The voice of the energy industry

Energy UK Response – Potential of marine energy projects in Great Britain: call for evidence

2nd October 2020

About Energy UK

Energy UK is the trade association for the energy industry with over 100 members spanning every aspect of the energy sector – from established FTSE 100 companies, right through to new, growing suppliers and generators, which now make up over half of our membership.

We represent the diverse nature of the UK's energy industry with our members delivering almost all (90%) of both the UK's power generation and energy supply for over 27 million UK homes as well as businesses.

The energy industry invests over £13.1bn annually, delivers around £85.6bn in economic activity through its supply chain and interaction with other sectors, and supports over 764,000 jobs in every corner of the country.

Executive Summary

Energy UK welcomes the opportunity to respond to the BEIS call for evidence on the potential of marine energy projects in Great Britain (GB). It is positive to see government seek further evidence of the potential for innovative marine energy technologies. The UK has over 11,000 miles of coastline, significantly more than many of its European neighbours, and favourable circumstances for marine energy deployment with shallow waters, significant deep offshore infrastructure expertise, and some of the largest tidal ranges in the world. It is clear that the share of renewable energy in the generation mix will need to grow substantially out to 2050, and therefore, it is sensible that government is considering all forms of renewable energy available to the UK.

The UK has a unique opportunity to be a world-leader in innovative marine technologies

The technologies considered in this response include floating offshore wind (FOW), tidal, and wave energy. From these technologies, Energy UK believes that FOW has the greatest deployment potential through to 2050 and is the closest to commercial deployment. Energy UK expects FOW deployment to ramp up significantly throughout the 2030s and eventually overtake fixed-bottom offshore wind in terms of installed capacity as the latter becomes constrained by the availability of shallow water sites. The global FOW market is in a nascent stage with an expected cumulative installed capacity at the end of 2020 of 125MW.[1] Two-thirds of this capacity is located in UK waters, however, with other countries recognising the potential of this technology, it is crucial that government moves quickly to establish the UK as a global-leader and ensure that the associated economic benefits are realised.

The UK is also home to the world's first marine energy test facility. The European Marine Energy Centre (EMEC) based in Orkney opened in 2003 and supports the development of wave and tidal projects, attracting developers from all over the globe to test their prototypes. In 2016, a hydrogen production plant was added to the site, which uses excess energy from the marine prototypes to create renewable hydrogen. This hydrogen is then used locally in a variety of fuel, power and heat applications, offering valuable learning and intelligence for the wider UK low-carbon hydrogen rollout. Wave (27GW) and tidal

[1] https://prod-drupal-files.storage.googleapis.com/documents/resource/public/FWJIP_Phase_2_Summary_Report_0.pdf

(32GW) have a combined estimated UK resource potential of 59GW, and are expected to contribute 14% of GB electricity capacity at 2050 should the technologies achieve a levelised cost of energy of £90/MWh.[2]

Government should use the upcoming Energy White Paper to set ambitions for innovative marine technologies

Energy UK believes government should set a clear ambition for the deployment of innovative marine technologies. For those with a high-level of technological readiness, such as FOW and tidal lagoons/barrages, this may manifest in the form of capacity targets. For remaining technologies, a UK ambition could be realised through a commitment to further competitive development funding to support the best technologies towards commercial deployment. We support the view of government outlined in the consultation document whereby different forms of policy support are needed to complement the different levels of commercial maturity across innovative marine technologies.

Beyond the obvious environmental benefits, we identify significant net positive economic benefits and job creation from the setting of innovative marine technology ambitions and welcome the opportunity to work with government on the design of such policies.

Government should include FOW in future CfD rounds and create a competition pot designed to support commercialisation of innovative marine technologies so they can compete in CfD auctions

In our response to the summer consultation – Contracts for Difference (CfD) Amendments to the Scheme 2020 – Energy UK welcomed the move from government to introduce FOW as a new technology for CfD Allocation Round 4 (AR4). This is an important move to facilitate the price discovery of the technology. However, as we have seen with wave and tidal energy in previous CfD allocation rounds, the ability to win contracts and have the opportunity to reduce cost through large-scale deployment is hampered by competition against technologies at different levels of maturity. We urge government to consider the use of minima to ensure all the innovative technologies discussed, with their significant export potential, have the opportunity to scale-up. We also recommend the introduction of a competition pot designed to support the transition of the most promising technologies from large-scale demonstrator through to CfD scale deployment.

