at Blaenau Gwent CBC, who spearheaded the project, explains that it was selected as one of the Welsh Government Smart Living's initial seven demonstrator projects.

The council's work was deeply rooted in a place-based strategy, meticulously analysing energy usage throughout the borough. This thorough examination initially covered a broad scope but eventually honed in on four specific sectors, with a particular emphasis on the business sector. The initiative recognised the internal management of energy efficiency and decarbonisation efforts within the public sector and, therefore, pivoted to make significant impacts in areas facing economic difficulties.

Taylor said: "The decline of heavy industries in Blaenau Gwent, once energy-intensive, has paved the way for advanced manufacturing.

"These new industries, despite facing rising energy costs, represent a transition towards sustainability. Our commitment to support these industries in adapting to increasing energy costs underpinned our strategic approach.

"Additionally, our work in partnership with our suppliers, in applying research to practical scenarios, highlighted the potential for replicability and scalability, proving that Blaenau Gwent is a great example of how focused, place-based solutions can effectively tackle energy and environmental issues."

Benefits

The Blaenau Gwent CBC WBRID project offers a number of benefits for businesses, the wider community in Blaenau Gwent and other local authorities in Wales:

- › **Innovative solutions:** Demonstrated potential for advanced manufacturing and energy optimisation in response to the decline of traditional heavy industries, marking a significant shift towards sustainability.
- › **Enhanced understanding:** Installation of sensors and deployment of technology provided businesses with invaluable insights into their energy usage, enabling more informed decision-making and efficient operations.
- › **Community collaboration:** Fostered a collaborative environment among businesses, encouraging shared energy solutions and mutual support, underscoring the benefits of collective action in energy management.
- › **Replicability and scalability:** The project highlighted the feasibility of replicable and scalable energy solutions, offering a model for other regions facing similar challenges.

Next steps

The Blaenau Gwent CBC project navigated several hurdles, including rapid energy market changes and the complexities of new grid connections, to pilot innovative decarbonisation solutions. The project team is currently taking stock and evaluating outcomes. Despite some operational successes and significant learnings, neither solution perfectly fits the local context.

Potential next steps involve assessing financial support avenues for businesses to adopt microgrid technologies, leveraging local initiatives like Tech Valleys for investment, and exploring scalability in partnership with other organisations who align with the council's decarbonisation goals.



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StorTera info@stortera.com

Innovation Partnership Supports Farming Projects To Accelerate Wales's Journey To Net Zero



Dairy cows grazing at Coleg Llysfasi, Ruthin.

A partnership between Ambition North Wales and Coleg Cambria, supported by Welsh Government Smart Living, has delivered three innovative pilot projects with the potential to accelerate the decarbonisation of the agriculture industry in Wales. All three projects were trialled through engagement with Coleg Cambria Llysfasi, the college's agricultural education and training campus in Denbighshire, and aimed to demonstrate potential for improving the future profitability of farming operations across Wales.

A total of 12 projects applied to Ambition North Wales for funding via the Welsh Government Smart Living scheme' Whole Systems Innovation Research for Decarbonisation (WBRID) SBRI programme. Four were selected for phase one feasibility studies, with three of those moving forward to concept development

stage. All three have the potential to make a significant contribution to Wales's Net Zero ambitions, while bringing about wider benefits for farmers. The Small Business Research Initiative or SBRI encourages innovation and collaboration between public bodies and businesses, with the potential to scale up successful projects through access to additional funding.

The projects at-a-glance

BioFactory Energy developed a prototype for a low-cost, modular system that enables owners of small to medium-sized dairy farms to generate heat or energy from slurry from their herds in a cost-effective way, while also reducing the amount of greenhouse gas emissions produced.



Net Zero Farm BioFactory anaerobic digester at Coleg Llysfasi with L-R; Dylan Penrith, Alwen Williams, Anita Davies and Dewi Jones.

The innovative anaerobic digestion system, known as the Micro AD Farm™, is easily transported and doesn't require any major on-site infrastructure. The system captures biogas from the process, which is converted to electricity using combined heat and power generators or, in the case of the pilot project, provides the heat required for milk pasteurisation. Alongside the energy savings, the Micro AD Farm™ produces a nutrient-rich liquid as a by-product, that can be used as a fertiliser.

BioFactory's Chief Commercial Officer, Jon Blake, says, "The project has enabled us to develop an affordable technology solution for carrying out anaerobic digestion on smaller dairy farms, for the first time in the UK. It has the potential to reduce emissions by between 15% and 30%, as well as providing clean, low-

cost energy and a fertiliser that can be used by farmers."

Promar International developed a piece of sustainability software to help farms accurately measure and take steps to reduce their carbon footprint, as well as improve wider environmental impacts. Aimed specifically at Welsh dairy, beef and sheep farmers, the project was supported by a number of stakeholders, including the Farmers Union of Wales, NFU Cymru, Hybu Cig Cymru, Coleg Cambria and the Carbon Trust, while separate discussions with local milk processors helped to ensure a focus on the context of the Welsh food supply chain.

