TIDAL ELECTRIC LIMITED

Dear Mr Hendry

28th July 2016

Please find our submission enclosed which we summarise below. We have tried to remove the passion we feel for our proposal and rely simply on facts to build our case.

Tidal-range power plants could be a major contributor to the UK energy portfolio because the technology is proven and offers predictable (base-load) power with a 'near-zero' marginal cost of production.

Additionally, tidal range plants can act as batteries, storing power (sourced from unpredictable sources such as wind or solar, or low value sources, such as nuclear at night when demand is otherwise very low) for release later. They could also play a role in grid balancing.

Unlike tidal stream, where the technology is emerging, tidal range utilises low-head turbines that are well developed – almost 'off-the-shelf' pieces of kit.

Given the predictability of power, why have tidal-range projects not already established themselves in the market?

The first reason is uncertainty about the cost of production.

The costs of all hydro plants (like wind and solar technology) are front-end loaded so the resulting cost of electricity is sensitive to build costs, dictated by the design adopted:

1. **Barrage**

Barrages have been around for a very long time but no new barrage has been built (other than for research purposes) since La Rance (in 1966) because of the environmental damage they cause. The most recently commissioned plant is in SIHWA (2014) where an existing (anti-submarine) barrage was pierced to allow the contaminated water in the lagoon to be flushed out to sea by the tide and allowing power generation as the tide retreats.

One of the consequences of the environmental damage caused by the barrage design is that despite having been designed for bi-directional generation, barrages predominately generate only on the ebb of the tide (La Rance experience is 60% ebb and 4% flood generation *[1]) yielding a 24% load factor. As such they are expensive white elephants.

2. Russell lagoon

The Russell lagoon is essentially a barrage without a river flowing through it – it still joins coast to coast. As such the inherent (costly) problems are:

a. Accessibility requires the human interface to be managed: either 24x7 policing to stop public access or alternatively amend the design (for the containment of the water) to become a tourist attraction. Both solutions add cost.

b. By encompassing the inter-tidal zone within the lagoon damage is caused. Parson Brinckerfoff in their report to DECC May 2010 concluded [*2] that the need for (i.e. cost of) reparation (assuming a suitable site could be found) might be substantially negative to the project.

c. Sediment drops out of seawater in inverse proportion to the depth of the water. Given that the depth drops to zero where the sea meets the shore, the shoreline is the point where maximum siltation occurs. In this lagoon design there is always a shore line! As with the barrage, it is questionable whether Russell lagoons can operate on the flood tide without exacerbating siltation.

The most recent example of this Russell Lagoon is the project being promoted by Tidal Lagoon Swansea Bay.

3. Ullman Offshore lagoon

This proprietary design is un-connected to the shore (and as a result is inaccessible) and is always wet (so avoiding damage to the environmentally-rich inter-tidal zone and minimising siltation). We are currently undertaking a (re-)feasibility analysis of a proposed 200MW site in the Solway and have commissioned ARUPs to that effect. We expect their first draft outline report in October this year, and would be happy to share the Executive Summary with you.

Additionally, there is a novel application of the technology that would smooth out (although not entirely remove) the intermittency: *see attachment 4 below*.

We believe we could build the Ullman Offshore Lagoon for around £1.5-2m/MW capacity. We believe this design offers the lowest Levelised Cost of Energy…..but then we would say that wouldn't we? The Solway feasibility study will give us proper insight.

The second reason is uncertainty about the quality of the buyer and the implication on financing.

Assuming a good credit quality buyer (not currently universally present for the commercial parties interested in buying the power) these power plants could enjoy high levels of project-debt financing (approaching say 80%). However, such aggressive financing will only develop with the successful development of a number of plants proving the value of the power-delivery predictability. We are planning for our first site in the Solway (assuming it is the first to be built) will be financed 50% debt and 50% equity on the basis that the credit quality of the revenue counterparty is unquestioned.

The current structure whereby the new ministry of BEIS (replacing DECC) is effectively the counter-party for the initial life of the plant solves this problem.

The third reason is uncertainty about the price the power can be sold at.

The previous ROC regime presented too much uncertainty.

The current CfD regime, offering a fixed price (above the volatile and floating wholesale market price) for the initial life of the plant, solves this issue. The question is at what price and for how long would this subsidy be required?

Note that

(i) Larger plants are inherently cheaper than smaller ones (because of the physics of the ratio of circumference – i.e. cost – and volume – i.e. power); and

(ii) plants that enjoy higher levels of debt, being cheaper than equity, would be viable with lower electricity pricing; and

(iii) long CfD contracts are not effective in supporting the build/don't-build decision because the effect of discounting to the present (decision) day means any support after say 30 years is immaterial to the return assessment conducted by the financiers. In other words, if the project won't work at a certain CfD for 30 years it won't work by extending the contract to say 50 years (or longer).

We have told DECC that a CfD of £100/MW for 15 years (or a lower sum for slightly longer e.g. £92 for 25 years) would yield the sort of returns necessary to attract the construction capital (once planning approval is achieved) for our site in the Solway.

