Scottish Renewables written evidence to the House of Commons Environmental Audit Committee inquiry into Technological Innovations and Climate Change: Tidal Power

About Scottish Renewables

Scottish Renewables is the voice of Scotland's renewable energy industry. The sectors we represent deliver investment, jobs, social benefits and reduce the carbon emissions which cause climate change. Our members work across all renewable energy technologies, in Scotland, the UK, Europe and around the world. In representing them, we aim to lead and inform the debate on how the growth of renewable energy can help sustainably heat and power Scotland's homes and businesses.

Executive Summary

Scottish Renewables welcomes the opportunity to provide written evidence to the House of Commons Environmental Audit Committee inquiry into Technological Innovations and Climate Change: Tidal.

We believe that support for tidal stream technologies must be part of wider UK Government action to diversify the mix of low-carbon generation that can support a green recovery and just energy transition, while also helping open up routes to decarbonisation for other ocean nations. With global attention on the UK at COP26 next year the UK has an opportunity to demonstrate ambition for accelerating the commercialisation of marine technologies, which can be an example and stimulus for countries around the world.

Response to questions

What contribution can forms of tidal power play towards the UK's energy mix?

1. Tidal technologies, especially tidal stream, can support diversification of low-carbon electricity generation and offer a geographically-dispersed energy source, with projects in or able to deploy on the north and west coasts of Scotland, and the coast of Wales and England. The UK practical resource of tidal stream is around 15GW and projects have proven reliability of the technology, which is ready to scale up deployment[1].

2. Additionally, studies have shown an extractable resource of more than 6GW from 30 key tidal sites across all regions of the UK[2]. Currently, the UK has 1,084MW of leased tidal stream sites and 10MW of operational tidal stream capacity, that has generated well over 30GWh. There are some 508MW of tidal sites in Scotland, with a further 382MW of sites in Welsh and English waters under development. Tidal power offers the UK an ability to diversify generation, and using conservative projections offers cost reduction potential to below £90/MWh by 2030[3].

3. Estimations from National Grid suggest that total electricity capacity could increase from 110GW today to between 220 and 320GW by 2050, which will incorporate high levels of electrification[4]. This will require higher levels of storage and interconnection to complement a

[1] ORE Catapult, (2018). Tidal stream and wave energy cost reduction and industrial benefit. Available at: https://www.marineenergywales.co.uk/wp-content/uploads/2018/05/ORE-Catapult-Tidal-Stream-and-Wave-Energy-Cost-Reduction-and-Ind-Benefit-FINAL-v03.02.pdf
[2] Carbon Trust report (2011). Available at: https://www.marineenergywales.co.uk/wp-content/uploads/2016/01/CarbonTrustMarineResourceJune2011.pdf -
[3] ORE Catapult, (2018). Tidal stream and wave energy cost reduction and industrial benefit. Available at: https://www.marineenergywales.co.uk/wp-content/uploads/2018/05/ORE-Catapult-Tidal-Stream-and-Wave-Energy-Cost-Reduction-and-Ind-Benefit-FINAL-v03.02.pdf
[4] NationalgridESO, (2020). Future Energy Scenarios. Available at: https://www.nationalgrideso.com/document/173821/download

system which should be smarter and more responsive to fluctuations in supply. In this context, tidal stream could enhance the energy system with a highly-predictable generation and could be an excellent partner for other renewable technologies. This could provide an alternative energy source if North Sea wind is not viable.

4. While technologies such as wind and solar require the maintenance of backup capacity to provide power when wind is not blowing, or the sun is not shining, tidal stream power is predictable and consistent seasonally. This means that the operating cycle of a battery installed in a tidal stream technology is higher than in wind turbines and PV panels, which makes them more affordable. Indeed, including tidal stream in the energy mix combined with staggering of peak times around the UK coast, tidal and storage present an excellent opportunity to help satisfy demand at low cost by 2050 using renewable sources.[5].

