TIDAL POWER

INTRODUCTION

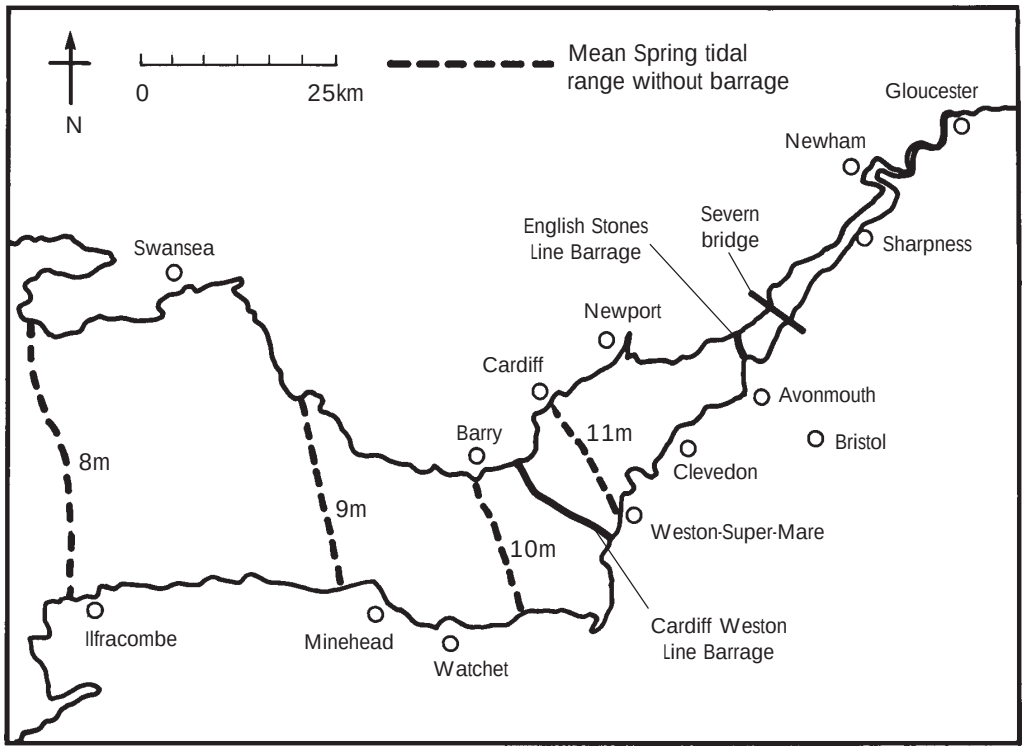
Policy on Renewable Energy
The government has a target of installing 1500 MW of new renewable electricity generating capacity by the year 2000. In addition the government has a commitment to return carbon dioxide emissions to 1990 levels by the year 2000. The government estimates that this will require implementing programmes to achieve annual savings of 36.7 million tonnes of carbon dioxide.

Potential in the UK for Tidal Power:
Technology for tidal power has been around for some time and there are suitable designs & plant commercially available. However, there are not yet any barrage schemes in the UK. From a technical point of view the potential resource available in the UK, from reasonably exploitable estuaries with a mean tidal range of 3m or more, is about 52TWh/y (about one fifth of present UK consumption). Approx. 90% of this is located in 8 large estuaries - the Severn, the Dee, the Mersey, Morecambe Bay, Solway Firth, the Humber, the Wash and the Thames.

The Severn Barrage
The Severn Estuary is considered to be one of the best tidal sites in the world and, if the Severn Barrage were built, it would be the largest single renewable energy project in the UK, generating 17 TWh of electricity per year.
The Estuary has extreme tidal conditions, with a large tidal range. The inter tidal zone is more than 200 sq. km, mostly formed of sediments with the rest being wave-cut platforms at the foot of cliffs. Salt marshes have been formed in some parts of shores. The rocky shores and cliffs are colonised by a variety of invertebrates and plants. Parts of the areas of soft shore on both sides of the estuary are backed by extensive wetlands that lie below the present high-water mark of spring tides and which are flooded by freshwater during winter.