Matthew Brennan, Head of Sustainability at Promar, said; "Phase one enabled us to calculate a baseline carbon footprint for Llysfasi Farm as a concept test. In phase two,

we built an online system that took a more holistic view of sustainability in a farming context, particularly looking at multi-livestock farms, and developed a bilingual platform specifically with Welsh farmers in mind.

“The tool helps farmers to understand their primary sources of emissions and target improvement actions at the areas with the highest benefit. We expect that an average farm should be able to achieve carbon reductions of approximately 10% by using the platform and making changes that can be implemented at low or no cost, such as altering grazing periods and improving feed efficiency. We also know there is a clear correlation between the farms that are doing better on sustainability and those doing better on the cost of production.”

Promar achieved verification from the Carbon Trust for the dairy element of the tool and



Promar International team conducting field trial of carbon calculator tool.

used additional data from a parallel project being run with a retailer in England map the cost of production to carbon footprint and sustainability. The software was also built with a fully bi-lingual capability, allowing Welsh speakers to use the calculator in their native language.



M-SParc, 42able.ai and Aerialworx team with Green Eagle prototype drones.

The third project was a collaboration between Wales' first Science Park **M-SParc, Coleg Cambria**, AI specialist **42able.ai** and drone developers, **Aerialworx**. The project explored the potential for using drones on Welsh farms to identify land issues that could lead to excessive carbon emissions and inefficient farming practices. The project team designed and built a bespoke drone – known as the 'Green Eagle' – with the ability to identify and 'treat' unwanted weeds, removing the need for traditional pesticide spraying, normally undertaken with a diesel tractor.

The project involved a wide range of other Welsh stakeholders, who are members of M-SParc's Agri-Tech Cluster, including BIC Innovation, Welsh Water, North Wales Wildlife Trust, Natural Resources Wales, the two main farming unions and local farmers. M-SParc also seconded a fully-funded degree apprentice to the project. Research identified a two-drone system as the most efficient delivery model, with a 'Scout' drone identifying target sites and the Green Eagle dispatched to deliver targeted treatment with on-board pesticide.

James Finney, Co-Founder of 42able.ai, said; "There have been some incredible learnings that are already being carried forward onto future projects. Evidence suggests the use of the Green Eagle and Scout drones could generate carbon emissions during their lifetime that were 130 times lower than using a traditional tractor to do the same work."

Dr Stef Williams, from Aerialworx, added; "Creating a purpose-built drone with the integration of artificial intelligence in a relatively short time frame was a challenging brief, but collaboration across the team enabled us to deliver a successful project."

Next steps

These three projects show how funding and support provided by a public sector partnership could accelerate the decarbonisation of the agriculture industry and make a significant contribution to Wales's Net Zero ambitions, while bringing about wider benefits for those working in the farming sector.

The Micro AD Farm was successfully trialled for two months at Coleg Cambria Llysfasi and BioFactory has secured additional funding for the development of two 'farm-ready' systems, with plans to reach a target of 75 installations by the end of 2025. Promar continues to work with Ambition North Wales on testing its software across the Welsh agricultural sector with a view to launching the platform commercially by 2025 and has also received enquiries from farms in Germany, Italy, Luxembourg, Netherlands and Belgium. Meanwhile 42able.ai has expanded use of the software and image recognition models created as part of the project into broader applications and is looking at releasing some of the code as open-source software.

Robyn Lovelock, Programme Manager with Ambition North Wales, reflects on the positive experience of navigating three diverse projects through the programme. "The WBRID programme represents a brilliant opportunity to bring public sector partners together with innovative technology companies and education providers to tackle some of the most difficult challenges faced by industry. Having the support of Welsh Government Smart Living throughout the process, as well as access to a panel of technical experts, was invaluable and supported robust testing of both technical and commercial elements of each project as they developed."

Dewi Jones from Coleg Cambria added; “These projects provide a taste of how innovation and technology can be used to benefit the Welsh agricultural sector, both in terms of reducing environmental impact and saving money for farmers. We call it agriculture 4.0 and it is exciting to think of how far we can take it over the next 5-10 years.”

Further information

To view the Green Eagle drone trial video at Coleg Cambria Llysfasi, visit: <https://www.youtube.com/watch?v=ZM-deptQvbE>

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42able.ai (James Finney): james@42able.ai

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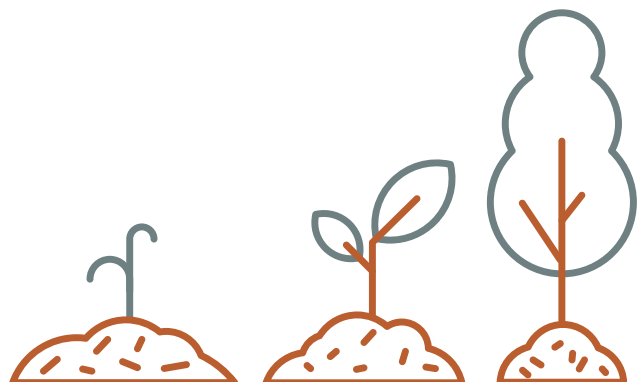
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2. HYBRID Hydrogen Business Research & Innovation for Decarbonisation SBRI Programme (2021 – 2024) Demonstrator Case Studies

