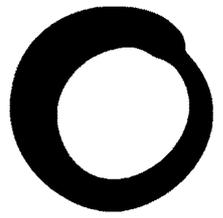


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A 'sustainable' Severn barrage ?

Friends of the Earth Cymru's response to the Sustainable Development Commission's support for a 'sustainable' Severn barrage

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A response to the Sustainable Development Commission's support for a 'sustainable' Severn barrage

Introduction

On 1st October 2007, following a year long study of the renewable tidal energy potential of UK coastal waters, the Sustainable Development Commission (SDC) launched a report called 'Turning the Tide'. This estimated that about 10% of current UK electricity consumption (ie 2% of current ENERGY consumption) may be economically exploitable. The SDC estimated about 5% could be generated from tidal 'stream' devices, which utilise the flow of water, and 5% from tidal 'range' schemes, which utilise the height or 'head' of water.

The report focused mainly on the Severn barrage project between Cardiff and Weston (the largest most detailed single tidal range project) proposed by the Severn Tidal Power Group. The SDC recommended 'that there is a strong case to be made for a 'sustainable' Severn barrage' as a 'climate mitigation' project. It went as far as saying that only IF a barrage was not deemed sustainable should other tidal schemes be considered. At the media launch of the report in Cardiff, the Commission also said that the Severn barrage could be 'a flagship for wider environmental change'.

The SDC qualified its advice by saying that a 'sustainable' barrage must: firstly, comply with existing Habitats and Birds Directives without 'reform or derogation'; secondly, include 'a radical approach to providing compensatory habitat' and a 'full compensatory habitats package to be in place before the barrage is built'; and thirdly, be financed by innovative financing mechanisms that would maintain overall public control and ownership of the project.

The SDC's view encouraged the Department of Business Secretary, John Hutton MP, to announce a 'barrage' feasibility study at the Labour Party's conference in September 2007. On the day of the SDC report's launch to the public, former Welsh secretary Peter Hain MP expressed strong support for the barrage project

Friends of the Earth response

Friends of the Earth Cymru was shocked by the SDC's recommendations for a so-called '*sustainable*' Severn barrage and alarmed by the view that it could be considered as a '*flagship for wider environmental change*'. We pointed out that £15 billion could be better spent in other ways on climate mitigation projects, such as CHP schemes/ city-wide heat grids, building an offshore wind and wave

manufacturing industry, offshore tidal lagoons, CCS strategic pipeline infrastructure, and energy conservation in homes. We criticised the SDC, restating our view that it would simply not be worth the considerable environmental damage to a major UK estuary of international ecological importance, protected by the highest European environmental law, for the generation of around just 1.4 % of UK energy consumption (17 TWh/year assuming 2050 final energy demand reduces to 1,200 TWh/y), even if it would be renewable.

We also pointed out that £15 billion could be better spent in climate mitigation and that the barrage's flood defence benefits could be cost-effectively achieved by coastal management and defences. A compensatory package of habitat mitigation measures may cost hundreds of million pounds more. A figure of £700 million has been estimated, on to of the barrage cost.

Public ownership would be achieved by financing the project with a government-backed low (3.5%) 'social' discount rate which reduces loan repayments. This fiscal support (essentially a 'government intervention' in the market – a subsidy financed by the taxpayer) would reduce the cost of barrage power to an estimated 3.5 pence per kilowatt hour (p/kWh) from between 9 to 19 p/kWh at commercial rates of interest. But such low discount rates could be applied to any carbon reducing scheme or project based on large-scale public energy infrastructure. Indeed, as it is probable that the barrage would breach the Habitats Directive then the UK government has to demonstrate to the European Commission that a barrage would be of overriding public need that could not be achieved in alternative ways.

