Chairman,
Environmental Audit Committee,
London

15th December 2020

The Environmental Audit Committee [EAC] Call for Evidence on tidal power.

Dear Chairman,

Please find attached the submission to the EAC call for evidence from the British Hydropower Association through our Tidal Range Alliance working group.

The BHA is pleased that the EAC has launched this Call for Evidence as we believe that tidal range energy can offer a significant contribution towards regional, as well as national, Net Zero targets. This Net Zero target of 2040 has now been set and the 9 potential tidal range projects, listed in our submission, when built, will make a significant contribution to helping meet that target.

In addition, an attractive advantage of tidal range is that its power intermittency is short, about 2-3 hours depending on the spring/neap cycle. A combination of a number of tidal range schemes could provide near continuous energy output, as a result of the difference of 3 to 4 hours in tide times.

A tidal range scheme can also store and release energy – by moving generation up to an hour can match demand peaks more closely.

Tidal range projects are long term. They are designed with an operating life of at least 120 years and offer significant multi-generational benefits. Other forms of low-carbon energy typically need rebuilding every 25 to 40 years, as well as being expensive and challenging to decommission.

The BHA and TRA look forward to working with the EAC to ensure that tidal range cements its place in the UK future energy mix.

Yours sincerely

Simon Hamlyn
Chief Executive Officer
British Hydropower Association

Henry Dixon
Chairman
Tidal Range Alliance

The Environmental Audit Committee [EAC] is inviting evidence on tidal power as part of its Technological Innovations and Climate Change inquiry.

The Tidal Range Alliance/British Hydropower Association

The Tidal Range Alliance (TRA) is a formal Working Group within the BHA, bringing together developers, companies, supply chain businesses and individuals involved in or with an interest in tidal range energy projects in the UK and overseas.

The British Hydropower Association is the leading trade membership association solely representing the interests of the UK hydropower and tidal range industry (from micro to large-scale) and its associated stakeholders in the wider community, both in the UK and overseas.

Executive summary

a) Security and scale of supply

- "fuel" is free and the source of supply is controlled, so is not subject to political uncertainty;
- UK needs broad energy mix to meet challenges of next 50 years and one tidal range station equals many offshore wind platforms.

b) System benefits: reliability and predictability of supply

- Tidal energy can supply predicted power which wind and solar cannot.
- This is a 'known technology' unlike new nuclear, SMRs etc.

c) Coastal protection vs rising sea levels/wave energy/storm surges

- The benefits of including tidal range developments in flood prevention programmes are clearly laid out in this response.
- Reduced flood-risk insurance premiums for communities protected by impoundments

d) Contribution to CO2 targets

- Tidal range contributes c. 2M tonne per large scheme p.a. or 200 million tonnes over lifetime.

e) Social licence
   - Popular with most audiences/demographics/voters including local government
   - Reduced flood-risk insurance premiums for communities

f) Social benefit

   - Economic regeneration, skilled jobs in economically challenged areas
   - Potential to stimulate/support additional associated industries: tourism, aquaculture, housing etc.
   - Creation of a benign recreational regime where these are not present now
   - Creation of a UK industry for turbine manufacture as the market grows
   - PPA's with Local Authorities which fix power costs for many years to come. This at a time when the cost of power is increasing, and Local Authority budgets remain under pressure.

g) Environment

   - Schemes can bring positive environmental benefits by close liaison with stakeholders and regulatory authorities
   - Acreage and approach can offer marine reserves/protected zones

h) Contribution to grid stability

   - Large potential power system response from each scheme
   - Inertia, voltage and frequency control etc.

i) Value for money

   - The best sites offer significantly better performance than Swansea Bay
   - 100+ year life and fuel is free, with relatively low O&M costs
   - Land capture value e.g. North Wales scheme will make additional 500+ hectares available for development

j) No decommissioning.

   - Once in place, contribution of sea wall to coastal defence will enhance its value.
   - Once a scheme is built, it is built and in place for 100+ years. Wind farm environments will be damaged every 20 years as new foundations

The EAC is inviting written submissions to inform its forthcoming session. These should focus on, but not be limited to:

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

The government is committed to net zero emissions by 2050. The National Grid System Operator has estimated that generation capacity will have to double by 2050. Around two thirds of existing power stations are expected to close by 2030.

The UK is an island that is blessed with having the 2nd highest tidal range resources in the world. These should be harnessed to ensure that electricity supply meets future demand and profits from the predictability, reliability and system benefits offered by tidal range to support intermittent and less reliable energy from wind and solar.

That is why tidal range projects in development offer an achievable 10 GW installed capacity, delivering over 20TWh/y (~ 5% of UK energy use). There is scope to expand this capacity significantly, with one scheme alone having the potential for a further 5GW capacity and other tidal range project sites around the UK already identified, which would mean that 20TWh/y could be available by 2030 or soon after.

A significant advantage of tidal range is that its power intermittency is short, about 2-3 hours depending on the spring/neap cycle. Because the sun and moon cycles are effectively fixed, tidal range outputs are entirely predictable years many ahead.

There is scope for varying the timing of power output by up to about half an hour by generating at times when the starting head is less than the optimum, albeit with some loss of total energy output.

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

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

In the majority of cases, the west coast of the UK is most ideally suited for tidal range schemes.