The Smart Living Hydrogen Business Research & Innovation for Decarbonisation or HYBRID SBRI programme supported innovative and research solutions to deliver the [Wales Hydrogen Pathway](#) and [Net Zero Wales CB2 – 2021-2025](#). Investment in the scheme was designed to speed up the deployment of hydrogen as a key energy vector, and help Wales meet our national commitment to achieve net zero emissions by 2050. One full SBRI funding cycle (HYBRID 1.1 and 1.2) and the first phase of a second cycle (HYBRID 2.1) were delivered in the period. HYBRID 1.1 (December 2021 – March 2022) funded seventeen projects across two strands through £1.7m of Smart Living funding. Four of these feasibility projects, of which three are case studied here, were successful in the next HYBRID 1.2 competition and awarded funding worth nearly £1.23m for hydrogen demonstrator solutions for decarbonisation across Wales. These ran from October 2022 to March 2023, trialling ways to better plan hydrogen production, use hydrogen to fuel trains, heat homes and support homeowners and businesses in rural areas.



Power plant tankers and cylinders for oxygen, hydrogen and water storing.



HyBont Bridgend Project Paves Way For Green Hydrogen-Powered Communities



Visualisation of proposed HyBont green hydrogen production plant in Brynmenyn, Bridgend.

Marubeni Europower, in collaboration with Bridgend County Borough Council (BCBC), embarked on the pioneering HyBont Project, aiming to supply green hydrogen to communities and organisations in Bridgend and beyond. This project was supported by Smart Living’s HYBRID SBRI programme and aims to accelerate the Welsh Government’s efforts towards achieving net-zero by 2050. By stimulating job creation and fostering new local markets, it promises to serve as a replicable guidance model for local authorities on how to harness hydrogen for decarbonisation.

The HyBont project at-a-glance

The project, named HyBont, combines “Hy” for hydrogen with “Bont” from Pen-y-Bont (Bridgend), meaning bridge in Welsh. Located at the Brynmenyn Industrial Estate in Bridgend, HyBont aims to establish a hydrogen production plant capable of generating 500-750 tonnes of green hydrogen annually. This initiative seeks to offer tangible benefits to communities and businesses in the local area and across other regions of Wales.

The project is not just about hydrogen production, it’s an ecosystem that includes a green hydrogen production facility, hydrogen storage, a refuelling station, private connection and even a solar power plant, all situated in Bridgend.

Phase One and Two activities

In 2021, Marubeni, a leading investor in renewable energy who develops and operates major infrastructure projects around the world, submitted proposals in two phases.

Phase One involved developing a ‘How to Guide’ for local authorities, focusing on technical specifications, planning requirements, and grid connection for hydrogen projects.

Phase Two applied the guide to the Bridgend Green Hydrogen Project test case and was completed in March 2023.

The HyBont ‘How to Guide’

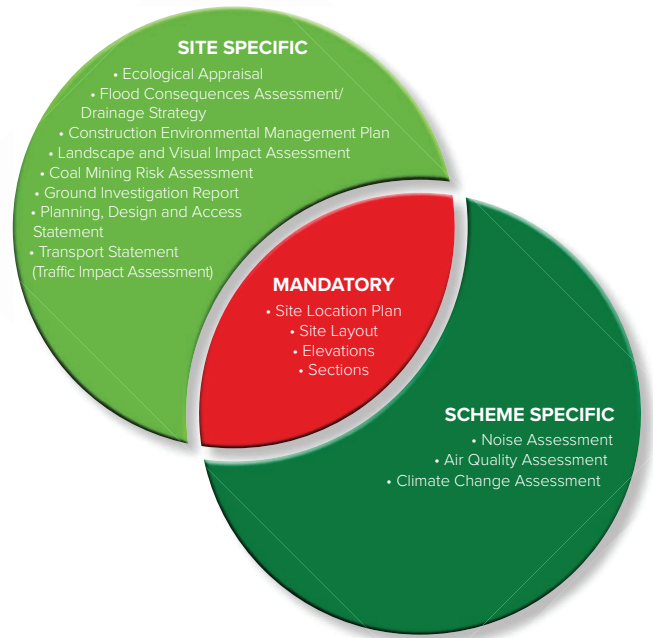
The purpose of the guide is to share knowledge and educate local authorities and other public organisations about the challenges involved in developing small-medium scale green hydrogen projects.

It also provides the Welsh Government with useful public communications material about why hydrogen is fundamental to meeting our decarbonisation targets of net zero by 2050, and the benefits of such innovative projects for the wider community.

The guide addresses key issues such as planning, technical requirements, private connection and grid connection processes.

George Dodd, Marubeni’s Senior Vice President and HyBont’s project leader, hopes the guide can inspire other local authorities in Wales and provide public sector organisations with practical tips in readiness to rollout similar green hydrogen projects fast and efficiently.

Dodd said: “Local authorities should be ready for these projects coming on, whether they are small, medium or large scale, as part of the national decarbonisation goals. We hope that the guide can help local authorities educate, grow, and be ready for this kind of key infrastructure.”



