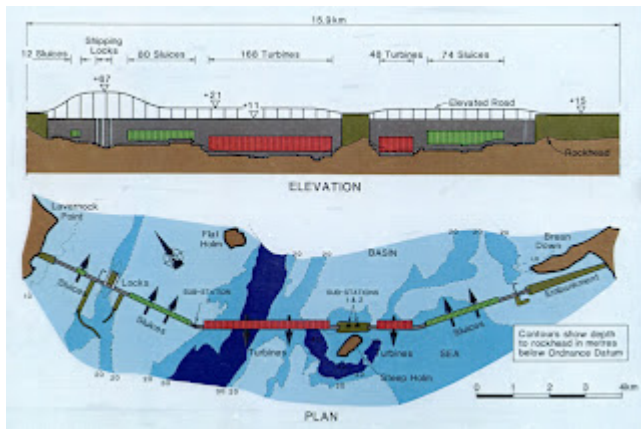


# Case for the Severn Barrage - does it hold water?

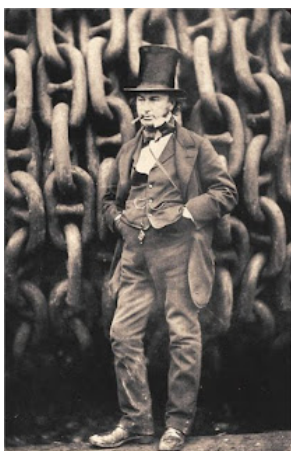


There's speculation in the papers [last weekend's [Guardian](#), earlier in the [Independent](#)] that the government is to back the [Severn Barrage](#). This huge project would capture renewable energy in the tidal movement of water in the Bristol Channel - the tidal range is one of the highest in the world: up to 15 metres. There have been various

designs and locations proposed, but the leading one is promoted by the Severn Tidal Power Group of major construction companies (see picture left and this [2006 presentation](#) by the group making their case). The Sustainable Development Commission is shortly expected to produce its [report on tidal power](#), and we should have much more data and analysis to consider at that point. But I thought I'd get my own thoughts on this straightened out in advance.

The inevitable question must be: "is this scheme bonkers?" In my view, bonkers would be too strong - but I can't see the case for the Barrage now.

## Arguments for



The argument in favour is a simple one: climate change is a massive problem demanding action far in excess of what we have mustered so far, and we can't afford to ignore any feasible options for reducing emissions. It doesn't cost *that* much if built with public money. It will last for 100 years and is critical 21st century infrastructure in a climate changing world, and will provide other benefits too, like energy security, flood defence etc. No project is a perfectly free of impacts, but the medium term disruption to habitats in the Severn is worth the longer term contribution to stability of the climate, which will protect all ecosystems. Now please just get on with it.

And there is something pleasingly Victorian about that argument... (and I mean that sincerely and with great respect for the Victorian can-do approach to civil engineering). One might even wish for [Isambard Kingdom Brunel](#) to supervise the project.

## Arguments against

The arguments against come down to: (1) local environmental issues: is the impact on birds and other wildlife in the Severn estuary unacceptable; (2) climate change economics: is this the best way to save carbon? Of these, I think the economics is the more compelling in pure environmental terms. It provides the justification for not compromising on habitats and conservation because the trade off is very poor. But the legal constraints arising from habitats legislation are fundamentally difficult to overcome.

### 1. Local environment - the Severn habitats...

The Severn Estuary is important as a habitat for migrating birds and other species that thrive in mudflats [[brief description of ecology](#)]. The concerns about impacts on habitats are summarised in this [joint letter from environmental regulators May 2006](#). The Severn estuary does have recognised biodiversity value and this will be subject to protection under EU law. The EU Birds Directive ([79/409/EEC](#) - see Art 4.4) and, with greater force, the Habitats Directive ([92/43/EEC](#) see Art 6) place stringent constraints on development that disrupts listed habitats. The Severn estuary is listed as a [Special Protection Area](#) and a candidate for [Special Area of Conservation](#) - these are collectively referred to as Natura 2000 sites. The basic requirement is that alternatives to the damaging development should be considered and compared. Where there is an 'over-riding public interest, development might be permitted provided the Commission is satisfied that *"any necessary compensatory measures are taken to ensure that the overall coherence of Natura 2000 is protected"*. See [Habitats regulations 47-59](#)

