Uchelgais Gogledd Cymru
Ambition North Wales

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Welsh Government
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European Social Fund

Case Study 1:

Smart Living Whole System Business Research and Innovation for Decarbonisation (WBRID)

Such projects have great potential to make a significant contribution to Net Zero ambitions whilst bringing about wider benefits for the region.

The competitive Whole Systems Business Research & Innovation for Decarbonisation (WBRID) SBRI pilot scheme delivered by the Welsh Government Smart Living initiative 2021 - 2022 addressed market failure for developing innovative decarbonisation solutions across Wales. WBRID ran in two phases: Phase One explored viable solutions and concentrated on proving scientific, technical and commercial feasibility. The following Phase Two demonstrated and prototyped these solutions and if successful developed pathways to commercialisation. The objectives of WBRID SBRI were to:

- Progress and accelerate net zero ambitions for Wales
- Increase the up-take of innovative solutions driven by the public sector which address place-based issues/needs in relation to decarbonisation
- Help reduce costs and/or and improve services for local communities and areas;
- Stimulate innovation by supporting businesses to develop flexible and new solutions to resolve place-based issues/barriers
- Support a 'green recovery' by bringing innovative markets to the local area

Potential benefits of the Scheme included cost reductions and improvements in products/services for consumers, direct benefits to participating businesses and their employees through increased business, profits and wages, and a contribution to Net Zero ambitions of public bodies.

Ambition North Wales, in partnership with Coleg Cambria, successfully secured investment under both phases, centring on net-zero land management, development of energy efficiency, and renewable energy solutions to support Welsh agriculture's transition to Net Zero.

To this end, more than £500,000 of WBRID grant funding was allocated by Ambition North Wales – alongside support and guidance via the PMO Team's Agri-food and Tourism programme – to the following three projects, based out of Coleg Cambria Llysfasi, which aimed to develop new technology that will materially reduce greenhouse gas (GHG) emissions in the Welsh agriculture sector:

BioFactory Energy developed a prototype for a low-cost, modular Micro Anaerobic Digestion (AD) system (Micro AD Farm™) for small to medium Welsh dairy farms (100-500 cows). Receiving circa £266k of funding, the company developed a containerised solution to reduce GHG emissions from slurry management, which:

- Is modular & scalable to farm needs, enabling it to be tailored to the farmer's herd size
- Is cost effective because the system design enables it to be mass produced
- Is rapidly deployable, robust and easily transportable
- Does not require major on-site infrastructure changes.
- Captures the biogas for use as on-site energy

Reducing on-farm energy costs and providing a financial benefit to the farmer makes the system applicable to a large portion of the UK dairy industry that is unavailable to

conventional, large-scale, expensive AD market solutions. The Micro AD Farm™ system has the potential to reduce overall GHG emission levels by between 15% and 30% for the target market, turning methane emissions from cow slurry into useful biogas to provide on-farm energy that will reduce farm running costs. Alongside the energy savings, the system also produces a nutrient-rich liquid that can be used as a fertiliser as the nitrogen, phosphorous and potassium present in the slurry remains in the digestate.

Taking up the narrative, Jon Blake, BioFactory CCO, stated that the development of an affordable, micro AD solution is the first step for BioFactory on the journey to establishing itself as a market leader in waste-to-energy technology – with the system having the potential to impact the wider environmental challenges faced by farming in the 21st century.

"The project has been a brilliant case study/reference site for BioFactory and has allowed us to leverage further investment for development of a second-generation system. Without the funding and support of the stakeholders, including Ambition North Wales, BioFactory would not exist as a company. The project demonstrated an affordable AD technology for the first time in the UK – a technology that has the potential to have a material impact on the decarbonisation of the sector."

Jon confirmed that BioFactory has recently been through a private equity raise and is now on the SEEDRS Crowdfunder platform, receiving 140% of target funding, which will allow development of another two systems. The company plans to deploy 75 systems by the end of 2025.

Promar International secured funding of £47,000 to develop a bilingual carbon footprint resource for farmers in North Wales. The overall aim of the project was to look at ways to support measurement and reduction of carbon footprint and wider environmental impacts of Welsh livestock farms – specifically covering dairy, beef and sheep – through development of a 'sustainability tool'.

Stakeholders on the project included the Rhug Estate, Farmers Union of Wales, Hybu Cig Cymru, NFU Cymru, Coleg Cambria, and the Carbon Trust, with Promar also undertaking discussions with milk processor clients in Wales to understand the pressures they are seeing from their customers and the consumer. Such discussions influenced development of the wider sustainability elements of the tool and helped to ensure a focus on the context of the Welsh food supply chain.

Matthew Brennan, Head of Sustainability at Promar, states that Phase 1 of the project was based on a common 'accepted' carbon model, which provided an initial platform to develop a basic Excel version of a tool. This allowed a baseline carbon footprint to be calculated for Llysfasi Farm as a concept test. This was then used to develop an online version in Phase 2:

"What we tried to do in Phase 2 was look at something which had a more holistic view of sustainability in a farming/agricultural context, and something which was more specific to Welsh agriculture, because there was no tool available that was developed with Welsh as its primary language. We wanted something which Welsh farmers would know had been developed with them in mind."

Matthew confirmed that development of the sustainability/carbon tool was relatively straight forward in relation to dairy and beef, evidenced by the dairy tool methodology recently being accredited by the Carbon Trust. Promar is now working on the beef- and sheep-related tools, aiming to have these completed and accredited by the end of 2023, as agreed with the Trust.

