COMMENTS FROM THE NATURAL ENVIRONMENT RESEARCH COUNCIL IN RESPONSE TO THE SEVERN TIDAL POWER PHASE ONE CONSULTATION

1. The Natural Environment Research Council (NERC) is one of the UK's seven Research Councils. It funds and carries out world-class impartial scientific research in the sciences of the environment at universities and wholly owned NERC research centres.

2. Details of NERC's Research and Collaborative Centres and Major Programmes are available at www.nerc.ac.uk.

3. This response has been prepared on behalf of NERC by the National Marine Coordination Office at the National Oceanography Centre, Southampton (www.noc.soton.ac.uk), with additional input from the Proudman Oceanographic Laboratory, Liverpool (www.pol.ac.uk)

4. NERC welcomes the opportunity to respond to this consultation and we would like to play a full part in the ongoing process of exploring the feasibility of large scale renewable energy generation around the UK's coast.

Overarching questions:

1. Is the feasibility study taking the right issues into account?

1.1 Yes. The need to decarbonise electricity production in the UK is fundamental to achieving the very large reductions in anthropogenic CO_2 production that must be achieved if 'dangerous'[1] climate change is to be avoided. The Severn proposals, particularly the Cardiff-Weston barrage, can make a significant contribution to UK electricity production and serve as exemplars for further schemes in other parts of the world. The technologies may also be applicable to other estuaries in the UK.

1.2 Whilst some degree of local environmental change could be caused by the short-listed schemes, continued carbon production will also have a very significant impact on the Severn ecosystem – sea level rise from the melting of the Greenland or West Antarctic ice sheets will cause a far larger amount of habitat change than any of the proposed renewable energy schemes, and the barrage proposals in particular can be engineered to fulfill an additional storm-surge flooding protection role.

1.3 There are ways of managing the barrage operation with 2-way generation, delays and pumping which can modify the impact on the tidal range and reduce (although not eliminate) loss of inter-tidal habitat (see http://www.liv.ac.uk/news/press_releases/2009/03/river-barrages.htm for a report on the research by Engineers at the University of Liverpool which has looked into this and link to project website).

2. Are there other aspects or other evidence that should be taken into consideration?

[1] as defined by IPCC

2.1 In view of the high cost of Severn tidal power compared with civil nuclear fission power generation (104-317 £/MWh vs 38 £/MWh according to table 1, page 18 of consultation document), it is important that nuclear options are taken into account as possible alternatives if the environmental impact from, say, the Cardiff-Weston barrage is considered too great.

2.2 It is unclear if the stated low costs of nuclear generation in table 1 take into account full life-cycle and decommissioning costs of nuclear installations.

2.3 Given the 120+ year design life of the proposed structures, it is reasonable to assume that civil nuclear fusion power – currently subject to fast-track funding by the international research community including the UK Research Councils – could become available within the lifetime of the Severn tidal power scheme. Availability of essentially inexhaustible non-CO_2 emitting power from future fusion power stations (which could be located on the sites of existing fission plants on the Severn estuary) would change the economics of tidal power.

2.4 Security of energy supply is paramount for the UK. Diversity of supply (i.e. using all available renewable technologies) will help. Chapter 1 of the executive summary states that the proposed target is to supply 15% of energy from renewable sources by 2020. 15% of usage in 2020 will amount to more energy than 15% in 2009. For both these reasons we need to implement the largest of the proposed tidal power schemes.

3. Have we given due weighting to the different benefits and impacts under consideration in our analysis?

3.1 Since the analysis was carried out, the global economic situation has deteriorated and some of the assumptions may no longer be valid. For example, the need to provide employment and income for the construction industry has assumed a higher priority. Against that view the long time scale of the proposed schemes would place construction activity at a different point in the economic cycle.

4. Do you think that it is better to wait for new and perhaps less environmentally damaging technologies to be developed, or to move ahead more quickly with available proposals?

4.1 Given the very long lead-time on seeking planning approval, and the long time required to build some of the options, it could be reasonable to start now rather than risk waiting. However to radically reduce CO_2 output, a mix of tried and new technology is appropriate. Smaller schemes could be tried elsewhere e.g. Mersey.

4.2 Most of the short-listed schemes can be operated alongside new technologies – future tidal current turbines could also be installed in the Severn Estuary/Bristol Channel downstream of the short-listed schemes, and in some cases upstream or alongside them.

