The Strategic Need for the Llŷr Project

Executive Summary

Deep water offshore wind will be crucial to achieving the net-zero targets of the UK and Welsh Governments; fixed bottom capacity alone will be unable to meet growing electricity demand. The Llŷr wind farm has been brought forward to showcase the next generation of clean, renewable offshore energy technology before it enters industrialisation. The project's goal is not only to help deliver clean energy but also to accelerate learning from new full-scale floating offshore wind technology solutions tested in UK waters.

The project fully meets the Wales National Marine Plan's low carbon energy Supporting Policies for the development of renewable energy activities, in particular ELC_01, which seek to ensure that potential for energy generation from renewable sources is achieved in line with climate and energy targets, and does so in a way which gives due regard to relevant environmental, social and cumulative impact considerations, in particular the Wales National Marine Plan policies SOC_06, SOC_07 and SAF_01 b.

Llŷr will enable several key benefits for Wales and the wider UK:

- *Catalyst for Accelerating the Floating Offshore Wind Industry*: Llŷr will help de-risk technology and reduce costs through early deployment. It will validate designs and demonstrate the manufacturing and installation of commercial-scale floating offshore wind turbines, allowing for further optimisation of substructure designs. This optimisation will lead to lower-cost, more efficient structures for gigawatt-scale projects.

- *Enhanced Understanding of Environmental Interactions*: The project will improve knowledge of the environmental impacts associated with the construction and operation of floating offshore wind farms.

- *Supporting the UK Clean Power 2030 Action Plan*: The project plays a crucial role in delivering the UK Clean Power 2030 Action Plan, which aims to reduce energy bills for households and businesses. It will facilitate the creation of more renewable energy sources, ensuring that Britain achieves energy security with clean power by 2030 and reaches Net Zero by 2050.

- *Economic Contribution*: Llŷr will significantly benefit the local and Welsh economy while contributing to the development and capacity of a new form of renewable energy generation at both a national and international level.

- *Maximizing Local Supply Chain and Employment Opportunities*: Llŷr will strengthen supply chains and create job opportunities in Pembrokeshire and throughout Wales, thereby contributing positively to both Welsh and UK economies. This initiative will provide the region with an early mover advantage to capitalise on domestic and export opportunities. An example of this is the recently announced 4.5GW Round 5 developments in the Celtic Sea, alongside ScotWind and other global prospects.

Requirement for Commercial Scale Turbines on Test and Demonstration Sites

The overall aim of the Llŷr project is to demonstrate a new model of deep water offshore wind technology to the emerging UK and international market. This Test and Demonstration (T&D) project will be amongst the first of its kind at this scale worldwide. Globally, to date, only 270 MW of deepwater offshore wind projects is fully operational across 16 projects in 8 countries. Of these

only two projects with a total capacity of 78 MW are in the UK (the Hywind and Kincardine projects in Scotland).

Since the first mega-watt scale floating offshore wind turbine (the 2.3 MW Hywind Demo) began operation in Norway in 2009, deep water has been recognised as the next frontier in offshore wind energy, unlocking 80% of the world's offshore resource in waters deeper than 50m.

Technical advancements through the learning experience from the deep water foundation technologies deployed to date mean that no deployed technologies in their current form are available commercially in the UK. This is due to a range of factors including:

- Learning and improvements identified during the T&D phase are being integrated into the design to mature it to a commercial market.
- Designs have been developed to specific regional supply chain capability that cannot be secured within the UK (e.g. Use of deep fjords in Norway).
- There is a need to move from a single, or low number of units, technology demonstration to move to a serial production scale to provide learning and feedback before significant investment is made into specialised port facilities for fabrication, assembly, and integration.
- Confidence needs to be established with project funders, insurers, warranty providers and policymakers that deep water offshore wind technology is scalable.

From a turbine technology perspective, the Kincardine floating wind project has the largest UK turbine capacity of 10MW, whereas the offshore wind turbine manufacturers have moved onto turbine capacities of 18MW or more[1]. To be an effective T&D project, Llŷr needs to showcase competitive commercial scale technology that represents the commercial market conditions. The size of a turbine is a critical aspect for deep water foundation technologies, having more of an influence on design and performance when compared to shallow fixed bottom foundations.

Llŷr will demonstrate deep water technologies that are capable of hosting turbines of 18MW (and greater) capacities and to provide small scale serial production deployment to validate technologies, trial logistics, and demonstrate supply chain capability at a significantly reduced risk and cost than full-scale commercial deployment. As a consequence, a successful Llŷr project, hosting new deep water foundation designs with turbines at an 18 MW scale will give funders and policymakers the confidence that the technology is scalable, not just on paper but in practice.