The SDC describes the barrage as a '*climate mitigation project*'. Yet it would not be a cost-effective infrastructure project to reduce carbon dioxide emissions in the most critical decades from now to around 2050. The most effective climate mitigation projects are ones which achieve the most emission reductions in the years before 2050 no matter how long such projects may generate for. However, the SDC did not attempt to make any 'climate mitigation' comparisons with what is an 'opportunity-spend' of £15 billion or more. A figure of £23 billion including contingencies has been reported in a civil engineering magazine a few months ago.

Friends of the Earth agrees that the Government should consider fiscal, or other interventions, to deliver risky or simply very large long-lasting strategic energy infrastructure projects. Providing access to low cost capital to ensure a 'fair allocation of risks and rewards' is certainly one way. It is clear that the Government's considerable if not ideological faith in liberalised energy markets

has not, and is unlikely to, deliver much of the infrastructure that the UK needs to provide energy security and climate protection.

Applying a low (3.5 %) discount rate to encourage a £15 billion plus investment in various potential UK strategic energy infrastructure projects could :

- * deliver around an additional 7.5 GW of offshore renewables (be it windfarms, wave and tidal stream arrays) by 2020 – 2022 by funding the manufacturing base, kit and skills needed for even bigger deployments in the decades after 2020 (see Annex 1 for detail). This option addresses the need to build significant renewable capacity by 2020 as part of the UK's share of the EU 20% RE by 2020 policy.

- * fund the construction and connection of heat grids in urban areas to about 3 million homes (ie £5 K per dwelling, typically 2 x 8 inch mains pipes down urban streets connected via smaller pipes to a homes' central heating and hot water system). The heat grids, carrying waste hot water from existing and or new power stations, would avoid the need to replace the ageing cast-iron methane distribution grid (see Annex 1 for detail)

- * build significant capacity of carbon capture and storage (CCS) pipeline infrastructure in the North Sea. If demonstrated to be viable (by 2020, possibly sooner), CCS could deliver three times more low carbon energy at a much smaller cost than the barrage (see Annex 1 for detail)

Furthermore, the barrage would preclude the building of one or more 'large' (10 to 30 square miles) offshore tidal lagoon impoundments in the Severn which may be much more cost-effective, especially if built out of silt-filled geo-textile tubes. It may also discourage the building of a 20 square mile offshore lagoon in Bridgewater Bay. Note that offshore lagoons, being located typically 1 mile out from the coast could in future decades be connected to land if sea level rise /flood protection deemed it reasonable at some future time.

Like the barrage, lagoons could also generate electricity for well over a hundred years. Such a multi-scheme lagoons 'project' may offer the potential to generate anything from 1 to possibly 20 TWh/year or so of electricity according to one developer. Much could depend on what is considered to be an environmentally benign or acceptable scale of deployment. Like the barrage, larger lagoon deployments may risk '*moral-hazard*' (underinsured risks effectively underwritten by the taxpayer) which is a rationale for some form of public control and ownership. Lagoons could be decommissioned relatively easily if constructed from geo-textile tubes, as the tubes could be slit open (and the plastic recovered).

The SDC report supported a small lagoon demonstration scheme (about 2 square miles) but dismissed 'large scale' tidal lagoons outright, without defining what

'large' might mean. It claimed that large lagoons would be expensive and environmentally damaging but it did not give any detailed reasoning as to why. At the Cardiff launch, the SDC did say that long walls would be expensive. It also appeared to confuse offshore tidal lagoons, built offshore beyond the intertidal area, and so-called 'Russell lagoons', built out from the coast across the intertidal area (which would of course alter the habitat). Considering the level of public interest, and scepticism in some quarters, in the output of the lagoons (as estimated by the developers and major engineering consultancies) the SDC's study signally failed to shed any light on this. It was a major omission and a lost opportunity.

Because the SDC views 'large' lagoons as not viable, it claims that *'there is minimal conflict between the potential development of tidal barrages and tidal lagoons'*. Yet if a small number of larger lagoons, or even a larger number of smaller lagoons, did constitute a viable project then there would be considerable conflict with a Severn barrage. This is because the best UK tidal range resource - and most suitable site for lagoons - is in what would be the basin area of the Severn estuary. A larger lagoon could also be sited just west of the barrage in Bridgewater Bay but even the output of this scheme could be adversely affected by the barrage.