The fourth reason is uncertainty about the process.

Government has to-date confined its support to renewable technology to the off-shore wind and solar sectors and to providing R&D funding to emerging technologies such as tidal stream and wave power. The indifference, and at times downright hostility, to the tidal-range sector has inhibited development to-date. We very much hope the outcome of your report will be a change to this attitude.

No doubt some of the reasons for this previous stance are the risks/concerns for the Government in offering support such as

1. What happens if the project is abandoned (during construction and separately while the support contract is still in place)?
2. How should financial support be structured for such long-life assets, given the pace of technological change and the future embarrassment potential?
3. Will the first project be just a 'one-off project' or can tidal-range power develop into a product offering, able to exist without on-going Government support and with a local supporting supply chain offering export potential?

4. Is there value being an early adopter or is it better letting other countries suffer the cost of R&D that will reduce the price for later adopters (as said previously by a senior executive of DECC "*the tides will always be there*…")?
5. Does intermittency of supply cause a problem for the grid and are there ways to mitigate this issue?
6. How does Government, having subsidised the development in the first place, prevent the developer from enjoying super-profits for the remaining asset life?

We have suggestions for all these issues we are happy to discuss.

The risks for a developer in starting a project can be summarised as assessing the probability of

(a) getting planning consent

(b) getting a suitable grid connection

(c) getting an affordable lease from the Crown Estates

(d) getting an acceptable CfD from DECC

(e) getting encouragement from Government

See the attachment 5 below.

Planning is clearly an issue all of its own.

National Grid and Crown Estates are generally open for discussion in advance of a project being committed: they obviously have to wait to see the specifics but have been happy to engage with prospective developers early in the process.

The Government could give comfort on the other issues to prospective developers with clear guidance on what might be achieved so as to encourage developers to commit the risk capital required to start projects down the road to development, construction and power delivery. Specifically, as a developer, we would welcome the following approach by Government:

1. **Separate the energy-support-budget from the "other benefits"-support-budget**. Many of the projects being considered (as discussed in the Cardiff seminar) offer some ancillary benefits that derive from the long-life of the assets – e.g. shore protection; flood defence, tourism etc. If a project cannot be viable with just the energy-support the developer should be encouraged to go to the other Government departments responsible for that issue – e.g. the Ministry for the Environment for flood-defence – to get the additional budgetary support they require from that department rather than the Ministry for Energy.

   The energy-support can be of limited duration because all energy projects (of all competing technologies other than nuclear) can be assessed over a 25-30year duration.

   Rolling multiple support into one pot confuses the issue: long life-time support may well be required for an infrastructure project but a long-life support that purports to

be an energy subsidy will be open to embarrassment with hind-sight (that can no longer remember the complexity of reasons behind the need for the subsidy when it was granted).

2. **Set out the level of the energy-support-budget in advance.**

   For example, (and with figures plucked out of the air as an example only) if the Government would commit to enter into contract for fixed amounts [*3], and keep the industry advised of the volume of contracts committed to, then developers could plan their capital commitments in advance, taking account of the fact that a project will take at least 5 years from inception to delivery.

   (Note in this example the different prices over 15 or 25 years offer roughly the same returns at the build/no-build decision point).

Ist Delivery	Total TWh p.a.	15 year price / MWh	25 year price / MWh
2019	10	£100	£92
2020	10	£100	£92
2021	10	£100	£92
2022	10	£100	£92
2023	8	£85	£77
2024	6	£80	£73
2025	4	£75	£68

**1: Source ebb/flow stats http://www.british-hydro.org/downloads/La%20Rance-BHA-Oct%202009.pdf slide 14*

*[*2]:https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/50069/2._SEA_Environmental_Report.pdf page 165*

*[*3]: Renewable power delivered to the grid Q1 2016 was 23.2 TWh (source: DECC Energy Trends 2016 report)*

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In this submission we attach

1. The Executive Summary of the Atkins feasibility study we conducted when we were looking to develop a 60MW plant in Swansea Bay. The full report is available for your team to read if they wish but we are not prepared to submit it because of your requirement that all submissions would be available for publication.
2. The scope of the ARUPs feasibility report (that we hope will revalidate the Atkins study) commissioned for the Solway. This report, the early draft being due in October 2016, will also benefit from a peer review from ABPmer and Geoisca concerning the critical geotechnical and sediment transfer (and siltation) issues.
3. The original patents issued in 1995 that support our proprietary technology.
4. An example of electricity delivery that mitigates against the intermittency problem through novel application of our offshore technology. Note, this simulation was run for our proposed 60MW plant in Swansea.
5. A Risk Assessment
6. Questions that need to be addressed in relation to the TLSB project. TLP have the most advanced project in this field. They have done a tremendous job in engaging with the local communities and the supply chain, and indeed PR generally. However, there are many issues with the project as proposed that have a high future embarrassment potential. We raise these issues from a concern that they might taint the industry in general rather than this project specifically.

We would be delighted to meet with you and your team to discuss some of these issues in greater detail, if you wish.

Regards

Amir Eilon .

Director