5. In addition, tidal generation could contribute with local power generation to reduce expensive transmission networks. Some studies suggest that islands and remote coastal areas face challenges to meet their energy needs and ocean technologies could be an excellent option for these markets. Also, coastal areas tend to coincide with good resource potential for tidal technologies and these could face fewer difficulties to compete with more mature technologies[6]. In fact, Scotland has recognised that in some remote Highland and island areas, ageing infrastructure has raised concerns about grid strength, which has been exacerbated by increased electricity demand. Tidal stream could provide a predictable, low-carbon, local energy source that would be cheaper to build and operate, and environmentally sustainable.[7].

Why, despite the considerable marine resources available, have relatively few developers established tidal projects?

6. Today, there are 22 tidal stream developers in the UK[8]. However, unlike more established industries such as offshore wind there are no large-scale developers in the market. These numbers do show that there is a growing market for tidal stream with a high potential to create a national manufacturing industry. This could also open an opportunity for creating green jobs in a sector where the UK is a global leader.

7. The UK has strong maritime history and has demonstrated global expertise in marine energy projects. UK is home to the first tidal stream arrays in the world and has already deployed more wave and tidal energy devices than the rest of the world[9]. In recent years many tidal stream projects have made significant progress towards commercialisation.

8. SIMEC Atlantis' four-turbine 6 MW MeyGen project had produced 35GWh of generation, with maintainability also demonstrated through recovery and reinstallation operations. An innovative subsea hub is being installed to simplify inter-array cabling with grant support from The Scottish Government.

   Nova Innovation's Shetland array continues to operate with turbines accumulating over 20,000 hours generating power to the grid. With a fourth turbine installed in 2020 integrated with a Tesla battery system the turbines are now able to provide continuous power to the local grid.

[5] ORE Catapult, (2019). Tidal stream: opportunities for collaborative action. Available at: https://ore.catapult.org.uk/wp-content/uploads/2019/05/Tidal-Stream-Opportunities-for-Collaborative-Action-ORE-Catapult.pdf
[6] OES, (2020). Ocean Energy in Islands and Remote Coastal Areas. Available at: http://www.policyandinnovationedinburgh.org/publications.html
[7] ORE Catapult (2019). Tidal stream: opportunities for collaborative action. Available at: https://ore.catapult.org.uk/wp-content/uploads/2019/05/Tidal-Stream-Opportunities-for-Collaborative-Action-ORE-Catapult.pdf
[8] EMEC, (2020). Available at: http://www.emec.org.uk/marine-energy/tidal-developers/
[9] Marine Energy Council, (2019). UK Marine Energy 2019: a new industry. Available at: https://www.scottishrenewables.com/assets/000/000/427/uk_marine_energy_2019_original.pdf?1579622626

Orbital Marine Power saw over 3,250 MWh of electricity generated by the SR2000 at the European Marine Energy Centre (EMEC) in Orkney. Building on the success of the SR2000 Orbital are currently in the process of manufacturing their 2MW O2 turbine to replace the SR2000 at EMEC early next year. The O2 incorporates key innovations and lessons from the SR2000 that, on a like-for-like basis will enable a 35% improvement in yield at EMEC.[10]

9. Some studies suggest that the UK has around 50% of Europe's tidal energy resource for tidal stream and show that a total of 20.6 TWh per year could be extracted from 30 key tidal stream sites in the UK[11]**.** The UK's strengths in this sector include cabling and substations, turbine blades, operations and maintenance, as well as costal and offshore engineering skills from existing sectors such as the oil and gas industry and offshore wind[12].

Are there certain locations where one type of tidal technology is best suited?

10. Tidal stream technologies have been deployed at full scale in locations around the UK, with a strong focus at Scottish sites around Orkney and the north Scotland coastline. The sector has delivered a number of first array projects and through these generated more than 30GWh of power into the GB grid. The sector is building its experience and seeking to grow to develop and deliver larger-scale projects.