Though this sounds tough at first glance, it is open to definitional fudging around 'overall coherence' and Defra has stressed that the listing of these sites does not foreclose development of the barrage. I think that if it was the *right thing to do taking everything into account*, a way could and should be found through these regulations. It is in essence a conflict between different environmental imperatives, and that may justify weighing the benefits and making a trade off. In

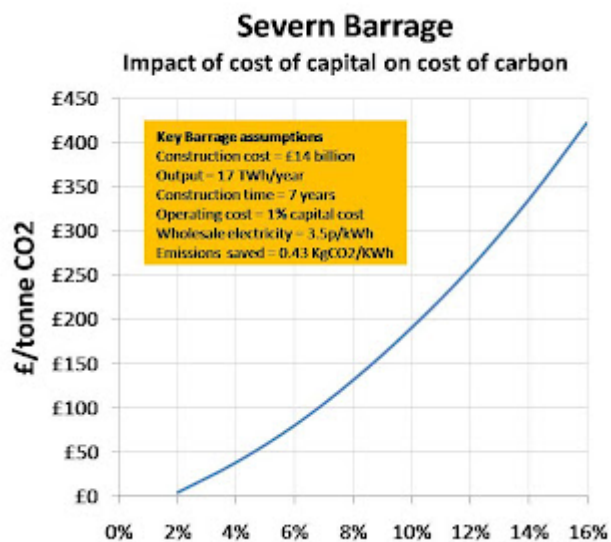
listing the Severn estuary, Defra points to the heart of the issue:

*We have also pointed out that these proposals could significantly alter the ecological characteristics of the Estuary and raise issues regarding the balance between habitat protection and tackling the wider problems caused by global warming. We are discussing this balance with the EU Commission. ([Defra statement](#)).*

**Environmental trade-offs - but only if it is worth it.** Arguments can be made that the habitats in the Severn estuary will be modified by the barrage not destroyed or even necessarily worsened. It might also be added that climate change will modify the estuary anyway. We might be able to find some compensatory measures that would help maintain migration routes for birds (though it seems implausible that large ecosystems might be moved around for our convenience). Finally, we might as a society consider that the loss of a specific habitat is less important than a general attempt to reduce the threat to all habitats - by reducing greenhouse gas emissions. I think the key thing here is not to rely on legal arguments from legislation drawn up when these trade-offs were not so evident - but to weigh the right thing to do compared to the alternatives. I think this is the wrong thing to do - but mainly because the economics do not justify the environmental trade-off. If it was a good energy and carbon project, then the trade-offs *might* be worth it. But it isn't and they aren't.

## 2. Economics and cost-effectiveness...

The main trouble with the barrage is that it is a fantastically expensive way to make carbon savings, at least using conventional financing assumptions.



**Basic shape of the project.** In round numbers, it will take 7 years to build (once the planning stage is over), cost £14 billion and produce 17 billion KWh (TWh) per year, saving about 7.3 mtCO<sub>2</sub> annually. Though it is a huge project, its electricity output is about the same as two nuclear power stations like [Sizewell B, which had output of 8.9 TWh](#). No doubt consultants will have produced a

complicated model, but these numbers can be used to produce a crude estimate of the cost of power and saved carbon. My [Google spreadsheet \[XLS\]](#) sets out a basic model for 'reality testing' figures for the Severn Barrage - allowing key assumptions to be varied and their importance to the cost case to be assessed.

Importance of cost of capital. The chart (click to enlarge) shows the most important relationship in any cost-effectiveness estimate for the Barrage: the variation of cost carbon saved with the return on capital required. At very low cost of capital the project is probably cost effective, but at commercial rates of return - it is an extremely expensive way to save carbon.

### Returns required on investment

	Vertically integrated company	Independent power producer
Gas CCGT	8.3-9.2%	12.6%
Advanced coal	7.8-8.8%	12.1%
Nuclear PWR	9.5-10.5%	14.0%
Coal with CCS	11.1-12.1%	15.4%

Source: Redpoint Energy and Energy Strategies, 2007 for BERR

**Cost of carbon savings.** Estimates of commercial rates of return for large-scale power projects suggest a range of 8-15% (see table left adapted from [p.17 of: Dynamics of GB electricity generation investment](#) for [BERR](#)). The exact rate would depend on the investors' views of risk and what arrangements are in place to sell the electricity or carbon savings.