Should you have any questions regarding this consultation response then please do not hesitate to get in touch via the details below.

Philip McNally

Policy Manager, Power

Energy UK

020 7024 7633 philip.mcnally@energy-uk.org.uk

Response to Questions

1. We welcome views and evidence on which marine energy technologies have the most deployment potential through the 2030s to meet the UK's net zero emissions commitments, and what trajectories for deployment are realistic and feasible, both in the UK and worldwide. We welcome views and evidence on the scope for wider benefits, or potential disadvantages, that specific technologies could bring to the energy system as a whole.

Floating Offshore Wind (FOW)

It is a sign of the speed of development and innovation in the offshore wind sector that the 2019 Committee on Climate Change (CCC) recommendation of 'up to 75GW of offshore wind by 2050' now appears a

[2] http://www.marineenergywales.co.uk/wp-content/uploads/2016/01/Summary-Report-FINAL.pdf

modest target.[3] For example, the net-zero consistent scenarios in National Grid's recent FES 2020 publication exhibited a 2050 offshore wind capacity in the range of 82-108GW.[4] Energy UK supports this level of ambition and urges government to build on the success of the Offshore Wind Sector Deal (OWSD) by incorporating ambitions and government-industry joint commitments for the FOW sector.

Aside from fixed offshore wind, FOW has the greatest deployment potential of marine energy technologies through the 2030s. Independent analysis undertaken by the Carbon Trust suggests a global FOW estimated deployment of up to 10.7GW by 2030 and 70GW by 2040.[5] On a UK level, the study estimates deployment of 1.1GW and 7.4GW by 2030 and 2040 respectively, however, Energy UK believes that to be a conservative estimate. We identify significant upside potential so long as government provides an appropriate regulatory and commercial framework to support FOW deployment.

This FOW potential raises the question of how government should integrate the deployment of FOW with existing ambitions for fixed offshore wind. Energy UK welcomed the launch of the OWSD in March 2019 and we were supportive of the Conservative manifesto commitment to increase the deployment ambition from 30GW to 40GW of offshore wind by 2030. We now encourage government to review the commitments within the Offshore Wind Sector Deal to ensure that they remain consistent with, and achievable under, the new 40GW target. We also suggest that government considers adding new elements to the deal that will support initial commercial scale FOW deployment in the late 2020s, and lay the foundations for at-scale deployment of FOW through the 2030s.

Industry is keen to continue to work with government to tackle the barriers to deployment that have been identified for fixed offshore wind, many of which will also be relevant to FOW. In particular, it is crucial that low-carbon infrastructure in UK waters is viewed in the round to ensure that potential co-benefits and efficiencies between the multitude of offshore technologies[6] are maximised. The ongoing Offshore Transmission Network Review is a key work stream in this space and should include consideration of the potential scale and location of innovative marine projects alongside the more established technologies.

A host of other countries are currently exploring opportunities for FOW. The Carbon trust identifies France, South Korea, Portugal, the USA, and Japan as lead markets and Ireland, Norway, Spain, Taiwan, the Aegean Sea and China as follower markets.[7] It is worth noting that whilst the UK currently accounts for 64% of installed FOW capacity across the globe, under current policy frameworks this is expected to fall to around 10% by the mid-2020s due to accelerated deployment in other nations such as South Korea and France.[8] This should provide incentive for government to move swiftly to create a route to market for FOW and capitalise on the UK's competitive advantages.

Wave & Tidal

Wave (27GW) and tidal (32GW) have a combined estimated UK resource potential of 59GW.[9] A study by Edinburgh University and the Energy Systems Catapult, which assumed a levelised cost of energy of £90/MWh for wave and tidal generation at 2030, estimated 37.7GW of installed UK wave and tidal capacity by 2050.[10] This level of deployment is expected to contribute £106.1bn net Gross Value Added (GVA), as well as a 7:1 and 6:1 ratio of benefit to industry support for tidal and wave respectively. Further to this, UK content in domestic projects is expected to be around 80% assuming a global lead, and a small share (5-15%) of UK content in global projects is expected to contribute half of the aforementioned GVA.