Explanatory graphic of potential plans and documents required as part of a planning submission, HyBont 'How to Guide'.

Key insights about project development

The project’s development was significantly supported by the Welsh Government Smart HYBRID SBRI programme, which provided initial funding and facilitated knowledge sharing among Welsh Government, BCBC and other local authorities, and the project team.

The project team, led by Marubeni, included subcontractors RPS Group, Challoch Energy and Mott MacDonald.

RPS Group, who are specialists in planning consultancy, drafted the ‘How to Guide’. They played a pivotal role in navigating the complexities of funding applications. Acting as strategic planners, they bridged the communication between the project team and the council, ensuring smooth coordination and comprehensive preparation of necessary surveys.

Challoch Energy, known for its expertise in electrical connections within the Bridgend region, contributed significant technical know-how, especially regarding local energy distribution challenges and solutions.

Mott MacDonald, a globally recognised engineering firm, brought its vast experience to the table, advising on technical aspects such as site layout, drainage, energy flow and risk management. Its insights were instrumental in laying the groundwork for safe and efficient hydrogen plant development.

This collaboration has been instrumental in addressing the planning, technical, private connection and grid connection challenges of the project.

Why Bridgend?

Dodd says Bridgend was chosen over the likes of Glasgow, Sheffield and Birmingham due to its supportive local authority and its partnership with [NEDO \(New Energy and Industrial Technology Development Organisation\)](#), a Japanese government body which promotes the deployment of energy and environmental technologies.

Bridgend also scored highly on its profile of potential hydrogen users, such as schools, leisure centre and public transport, making it an ideal location for implementing new technologies such as an Area Energy Management System (AEMS) optimised for hydrogen production and utilisation.

Indicative solar farm landscaping plan, HyBONT.





Aerial visualisation of proposed HyBont green hydrogen production facility at Brynmenyn, Bridgend.

Dodd added: “We chose Bridgend in large part due to our collaboration with NEDO. We made a funding application to NEDO, which funds new innovation projects and one of the new innovations of HyBont was the AEMS. The AEMS dynamically matches hydrogen production with demand, optimising efficiency and competitive pricing.

“HyBont in Bridgend was the perfect project and location to test this new technology.”

Benefits

The HyBont Project offers several benefits for the community, businesses, and public sector organisations in Bridgend:

- › **Boost to local economy:** By fostering innovation and utilising local resources, the project will help reduce energy costs and stimulate economic growth and job creation in Bridgend.
- › **Public sector innovation:** The project serves as a model for public sector organisations, demonstrating how to implement and benefit from green hydrogen technologies and improve local services.
- › **Business growth:** Local businesses, particularly in engineering and technical services, benefit from the project through increased demand for their expertise and potential expansion opportunities.

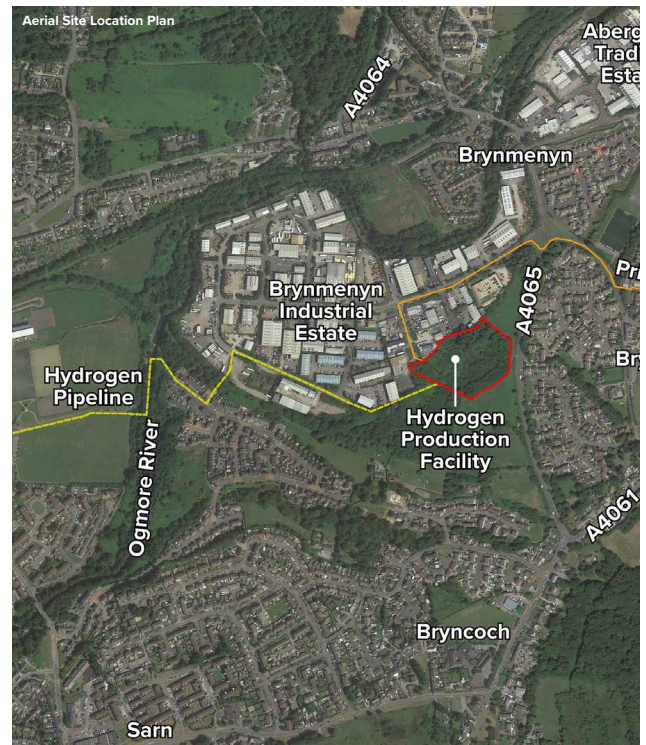
- › **Unlock new grid connections:** Hydrogen (electrolyser) production plants can make new grid connections easier by offering flexible energy storage and supply solutions.
- › **Environmental sustainability:** By focusing on green hydrogen, the project contributes to reducing carbon emissions and promoting renewable energy sources, aligning with the Welsh Government's broader decarbonisation goals.

Next Steps

The HyBont project represents a significant step towards decarbonising the energy system in Wales and offers a practical blueprint for other local authorities to follow. Its comprehensive 'How to Guide', expertise from various partners and the support from BCBC showcase a collaborative approach to tackling the challenges of green hydrogen production and use.

The guide has been shared with the Wales Local Government Association and local authorities in all regions of Wales.