It is possible that a study would demonstrate that an environmentally acceptable lagoon scenario might generate anything from a half to even more than the annual output of the barrage. Such a lagoons project might require significant, little or no subsidy. What would happen then in terms of decision-making, including consideration of the Habitats Directive? The SDC made it clear at the Cardiff launch that only IF a barrage did not meet its sustainability criteria then other schemes should be considered. The Severn Tidal Power Group says that the project that generates the most energy should be favoured. Yet, what if an environmentally acceptable lagoons scenario could generate a significant annual output, potentially with little or no public subsidy. If so, the UK government would have to demonstrate an overriding public need for the additional output of the barrage alone. Given the choice of opportunity spend, then the barrage would be even harder to justify.

There is another scenario that needs to be considered. Lagoon deployment in the basin area of the Severn would NOT preclude the building a Shoots flood barrier or combined tidal scheme be it barrage, 'reef' or tidal fence structure in the 'Shoots' area. Either structure would generate additional power and could carry a new main south Wales-London railway link avoiding the ageing Severn tunnel. Such a link would be a spectacular transport gateway to Wales and could avoid the cost of a new and/or modified tunnel link, costing up to £200 million.

It appears that an 'ebb-only' Shoots barrage would permanently submerge relatively much more intertidal area per unit energy output compared to the Severn barrage. So despite any possible future flood defence benefits to Gloucestershire, it too would have to be assessed under the Habitats Directive. However a tidal energy structure across the Shoots area would probably be less environmentally compromising (eg high-level sluices, etc).

The SDC then makes misleading and extraordinary comments about lagoons and their proponents. It states *'Despite there being no examples of tidal lagoons anywhere in the world, the technologies used are not in themselves new or innovative; the innovation is in the concept, design and construction. This places tidal lagoons in a difficult position in relation to the available financial incentives for renewable energy technologies, which are currently justified on the basis of innovation and long-term cost reductions. The situation is not helped by the insistence of some tidal lagoon proponents that the technology does not require subsidies to be economically viable.'*

It implies that the lagoon developers are in 'difficulty' and need, or are asking for, 'financial incentives' to develop their technology. Yet the proposers of the Swansea Bay lagoon have made it widely known that they are not asking for any grants or subsidy and that they would privately fund a Swansea Bay scheme. The lagoon developer's difficulty has been what they describe as 'hostility' from the then DTI in regard to the likelihood of obtaining consents to build the scheme. In October 2006, the House of Commons Welsh Affairs Committee tried to address the DTI's hostile stance in their report 'Energy in Wales: Government Response The Committee's Third Report of Session 2005 - 06'. It stated in paragraph 36 that:

'Regardless of the merits and economic viability of the Swansea Bay tidal lagoon scheme, we have concerns about the DTI's handling of the scheme and the damaging effect that this has had on investor confidence and potential commercial development. We are pleased that the DTI has now withdrawn its technical objections to the scheme, but the errors made by the DTI officials have undermined and delayed a highly promising project. We recommend that the DTI takes urgent steps to address the damage it has caused, and to set out clearly its strategy for rebuilding investor confidence in this scheme.'

Surely the SDC should have been aware of this. Indeed, this situation has not been helped by the insistence of those that say that lagoons would require subsidies to be economically viable. A demonstration scheme would identify if lagoons would be commercially viable and Friends of the Earth Cymru has been recommending such a demonstration since December 2003. However, at this rate no one will know either way because those who would privately fund a

demonstration scheme have been discouraged in putting forward an application and no one has applied for a publicly funded demonstration because such funds are not available. The SDC should have shed light on this situation rather than fuelling further confusion.