There are strong economic and social benefits associated with the deployment of wave and tidal energy, and a clear opportunity for the UK to be a world leader. Analysis from the Offshore Renewable Energy Catapult has shown that, by 2030, the tidal stream industry could generate a £1.4bn net cumulative benefit

[3] https://www.theccc.org.uk/wp-content/uploads/2019/05/Net-Zero-Technical-report-CCC.pdf
[4] https://www.nationalgrideso.com/future-energy/future-energy-scenarios/fes-2020-documents - go to Data Workbook
[5] https://prod-drupal-files.storage.googleapis.com/documents/resource/public/FWJIP_Phase_2_Summary_Report_0.pdf - Page 1
[6] Fixed offshore wind, FOW, tidal, wave, interconnectors, infrastructure for oil & gas CCUS and hydrogen
[7] https://prod-drupal-files.storage.googleapis.com/documents/resource/public/FWJIP_Phase_2_Summary_Report_0.pdf - Page 26
[8] https://prod-drupal-files.storage.googleapis.com/documents/resource/public/FWJIP_Phase_2_Summary_Report_0.pdf - Page 22
[9] http://www.marineenergywales.co.uk/wp-content/uploads/2016/01/Summary-Report-FINAL.pdf
[10] http://www.policyandinnovationedinburgh.org/uploads/3/1/4/1/31417803/uedin_wave_and_tidal_energy_the_potential_economic_value.pdf

to the UK, including considerable exports, and 4,000 jobs. The wave energy industry is expected to take longer to develop due to the level of technological maturity, however, by 2040, the sector is estimated to generate a £4bn net contribution to the UK economy and 8,100 jobs.[11]

Further to this, the predictable generation of these technologies, especially from tidal will have wider system benefits that should be taken into account by government in any cost benefit analysis. Water has one thousand times higher density than air meaning that wave and tidal technologies can generate at much lower flow speeds than wind. The predictable, reliable output from these technologies, especially tidal has significant value to the system operator. Furthermore, there is evidence that co-location of wind and wave farms has a material positive effect on intermittency, with one study finding reductions of up to 87% and 6% in downtime and power variability.[12]

Tidal lagoons can be set up as connected cells, which allows them to ensure they are able to generate electricity in periods of high demand via differences in water levels across those cells, as well as from the cells to the open sea and upon return of water to the cells. This design is estimated to boost energy returns by 10% or 20% for relatively modest additional outlays in increased height of the containing perimeter. It can also bring forward the date of first generation by a year or more, something that may be viewed as particularly valuable in future as the proportion of intermittent and nuclear generation increase and decrease respectively.

Energy UK encourages government to develop a methodological approach to assess the value of flexibility from different technologies and we welcome an open discussion with our membership on this topic.

2. We welcome views on how the CfD competitive allocation process would most effectively support early commercial deployments of innovative marine technologies. We welcome suggestions for approaches that could deliver a clear path towards commercialisation - while also focusing on the more cost-effective technologies and projects? At what stage are technologies ready to seek the support offered by the CfD scheme and bid competitively for contracts? How can competitive processes best be used to drive cost reductions?

Energy UK welcomes the recognition from government that technologies at different levels of commercial readiness require different forms of subsidy. At present, FOW would appear to be the only technology of those discussed that is at a level of commercial maturity to compete in CfD auctions. However, FOW is not a homogenous technology type, there are at least 15 different designs at different levels of commercial maturity. We therefore believe there needs to be a renewed focus on R&D/competition grant funding for wave and tidal projects, and also for the most promising pre-commercialisation FOW designs, to support these technologies on their path to commercialisation. Larger-scale tidal barrage and lagoon projects that are ready to deploy at scale may require either a bilaterally agreed CfD, if an acceptable strike price can be agreed, or an innovative financing model, similar to those being considered for new nuclear, should that route provide value for money to citizens.

In our response to the summer consultation – Contracts for Difference (CfD) Amendments to the Scheme 2020 – we welcomed the move from government to introduce FOW as a new technology for CfD Allocation Round 4 (AR4). We supported the proposal to define this technology separately from fixed-bottom offshore wind, noting that this is key to enabling the price discovery of FOW. We expect FOW to follow a similar cost reduction trajectory to fixed-bottom wind as long as it benefits from a similar stable policy and regulatory framework.