We could for comparison purposes use the rate of return for new nuclear projects built by vertically integrated companies -10%. In this case a crude saved-carbon cost estimate comes to £190/tCO<sub>2</sub>. That compares with the EU ETS at about £15/tCO<sub>2</sub>, energy efficiency at negative cost and a large supply of Clean Development Mechanism projects at less than £20/tCO<sub>2</sub>. New nuclear might be expected to save carbon at less than £40/tCO<sub>2</sub>. It's true that the Renewable Obligation has a high cost (£65-140/tCO<sub>2</sub> - so not as high as the barrage) - but that arises from the design of the mechanism, which makes the carbon savings especially expensive and justifies changing, and certainly not repeating - see [OFGEM critique](#)).

Is there a case for building it with cheap capital? The short answer is 'no' - in fact this is about the worst way to subsidise a project. The price of capital will properly reflect construction and other risks and the overall scarcity of capital. This is valuable information about risk and should not be lost. In my view the private sector should finance and build major projects, dealing with the risk, and the government (or consumer) should pay for the valuable outputs (renewable electricity, carbon savings). This is the basic idea underpinning PFI and the

general move to have commercial risks (eg. construction overruns) managed in the private sector. In a market (electricity generation) that is already almost entirely private sector, it seems obvious to me that it would be highly distorting to introduce a competitor with access to capital at Treasury bond rates. The problem for the Barrage is that when it is built with money at commercial rates of return it will produce carbon savings that are many times the cost of alternatives and will require the government and its regulators to ensure that contracts are in place to buy very expensive carbon savings for several decades - or no-one will put up the cash. But that should be telling us something about this project - in terms of its carbon economics, it's a turkey. Doing this would upend the market basis of the government's energy policy:

*Our strategy continues to be based on the principle that independently regulated, competitive energy markets, are the most cost-effective and efficient way of delivering our objectives.*(see [2007 Energy White Paper p.8](#))

It would also violate climate change policy principles set out the Better Regulation Commission report: [Regulating to mitigate climate change - a response to the Stern Review](#).

- *Ensure climate policy is consistent with a healthy UK economy*
- *Government must develop and act consistently with a climate change strategy; avoiding piecemeal announcements*
- *Test policy against a carbon price benchmark*
- *Carbon policy choices must be efficient; don't do things twice*
- *Keep administrative costs to a minimum*
- *Do not use climate change as a justification for other policy goals*
- *If it isn't working, change it*

Interestingly, the Sustainable Development Commission took quite an arid market perspective in its report on the role of nuclear in climate change policy: [Is nuclear the answer?](#)

*"...the economics of nuclear new-build are highly uncertain. There is little, if any, justification for public subsidy, but if estimated costs escalate, there's a clear risk that the taxpayer will be have to pick up the tab.*

We don't yet know how the SDC will regard the uncertainties and the case for public subsidy for a Severn Barrage, but one can only hope there will be some



consistency. If subsidised capital or other support was given to the barrage, then I'd expect the nuclear industry and several other to come in arguing 'what about us?' and possibly taking legal action to secure non-discriminatory treatment. [\[Post script 2 Oct: completely different approach taken with the Barrage!\]](#)

So, leave it to the market? The market fundamentalist would argue that the incentives already in place for an effective market for carbon should be sufficient: eg. the EU Emissions Trading System, Climate Change Levy etc. They might also argue that we have a Renewables Obligation and that will persist until 2027, with major EU commitments to 20% of primary energy from renewables by 2020. In fact, this is in effect what the government argues when it says: ['\*There won't be any taxpayers subsidy for new nuclear\*](#)'. Nuclear has to 'wash its face' aided only by the cost penalties arising from the ETS and other mechanisms that apply a cost to its more carbon-intensive competitors - but the long lead times means the effect of these mechanisms is very hard to call in, say, 2025. If nuclear suffers from this, then a massive barrage would suffer even more.