Future Energy Demands, Energy Security and the Climate Emergency

The UK government's Clean Power 2030 Action Plan[2] sets out a clear intent on electrification across various sectors to meet the pathway to Net Zero. This move will see a dramatic shift in consumption demand where the UK must roughly double its electricity generation capacity[3] while simultaneously transitioning to clean energy sources to meet both rising demand and net-zero targets by 2050.

A key aspect in delivering this transition is the development of new low carbon technologies, such as deep water offshore wind. This requires enabling the key necessary groundwork actions to accelerate the scaling up and delivery of deep water technologies to the market. This has to

[1] Zahle, F., Barlas, A., Lønbæk, K., et al. (2024). "Definition of the IEA Wind 22-Megawatt Offshore Reference Wind Turbine." Technical University of Denmark. https://doi.org/10.11581/DTU.00000317
[2] https://www.ukwa.org.uk/wp-content/uploads/2024/12/clean-power-2030-action-plan.pdf
[3] Energy and emissions projections 2023 to 2050

happen over the next 5 years to prepare the roll out of these technologies and embed their transition to a long-term, secure and clear energy system to 2050 and beyond.[4] This is due to the time required to secure the development projects (circa 10 years) and essential supply chain and infrastructure investment / upgrades necessary to meet the fabrication, integration and installation timeline requirements.

In addition to contributing 200 MW capacity to the Clean Power 2030 Action Plan objective by 2029, Llŷr is also a key enabler to the longer term ambition. As stated in a recent report by the joint government-industry Floating Offshore Wind Taskforce "*Floating wind test and demonstration sites are critically important to the UK's offshore wind ambitions, playing an essential de-risking and cost-reduction role as the country pursues what some describe as the "industrial opportunity of the century*"[5]. Fundamentally, T&D sites are the essential bridge between prototype concepts and commercial-scale deployment, without which the UK risks losing its current global leadership position in this emerging trillion-pound industry.

Strategic Importance of Test & Demonstration Projects

The Llŷr project will enhance understanding of environmental interactions, optimise designs, and create significant opportunities for training, employment, as well as manufacturing and supply chains in Pembrokeshire and Wales, especially as global demand for floating offshore wind energy increases. The Llŷr development will enable the realisation of a significant sustainable and low carbon economic opportunity for the local community and supply chain within the region by providing an early mover advantage not only for the forthcoming Round 5 developments in the Celtic Sea but also across the wider UK, European and global opportunities.

By reducing risk and uncertainty and demonstrating performance through T&D projects, stakeholders have the confidence and clarity they need to move forward with larger GW scale investments, such as the Round 5 Celtic Sea projects. Local supply chain could not tender for giga-watt scale projects in the region with prohibitive investment requirements. Llŷr provides the opportunity for local Welsh and UK suppliers to support offshore wind at an accessible scale, demonstrating their capabilities to the global market using existing facilities, before making large capital investments to support larger scale projects. Deepwater offshore wind (including floating) is at a crucial stage - decisions being made now will set the trajectory for the next decade. The UK Government is targeting 5 GW of deployed deep water offshore wind by 2030 and this remains a key component of the UK's broader clean power strategy to achieve 95% clean electricity generation by 2030. This ambition is severely under threat due to the lack of technology demonstration and lack of opportunity for the local UK supply chain to adapt and prepare for this ambition. T&D projects, such as the Llŷr project are a crucial enabler to address these challenges; either we build the supply chain and financial frameworks to scale, or the UK remains quoting ambition about potential without ever quite getting there.

The Llŷr site has been carefully chosen to allow suitable access to evaluate both the technology performance and its environmental interactions. The smaller scale of up to 10 turbines the demonstration project and its relative proximity (although the nearest turbine is still nearly 36 km offshore) to the coast means that it will be more feasible to access and learn from this early installation, make corrections, and prove concepts of environmental avoidance and operation.

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[4] "Future Energy Scenarios: Pathways to Net Zero", July 2025 (V.4), National Energy System Operator (NESO) - https://www.neso.energy/document/364541/download

[5] floating-offshore-wind-2050-vision-final.pdf

We would also like to highlight (as we did in Table 2-1. Description of the two main policy statements under WNMP ELC-01 (Welsh Government, 2019c, Volume 1: Chapter 02 – Regulatory and Planning Context) the Wales National Marine Plan's low carbon energy Supporting Policies for the development of renewable energy activities, in particular ELC_01, seek to ensure that potential for energy generation from renewable sources is achieved in line with climate and energy targets, and does so in a way which gives due regard to relevant environmental, social and cumulative impact considerations, in particular the Wales National Marine Plan policies SOC_06, SOC_07 and SAF_01 b.