The strong currents and high levels of sediment carried by the water mean that the food resources are relatively small and so the diversity and density of wildlife is lower than in other estuaries. However, because of the large feeding areas this estuary does support internationally important numbers of several species of waders and wildfowl and these species are not found in many other places. It is considered to be a site of global importance and qualifies for protection under European law and under the Ramsar Convention which is an international agreement for the protection of wetlands: neither of these have been granted yet. In 1989 the Nature Conservancy Council (now called English Nature) made the whole of the Estuary a Site of Special Scientific Interest.

After a number of studies by the Department of Energy, the Severn Tidal Power Group (STPG) and the Central Electricity Generating Board a decision was made in 1981 on what was considered the most suitable site (see map).



The estimated cost was £9.1 bill. at 1988 prices. (5 times more than the Channel Tunnel). It would produce about 13 TWh/year (5% of current electricity demand) and have an installed capacity of 7,200MW. It could replace two large conventional or nuclear power stations. The cost of electricity produced would be approx. 7-12p/kWh - twice that of the cost from coal.

A £20 million programme of research was then launched and some of the findings are presented in the following pages.

Task
Tidal power is a renewable energy source and as such is a preferable option for the generation of electricity - or is it ?

Your task is to consider whether construction of the proposed Severn Barrage should be supported or not and to present your findings in the form of a report to the Government.

Within your report you will need to:

- consider the economic arguments
- consider the importance of the environmental impacts and benefits
- take into account the Government policy on the development of renewable energy.
- highlight the main interest groups, and what should be done, if anything, to meet their needs and concerns.

Your report should include some form of assessment of local environmental impacts as well as comment on any potential environmental benefits. These benefits should be quantified where possible. For example the potential savings of carbon dioxide emissions due to the barrage could be calculated. You will need to be clear about the assumptions you make with respect to the mix of fuels displaced by the barrage.

You have been provided with information sheets and newspaper articles about the proposal. This information could be used to lead any further research you might need to complete your task.

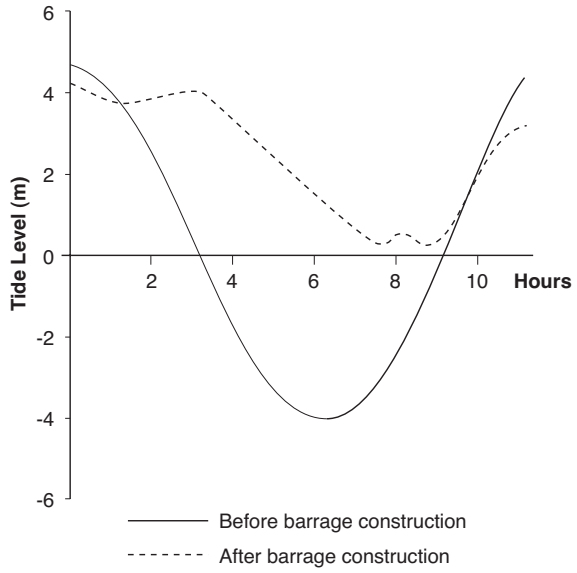
Additional research should be aimed at establishing alternative views and different sources of information that might further inform your conclusions.

FACTORS TO CONSIDER WHEN ASSESSING THE IMPACT OF THE SEVERN BARRAGE

Environmental and Ecological Effects
a) Changes in the Behaviour and Quality of the Water.

Construction of a barrage would result in higher minimum water levels and slightly lower high water levels in the basin. Less water will enter and leave with each tide.
Currents will be reduced and extreme wave conditions will, in many places, be less severe.

Graph of Water Levels at Newport



The changes in the tides and currents will cause changes in sediment characteristics and in the salinity and quality of the water. Salinity levels naturally vary substantially through the tidal cycle and the barrage would reduce this variation within the basin, although the average salinity level may increase.