With construction of the hydrogen production plant set to begin in 2024, the HyBont project has a potential to become a cornerstone of Wales's green revolution, aiming to be fully operational by 2026.



Further information

You can download the HyBont 'How to Guide' here: www.gov.wales/bridgend-green-hydrogen-project-hybont-guidance



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Green Hydrogen Pilot Delivers Blueprint For Rural Energy Transformation In Wales

An innovative partnership between low-carbon energy consultancy Challoch Energy, Wales & West Utilities, Nuvision Energy Wales and Welsh Government Smart Living HYBRID SBRI programme, with support from Bridgend County Borough Council, is helping to develop ways to supply low carbon or ‘green hydrogen’, produced from renewable sources, into a rural energy system through a fully integrated, local energy network.

The HyRES (Hydrogen in Rural Energy Systems) project, centred around the village of South Cornelly in the west of the county borough, will create a state-of-the-art energy centre on a site close to the village. It will have the ability to generate hydrogen, which can be used to power industrial and agricultural machinery, stored in large scale batteries or blended with natural gas to supply nearby homes and businesses.

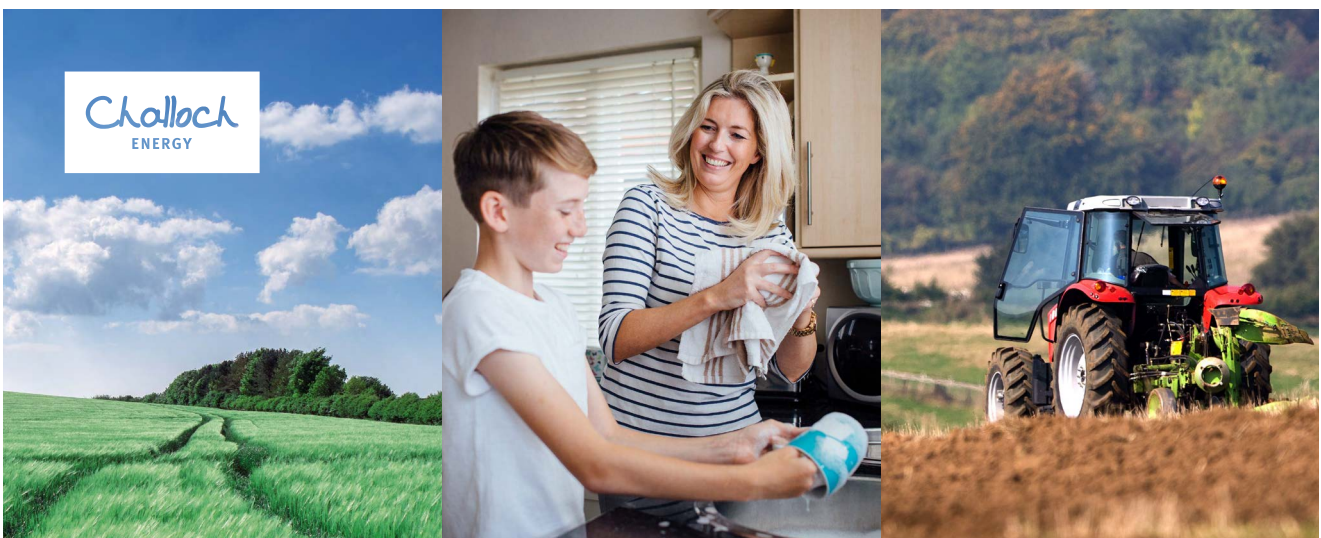
“Bridgend is a forward-thinking authority when it comes to low-carbon energy and one of the first in the UK to develop a Local Area Energy Plan”, said Dr Simon Minett,

Director of Challoch Energy. “The approach and funding from Welsh Government Smart Living has enabled some really innovative projects to come forward that will benefit local communities, as well as helping Wales to tackle climate change.”

“We were delighted to support on the project,” continues Lewis Garvey, Regional Energy Planning Manager at Wales & West Utilities. “As part of our ambition to support the energy transition in Wales and beyond, we are currently undertaking many projects which seek to reduce the cost and operational barriers of green hydrogen production and supply. We are optimistic that projects such as HyRES will help stimulate the hydrogen economy in our region.”

The HyRES project at-a-glance

The vision for HyRES is to create a local energy network, which will harness electricity generated from renewable sources and use it to produce and store hydrogen gas for a range of uses. The local network would run on

