



# The Severn and other Tidal Barrages

Price  
30p

## Some history

There is nothing new in capturing tidal power. Tide mills pre-date windmills and many were recorded in the Domesday Book. Banks were built across tidal inlets and some form of pipe and valve or gate installed in them. Water flooded into the enclosed area or 'pound' behind the bank at high tide. It was held until the tide dropped and then allowed out through a mill race driving a waterwheel in a similar way to watermills on rivers. Records have been found of tide mills at over 200 sites. Many operated for at least 6 centuries. The site at Woodbridge, Suffolk\* (see Fig. 1) was first

used in 1170 AD with commercial milling continuing there until 1957, a span of nearly 800 years. Tide mills gave power for about 4 hours on each tide, and though this meant the miller

often worked unsocial hours, the timing of his work was at least predictable.



*Fig 1 Woodbridge tide mill, now a working museum. The pound was originally 15 times the present demonstration size.*

## The situation today

Much more recently the French built a 240 Megawatt (MW) tidal power station at La Rance on the Channel coast using modern engineering technology. This has operated successfully since 1966. There are also two smaller modern barrages, a 20 MW barrage in the Bay of Fundy, Canada, and a 0.5 MW one in Russia. A 260 MW barrage, to be constructed at Sihwa Lake, Korea, should be ready by 2009.

Many of the estuaries around the UK have large tidal ranges. The incoming Atlantic tide is funnelled up the

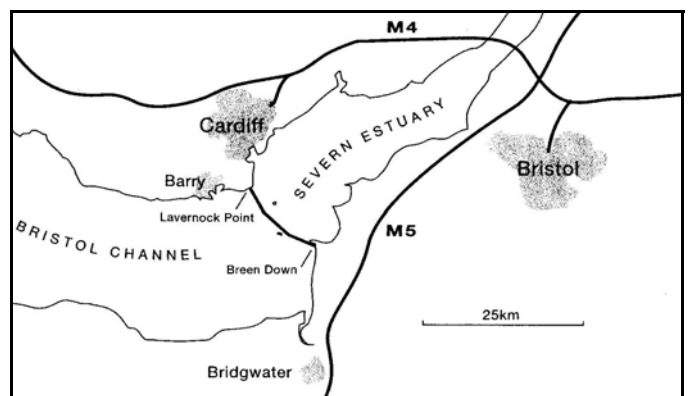
\*Others can be found at Eling on Southampton Water, Carew Castle in Pembrokeshire, and Thorington, Essex

English Channel, Bristol Channel and elsewhere and the water level rises as it does so. The Severn for example has a 14 metre tidal range at one point and, because the available energy is proportional to the square of the range, it is not surprising the Severn Estuary has been identified as an attractive site for many years. Indeed, the first scheme was put forward in 1923. Other potential sites are located in the Mersey and Dee Estuaries, Morecambe Bay, Solway Firth, the Wash, and the Humber and Thames Estuaries. Barrages could also be built at 34 smaller sites.

## The Severn Barrage

A barrage across the Severn however would dwarf all others. It could generate over 30 times as much power as the one on La Rance. In the '80s the Severn Tidal Power Group, formed from leading British construction and power generation groups, spent £4m to show that the Severn, with its large tidal range and huge estuary, could generate 8640 MW of electricity at peak and 17 TWh (Terawatt-hours) of electricity a year. This is equivalent to an average of 2000 MW or about 5% of total UK electricity demand.