The design of future auction parameters is crucial in attracting investment in these innovative marine technologies. We urge government to ensure that sufficient budget and capacity is allocated to the different technologies in line with the maturity of the respective pipelines. Applying a technology minima to FOW, tidal and wave technologies can be an effective means of attracting early investment and triggering price discovery.

Given that FOW deployment is at an early stage, it is likely that FOW projects that are ready for AR4 will be at a “demonstration” scale. If FOW is included in AR4 (which Energy UK strongly supports) and

[11] https://s3-eu-west-1.amazonaws.com/media.newore.catapult/app/uploads/2018/05/04120736/Tidal-Stream-and-Wave-Energy-Cost-Reduction-and-Ind-Benefit-FINAL-v03.02.pdf
[12] https://www.sciencedirect.com/science/article/abs/pii/S0360544215017533

technology minima/maxima are applied, then we would highlight that it will be important that the budget and capacity allocated to FOW is consistent with the scale of the projects that will come forward.

3. The government welcomes evidence on how specific technologies expect to reduce costs to the point where they can be commercially competitive with other renewable and low carbon generation options. Where does the scope for cost reductions arise, and what scope for innovation exists in the sector? What trajectories for cost reduction are realistic and feasible – at a project level but also across the relevant sector? We also welcome evidence of any successful approaches to cost reduction that have already been adopted.

Energy UK sees significant opportunity for cost reduction in marine technologies. A joint report from the Offshore Renewable Energy (ORE) Catapult and Crown Estate Scotland has provided assessments of the potential steps in cost reduction of FOW as follows:-

- LCOE of initial demonstration sites of ~30MW is ~£200/MWh.
- Subsequent pre-commercial sites of ~100MW have estimated LCOE of ~£135/MWh.
- LCOE for full commercial-scale projects (>300 MW) is estimated at ~£85/MWh.[13]

After FOW projects have reached full commercial scale, projections by the ORE Catapult suggest that a combination of substantial volumes of total deployment and a realistic innovation learning rate will enable FOW costs to decrease rapidly and converge with fixed foundation offshore wind by 2031. These findings are corroborated by Wind Europe, which estimates the first commercial scale projects to cost in the region of €100-80/MWh, and mature commercial-scale costs of €40-60/MWh by 2030.[14]More recent research from the ORE Catapult suggests that at scale projects could be already be deployed at a relatively competitive costs with LCOE estimates of £80/MWh and £64/MWh for 300MW and 500MW sites respectively.[15]

To get maximum value from the FOW resource, Energy UK believes that there should now be a development focus, leading to initial commercial scale FOW deployment in the late 2020s, and laying the foundations for at-scale deployment of FOW through the 2030s.

4. If specific emerging marine technologies are unlikely to be able to compete with other marine technologies for income based on the electricity they generate; what forms of support could move the technology towards commercialisation in the short term? We particularly welcome evidence on why any proposed approaches are likely to be effective, how they can be designed to minimise costs to consumers, and how long before the technology will be able to compete against other technologies.

Energy UK believes that wave and tidal stream technologies, alongside the most promising pre-commercial FOW designs, would benefit from grant funding to support technological development. Lessons can be learnt from the Scottish experience of wave and tidal grant funding. The Scottish Government is currently investing £10 million in tidal energy through the Saltire Tidal Energy Challenge Fund, which is specifically aimed at helping commercial deployment of tidal projects.[16]

The Scottish Government has also supported wave energy to the amount of £30 million through the dedicated body, Wave Energy Scotland (WES).[17] The WES programme utilises a number of competitive 'stages' with the goal of supporting the best technologies to the point of commercial deployment. This is an effective means of introducing competition to the allocation of grant funding, therefore ensuring that the majority of funding is directed at the technologies with the highest commercial deployment potential.