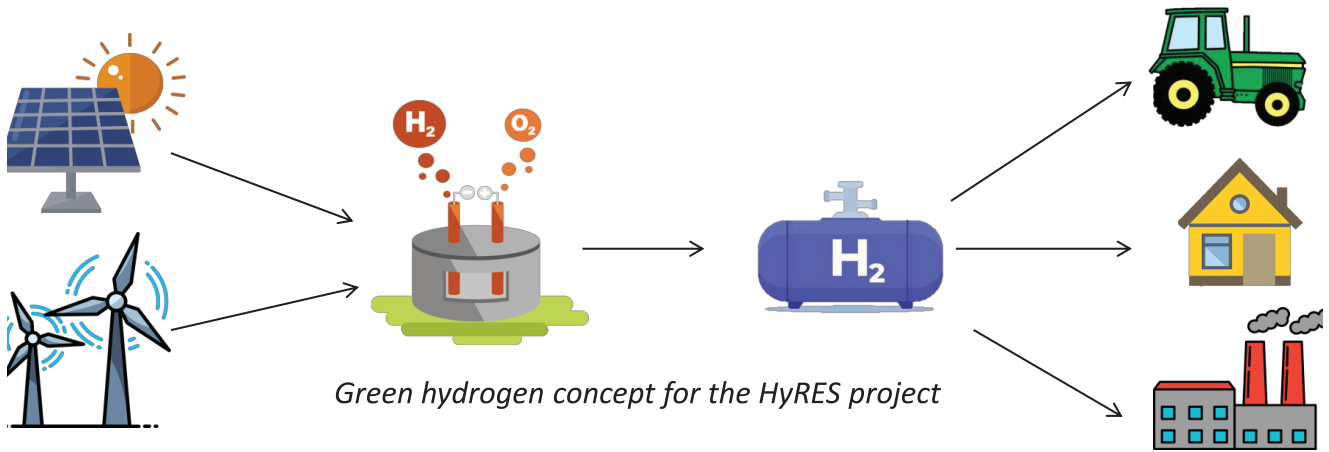


Hydrogen in rural energy systems

How to Guide

August 2023





electricity supplied by a new, dedicated wind turbine and a ground-based solar installation, using the bulk of the generation to produce hydrogen for blending in the gas network and for transport uses.

well as the potential for a new hydrogen-driven network, including analysis of current and future demand, assessment of different routes to market and possible locations for hydrogen production, storage and metering.

Phase One

HyRES was one of 17 projects to qualify for feasibility studies, funded by the Welsh Government’s Smart Living scheme, via the Small Business Research Initiative (SBRI). The studies formed part of the HYBRID SBRI (Hydrogen Business Research & Innovation for Decarbonisation) programme in 2021 – 2022. An extensive study looked at existing gas infrastructure and renewable assets, as

The team developed the architecture for an integrated energy system design, in the form of a Local Energy Operating System (LEOS) and undertook an initial assessment of a potential regulatory framework that could underpin the system. Extensive discussions were held with the gas network operator, Wales and West Utilities, and representatives of Wales’s two main farming unions as part of phase one activity, alongside meetings and presentations for local residents and businesses.

Stage	Awareness		Consideration			Decision	
Customer Goals	No goals at this point		Aim to be in a position to make an informed decision			Decide best option	
Customer Activities	Need to consider energy options	Read HyRES leaflet delivered to door	Research HyRES online resources	Attend Event 1	Further ad-hoc interactions	Event 2	Homeowner 'buy-in' to 20% blend
Touchpoints Experience	No touchpoints at this stage	Read leaflet Engage tel Engage email	Read website Read BCBC info? Compare options	View stands etc View brochures Speak to Team Take aways	Engage email Engage tel Visits by Team Event2 leaflets	View stands etc View brochures Speak to Team Take aways	
HyRES Goal	Identify target customer area	Raise awareness	Raise interest and educate	Make Hydrogen attractive	Reinforce message	Make Hydrogen match expectations	Deliver an attractive Hydrogen offering
KPIs	Number of homes targeted	Number of leaflets delivered to door.	Number of visits to web site	Number of attendees leaving details.	Number of 'follow on' interactions.	Number of attendees leaving details.	Number 'signing up' to Hydrogen offer
Organisational Activities	Develop engagement plan	Prepare/deliver leaflets.	Develop online resources, FAQs etc.	Prepare/deliver event	Respond to queries via email, tel & visits	Prepare/deliver event	Proactively emailing, telephoning, visits

Phase Two

HyRES was one of four projects successful in securing further phase two demonstrator funding as part of the Smart Living HYBRID programme. This enabled Challoch Energy, supported by Nuvision Energy (Wales) Ltd and gas network operator Wales & West Utilities, to develop the concepts from phase one and prepare the groundwork for a full demonstration system.

A business case was developed, including a route to market that involved both the supply of hydrogen to local business customers and the use of blended hydrogen within the local gas supply network. The working concept that could be replicated in other rural locations. Wales & West Utilities used Network Innovation Allowance funding from Ofgem to undertake supplementary work on new regulatory and

commercial regimes, as well as transmission system operations which reflect the unique aspects of HyRES. Included in the phase two outputs was a detailed 'How-to-Guide', providing essential information and inspiring other authorities to consider similar projects in their own communities.

Why South Cornelly?

There are a number of reasons the village was selected for an initial feasibility study and was considered highly suitable for the HyRES project. South Cornelly is a relatively discrete community of around 200 houses and a number of small industrial and agricultural businesses. The village is supplied by a single electricity substation and has a dedicated gas let-down governor, allowing a new pipeline for blended gas to run directly from the energy centre. The HyRES project benefited

HyRES engagement event with FUW officials and rural stakeholders at the Vale of Glamorgan Agricultural Show (2023).