11. The below map shows the tidal stream projects across the UK. The demonstrates that many of the best locations for tidal stream are in the north and west of Scotland.

Tidal Stream projects in the UK. Source: Renewables UK[13].

How could financial support be structured to assist technological and project development in this area?

[10] Orbital Marine Power, (2020). Available at: https://orbitalmarine.com/news/press-releases/170-orbital-marine-power-takes-final-lessons-from-sr2000-tidal-turbine
[11] Carbon Trust, Black & Veatch (2011) UK Tidal resource and Economics Study. Available at: https://www.carbontrust.com/media/77264/ctc799_uk_tidal_current_resource_and_economics.pdf
[12]BEIS Research Paper number: 2019/033, (2019). Energy Innovation Needs Assessment. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/845665/energy-innovation-needs-assessment-tidal-stream.pdf
[13] Renewables UK Database. Available at: https://www.renewableuk.com/page/UKMED2

12. Scottish Renewables welcomed the recent government response to the consultation on proposed amendments to the Contract for Difference (CfD) system, which sets out 3 pots for the next year's CfD allocation with a new pot for offshore wind. The pot structure includes Pot 1 for established technologies such as onshore wind and solar PV, Pot 2 for less established technologies such as biomass with CHP, floating offshore wind, geothermal, remote island wind, tidal stream and wave and a Pot 3 for offshore wind.

13. CfD still presents a disadvantage for tidal stream projects as it would still be difficult for tidal projects to compete against remote island wind technologies. We recommend reform of CfD which will allocate sufficient capacity to Pot 2 in future CfD auction rounds, along with the use of a technology-specific minima for tidal stream of 100 MW at a £250/MWh strike price. The creation of a technology-specific minima will ensure the CfD auction delivers the cheaper established technologies in Pot 2 without increasing the clearing price to a level necessary for supporting tidal stream.

14. Today there are 1GW of tidal stream sites under development. 124MW of these sites are in an advanced stage of development in Scotland, Wales, and England, preparing to bid into AR4, and each subsequent auction round thereafter. To secure a global lead, export, reduce the down cost of energy to below £90/MWh and provide economic benefits across the country, the tidal energy sector requires a minima of 100MW to be established within AR4. A 100MW minima is a credible way of managing the uncertainty in the project pipeline whilst supporting the business targets for those whose projects are in development. To help ensure the build out to this level of this 100MW of tidal energy within AR4 an Administrative Strike Price of £250/MWh would be appropriate.

15. We also recommend supporting technology developers for smaller wave and tidal projects. Industry has proposed introducing an 'Innovation Power Purchase Agreement' (IPPA) which can be used to support technology developers to deliver projects of up to 5MW whilst protecting consumers from costs by providing off-takers a tax rebate when buying marine energy. This would allow marine projects to sell their power over the market rate, with the off-takers reclaiming excess costs against tax, with this cost declining over time. The sector has been in dialogue with the Department for Business, Energy and Industrial Strategy on how this model would be implemented and looks forward to continuing this discussion outside of the consultation.

16. Alongside larger generation and transmission, small-scale community and locally-owned projects have an important role to play in reaching net-zero targets. These projects offer significant benefits to local communities including job creation, income for local infrastructure and support to local businesses. Creating a pot for technologies under 5MW could encourage not only greater diversity in the technology mix but also in ownership, as community and locally-owned projects would be able to compete.

17. It is also important to recognise the huge role that innovative funding plays in the development of our leading renewable technologies, and the reality that much of this has been sourced from EU programmes. For instance, the Marine Energy Council estimates that over £200 million has been provided for marine renewables over the last four years. It is vital that following once the UK withdraws from the UK, research and development funding steams remain comparable in scale so that the UK's lead in so many areas of energy transition and cost reduction is not lost.

How might tidal schemes reduce costs to become commercially competitive with other low carbon or renewable options?