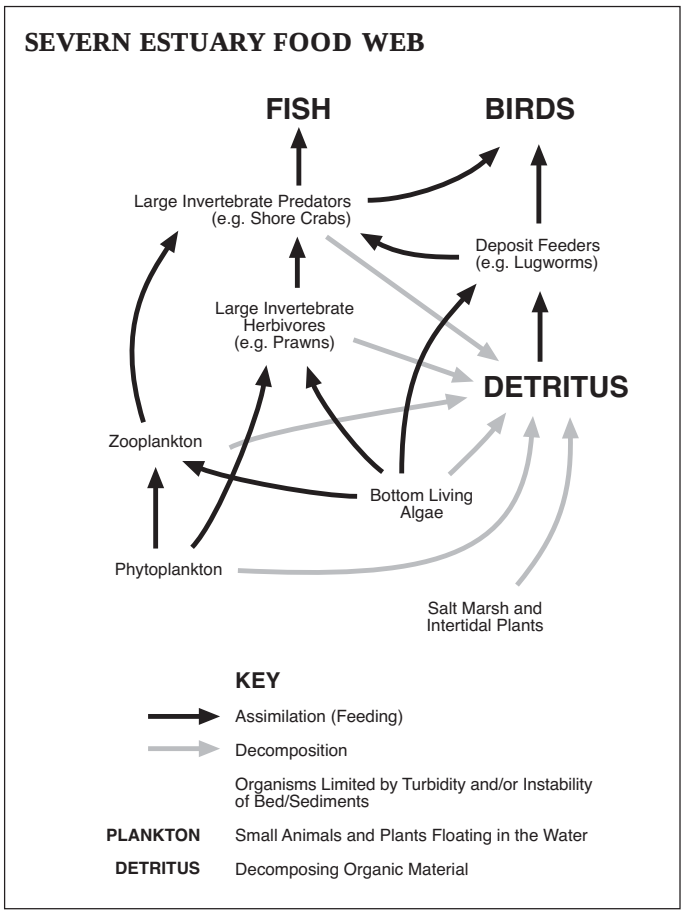
The reduction in the average currents is expected to decrease the quantity of suspended sediment which could cause an increase in biological productivity.

The level of pollutants, such as heavy metals like cadmium and mercury, received by the estuary from discharges of industrial and domestic wastes and their rates of dilution and dispersion could be affected. Little is understood about the processes of pollution movement and distribution in the Estuary. There is a danger that sewage and agricultural run-off from the catchment area may accumulate and cause toxic algae blooms in the water behind the barrage.

b) Effects on Wildlife and Plants:

Present predictions suggest an increase in species and numbers of plants and invertebrates due to the decreased suspended sediment in the water. This in turn could lead to an increase in the fish population; however, this is not known for certain. The type of species that might thrive in the new conditions are likely to be different from existing species.

The physical structure of the barrage could act like a reef and attract many species. However there are still uncertainties about the safe passage of fish through the barrage. It is known, for example, that 25% of fish are killed in their attempts to pass through the tidal power barrage in the Bay of Fundy.



The estuary supports internationally important numbers of overwintering birds and has significant spring and autumn populations. Studies indicate that overall numbers are as likely to increase as decrease. However, as 60% of the mudflats would be lost, the special conditions that they offer would be lost too, and the particular species that depend on them e.g. dunlin, curlew, would suffer. The most valuable food is found at the lowest tidal level which would be lost. Also the shore above the high tidal level, which is vital for birds as resting places, will be under pressure from development.

The saltmarsh zone would be particularly affected with the lower marsh washed away and the upper marsh drying out as it would be no longer flooded at any time. Several rare plants, e.g. sea-clover and wild celery, would be threatened and less tidal scour would favour cord grass which tends to be very dominant and would therefore reduce the number of species. Development of the shores would also threaten plant life.

