

THE SEVERN BARRAGE DIGEST

ALTERNATIVES

Of the 10 schemes that have made it onto the BERR long list to be considered in the feasibility study, six of them are barrages. The remaining four places are taken by proposals for a tidal reef, a tidal fence plus two suggestions involving tidal lagoons.

TIDAL REEF

Promoters of a tidal reef scheme claim that this option offers many benefits over a barrage including a minimal impact on habitats and, most impressively, the safe passage of migratory fish.

Because of the small difference in levels between the sea and the estuary with a reef scheme, shipping would be able to pass through open sections of reef on their way to Avonmouth without the costly delay of having to pass through a lock. The port is at present planning massive redevelopment to accommodate the latest generation of container ships and this could be thwarted by a conventional barrage. Unlike the barrage proposals designed to hold back the full height of the tide, a reef works with just two metres of head water but “slices off” power over a much longer generation period. This is much easier to match to peaks in electricity demand. It would also allow the safe passage of migratory fish through special turbines, a feature which cannot be replicated with conventional turbines because of their high pressure drop and sharp edged, high speed rotors.

The proposed route for a reef is along the Minehead to Aberthaw line, a distance of some twelve miles, yet it would apparently use fewer materials than either barrage or lagoon schemes because of the low pressure difference and the shape of the structure. It also means a faster build time and low visual impact. Another unique feature is the “Active Tidal Control System” that would allow the modification of high water levels from tide to tide. A sophisticated computer system would “know” the height of the expected tide, even during storm surges, and thereby optimise power extraction or the free flow of water. This variable would enable the system to match itself to peaks in demand and simultaneously provide navigable depth for particular ships while

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protecting the valuable intertidal areas upstream. Its predicted output could equal, or on some estimates, exceed that of the Cardiff Weston Barrage.

TIDAL FENCE

A tidal fence has vertical axis turbines mounted in a fence. All the water that passes is forced through the turbines. They can be used in areas such as channels between two landmasses. In the Severn estuary scheme it is proposed to build the fence between the two islands of Flat Holme and Steep Holme, linking them both to each other and the shore. Tidal fences have less impact on the environment than tidal barrages although they can disrupt the movement of large marine animals. They are cheaper to install than tidal barrages too. A tidal fence is planned for the San Bernardino Strait in the Philippines.

Tidal turbines are a new technology that can be used in many tidal areas. They are basically wind turbines that can be located anywhere there is strong tidal flow. Because water is about 800 times denser than air, tidal turbines will have to be much sturdier than wind turbines. They will be heavier and more expensive to build but will be able to capture more energy.

LAGOONS

The idea of Tidal Lagoons seems to have derived from something called the Bondi Committee report in 1981. This considered a concept called the Russell Lagoons which were to be built out from the shore line of the estuary. They consisted of three separate bunded enclosures that would impound water on a flood tide and release it on the ebb, basically the same tidal range technology as the barrage but with the advantage that it would leave an unobstructed channel between lagoons. This having been said, when the SDC reviewed the case for land bordered lagoons in its 2007 report, it suggested that the effect of restricting the river's main flow through a gap between the lagoons would be to create a scouring effect in the channel likely to be disruptive to the estuarine environment and possibly even shipping. The other factor resulting in a "thumbs down" from the SDC was that generated power from the scheme would not amount to even half of that from a Cardiff- Weston barrage while the barrier lengths would be longer and so presumably more expensive.

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However since the 80s there have been refinements in lagoon technology. A private company called Tidal Electric has pioneered the idea of completely off-shore impoundments in shallow coastal waters. Lagoons would be circular constructions built from sand and rock dumped on the sea bed and then armoured with larger rocks to prevent erosion. Pre-fabricated generating units would be incorporated on the downstream edge. Some sophisticated models may be subdivided internally in order to further “stage” the generating process that in any case is superior to a barrage by virtue of its operation during both flood and ebb tide. Visually they would only be as intrusive as breakwaters or other similar harbour mouth constructions.

Estimates for capital costs vary wildly for this untried technology and make it impossible to get an accurate unit cost of electricity produced. Tidal Electric’s own figures for the Swansea Bay prototype indicate a cost of £81.5 million whereas the DTI review of the same scheme came in at £255 million. A similar sized scheme for Liverpool bay was priced at between £108 and £135 million. Never the less AEA Technology Consultants reviewed the Swansea project and pronounced it as “mechanically mature, environmentally acceptable and economically self sustaining.”

Friends of the Earth produced a briefing paper in 2004 “A SEVERN BARRAGE OR TIDAL LAGOONS?” and their initial comparisons between the two types of tidal range technology suggests that lagoons would cause significantly less damage to the environment than a barrage and would in fact be more cost effective. Lagoons located in the Severn estuary or Bristol Channel would leave the ecologically valuable inter-tidal areas un-impounded and could even become useful habitats themselves.

Friends of the Earth claim that lagoons would generate twice the electricity per square mile of impounded estuary than a barrage and extract up to 40% more energy from an area two thirds smaller than would be captured by the barrage. Large lagoons built in the Severn Estuary would impound an area of approximately 115 square miles as opposed to a barrage on the Cardiff Weston line that would pen something like 185 square miles. While Tidal Electric have no plans for generating on the Severn they estimate that a large scheme as mentioned above would provide 7% of England and

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Wales' electricity requirement while the near to zero carbon output potentially saves 23 mega tonnes of emissions.

Generally speaking the minimised effect on the inter-tidal areas and tributary rivers would seem a good thing for the environment; however when it comes to migratory fish species the matter is not as clear cut. As there is not a lagoon in existence anywhere in the world at the moment it is hard to evaluate possible impacts but evidence gathered by the Wye & Usk foundation predicts similar poor outcomes for fish stocks from both technologies. Fish moving on the flood tide are very likely to find themselves drawn into a filling lagoon under the impression that they are heading landwards up the estuary. In order to leave the impoundment they would have to cross the generating line again and indeed, with some designs containing sectioned interiors the risks would be multiplied.