4.3 Areas elsewhere in the Bristol Channel such as Swansea Bay and Carmarthen Bay may also be suitable for tidal lagoons, with little or no impact on power generation by a barrage further upstream. Tidal stream energy systems could be well suited to locations such as Ramsay Sound (Pembrokeshire) with little or no adverse impact on schemes in the estuary. Liverpool Bay also offers potential.Wind turbines can be located on top of the surface structures under most of the

proposals, further increasing energy yield.

Regional Economic Impacts Study:

5. Do you agree with the conclusions of the DTZ study and are there any other factors that the feasibility study should be aware of?

5.1 As per answer to question 3, the economic impacts of such a major construction project could be more significant if the current recession is prolonged. However projects should not be built simply as job creation schemes, the same money may generate more jobs if allocated in other ways.

5.2 The need to achieve carbon reduction is so important that other considerations such as continued access to dock facilities upstream of any power scheme may have to be considered as secondary. Only the barrage options present significant access issues, and these can be overcome with suitable design. If accessibility increases costs of construction, commercial access beneficiaries could reasonably be asked to contribute to the additional costs.

5.3 Tourism or visitor access is not included in the current regional economic impact. Larger schemes such as Cardiff-Weston could be significant attractors to the area for visitors, particularly if there is access across the barrage. In terms of public 'buy-in' the civil amenity value of a barrage could be high – the structure can be designed to be attractive, with access over a spectacular vista of sea and shore. There are health benefits in encouraging walking or cycling access across the barrage, and business opportunities at either end.

5.4 The present Severn Tunnel is an item of Victorian infrastructure that is expensive to maintain and imposes restrictions on use of new rolling stock. Double-deck stacking of freight containers is not possible. This forces additional traffic onto motorways in South Wales and therefore has an impact of carbon footprint and ability of ports such as Pembroke Dock, Milford Haven, Port Talbot and Swansea to benefit from possible commercial opportunities to grow their container traffic.

5.4 If it is cheaper to add rail access to a barrage than to build a separate bridge or new tunnel, it could be reasonable to at least include foundations in the structure for future upgrade to carry a rail link.

Financing and Subsidy Mechanism:

6. Do you agree with PricewaterhouseCoopers' (PwC) analysis on ownership and delivery of a Severn scheme?

6.1 The analysis seems thorough.

7. Are there any other options for delivery or subsidy that should be considered? Would they be appropriate for all of the tidal power options under consideration?

7.1 Much depends upon the real-world cost of power delivery from tidal renewables versus other

forms of power. Fossil fuels may have to be phased out more quickly than expected to reach CO_2 targets, and nuclear options might turn out to cost more than expected once full decommissioning costs are taken into account. Subsidy could be of most help to the more embryonic technologies, as they may also form the basis of commercial systems intended for export, and require a period of 'proving' in the harsh environment of the Severn to build marketplace confidence.

8. Government believes that the private sector is best placed to design, build and operate a Severn tidal scheme. Government's role would be to set the conditions in which a scheme could come forward. Do you agree?

8.1 This will depend upon the ability of the private sector to secure long-term funding at reasonable cost. Public ownership is not necessarily a worse option than private ownership, but the private sector would be most appropriate as the contractors to build the Severn tidal scheme.

8.2 The merits of the scheme should not be judged by whether private-sector funding would be available. The government should not expect the private-sector to fund such schemes in their entirety.

Impacts on Energy Markets:

9. What are the impacts and potential risks of tidal intermittency on the balancing and energy market?

9.1 With a fragmented, privatised electricity generating industry the need for system balancing to match the intermittent nature of tidal power generation will require further investigation once the preferred power generating option(s) have been selected.

9.2 Fortunately tidal power is highly predictable – more so than wind – and this will facilitate long-term planning and use of the electricity interconnector with Europe, balancing output with the French nuclear electric capacity.

9.3 Investigation into options for energy storage such as pumped storage schemes could be incorporated either at the start, or as later additions to the project.

9.4 Please refer to the papers listed at the end of this input in which these issues are addressed in detail.

10. Is it worth considering exploring the option of demand management?

10.1 Yes. Industry that is electricity-intensive such as aluminium smelting could be attracted to the region by timing processes to take advantage of the peak outputs throughout the day.

11. Do you consider that a Severn tidal scheme could impact on investment in other energy supply capacity, and if so in what ways?