The significance of the Severn Estuary for shelduck and waders from individual breeding populations

Species	Breeding area	Population size in N W Europe	Average winter peak in Severn Estuary	In Severn as proportion of N W Europe (%)
Shelduck**	N W Europe	125 000	2300	1.8
Dunlin** (Alpina)	Iceland	1 500 000	41000	2.7
Curlew**	Britain	105 000	3300	1.0
	Fenno-Scandinavia	195 000		
	Wadden sea	30 000		
Redshank**	Britain	105 000	2400	0.6
	Iceland	(300 000)		
Ringed Plover*	Britain	25 800	250	0.6
	E North Sea	13 500		
Grey Plover*	USSR	80 000	250	0.3
Oystercatcher	Britain	111 000	420	0.1
	Faeroes	26 000		
	Iceland	30 000		
	Wadden Sea	300 000		
Snipe	Britain	88 800	2300	0.01
	Fenno-Scandinavia /USSR	1 500 000		
	Iceland	900 000		
Golden Plover	Iceland	900 000	60	0.003
	Fenno-Scandinavia	840 000		
	USSR	?		
Lapwing	Britain	544 500	5900	0.3
	Continental Europe/USSR	1 500 000		
Knot	Arctic	350 000	1300	0.4
Turnstone	Arctic	50 000	270	0.5

* Nationally important
** Internationally important

c) Effects on People:
The tidal range, the areas of mud flats seen in the estuary and the quantities of sediment carried by the water will all be reduced and will change the appearance of the estuary.

New road links would be required and this could lead to an increase in activities in and around the estuary as well as the associated environmental impact of the road linkages.

New employment could be created both in the construction and maintenance of the barrage and in the industrial and leisure developments that may occur as a result of its construction.

The value of land around the new motorway junctions, the barrage landfall points and along the shores of the Estuary, is likely to increase.

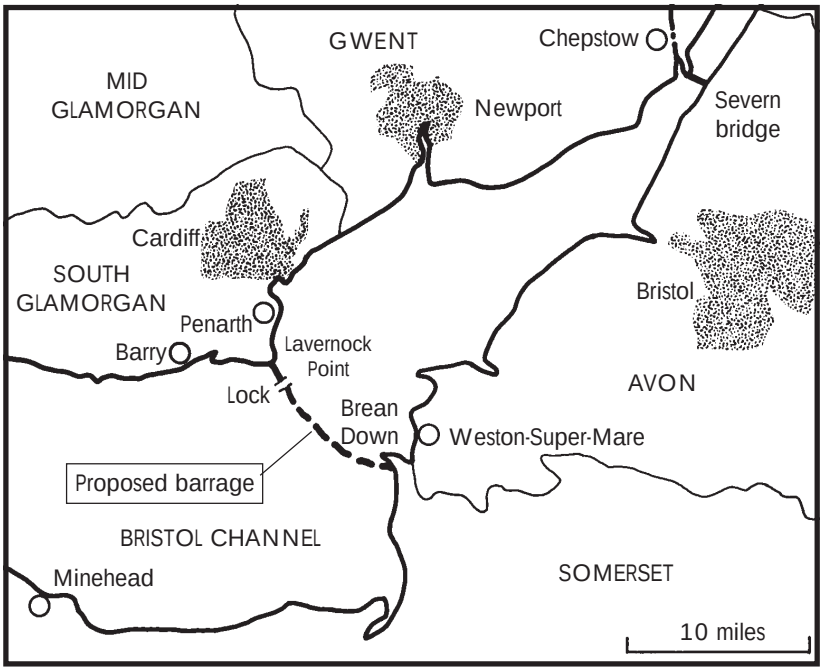
The construction of the barrage could cause considerable disruption.

The rise in mean water level in the basin will affect present arrangements for drainage and sea defences in some places.

Some low-lying parts of towns and cities around the estuary are known to be susceptible to flooding at times of high spring tide. The barrage may offer protection against this.

