RTPI Cymru POLICY AND RESEARCH FORUM

30th November 2007

Severn Barrage – Briefing Paper

PRF0709 -

Report by the National Director

The Forum is asked to:

- To note the contents of the report.

Introduction

1. This UK Government and Welsh Assembly Government are promoting electricity generation through renewable sources. The construction of a barrage in the Severn Estuary has been proposed as a potential significant contributor to the UK's energy needs.

2. The purpose of this report is to provide the Forum with a briefing on the current position. The RTPI does not normally take a position on specific schemes. However, given this is a mega project, affecting South Wales, it is appropriate for the Forum to be briefed.

Background

3. It is anticipated that at least 10% of the UK's electricity could be generated using tidal resources (tidal stream and tidal range). Annex 1 sets out some background information on capturing tidal energy.

4. There are currently no barrages in the UK exploiting electricity generation through tidal resources, principally because of the high capital costs and concerns over environmental impacts. There are schemes operating in France (La Rance, near St. Malo on the Brittany coast) and Canada (Annapolis Royal tidal power plant at the inlet to the Bay of Fundy, Nova Scotia).

5. The Department for Business, Enterprise and Regulatory Reform will now consider the report, and where appropriate commission further studies. A Q&A section from the Department is provided in Annex 2.

Sustainable Development Commission Report

6. The Sustainable Development Commission (SDC) launched a report in October 2007, *Tidal Power in the UK*, in which it draws on extensive research and public and stakeholder engagement. The report concluded that a Severn barrage could generate just under 5% of the UK's electricity.

7. The report lays down tough conditions which a Severn barrage would have to meet for it to be considered sustainable. These are:

    - It must be publicly led as a project and publicly owned as an asset to avoid short-termist decisions and ensure the long-term public interest;

- Full compliance with European Directives on habitats is vital, as is a long-term commitment to creating compensatory habitats on an unprecedented scale; and
- Development of a Severn Barrage must not divert Government attention away from much wider action on climate change.

8. The SDC also stressed the importance of the active involvement of all parts of Government in the project, including the Welsh Assembly Government and the South West Regional Development Agency. This would be needed to ensure that work is fully integrated into regional economic and development plans.

9. In the press statement Jonathon Porritt, Chair of the SDC, said: "*The enormous potential for a Severn barrage to help reduce our carbon emissions and improve energy security needs to be balanced against the impact on the estuary's unique habitat, as well as its communities and businesses. This is why we believe that any development must be publicly-led as a project and publicly-owned as an asset, in order to ensure that the Government takes full responsibility for taking a sustainable, long-term approach*."

Current Options

10. A number of different barrage options have been proposed for the Severn Estuary. The SDC considered two in detail: the Cardiff-Weston scheme and the Shoots scheme (which would run near to the two Severn road crossings) (formerly known as the English Stones barrage). A summary of the data provided in the SDC report is given below.

	Cardiff-Weston	Shoots
Length of embankments	16.1 km	4.1 km
Generating capacity	8.64GW	1.05GW
Annual average electricity output	17TWh	2.75TWh
Contribution to UK electricity supply (2006 data)	4.4%	0.7%
Estimated cost of construction	£15bn	£1.5bn
Annual carbon saving	7.3 Mt of CO_2	1.18 Mt of CO_2

Potential Benefits

11. On the potential benefits of the two schemes, the SDC report: concluded:

- Electricity from a barrage would displace output from fossil-fuelled power stations, making a significant contribution to the UK's renewable energy targets;
- The variability in output from a barrage is not a major problem for the electricity grid and can be managed at very low cost.
- There would be substantial flood risk benefits from a barrage, but these are only marginal to the economic case for its construction;
- The case for new transport links over a barrage is unproven, and needs to be assessed looking at the net costs and benefits.

Compliance with environmental legislation

12. Compliance with environmental legislation is an underpinning condition for support for the barrage by the SDC. In considering the two schemes, the SDC concluded:

    - The Severn Estuary is a distinctive habitat that is protected by national and international designations – in particular, the EU Birds and Habitats Directives, which apply a series of tests to prospective developments.
    - A Severn barrage could lead to a loss of biodiversity, resulting in the need for a compensatory habitats package to maintain the overall integrity of the Natura 2000 network.
    - The EU Directives provide a clear and robust legal framework for achieving sustainable development and therefore compliance with the Directives is a central condition for a sustainable barrage.
    - Providing compensatory habitat would be a very significant undertaking on a scale hitherto unprecedented in the UK – but this would have to be an integral part of any barrage proposal.