[13] https://s3-eu-west-1.amazonaws.com/media.newore.catapult/app/uploads/2018/10/29105933/PN000244-FWMS-Report_FINAL.pdf
[14] https://windeurope.org/wp-content/uploads/files/policy/position-papers/Floating-offshore-wind-energy-a-policy-blueprint-for-Europe.pdf
[15] https://www.marineenergywales.co.uk/wp-content/uploads/2020/01/Benefits-of-Floating-Offshore-Wind-to-Wales-and-the-South-West.pdf
[16] https://www.gov.scot/publications/saltire-tidal-energy-challenge-fund/pages/additional-criteria/
[17] https://www.waveenergyscotland.co.uk/

Wave and tidal technologies have had access to all three CfD ARs to date, but are yet to win a single contract. This is mainly due to the transition from large-scale demonstrator to competing for CfDs being underestimated. We encourage government to consider different forms of support focused on factories and supply chains, and focus on pre-commercial projects that bridge the gap between pilot and commercial projects by testing supply chains. This approach would assist wave and tidal technologies in making the transition to commercial readiness, therefore presenting the opportunity for price discovery through competitive CfD auctions. We reiterate that minima may need to be applied in early stages to build up a pipeline of projects that will generate the competition required to drive efficiencies in future auctions.

5. We welcome views on which areas of industrial potential the UK has specific strengths in. If there a natural pathway from one sector to another as we transition to a low carbon society? What particular strengths does the UK bring to the development of specific marine technology sectors or projects, and what opportunities and risks are present? What wider benefits to UK, or to particular regions, do you expect to emerge from particular technologies?

It is well known that the UK is leading the world in the deployment of fixed offshore wind (9.9GW[18]) with a 34% share of global offshore wind installed capacity (29.1GW[19]) at the end of 2019. As a pioneer of fixed offshore wind, the UK has built up a wealth of research and expertise. This, combined with a long-standing strength in deep offshore infrastructure from historic oil and gas exploration, creates a natural pathway from the UK to lead on FOW deployment. It is key that the UK pursues FOW deployment through the 2030s to secure internal investment from the sector and avoid losing out to competitive markets abroad. Energy UK would welcome government setting a FOW ambition in the upcoming Energy White Paper.

Another strength the UK possesses lies in the coastal infrastructure which was built to support oil & gas and fishing industries. These sectors are now in decline, but there have been examples of regeneration in recent years as the offshore wind industry has breathed new life into coastal regions providing new jobs for skilled workers, training local apprentices and investing in the local community. Marine energy in GB has the potential to contribute to the Government's levelling up agenda, providing local jobs and investment to communities across the nation.

6. We welcome information on the potential development of the supply chain. What activities can be undertaken as part of the development of early projects to further strengthen the supply chain for marine technologies? Are there opportunities for early knowledge sharing and standardisation in the industry, and how could they be maximised?

Energy UK supports the commitment in the OWSD to pursue 60% UK content in the offshore wind supply chain. It is crucial that the UK capitalises on new supply chain opportunities to maximise internal investment from emerging industries. We believe creating visibility of an order book and pathway will attract supply chains and therefore encourage government to provide as much forward clarity as possible in the form of technology targets, roadmaps and strategies. In our response to the summer consultation we call for a clear procurement strategy, noting that it would instil confidence in investors, the supply chain and reduce the likelihood of political disruption. All of which would increase the UK's chances of reaching its low-carbon targets.

The geographical spread of the marine resource can create opportunities for supply chains in new areas. FOW has development potential in areas that have not so far been able to progress fixed foundation offshore wind, such as Cornwall and South Wales.

There is also a major opportunity for the UK to develop an export market for marine technologies, building on the success of the UK fixed foundation offshore wind industry. The greatest export opportunities are likely to be in the development and application of novel technology and techniques that are specific to FOW, wave, or tidal, rather than in the components that use established engineering capabilities already in use in other sectors. It is important that government explores the different elements of supply chains,

[18] https://windeurope.org/wp-content/uploads/files/about-wind/statistics/WindEurope-Annual-Statistics-2019.pdf
[19] https://gwec.net/windsights/

identifies those that will deliver the highest inward investment, and then focuses on developing skills and expertise in these areas.

Looking at the patterns of seabed depth globally, FOW has the greater potential for global deployment, as few coastlines have the same large areas of shallower waters as the UK, where fixed foundation wind can be deployed. FOW, tidal ad wave energy are at a relatively early stage and international supply chains have not yet developed. The UK has an opportunity to move early and establish itself as the global leader in these technologies, and enjoy the associated benefits from exporting expertise to the significant global demand that is likely to come forward.