Reducing the Cost of Energy

Currently there is over 25 GW capacity of deepwater wind seabed leases already in place within the UK to deliver the 2050 net zero target; however, the deep water offshore sector is under increasing pressure with the rise in supply chain costs, lack of technology demonstration and a need to achieve at least 30% cost reduction to compete with current market prices. While the technology currently carries higher costs than traditional offshore installations, taking a measured, stepping stone approach, will maximise long-term value to the UK, enhance future large-scale initiatives and strengthen the UK's position as a global leader in offshore wind development.

Hywind Scotland, a 30MW project, reduced costs by 70% compared to the Hywind Pilot. Hywind Tampen, a Norwegian 88MW project installed in 2022, is estimated to have reduced costs by 40% compared to Hywind Scotland[6].

Llŷr's own analysis[7] demonstrates that following a fully phased, structured approach, incorporating T&D projects like Llŷr unlocks cost reductions in future deployment of approximately 28% compared to moving to direct giga-watt scale deployment. This delivers multiple benefits including:

- Optimising infrastructure development based on operational learning
- Steady supply chain scale-up with clear investment signals
- Technology and deployment risk reduction through full scale experience
- Higher investor confidence through demonstrated success – unlocks lower cost of capital for giga-watt scale projects
- Development of continuous workforce development and skill retention

As a new technology, deep water wind carries a higher risk premium than established technology. However, this risk premium will decrease as operational assets accumulate a proven history, particularly compared to first-of-kind projects. As stated by the joint Government-industry Floating Offshore Wind Taskforce, "Building investor confidence through 'stepping-stone' projects, allowing reduced cost of capital is key.[8]"

Perceived Harm

Stakeholders have legitimate concerns that the proposed projects in the Celtic Sea at large scale may pose a significant risk of unforeseen environmental harm. The Llŷr project has the ability to

[6] https://cms.ore.catapult.org.uk/wp-content/uploads/2021/09/7527-Catapult-Report-–-Industrial-Leadership-FINAL.pdf
[7] https://www.llyrwind.com/wp-content/uploads/2025/06/Political-Insight-APPENDIX_MAY-2025_ENGLISH-1.pdf
[8] https://www.renewableuk.com/media/scccdrxe/floating-offshore-wind-2050-vision-final.pdf

address those issues at an appropriate scale before the larger commercial build out. A demonstration project allows for carefully controlled management of wildlife interaction, environmental risks, and the testing of effective mitigation measures before large-scale build-out proceeds and offers the opportunity to study the impacts of floating offshore wind projects in these relevant areas during construction and operation.

As acknowledged by NRW(A), in principle, the proposed mitigation measures to be adopted by the Llŷr project (and relied on in HRA and EIA assessments) are capable of avoiding adverse effects on site integrity and likely significant effects. The project is committed to ensuring that the mitigation measures presented during the application process are implemented to avoid adverse effects on ornithology or marine mammals.

In relation to the specific issue of potential landscape and visual effects from the Llŷr project, as we have outlined previously:

- The tip height of 325.5m assessed in the LVIA presented the "worst case" scenario used to enable a reasonable worst case assessment of the project and to inform mitigations and other measures that inform detailed design and implementation of a project. The assessment concluded that the majority of views (12 out of 15 viewpoint locations) are assessed as experiencing a small adverse change in visual amenity, resulting in effects of minor significance. At the remaining three viewpoint location viewers are assessed as experiencing a negligible adverse change in visual amenity, resulting in effects of negligible significance.

- However, in recognition of the concerns raised by the members of the PCNPA during the Members meeting and by NRW(A), and the project has committed to limit the turbine tip height to 300m above Highest Astronomical Tide (HAT). From a technical point of view, this is the minimum height achievable to ensure commercial scale turbine technology (up to 18 MW) whilst maintaining the necessary financial margins and turbine technical demonstration parameters needed to maintain the viability of the T&D project.

- Based on the 'ready reckoner' provided in the Stage 1 Report of the Offshore Wind Sensitivity Guidance, and the guidance within the Stage 2 and 3 Reports (including that on the specific sensitivities of the PCNP), NRW(A) advised that a reduction in blade tip height to 270m (the same height as the consented Erebus turbines) would be expected to reduce impacts within the PCNP. However, the Offshore Wind Sensitivity Guidance, 2019 is an approximation of potential effects based on subjective judgements and a limited number of case studies from SLVIAs and offshore projects. As demonstrated by the further information presented by the Llŷr project there is no discernible difference in landscape and visual effects from Llŷr Floating Wind Farm turbines of 300m or 270m. At 300m the Llŷr turbines are not perceived as larger than the Erebus turbines from key locations, including the PCNP. This is due to distance and relative proximity of the two schemes to the onshore viewpoints.

- In addition, it is likely that the visibility of the Llŷr turbines will be more limited, and magnitude of impact lower that stated in the SLVIA, for the majority of the time (as indicated by a review of average visibility data for the Milford Haven weather station suggests that frequency of visibility >35 km would be less than 33%, frequency of excellent visibility (>40 km) would be less than 24%, and frequency of visibility >50 km less than 10.5%).