Views from other organisations

13. A short web search has looked at the position of other agencies on the principle of a barrage; this was not a complete search. These are summarised below.

14. The Environment Agency, Countryside Council for Wales and English Nature (now Natural England) jointly prepared a position statement in 2006. The Agencies are all agreed that no-one should push ahead with plans for a barrage without carefully studying all its implications, including legal considerations. There should also be careful consideration of whether there are other, less damaging, ways of tapping the Severn's tidal energy.

15. WWF, RSPB and Friends of the Earth Cymru also issued a joint statement in 2006, stating a barrage will be "*totally inappropriate on grounds of its scale, cost, transportation, regional effects and environmental damage*". In response to the SDC report, Dr Mark Avery, Conservation Director at the RSPB stated: "*Its construction will cause the emission of ten million tonnes of carbon. Greenhouse gas savings will be substantial in the long run, but those savings could be too late to avert the damage of climate change. It would be far better to spend the £15 to £20 billion the barrage will cost on measures that will cut emissions more quickly. The Severn estuary is an irreplaceable refuge for wildlife and because of that, the SCD report questions whether a barrage across the Severn is the best way to spend that money."*

16. The Institute of Civil Engineers (ICE) has called for a commitment to a barrage in its Agenda for a Nation: An Assessment of Infrastructure in Wales, 2007. It states: "*Wales should commit to large-scale projects such as the Severn Barrage, which could harness enough tidal energy to generate 6% of English and Welsh demand and could be generating electricity as early as 2017*."

Annex 1 – Tidal power

Several types of device have been designed to capture tidal stream energy:

- Tidal stream turbines – These work on a similar principle to wind turbines and indeed may look quite similar. Both horizontal- and vertical-axis machines are being investigated, some with ducting/cowling around the rotor. The turbine may be coupled directly to a standard generator via a gearbox, or use an alternative power train design;
- Reciprocating tidal stream devices – These have hydrofoils which move back and forth in a plane normal to the tidal stream, instead of rotating blades. One design uses hydraulic pistons to feed a hydraulic circuit, which turns a hydraulic motor and generator to produce power; and
- Venturi effect tidal stream devices – In these, the tidal flow is directed through a duct, which concentrates the flow and produces a pressure difference. This causes a secondary fluid flow through a turbine.

Alongside these options, there is a debate about the relative merits of fixing devices to the seabed for stability and deploying floating devices to allow retrieval for maintenance. Some tidal stream devices are being demonstrated in the UK and the MEC has a work package to look at all the designs mentioned above.

Tidal power can also be extracted from tidal barrage and tidal lagoon systems. These are outside the scope of the MEC but are mentioned here for completeness. The tidal barrage is a long-established, technically-proven concept which essentially involves a structure with gated sluices and low-head hydro turbines. Bridging two sides of an estuary, the principle of operation is to allow water to flow into the area behind the barrage with the flood tide and out during the ebb tide. As water flows out, the collected head of water turns the turbines to generate power. A tidal barrage has been in operation at La Rance on the northern French coast for more than 40 years, and schemes have previously been proposed in the UK, notably at the River Severn. The tidal lagoon operates in a similar way to the barrage, but uses an impoundment structure rather than a barrage.

Source: The Carbon Trust,
www.carbontrust.co.uk/technology/technologyaccelerator/ME_guide.htm

Annex 2

Severn Estuary – Tidal Power Q & A

Q. What is the Sustainable Development Commission Tidal Power Study?

A. The study of tidal power in the UK led by the Sustainable Development Commission (SDC) was commissioned at the time of the 2006 Energy Review. The terms of reference for the SDC study were broad, and cover the various aspects of tidal energy on a UK wide basis. A significant part of the SDC's work has focused on tidal power in the Severn Estuary. The SDC is assessing the potential role of tidal power generally, and of options for a barrage across the Severn estuary, to contribute to the UK's energy mix. Over the past 12 months it has gathered evidence relating to the currently available technologies and sites, and is testing their suitability against the five principles of sustainable development. The SDC's final report can be seen at http://www.sd-commission.org.uk/pages/tidal.html

Q. So how would a Severn barrage scheme work?

A. It would work by building a wall or 'barrage' across the estuary effectively converting it into a hydroelectric dam. This would be achieved by placing a number of large concrete caissons across the estuary, some of which would house conventional hydro-electric turbines. The electricity would be generated by allowing the incoming tide to pass through sluices in the barrage. This body of water is then held as the tide ebbs. When the water level on the seaward side of the barrage is low enough the water behind the barrage is released back to the seaward side through the turbines, generating electricity. There would be locks in the barrage to ensure access to the docks upstream.