18. Cost reduction will come from economies of scale and volume, accelerated learning and innovation. In particular an ability to grow a market offers an opportunity for manufacturing at volume for a number of companies, as well as the ability to scale projects and develop large sites with opportunities for cost reduction, for example lower development and infrastructure costs per MW developed. These factors are clear and generally shared across different innovations and technologies.

What are the environmental impacts of tidal schemes and how can these be minimised?

19. In general, environmental impacts of tidal stream technologies are associated with the natural variability of sedimentary process, the impact of the blades on marine mammals and the effect of the noise from the tidal turbine on mammal's behaviour. This is a topic still under research, but current ongoing projects have already provided valuable information to minimise the environmental impacts of these devices. This information can assist marine energy developers in developing engineering, siting, monitoring options and operational strategies for tidal projects to minimise encounters with marine animals and minimise the amplitude and/or change the frequency of sound from their devices to mitigate effects on marine animals[14].

What are the wider economic benefits and what potential disadvantages could tidal schemes bring to regional areas?

20. Some studies suggest that the economic benefit of tidal stream could achieve net values of £41.5bn GVA and a 7:1 ratio of benefit to industry support from 2030 to 2050. Almost half of this GVA comes from the UK supply chain exporting to projects overseas. These values were obtained assuming that the technology achieves cost parity with a LCOE of £90/MWh by 2030[15]. Previous studies have already suggested that tidal stream has the potential to achieve cost reduction of around £90/MWh for 1GW of capacity installed, with net cumulative benefits to the UK of £1,400m and with the potential to create 4,000 jobs by 2030[16]. Therefore, with the correct support tidal stream could provide significant economic benefit to the UK.

    In addition, recent reports have shown that the UK could capture £76 billion of the potential global market for wave and tidal technologies and the country could also maximise its potential securing the existing supply chain, which has already had investments of £450 million, primarily from the private sector.

    The UK has a potential growing export sector in marine energy. The UK marine energy supply chain already exports to countries such as Canada, France, Portugal, USA, China, Chile, Japan, South Korea and the Philippines. Moreover, EMEC has exported its knowledge to 18 countries since 2003 and generated £249.6 million (GVA) for the wider economy.[17] In this context, support for export finance will be highly welcome in the sector.

[14] OES & IEA, (2013). Environmental Effects of Marine Energy Development around the World. Available at: https://tethys.pnnl.gov/sites/default/files/publications/Final-Annex-IV-Report-2013-v2.pdf
[15]Policy and Innovation Group, The University of Edinburgh, (2019). Wave and Tidal Energy: The Potential Economic Value. Available at: http://www.policyandinnovationedinburgh.org/uploads/3/1/4/1/31417803/uedin_wave_and_tidal_energy_the_potential_economic_value.pdf
[16] ORE Catapult, (2018). Tidal stream and wave energy cost reduction and industrial benefit. Available at: https://www.marineenergywales.co.uk/wp-content/uploads/2018/05/ORE-Catapult-Tidal-Stream-and-Wave-Energy-Cost-Reduction-and-Ind-Benefit-FINAL-v03.02.pdf
[17] Marine Energy Council, (2019). UK Marine Energy 2019: a new industry. Available at: https://www.scottishrenewables.com/assets/000/000/427/uk_marine_energy_2019_original.pdf?1579622626

Tidal stream has the potential to generate high quality, highly-skilled jobs across the UK in maritime and peripheral regions. These jobs would be distributed across the UK, with significant opportunities for Scotland along with an indigenous supply chain located throughout the country.

In that regard, the marine energy sector can support the UK Government's levelling up agenda within post-industrial and maritime communities. Due to the UK's marine environment and heritage, it is uniquely positioned to support and develop UK companies as part of the global marine energy supply chain.

Furthermore, considering the current climate, strategic support for this sector would help deliver three key Government objectives – a boost to UK manufacturing and jobs; practical application of the 'Green Transition' as a route to post-pandemic recovery and a major exporting opportunity in technologies where the UK currently leads the world.

December 2020