Matthew is now waiting on additional data to come through from a parallel project being run with a retailer in England, looking at matching the cost of production to carbon footprint and sustainability:

"There is a clear correlation between the farms that are doing better on sustainability and the farms that are doing better on the cost of production. The tool we are developing will help us get this message across to the Welsh agricultural sector."

The impact of this work obviously depends on the level of uptake within the Welsh livestock sector; however, the tool will help farmers to understand their primary sources of emissions and to target improvement actions at the areas with highest benefit.

"We expect that an average farm (when considered over a large pool) should be able to achieve reductions of approximately 10% through changes to management and farming practices that can be implemented at low or no cost – changing grazing periods, feed efficiency, etc."

Targeting the national herd, publications by the Welsh government indicate livestock emissions account for approximately 53% of emissions from Agriculture, which is 12% of total national emissions (Agriculture: Sector Emission Pathway). Achieving an average 10% reduction across all participating farms therefore has potential to provide a quick contribution to national reduction targets if participation can reach a significant level.

The reach and significance of the tool is evidenced by interest and enquiries from teams in Germany, Italy, Luxembourg, Netherlands and Belgium but Matthew confirms the initial focus remains on the Welsh agricultural sector.

"How do we increase the benefits and minimise the negative impacts across the board for current farming practices. First, we reduce the negative environmental impacts of agriculture in Wales and, secondly, we improve the profitability of farms in Wales."

Matthew stresses that this work is not about going in to farms and telling farmers what they are doing wrong, but more about identifying opportunities, e.g. if you improve your soil health, you will have better grass yields, you will have healthier animals as they graze in better conditions etc.

"Getting a large proportion of the farmers in Wales to start thinking about their environmental impact – affecting that cultural change – would be significant evidence of impact for the project. We need to sell the benefits of better environmental practice to Welsh farmers. If we are hitting the top 30/40% of farms in Wales over the next five years – that would be a tremendous success."

SPARC

gan Brifysgol Bangor
by Bangor University

Thanks to Ambition North Wales funding of almost £187k, a collaboration between **M-SParc** on Anglesey, Coleg Cambria, and regional businesses, including AI specialist 42able.AI (www42able.ai) and expert drone developer Aerialworx (www.aerialworx.co.uk), explored the potential for drones to identify on-land issues, such as weed growth, facilitating the ultimate goal of a Net-Zero farm.

The project investigated how Artificial Intelligence (AI), computer vision and drone technology could be combined to accelerate the farming industry (what the team term 'Agriculture 4.0') and the Welsh economy; reducing time and costs for local farming communities, whilst introducing an innovative energy efficiency opportunity to decarbonising farming techniques. To fit with funding timetables, the project encompassed the development and construction of a bespoke drone (the Green Eagle) in the space of just five weeks, completed under the constraints of Covid lockdown requirements. The drone system developed was novel due to its use of AI to identify and 'treat' unwanted weeds one by one, removing the need to employ pesticide spraying normally undertaken via diesel tractor, thus contributing to the decarbonisation of the agricultural sector.

Phase 1 of the project involved assembling a group of specialists and delivering the proof of concept, with a successful demonstration of Green Eagle held at Coleg Llysfasi on 1 April, 2021. Phase 2 comprised the development and production of a two-drone solution pursuing Grasslands Management requirements. Research undertaken as part of the project had identified the two-drone system (Green Eagle and a scout drone) as the most efficient delivery model, with the scout surveying additional sites whilst Green Eagle treats the initial site.

Evidence obtained as a result of completing the project confirmed that UAV (unmanned aerial vehicles) used in agricultural applications can achieve lower environmental impact than current conventional methods, thus saving time and money. A 'Life Cycle Assessment'

– extraction of raw materials through to end-of-life treatment of components – was carried out as part of the project to investigate the environmental impacts, identifying that embodied carbon emitted for the Green Eagle and Scout Drones combined was 131 times lower across their life cycle than a traditional tractor to carry out the same work, reinforcing the merits of the project from a carbon footprint perspective.

The project brought a wide range of stakeholders together, with input from an Advisory Board that included the likes of BIC Innovation, Menai Science Park, Welsh Water, North Wales Wildlife Trust, Natural Resources Wales, Farming Unions and local farmers (including four precision farmers). The crop management IP (Intellectual Property) and technology developed as part of the project will be taken forward by project partners, with perhaps the biggest impact being seen by 42able.AI, whose future business practices have been influenced by the work undertaken during the Green Eagle project. James Finney, Co-founder of 42Able.AI, comments that:

"The project had a fantastic impact on 42able.AI, with lessons learnt carried forward onto future projects and, in essence, being what has led us to the point that we are at today. Due to drone regulatory issues, we had to divert from the intended commercialisation plan, but the software and image recognition models created as part of the project are still in use today and have been expanded into a much broader application. Although we are not commercialising in a direct manner, from a software perspective, what was created as part of Green Eagle is still in use, and will soon be released as a broad business data platform application. We are also looking at open-source releasing some of the code behind what made Green Eagle work – such as our coordinate targeting system and best pathway finder."

CONCLUSION

The three projects show how Welsh Government funding provided through a partnership between Ambition North Wales and Coleg Cambria, and supported by the Agri-food and Tourism programme at Ambition North Wales, facilitated the decarbonisation of the agriculture industry in North Wales. Such projects have great potential to make a significant contribution to Net Zero ambitions whilst bringing about wider benefits for the region.

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