Stakeholder and public attitude

The findings and attitudes of the SDC's stakeholder meetings and public surveys should be treated with caution. No alternatives of any equivalence were put of for comparative purposes, be it a £15 billion spend on alternative energy projects outside the estuary or lagoon scenarios within the estuary. Stakeholders at the Cardiff event were given a choice of a 8,760 MW Severn barrage or a 60 MW tidal lagoon in Swansea Bay (as large lagoons had been discounted). Before there can be any confidence gauging public opinion about the barrage there must be an equivalent range of options and opportunity-spend scenarios.

Habitat compensation and mitigation

The Commission believes it would be possible to provide compensatory habitat as would be required under the Habitats Directive. Indeed, it stated that *'Providing compensatory habitat is not a burden on the project; rather, it represents an 'environmental opportunity' to use a revenue-generating climate change mitigation project to help fund a large-scale compensation package that is designed around the need for climate change adaptation.'* It goes on to say this could include *'coastal realignment strategies which can have a number of flood protection benefits'*.

It is difficult to estimate at this point what habitat would need to be created or recreated to compensate any adverse changes the barrage would cause. Indeed, it is strongly argued that there would be various ecological benefits. However, the loss of habitat would be considerable and it would be difficult to protect several species of protected bird and migratory fish species. The SDC estimates around between 6,000 - 14,500 hectares of inter-tidal mud and sand flats would be lost. Schemes to create habitat can be successful. For example, a 1.3 mile, 4 metre high coastal management scheme at Wallasea, which cost £ 7.5 million, created 115 hectares of saltmarsh and mudflat for £65k per hectare. On this basis an inter-tidal habitat creation project of the same cost per hectare would amount to some £ 950 million.

Yet, in the absence of the barrage, similar coastal management techniques could be instigated around Severnside to address coastal erosion caused by climate change. Friends of the Earth Cymru had proposed such management schemes and techniques as an alternative to the barrage. Indeed, a project to provide enhanced flood defences around Severnside could actually conserve and enhance the

protected features of the estuary. For example (scaling up the Wallasea scheme), a project to significantly increase flood defences for 35 miles of the Severnside coastline might cost around £200 million and might create up to 3,000 hectares of new saltmarsh and mudflats. Such sums are relatively small in comparison with a barrage and its compensatory package. Furthermore, the flood defence benefits and habitat enhancements could be achieved well before 2020, within which time some flood defence spending may be needed anyway.

The SDC says that the 'full compensatory habitats package' should be in place before the barrage is built. So any substantive revenues from the barrage for additional 'coastal realignment' might only be available after 2060 when the construction and compensation costs is paid off around 40 years after commissioning. Presumably, a part publicly-owned series of lagoons could also generate revenue for long term coastal protection in a similar fashion.

Wider implications

A Severn barrage would also have wider environmental and political implications. How many other major or smaller UK habitats might be damaged or destroyed for relatively small amounts of energy given such a precedent? Why should developing countries protect their most valuable environmental areas, such as tropical rainforests, if the UK showed such 'leadership'? What other 'flagship' renewable or other low carbon developments would not go ahead?

Friends of the Earth Cymru's concern was intensified by the favourable response to the SDC's report by senior New Labour politicians including the prime minister. There is a wide public view, shared by environmental groups, that some politicians have and might support big 'flagship' projects following 'tough' decisions to show the electorate that they are decisive and doing something. Attention to details, which can have significant and long-term consequences, is often missed or dismissed once 'colours are nailed to the mast' let alone a flagpole of major environmental change.

The SDC stated that *'proposals of this scale require a new approach to decision-making. Government must avoid a 'decide-and-deliver' approach and not set off on a course of action where important conditions and principles could eventually be discarded.'* Unfortunately the overall thrust of the report has achieved the very decide-and-deliver response, from some ministers at least, it was warning against.

Friends of the Earth Cymru report - Summary (published 1st October 2008)

Various environmental groups have long opposed ideas for a major barrage across the Severn estuary. While such groups strongly support renewable energy, they consider that the environmental damage to the unique hyper-tidal environment outweighs the amount of renewable energy that would be generated.