HyRES pub drop-in session with South Cornelly residents and other stakeholders (2023).

from previous work, also funded by Welsh Government's Smart Living scheme, to develop a low carbon, local energy network in the village, where home owners were provided with solar panels and home energy management systems. This allowed them to generate their own renewable energy, with the potential to connect into the HyRES energy centre.

Benefits of HyRES

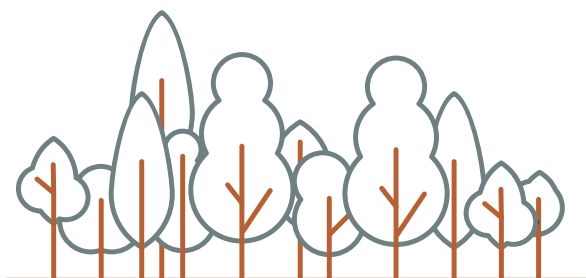
- › **Creating local jobs:** local businesses, particularly in engineering and technical services, will benefit through increased demand for their expertise and potential expansion opportunities.
- › **Decarbonising agriculture and industry:** green hydrogen is ideal for powering heavy machinery on local farms, or earth moving equipment at the local quarry. With 1kg of hydrogen delivering the same energy output as 4.5 litres (1 gallon) of traditional fuel, it is extremely energy-efficient, with a similar range and power output to a regular engine.
- › **Decarbonising domestic gas supplies:** minor modifications to the gas system would allow a 20% blend of hydrogen to natural gas to be fed into local homes, with the potential to increase to 100% hydrogen, subject to future government strategy.
- › **Providing energy security:** producing and storing hydrogen within the energy centre provides the local community with access to clean energy all year-round.
- › **Grid connections:** enables faster connections than directly connecting renewables.

Next Steps

“Now that a viable operating model and regulatory framework exists, the HyRES project can move forward in South Cornelly,” added Anna Limbrey, Director and Co-Founder of Challoch Energy. “We are currently looking at potential sites for the new renewable energy assets that could feed the energy centre and preparing to undertake further testing on the gas network to ensure that all properties and appliances are compliant. The project has come a long way in a relatively short time and we are excited about the possibilities ahead.”

Further information

To download the HyRES ‘How-to-Guide’, visit:
www.gov.wales/hydrogen-rural-energy-systems-hyres-guidance



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Revolutionising Rail Transport In Wales: A Journey Towards Hydrogen-Powered Trains



Trains and traffic on the North Wales Coastal Railway at Dwygyfylchi. © Robert Mann MA Photography.

Arup and Transport for Wales (TfW), with support from the Welsh Government's Smart Living HYBRID SBRI programme, are leading the charge with the innovative Wales Hydrogen Train Project. This initiative aims to make innovative steps in decarbonising transport by introducing hydrogen fuel cell technology to some of TfW's routes, providing rural communities with a decarbonised rail service and marking a significant step towards a sustainable and cleaner future for Wales. The project provides a framework for national governments on leveraging hydrogen technology for eco-friendly transport solutions.

The Wales Hydrogen Train project at-a-glance

This new collaboration between the private and public sectors is charting a new course for sustainable travel, centred on introducing hydrogen fuel cell technology to rail. Beyond the technical milestones, this project is about enabling the Welsh Government and rail industry stakeholders to make informed decisions for future procurements.

This transformative project, shifting from diesel to hydrogen, is set to significantly cut carbon emissions, benefiting Welsh communities with cleaner air, fostering local innovation and paving the way for a sustainable transport future in Wales.



Phase One and Two projects

The HYBRID SBRI Wales Hydrogen Train project, led by Arup – a global collective of designers, engineers, sustainability experts and consultants – in collaboration with Transport for Wales (TfW), rail industry stakeholders and other hydrogen production initiatives, focused on enabling the transition to hydrogen fuel cell-powered trains. This initiative offers a zero-emission alternative to diesel fleets, particularly targeting the needs of rural communities.

This project encompassed two research and development phases, with additional phases mapped to convert and operate a hydrogen train trial subject to additional support and funding:

Phase one: Began in October 2021; focused on feasibility studies for converting diesel trains to hydrogen power.

It identified various operational scenarios and demonstrated the potential for future

trials and operational deployment of hydrogen trains within Wales. It laid the groundwork by highlighting the feasibility and the impact of transitioning to hydrogen-powered rail services.

Phase two: Launched in May 2022 and delivered one year later; aimed at developing a detailed business case for hydrogen train integration, including infrastructure and operational strategies.

This second phase was divided into two segments:

Segment one: Conducted an Industry Readiness Study to assess the rail industry's preparedness for development of hydrogen trains and hydrogen supply infrastructure.

Segment two: Developed a Commercial, Operational and Safety Strategy for deploying hydrogen trains, focusing on the practical aspects of implementation, such as depot and refuelling infrastructure, training and safety protocols, and commercial viability.

James Alton, Senior Consultant at Arup, sees the Wales Hydrogen Train project as a pivotal opportunity with far-reaching benefits for Wales and beyond.

He said: "This project is not just about transitioning from diesel to hydrogen, it's about reimagining sustainable transportation in Wales. We're aiming to demonstrate that with a collective approach and robust technology, hydrogen can play a pivotal role in decarbonising the rail industry, offering a cleaner and more efficient alternative.