Heritage sites, sites of special scientific interest and areas of archaeological and geological interest may be affected.

BARRAGE ON SEVERN 'WILL HELP REDUCE POLLUTION'



A tidal barrage generating electricity on the River Severn could provide 100 years of environmentally-friendly energy, according to a study published by its backers yesterday. The report said the barrage could displace 7% of the electricity demand of England and Wales now supplied by coal-fired power stations, reducing pollution and helping to curb the greenhouse effect.

The study, which cost £4.4m, was carried out jointly by the Department of Energy, the Central Electricity Generating Board and the Severn Tidal Power Group. They say the project would create thousands of jobs for the region.

But the development's effect on the immediate environment is causing a major dilemma. The proposed site for the barrage - between Lavernock in Sough Glamorgan and Brean Down in Somerset - would affect some important mudflats and designated Sites of Special Scientific Interest. The Royal Society for the Protection of Birds if particularly concerned about the loss of important habitats. Conservation groups fear they would be trading off the advantage of reduced pollution for the disadvantage of damage to the region's wildlife.

Yesterday's report claimed the project would create "no insuperable ecological problems." But it said that "a great deal more work will be necessary before a full environmental assessment may be made." Simon Roberts, energy campaigner for Friends of the Earth, said the scheme cam some way down the list of environmentally-sensitive energy projects. "The Severn Tidal Barrage risks being a very expensive international environmental disaster," he said. "It would be money and an internationally important natural habitat wasted."

The cost of building the 10 mile barrage is estimated at £828m at 1988 prices, excluding the cost of roads, with a further £850m for off-barrage transmission and grid reinforcement. More exact costs could not be worked out until after privatisation of the electricity supply industry, the study said.

The barrage would include two power stations, containing 216 turbine generators. It would carry a dual carriageway linking motorways on both shores and providing a second crossing of the estuary 25 miles from the Severn Bridge. Building work could take up to seven years, with the creation of 35,000 jobs during the third year. Half of those jobs would be filled locally, the study said.

The report concluded: "If renewable energy sources are to be utilised to increase diversification of electricity generation and reduce pollution, the Severn Barrage remains the largest single project which could make a significant contribution on a reasonable timescale."

THE INDEPENDENT
Tuesday 24 October 1989

GREENS' REPORT FAVOURS BARRAGE

by Chris Rundle

The Severnside Green Party has welcomed the prospect of a Severn Barrage being built. The group, representing 20 local parties in Somerset, Avon and Gloucestershire, has published a 30 page response to the Severn Tidal Power Group's proposals for a barrage to harness the estuary's tidal energy. But the report says the project should take steps to minimise its environmental impact including a clear up of discharges into the estuary and a switch to organic farming in the Severn basin to reduce soil erosion, and thus silting, upstream of the crossing.

The report also says tourism should be discouraged to preserve the natural peace and beauty of the estuary.

WESTERN DAILY PRESS 1/8/90

SMALLER SEVERN BARRAGE SCHEME 'MORE EFFICIENT'

ENGINEER REVIVES OLD PLANS by Vikki Crvice

Plans for a small Severn barrage - first put forward 57 years ago - are more realistic than the current ambitious power project, it was claimed yesterday. Proposals for a 15.9 kilometre barrage from Cardiff to Weston were published earlier this year by the Severn Tidal Power Group, a consortium of contractors.

But yesterday consulting engineer Mr Arthur Hooker told scientists that a smaller barrage further upstream would be more efficient, less environmentally damaging and quicker to build.

Mr Hooker said a 5.8 kilometre barrage at English Stones, near the road bridge, could generate one-sixth of the energy at one-tenth of the cost, and be built in six years instead of ten. The present plan is a shipping hazard and would flood a stretch of estuary which is a Site of Special Scientific Interest, he said.

But the new proposals, costing £1.5 billion compared to £15 billion, could eliminate or reduce these problems, he told the British Association's Annual meeting in Swansea. The English Stones plan was first put forward by scientists in 1933 and rejected by STPG four tears ago because of possible silt problems.