In October Friends of the Earth Cymru completed a year long study reassessing the issues and opportunities :

http://www.foe.co.uk/resource/briefings/the_severn_barrage.pdf

The group concluded that generating about 1.2 % of UK final ENERGY demand¹) does not outweigh the environmental disbenefits to this internationally important and legally protected wildlife site and that £15 billion could be much better spent on considerably more powerful energy generating projects.

Friends of the Earth does not support the Severn barrage project because :

- * for around 1 – 1.4 % of UK energy consumption, it would be too damaging to the ecological features and species of international importance - even given that climate change and sea level rise would be gradually affecting habitats

- * at around £15 billion it would be uneconomic, and public funds for 'climate mitigation' projects could be better spent generating more energy in a shorter period of time from alternative renewable and or low carbon schemes

- * it could adversely affect navigation of very large ships to the Port of Bristol which would then have knock-on transport implications at other UK ports and on other transport links

- * the barrage scheme would preclude the building of large tidal lagoon impoundments and other tidal schemes in the Severn estuary from Bridgewater Bay eastwards which may amount to considerable electricity and storage potential

Note 1. UK final energy consumption in 2007 was about 1,900 tera-watt hours a year (TWh/y), UK electricity demand was 400 TWh/year, and the Severn barrage would generate 17 TWh/year. Assuming, due to efficiency improvements, UK final energy demand reducing to 1,400 or even 1,200 TWh/y by 2050 the barrage would then generate 1.2 – 1.4 % of UK final energy demand.

UK government Severn Tidal Study

The Government announced a Severn tidal power study on 22nd January 2008 which will look at all tidal range projects (barrages and lagoons). The £ 9 million study comprises two year-long phases.

Phase 1 of the study, which will last around 11 months, will assess any legislative 'showstoppers' such as alternative ways of spending £15 billion on energy projects (not necessarily tidal range). The study is necessary because the estuary is legally designated so the Government has to demonstrate an overriding public need for a barrage that cannot be achieved in other ways.

Road and rail proposals across any barrage options will not be considered in the study due to their additional construction expense and low strategic importance. Ministers will then decide if a Phase 2 study is carried out on any tidal project(s) deemed worthy of further investigation.

Much may depend on what projects are genuinely considered in Phase 1 of the study and which consultants are put forward by the Department of Business to carry out the assessments.

Appendix 1

Options for public energy infrastructure projects to the value of £15 billion :

* deliver around an additional 7.5 GW of offshore windfarms (and wave/tidal stream) by 2020 – 2022 by funding the manufacturing base, kit and skills needed for even bigger deployments in the decades after 2020. The government is scoping and assessing up to 33 GW of offshore wind by 2020 but has forecast about 15 – 20 GW by then. The additional funding could add 7.5 GW to the forecast figure which would generate 25 TWh/y ($7.5 \times 8.76 \times 38 \% = 25$) or over 40% more power than the barrage annually up to around 2040 (the lifetime of the turbines). If built to last, the wind turbine foundations and grid connection infrastructure, amounting to about half the cost of the initial investment, would still be serviceable for the installation of new replacement turbines. Similarly, 'emerging' wave and tidal stream technologies could also be part of this marine scenario if the costs compare well with offshore wind after a GW or so of deployments (as their developers estimate)

* fund the construction and connection of heat grids in urban areas to about 3 million homes (ie £5 K per dwelling, typically 2 x 8 inch mains pipes down urban streets connected via smaller pipes to a homes' central heating and hot water

system). The heat grids, carrying waste hot water from existing and or new power stations, would avoid the need to replace the ageing cast-iron methane distribution grid.