- To address concerns raised on nighttime navigation lighting, the navigational lights will be designed to be legally compliant with CAA SARG Policy Statement (g) and will integrate a detection system to detect when visibility is greater than 5km. When this is the case, the

aviation lights will be dimmed to 10% of the 2,000 candela (cd) maximum so that the intensity of the light emitted would be 200 cd and this measure has been welcomed by NRW(A).

- In the spirit of working together with the National Park as a good neighbour and recognising the concerns raised by the PCNPA members and NRW(A), Llŷr is proposing the implementation of a Landscape Enhancement Scheme. This £200,000 scheme will be set up to support the goal of landscape enhancement within the PCNPA, where the funds will be dispersed to landscape initiatives agreed by a steering group consisting of representatives from the project, the PCNPA and NRW(A).

Achieving Balance

The Llŷr project has adopted and incorporated all reasonable mitigation measures in the delivery of the project to avoid adverse effects on site integrity and likely significant effects identified during the assessment process.

The project represents a significant step in enabling the Welsh Government goal in achieving sustainable development. In accordance with the Well-being of Future Generations (Wales) Act 2015 (WFG), taking into account the ways of working as set out at section 5(2) of the WFG Act and 'SPSF1: Core Guidance, Shared Purpose: Shared Future – Statutory Guidance on the WFG Act', in that it:

- Provides a positive contribution to the Welsh Government's long-term, ambitious commitment and target for Wales to increase the renewable energy production to meet the equivalent of 100% of its annual electricity consumption from renewable sources by 2035, and to continue to keep pace with consumption thereafter.

- Provides a positive effect in building a stronger, greener economy delivering a significant step in decarbonisation, not only in its direct electricity production, but also by significantly contributing to the case for use of the technology at large scale by providing the economic, technology performance, social, supply chain, workforce development and environmental evidence necessary to enable large scale deployment of offshore wind in deeper water. This is turn will provide an opportunity for Wales and the wider UK to expand its offshore wind electricity generation contribution and to play a significant role in the international deep water offshore wind market.

Future Wales: The National Plan 2040 (the national development framework for Wales) recognises the potential for wind generation in the Southwest Region and sets out the Welsh Government's ambition for energy generation to play a role in supporting the Southwest economy. Policy 17 requires decision makers to give significant weight to the need to meet Wales' international commitments and the Government's target to generate 70% of consumed electricity by renewable means by 2030 in order to combat the Climate Emergency.

Consequence of not proceeding

In the situation that the T&D scale approach is not undertaken, or where the Llŷr project is not allowed to proceed, limited progress is achievable but with significant drawbacks. The UK could wait for other deep water offshore wind markets to progress the deep water offshore wind technology and thus avoid the burden of development costs. A development project constructed in the mid-2030s could benefit from a cost reduction of 10-15% due to global learning.

However, taking this approach would result in the UK losing its global market position as a leader in the offshore wind market; resulting in the inability to secure the necessary investment infrastructure to achieve a commercially competitive supply chain and failing to develop a skilled knowledgeable labour force that would not only service the UK market but have a significant potential export opportunity. It would also not lead to the 30% cost reduction target identified by RUK as necessary to compete with current market prices.

Instead of small-scale projects, the UK could progress directly to GW scale projects which could achieve a Levelized Cost of Energy (LCOE) of around £145/MWh in the 2030s. However, this requires significant investment in port facilities, grid infrastructure, and manufacturing, which may be challenging for private investors due to high initial costs and perceived risk.

Not proceeding with the Llŷr project will undermine the opportunity to effectively understand the environmental interactions of these technologies in the region before large scale build out. In addition, as stated by Marine Energy Wales, the T&D stepping stone approach recognises the need to develop the UK supply chain and supporting infrastructure, and provides opportunities for growth and investment.[9] The Llŷr project represents a key contribution to that stepping stone approach.

The Llŷr project provides an early mover opportunity to create significant opportunities for training, employment, as well as manufacturing and supply chains in Pembrokeshire and Wales, especially as global demand for floating offshore wind energy increases. The UK's floating wind industry has the potential to employ 97,000 people by 2050, with many of the jobs based in Scottish and Welsh ports, contributing £47 billion to our economy by building and supplying projects here as well as exporting our cutting-edge technology worldwide – but only if the right measures are put in place to enable more projects to go ahead faster.[10] The Llŷr project represents one of those measures necessary to capture this opportunity – without it, the potential for reaping the economic, energy security and environmental benefits may be lost.

[9] https://research.senedd.wales/research-articles/harnessing-wales-marine-renewable-energy-the-story-so-far/

[10] https://www.renewableuk.com/media/scccdrxe/floating-offshore-wind-2050-vision-final.pdf