Q. Is this type of scheme technically feasible?

A. Yes. A tidal power scheme would be a very large and complex project but the basic concept is well understood and is the application of mature and commercially available technology. A tidal barrage has been successfully operated at La Rance, Northern France since the 1960s.

Q. So where exactly would a scheme be located?

A. Tidal barrages were the subject of a comprehensive programme of studies in the 1980's costing over £20 million. Several schemes were considered in UK estuaries including in the Severn and Mersey. The largest of the schemes studied in the Severn estuary known as the 'Cardiff-Weston' barrage would involve building a 16km long structure across the estuary, just downstream of a line between Cardiff and Weston super- Mare. There is also a smaller scheme known as the 'Shoots' barrage that would be located above Avonmouth Docks (just below the second Severn crossing). The feasibility work will look at all practicable options.

Q. How much energy would a barrage scheme produce?

A. The Cardiff-Weston scheme would have a generation capacity of some 8640 MW (Mega Watts) and an annual electricity output of 17 TWh/y (Tera Watt Hours per Year) or around 5% of UK annual electricity demand. The Severn Estuary has the second highest tidal range in the world (after the Bay of Fundy between Maine and Nova Scotia). It can top 14 metres on a spring tide - tides vary with the lunar cycle.

Q. How long would it take to build?

A. Previous studies suggest that a large barrage scheme would take between 5 and 7 years to construct. There would also be a period prior to construction needed to undertake necessary work on things such as engineering design and environmental assessment. Previous estimates suggest it could take, in total, around 12 years.

Q. How would a barrage affect flooding in the Severn region?

A. A barrage would not have provided protection against the recent flooding in the Severn but could provide some protection against flooding coming from strong tidal surges so help with flood management in this way.

Q. Why has Government decided to undertake work on tidal power in the Severn given it was rejected in the past?

A. Climate change and the need to ensure secure supplies present us with two major long-term energy challenges. If we are to have the best chance of meeting those challenges it makes sense to consider our options. We therefore asked the Sustainable Development Commission (SDC), at the time of the Energy Review, to look at tidal power in the Severn.

Q. Does this mean Government has already decided to build a barrage across the Severn estuary?

A. No. The energy resource in the Severn estuary is substantial and could provide up to 5% of UK electricity demand. But lots more work is needed on the pros and cons before a decision could be taken to go ahead. We need to understand the implications for the environment and how far this could be mitigated. We also need to understand the economic, social and regional impacts and many other aspects, including the likely effect on the energy market.

Q. Has Government considered other options to a barrage in the Severn such as Tidal Lagoons, or barrages in other estuaries?

A. The SDC study has looked in some detail at the issues arising on tidal power. The SDC's report provides a strategic, independent and evidence based consideration of all the environmental, social and economic aspects of options for tidal power in the Severn estuary from a sustainable development perspective. It also cover possibilities in other locations – there are several in the Severn and the Mersey.

Q. The UK has recently submitted the Severn Estuary to the European Commission as a Special area of Conservation (SAC). Doesn't that make a barrage impossible to do?

A. Designation does not rule out the possibility of future development in appropriate circumstances. If a development is proposed that is thought likely to have an effect on the SAC the developer will be expected to take appropriate steps to mitigate any potential damage. Where a development is permitted, the European Commission must be notified of the compensatory measures adopted and will need to be satisfied that these are sufficient. The designation of the estuary, given its potential to contribute towards emissions reduction and renewable energy targets, raises issues regarding the balance between environmental protection and the wider problems caused by global warming. We are discussing these with the Commission.

Q. How about the impact on the local population?

A. Further work will be carried out in a transparent and consultative way, and as quickly as possible to minimise the uncertainty for the people who live around the Severn Estuary. There are potential benefits for the local population – increased employment opportunities for example – but the Government is keenly aware of the downsides as well.

Q. What could be the impact on the local and regional economy?

A. This needs to be carefully considered. There are many organizations that would be affected, including the ports on the Severn. Previous studies estimated construction of a barrage would bring with it a number of socioeconomic benefits to the region, including job creation and inward investment.

Q. What does 'feasibility work' mean?

A. Initially to assess the many issues that arise, looking at potential scheme options, their impact, costs and risks, and the possible nature of a Government intervention. Subject to this, the next stage would be to work up the specification for detailed technical, engineering and environmental studies. This stage of the work alone could take from 18 months to several years. The Government intends to do this work transparently and to engage the people and organisations who would be affected by any such scheme.

Department for Business, Enterprise and Regulatory Reform. www.berr.gov.uk