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

For energy sources, such as tidal range schemes, that have a very high capital cost and long construction period, *"The cost of capital is so dominant that it can explain as much as almost half the costs of a project."*[1]

The Department for Business, Energy, and Industrial Strategy (BEIS) has issued a consultation paper on using the Regulated Asset Base (RAB) method for funding nuclear development and has raised the possibility of applying the RAB method to other energy generation systems; "*We are also considering whether a RAB model could be applied to other firm low carbon technologies such as transport and storage infrastructure for carbon dioxide*."

[1] Dieter Helm The Nuclear RAB model. June 2018 page 3

Currently there is no allocation of CfD funding to tidal range and insufficient government support to raise the funding to develop the schemes.

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

Unit energy cost can be reduced by increasing the energy output, decreasing the capital and operational costs, and reducing the financing costs, which, on a large, long construction period scheme, can be substantial.

Regulated Asset Base funding, for example, can mean that the risk of such low probability/high impact events can be borne by the taxpayer and scheme income can be provided from the start of construction. On the Thames Tideway tunnel RAB funding reduced the household water bill from £75/year to £25/year. RAB is currently being examined by BEIS for nuclear projects. RAB funding could make tidal range schemes cost competitive with other forms of energy.

There have been significant advances in tidal range power generation technology since the last full assessment in 2011, providing an uplift of approximately 30% extra output, substantially enhancing the industry's financial model and value for money:

- Net benefit of pumping, depending on allowable tidal range - 10% increased output
- Artificial Intelligence (AI) optimisation of turbine start and finish heads for each tide - 7% increased output.
- Triple regulated turbines with non-synchronous generators - 10% increased output.
- Traditional tidal range operation, such as for the Severn Barrage in the DECC 2010 feasibility study, was based on ebb only generation, ie two pulses of power each day. This resulted in about 7 hours power gap. Operation now proposed is ebb/flood generation which provides four power pulses each day with power gaps of about 2 hours for spring tides and about 4 hours for neap tides. This also reduces peak power and tidal range generation which is more even and more acceptable to the grid.

Construction methodologies and techniques have also changed. The widespread adoption of floating caissons for deeper water in tandem with traditional embankments offers faster (reducing finance costs) and cheaper lagoon and barrage wall build costs (estimated at 10%).

In addition, the imposition of a Treasury optimism bias of 30% in previous assessments (a standard addition on public sector procurement cost estimates) needs removing. Tidal range schemes are projected to be driven by the private sector scheme with assessed contingencies so little or no optimism bias should be applied.

Compared to the DECC 2010 Severn report, energy output improvements are estimated to be 25% higher with potential cost reductions of over 20%.

These improvements make previous assessments in 2010 and 2011, upon which much government policy is based, no longer accurate.

We believe that the cost of energy should reduce by about 50% compared with the original Swansea bay scheme. This is borne out by the ratio of capital cost to

energy, £1.3bn/0.5TWh/y = 2.6 at Swansea and £8.5bn/6.5TWh/y = 2.3 at North Wales Tidal Energy [NWTE]. Other large tidal schemes show a similar reduction.

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

Current schemes are focused on mitigating any loss of intertidal habitat that had been seen with previous schemes such as the Severn. The adoption of triple regulated turbines, which can pump and generate efficiently in both directions means that natural tidal amplitudes can be replicated. In addition, these larger, slower turbines also have fewer blades with rounder profiles for low impact on fish passage through them.

Tidal range projects that protect coastal communities also shield the natural world from the damages caused by storm surges and rising sea levels. Protected waters, nesting sites and sand dunes will be defended, while migration routes for birds and fish will be carefully safeguarded.

The more efficient turbines can also be used as pumps. A greater amount of energy can be obtained by pumping up near high water and down near low water. Whilst this uses input energy this is against a low head difference whereas the pumped water generates energy with a much larger head difference, thus resulting in a net energy gain. The result is that any lagoon tidal level can be maintained.

In some examples this would result in increasing inter- tidal habitat under lower tidal range conditions. This would replace the small area of intertidal habitat lost due to the footprint of the lagoon wall crossing the intertidal area.

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

Unlike other renewables, tidal range projects offer significant non-energy benefits and a system wide analysis is required to determine the full value of their creation.

Many tidal range schemes are planned in areas such as North & South Wales - Somerset and the North West where the coast is liable to the impact of storms, waves and tidal surges – a threat that is increasing due the effects of climate change.

Only small, wind driven waves will build up behind the impoundment, greatly reducing potential coastal erosion. Tidal surges can be controlled by the wall and sluices ensuring, on the rare occasions when external storm surges do occur, that the basin water level is controlled, allowing river waters to void into the lagoon basin and reducing storm impact on the coast.

Tidal projects will have benign impact on property insurance for houses and businesses affected by flooding and liberating extensive acreage for development (e.g. 500 Ha freed up by the North Wales Tidal Lagoon).

Barrages can also provide a structure for new transport links, such as that proposed in Hull and the Morecambe Bay and Duddon tidal energy schemes.

The design life of a tidal range scheme is typically about 120 years, with actual life possibly double that figure. Critically, the design proposed for many schemes allows for sea wall height increase (needed to combat rising sea levels) and

technology/turbine overhauls and updates (every 25/30 years) to be carried out cost-effectively.

This lifespan compares favourably to other low-carbon energy sources; the lifecycle of a nuclear plant may span 40 - 60 years whilst off-shore wind farms are expected to last 20 to 30 years.

The massive potential carbon reduction savings and increased electricity generation, not to mention job creation and infratsructure improvements, that can arise as a result of developing tidal range power projects cannot be ignored. The BHA supports and encourages the development of all these types of schemes.

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