I think the market fundamentalist approach is wrong, or rather that the market is not yet sufficiently mature to rely on it. The long-term market for renewables and carbon are not at all clear and laden with 'political risk' (ie. the consequences of policy changes and decisions not yet made). So I think there is a case for having some means of supporting investments that provide long term carbon savings.

What should be done? An auction for future carbon savings...

There is a case for making a more robust market for long-term carbon savings. the case for this is market failure based on the inadequacy of the current mechanisms for signalling future carbon prices and concerns about 'credibility' in carbon policy (for example the absence of any sort of compliance mechanism in the Climate Change Bill, uncertainty about the future of the EU ETS, doubt about the next stage of the Kyoto Protocol and so on). There are also problems in contracting for benefits in carbon savings and electricity output that might arise several decades from now, but would need to be captured with some confidence today.

There have been several proposals for creating a long term credible market in carbon - for example through auctioning contracts for carbon reductions to be delivered far into the future (see [Carbon contracts and energy policy: an outline proposal](#) by [Dieter Helm](#)). Other ideas include a fixed future price for low carbon

energy, a 'put' option to underwrite future carbon prices, a guaranteed future carbon tax that would set a floor price for carbon (see [sources](#)). In all the proposals, the government effectively underwrites a future carbon price (even if the cost is eventually paid for by energy consumers).

A barrage might compete in such a market - however defined. However, there are many other low carbon alternatives that might compete: nuclear power stations; carbon capture and storage; wind power on and offshore; biomass in all its forms; CHP; and large energy efficiency programmes (for example an overhaul of social housing) - and potentially schemes to reduce carbon overseas (though that raises other questions). It's far from obvious that a barrage project would do well in such an auction and it might require an immense future purchase before the costs of carbon saved by the barrage was competitive. But if it did, then one could not object on economic grounds.

What about a feasibility study?

One argument might be just to continue to study the Barrage. The trouble is that continuing to study something that really doesn't make sense just sows confusion about the government's market based-approach to energy policy and the future markets for carbon and renewables. At some point, we must be capable of reaching a conclusion and stop spending money on unpromising ideas. What I would like to see instead is a review of the market framework for long-term low carbon investment (see [suggestions](#)). I think that would point up some important policy opportunities - but I doubt it would lead to the construction of the Severn Barrage.

\*\*\*\*\* End of original post \*\*\*\*\*

### **Post-script 1...25th September - government announces feasibility study**

The government announces a feasibility study through [John Hutton's speech to the Labour conference](#):

*And the Government Gordon Brown leads will drive forward with delivering a step change in our use of renewable energy. We must lead at home as well as abroad. A country of change must be prepared to embrace tomorrow's energy sources. So today I can announce that the Government will now start work on the feasibility of a Severn Barrage. A truly visionary project, unparalleled in scale, potentially generating 5 per cent of the UK's electricity from renewable sources. As we*

*undertake this work, we must understand the true environmental, social and economic impacts of such a project. They are potentially considerable. But so too is the challenge of climate change. And we must all have open not closed minds about how we meet the energy needs of tomorrow.*

This was backed up with government press release: [Hutton Calls For Open Minds on the Future of the Severn Barrage](#) (who can he be referring to?) and an updated [Severn Barrage page on the BERR web site](#).

### **Post-script 2... 1st October - SDC launches tidal report**

The SDC report is now available: [Tidal Power in the UK](#).

The crux of the report is section 4.8 on the economics and financing of the Severn barrage. If the project doesn't make sense as a climate change project - ie. a good way of reducing carbon emissions, then all the fretting about nature conservation, compensatory habitat creation and changes to the environmental, social and economic life of the Severn estuary shouldn't arise. Trade-offs and hard choices only make sense if the barrage is justified on carbon reduction terms - if it isn't even that, then why bother harassing the worms, fish and birds? And there is no credible justification, except pleading for exceptional treatment in the (poorly articulated) public interest and distorted presentation of costs (see fig 33 on page 119 - a classic!). Section 4.8 moves effortlessly from 'if' to 'how' without dwelling too much on 'why?'. I will return to this: see [Severn Barrage - flawed economics](#) posting published after the SDC report came out.

A sober assessment of the economics is presented in the SDC consultants' report: [Research report 3 - Review of Severn Barrage Proposal, Black and Veatch](#) p.105-115.