"We envision a future where our work not only reduces carbon emissions but also serves as a beacon for innovation, fostering a green economy and supporting rural communities."



Transport for Wales train on the Heart of Wales line.

Benefits

The Wales Hydrogen Train Project represents a groundbreaking move towards a sustainable future, offering numerous benefits to Welsh local authorities, public sector organisations, businesses and the climate-conscious public:

Decarbonisation and improved air quality:

Employs green hydrogen, slashing carbon emissions and enhancing air quality, directly contributing to Wales's ambitious decarbonisation targets and ensuring healthier communities along the routes.

Economic and technical advancement:

Acts as a catalyst for local economic growth, fostering advancements in green technology, hydrogen production and rail infrastructure, thereby nurturing a vibrant ecosystem for innovation and job creation within Wales.

Enhanced passenger experience: Offers commuters a quieter, smoother and cleaner service compared to aging diesel fleets, improving public transport's appeal and encouraging the shift from cars to trains.

Operational efficiency: Hydrogen trains offer a range of up to 1000km with refuelling times comparable to conventional diesel refuelling

(15-20 minutes), ensuring operational efficiency and minimal disruption to existing rail services.

Rural community support: Specifically targets enhancements in rural transport infrastructure, connecting isolated communities and providing access to cleaner, more efficient public transportation options.

Community and environmental impact:

Establishes a hydrogen hub, laying the groundwork for comprehensive decarbonisation that extends beyond rail to include local buses and council vehicles, enriching community life and environmental health.

This initiative not only represents a significant step forward in environmental stewardship but also positions Wales as a leader in the adoption of green hydrogen technologies, setting a replicable model for sustainable transportation globally.

Why Wales?

Alton believes Wales's long-distance routes with challenging terrain and frequent small stations uniquely position it for hydrogen rail technology, driven by the Welsh Government's leadership towards zero-emission services.

He added: "The country's commitment to developing a hydrogen economy, coupled with its mountainous terrain and extensive green energy production schemes, makes it an ideal testing ground for this innovative technology.

"By focusing on Pan-Wales routes and leveraging existing hydrogen initiatives in South Wales, the project contributes to regional development and offers a model for sustainable transportation that could be replicated globally."

This transition not only emphasises hydrogen's role in connecting remote communities but also underscores Wales's commitment to innovation and local economic enhancement, demonstrating the nation's strategic advantage in pioneering sustainable transport solutions.

Andrew Gainsbury, Rolling Stock Strategy Manager at Transport for Wales, said: "Collaborating with Arup, especially with James Alton, has been an incredibly positive experience. Their exhaustive technical insights have not only highlighted the complexity and cost involved in pioneering a hydrogen train service but also underscored the critical challenges of integrating new technologies with our existing rail systems and infrastructure.

Wales has some long-distance rural routes that are unlikely to ever justify electrification and will be a challenge for battery technology. With current capabilities a hydrogen train seems the obvious long-term solution. Geographically, this project could also link in with the proposed hydrogen bus initiative at Swansea.

"If a trial on our rural rail lines were to be funded and progressed, it could see Wales taking the lead on hydrogen train deployment in the UK and allow the technology to be refined so that it can be rolled out across other suitable routes across the UK."

Next steps

The HYBRID SBRI Wales Hydrogen Train Project will evolve through design, vehicle conversion, trials and testing over the next three years. By 2027, Arup and TfW aim to showcase Wales's first hydrogen-powered train, with ambitions for a new fleet by 2030, contingent on ongoing support and collaborative efforts.

The plan involves comprehensive off-network testing, potentially at the Global Centre of

Rail Excellence (GCRE) near Onllwyn in South Wales, to guarantee safety and performance standards are met before introducing the train to passenger services.

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Glossary

Term	Definition
Smart Living	Welsh Government programme to catalyse and support diverse pre-market innovative decarbonisation projects.
HYBRID	Hydrogen Business Research & Innovation for Decarbonisation. This is one of the Smart Living SBRI programmes.
WBRID	Whole Systems Business Research & Innovation for Decarbonisation. This is one of the Smart Living SBRI programmes.
SBRI	The Small Business Research Initiative model. This is the UK public sector's leading pre-commercial procurement vehicle which procures research and development to support the creation of new products and solutions to address perceived unmet needs. SBRI was used for the HYBRID and WBRID programmes under Smart Living. Since May 2024 SBRI has been renamed "Contracts for Innovation".
Place-based	A concept and approach where interventions contribute to meeting local needs, matching the local contexts, addressing challenges and/or mitigating risks.
SLES	Smart Local Energy Systems. A concept for creating smart, locally integrated energy systems that are clean, cost-effective, and beneficial for local stakeholders.
SME	Small to medium sized enterprise, which reflects enterprises with ten or more employees and less than 250 employees.
TRL	Technology Readiness Level. This is a method for estimating the maturity of technologies.
Whole-systems approach	A concept and approach where there is interaction between different energy systems. Innovations are effectively connected in a smart and/or holistic system or have the opportunity to be.