11.1 The grid infrastructure that will be developed in the area could attract other forms of renewable energy such as offshore wind, and marine current turbines downstream of the core

area.

11.2 Future nuclear capacity, including in the mid-life of the Severn tidal power scheme the eventual introduction of nuclear fusion power after 2050, could also make use of the grid infrastructure.

Short-listing Process:

12. *Do you agree with the factors that have been used to determine the short-list for further study?*

No comment

13. *Do you agree that the test of economic feasibility should be relative to the cost of other renewables?*

No comment

14. *Do you have any further comments on Parsons Brinckerhoff's Interim Options Appraisal Report? Please support your response with evidence where possible.*

No comment

Severn Tidal Power Proposals:

15. Do you agree that the two lagoon options selected for further study represent a good basis for studying the lagoons?

15.1 Yes. The two proposals offer the opportunity to see if they can generate sufficient power at reasonable cost to justify their construction. Even if they are not built, similar lagoons can be constructed at other high tidal-range locations such as Swansea Bay using lessons learned from this study. Other locations should be mentioned e.g. North Wales.

16. Given the short-listing criteria, are there any proposals on the short-list which are not suitable? Please support your response with evidence where appropriate.

16.1 The proposal with the least vision would appear to be the Beachley Barrage, which only saves 10% of the CO_2 that the Cardiff-Weston Barrage would save, and only generates 0.625 GW of power.

17. Does the short-list represent an appropriate level of ambition given the energy potential of the Estuary?

17.1 Of the short-list given, it can be argued that only the Cardiff-Weston Barrage presents an ambitious, visionary proposal able to capture public imagination and demonstrate UK leadership in tidal renewable energy. The other schemes are much smaller, contribute less to reducing the UK's CO_2 output, and could be built without much technical or financial risk. However they also

offer a reduced environmental impact.

17.2 If both tidal lagoons plus one of the small barrages were built (together costing approximately half the cost of the large barrage option) they would together generate less than half the Cardiff-Weston Barrage's power, and save less than half the amount of CO_2.

18. Are there any other schemes that, in your view, should be short-listed? Please provide appropriate evidence wherever possible and refer to the short-listing criteria.

18.1 The tidal fence and tidal reef options could offer promising results, particularly if they were combined with the tidal lagoons. They are not sufficiently developed technically at the present time, but based on discussions with offshore engineers via the Society for Underwater Technology (SUT) and Institute for Marine Engineering, Science and Technology (IMarEST) it is reasonable to believe that the engineering issues are not difficult to solve.

18.2 We welcome the announcement by DECC and the Welsh Assembly Government of funding to further explore these options outside of the Phase One consultation, and believe that in time these technologies could be incorporated elsewhere in the Severn estuary, Bristol Channel and many other locations around the UK coast.

18.3 It is reasonable to predict that within 20 years some form of marine current turbines will be an established part of the renewable energy infrastructure.

18.4 This is discussed in the references below. The energy obtained from current turbines will not match that from the barrage but may help with phasing issues. There may be maintenance issues with underwater equipment.

Strategic Environmental Assessment:

19. *Which plans, programmes or environmental protection objectives are most significant for this strategic-level environmental assessment?*

No comment

20. *Is there any additional information that could help supplement the baseline data? Any further information relating to the baseline indicators, existing problems and trends over time would be very useful.*

No comment

21. *Is there any important information that has not been addressed in view of the SEA scope?*

No comment

Next Steps:

22. *Do you agree with the work plan, as outlined in Chapter 6? If not please specify any other*

areas to be studied.

No comment

References:

Papers in press that are relevant to this consultation:

Burrows, R., Walkington, I.A., Yates, N.C., Hedges, T.S., Li, M., Zhou, J.G., Chen, D.Y., Wolf, J., Holt, J. and Proctor, R. 2009 *Tidal energy potential in UK waters.* To appear in Maritime Engineering, ICE Special Issue.

Wolf, J, Walkington, I.A., Holt, J. and Burrows, R. *2009 Environmental impacts of tidal power schemes.* To appear in Maritime Engineering, ICE Special Issue.
Burrows, R., IA Walkington, NC Yates, TS Hedges, M Li, JG Zhou, J Wolf, J Holt, R Proctor and D Prandle 2009 Tidal Power from the Estuaries of NW England. Coasts, Marine Structures and Breakwaters Conference, Edinburgh, 2009.

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