The barrage would be built from Lavernock Point near Cardiff to about 1 km W. of Brean Down, Weston-s-Mare (see Fig 2). It would be 16 km long, take 7 years to build and, in 1989, would have cost £10bn - probably double that now. The cost of the



*Fig 2 Location of Severn Barrage*

electricity depends on the interest (or discount) rates used. It would now be about 7.2p/kWh at an 8%

## An ALDES Briefing Note

Last Updated August 2006

Most of the material for this note arises from a meeting at the Liberal Democrat Spring Conference in 1997 at Cardiff. The speakers were Rowland Morgan, lecturer in Civil Engineering at Bristol University and Duncan Huggett, RSPB. Comments are welcomed and should be sent to the ALDES secretary, Richard Balmer at 79, Links Drive, Solihull, B91 2DJ or email: richard\_balmer@blueyonder.co.uk

---

discount rate, the minimum a private company would seek, and about 6p/kWh if funded by government using a 5% rate. This compares to average generation costs of less than 2.5p/kWh from fossil fuels and about 3.5p/kWh for the best wind farms. Gains from new recreational opportunities, such as sailing and tourism, and the benefits from a new road crossing of the estuary, are not included in the figures.

Power would be generated mainly on the ebb tide. Because tide times vary, the maximum power would not usually coincide with peak demand, but some juggling would be possible to increase peak output at the expense of total electricity produced. It would also be possible to use the reservoir for 'pumped storage'. Electricity could be used at times of low demand to pump water behind the barrage making more available at times of peak.

One important advantage of tidal power is that it is *predictable*. Electricity from wind, wave and solar energy is unpredictable and fossil fuel generators spinning on standby are needed in case output suddenly drops.

### **The Objections**

There are a number of problems however. First, the project would commit a large fraction of the UK heavy construction industry. Indeed, when it looked like receiving the green light, it was competing with construction of the Chunnel - and the Chunnel won. Second, huge quantities of rock, stone and sand would be required though, rather than clog the roads, it is likely they would come by ship from quarries in North Wales or even as far away as Scotland. Third, there would be losses of farmland due to flooding, though elsewhere there would be gains and more protection against exceptional floods. Fourth, there would be problems with effluent from existing sewage works which would require either more expensive treatment or re-routing downstream. Fifth, locks would be needed for shipping but, due to these and the slow speed of the turbine blades, it is thought fish movements would not be badly affected. Sixth, there would be drastic changes to the nature of the estuary, especially to the area of tidal mud flats.

### **The Natural Habitat**

The coastline of the UK is of international wildlife importance. There are 130 important coastal areas, over half in estuaries, with the Severn especially important. Estuary mud flats provide ideal feeding grounds for a wide range of bird species. The barrage would massively reduce the feeding area. It would also reduce sediment flows and velocity so reducing the quantity and type of food especially shellfish. It is feared the estuary would support substantially fewer birds with particular species threatened, though it is

very difficult to know how badly and whether or not there would be compensating gains.

### **Other Impacts**

Construction would provide an estimated 200,000 man years of work but also disturbance. Recreational opportunities would increase, but so would local traffic. Interestingly the barrage will change the Atlantic tidal regime and have effects on other coastlines. It has been calculated, for example, that a new barrage in the Bay of Fundy, Canada, half the size of the Severn, could raise high tides by 15-20 cm as far away as Boston, USA.

### **Present Position**

In mid 2006 the Welsh Assembly sought to revive consideration of the Barrage and several MPs and AMs have spoken in support. Conscious of the environmental concerns and aware of proposals for a so called 'tidal' lagoon in Swansea Bay, FoE advocated the use of lagoons in the Severn Estuary rather than a barrage. This would eliminate the need for locks, though the option of a road crossing would be lost or at least be more complicated. FoE claimed that lagoons with a total area of 115 sq miles (compared to 185 for the Barrage) could produce one third more electricity at less than half the cost. There is no reason why tidal lagoons can not operate like barrages but FoE's claims must be considered fanciful, not least because the total length, volume and cost of the walls will be almost 10 times greater (95 miles compared to 9.8)

### **Conclusion**

The Severn Barrage is a technically sound project and employs mostly tried and tested technology. It is a relatively expensive way to increase the UK's proportion of renewably generated electricity and, like most renewable sources, it has environmental advantages and disadvantages.

However given that the search for alternative renewable sources of power is proving far more difficult than optimists supposed a few years ago, barrages, and particularly the Severn Barrage, are slowly beginning to look genuinely attractive.

---