But yesterday Mr Hooker said: "No steps were taken at the time to investigate measures which might eliminate or reduce the problem." He said recent studies showed that the problem might be solved by adapting the sluice gates. "It would be much more cost effective with a good prospect of private sector investment, subject to the problem of siltation being overcome," he said. "A comprehensive study is needed to define the extent of the problem and to confirm that the proposed measures would be effective."

WESTERN DAILY PRESS 24/8/80

BARRAGE ROAD 'COULD BE NEW LINK'

by John Turner

A glimpse into the future by Somerset County Planning Officer Eric Barnett involves a dual carriageway road west to east across the heart of Somerset. It would link up the A303 with South Wales via a double carriageway road across the top of the Severn Barrage.

Mr Barnett put forward his views when more than 200 people packed into the Princess Hall, Burnham-on-Sea, last night. They were there for a meeting organised by Sedgemoor District Council to hear details of the Severn Barrage and arguments for and against harnessing the tide waters for producing power. He described his theory as "the realms of speculation." But he went on: "It opens up all sorts of possibilities with a road on top of the barrage. It makes eminent sense to have a road across the barrage. That road could then link with the A303 and then to the M3 giving an alternative route to London from South Wales, easing the pressures on the M4."

Dr Tom Shaw had earlier put the views of the Severn Tidal Power Group which had just completed its latest reports into the giant project. The 10-mile construction from Brean to the Welsh Coast would produce clean power, enough for seven or eight per cent of power consumption in England and Wales at present levels.

Cold water was poured on the project by Janet Forbes, of the Nature Conservancy Council. While she appreciated tidal power was a "more favourable" type of power generating she said "the barrage would have a detrimental effect on the local environment."

EVENING POST 20/6/90

ESTUARY BARRAGE 'PUTS WILDLIFE IN DANGER'

The Severn estuary is in immediate danger of being permanently damaged, according to a major report out today. Plans for a barrage put it on a blacklist of 30 estuaries where only urgent government action can safely guard the future for wildlife, says the Royal Society for the Protection of Birds. In Turning the Tide - A Future for Estuaries, the RSPB says the Severn Estuary's 80,000 waders and wildfowl are in immediate danger. It is among the most threatened habitats in the entire UK.

The threatened birds, all of which migrate thousands of miles to the estuary in the winter, include the Bewick's swans from Siberia which have made Slimbridge world-famous, white-fronted geese, widgeon, ringed plover, dunlin, curlew and redshank. More than two million waders and wildfowl rely on the UK's estuaries for feeding and roosting in winter with many more stopping off in spring and autumn. If forced to move, many would die of starvation.

The report lists 80 estuaries at risk of some kind, blaming marinas, land reclamation, barrages, port and industrial expansion, and pollution for causing irreversible damage.

EVENING POST 5/9/90

BOOM ZONE WORRY IF SEVERN BARRAGE IS BUILT

by Ian Tabrett

Avon county council is likely to back the Severn Barrage - providing it gets a major say in planning the £9.7 billion project. But a report by senior officers to be considered by councillors tomorrow warns that much more research is vital.

They are worried about the impact the scheme will have on roads and services, and the high demand for homes likely in Weston-super-Mare, Clevedon and Portishead. They are also concerned about legal headaches as a result of higher water levels upstream from the ten-mile dam, and compensation for loss of trade by ports.

The consortium of contractors behind the project have forecast it will create up to 36,000 extra jobs and bring a population increase of 96,000. The report warns that West Country quarries should not be allowed to expand to provide the millions of tons of stone and cement which would be needed.

There would be such a massive increase in traffic that the builders should be asked to pay for road improvements over a wide area, as well as a six-lane highway over the dam linking up with the M5. And there should be safeguards to prevent damage by the sluices and 216 electricity-generating turbines to areas like Weston Bay.

WESTERN DAILY PRESS 11/4/90