Heat grids to 3 million homes would avoid around £ 3 billion in new methane pipe installation in urban areas. Heat grids to 3 million urban homes would save around 30 TWh/year in gas heating (3 m x 10 MWh/year per home = 30). This energy saving would be the waste water from about 8 GWe of gas-fired power stations (in electricity-only mode at 60 % efficiency) and essentially converts that capacity to efficient Combined Heat & Power (CHP) mode at 80+ % overall efficiency. This 8 GWe of efficient CHP would be additional to the 10 GW+ of new industrial CHP that could be built by 2020. The government's aspirational targets is, or at least was, 20 GWe of CHP by 2020 and a recent DEFRA report estimates a UK wide potential of 33 GWe at a 3.5% discount rate (incidentally – this is the rate at which the barrage may be financed). The UK currently has about 7 GWe of CHP, one of the lowest per-capita CHP rates in the EU.

It would require typically two plastic pipes of 8 inch diameter, laid in the verge areas of streets, possibly within hollow kerbstones (eg 'KerbIT) made from recycled plastic or tough composite materials. Hollow kerb trenches would be around 14 inches wide and 18 inches deep and would replace existing concrete kerbs which would be recycled for other construction uses. Hollow kerbstones would facilitate the deployment of fibre-optic broadband and other wire and pipe services (eg electric cables, water pipes), either installed new or retro-fitted. Heat grids would be built in the more densely built-up urban areas and could be complimented by 'hydrogen-ready' pipelines in the less dense urban areas. Indeed, hydrogen distribution grids might also be part publicly financed being essentially long-lasting public infrastructure.

Such long-lasting strategic heat grid infrastructure (the plastic pipes would last over 100 years at 90 degrees C feed-water) would start to replace the UK's methane gas distribution network with a more flexible and sustainable energy distribution grid. Gas needs to be phased out anyway over the coming decades or its use would account for a significant an increasing percentage of UK carbon dioxide emissions which would also be 'beyond capture' as the emissions would be from 15 million small domestic point sources. Continuing to use methane gas also has implications for UK energy dependency and increasingly 'UK balance of payments'. Yet, the UK gas distribution pipeline companies (National Grid and others) are just embarking on a 30 year, £15 billion strategic replacement of the UK's ageing cast-iron methane distribution grid (90,000 miles) - with new methane pipes. This could be a 'stranded' investment by the time it was completed – depending on to what degree hydrogen could be used in the new

methane gas pipe infrastructure (eg issues of leakage, energy content, pressure, frictional losses on gas deliver speed).

New heat grid networks would also enable significant if not strategic levels of energy storage in hot water tanks (large purpose built and/or domestic scale) which would usefully absorb peaks in renewable electricity output 'excess-to-grid' demand which are likely to be significant by 2020 and huge by 2030. Indeed, by 2040 the heat grids could be mainly used for storing and distribution energy from very large-scale renewable capacity. Note: the predictable but problematic fluctuations in barrage power (possibly 8.6 GW in less than an hour around the spring tides) would significantly worsen the variability of renewables

* build significant capacity of carbon capture and storage (CCS) pipeline infrastructure in the North Sea. If demonstrated to be viable (by 2020, possibly sooner), CCS could deliver three times more low carbon energy at a much smaller cost than the barrage. An under-sea CCS pipeline with a capacity of 15 million tonnes/year would cost about £ 500 million. This amount of carbon dioxide would be emitted from 2.5 GW of coal power stations generating 18 TWh/year ($2.5 \times 8.76 \times \text{baseload } 82\% = 17.96 \text{ TWh/year}$) or around 5 GWe of gas-fired capacity. A strategic public CCS deployment could be three such pipelines by 2020 along the Thames, Humber and Teesside rivers costing £1.5 billion. The three pipelines could be used by about 7.5 GW of CCS coal schemes generating 40 TWh/y (at a load-following 65% load factor) to 60 TWh/y (at baseload 80+%,) of low carbon electricity. If this 7 GWe of CCS capacity were connected into a heat grid network then an additional 40 - 60 TWh/year of gas heating would be avoided. The UK's existing and new methane-fired CCGT's could also be converted to run of hydrogen from CCS-fitted coal gasifiers (pre-combustion CCS) which could also be connected up to heat grids to utilise the valuable low-carbon heat.

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