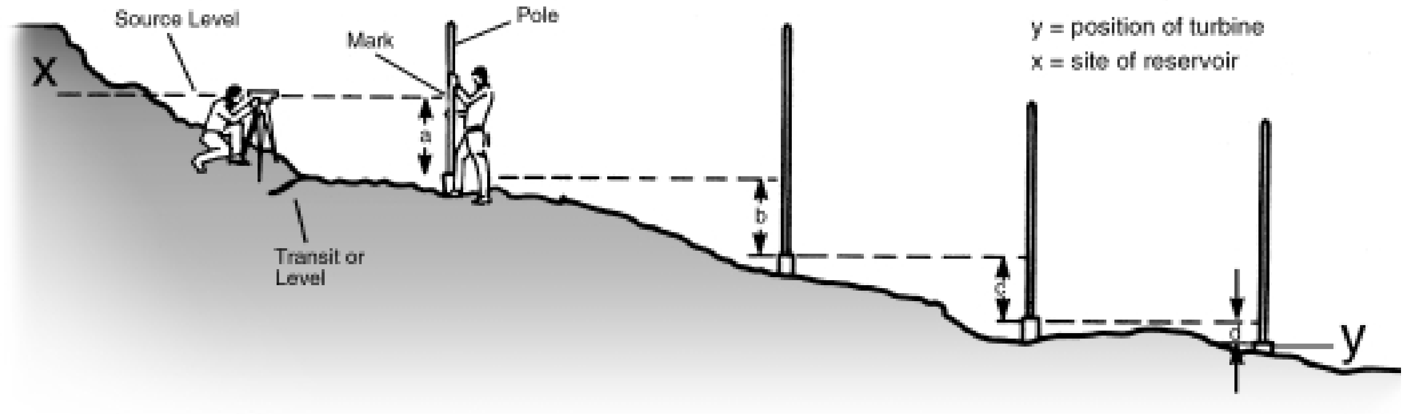


Fig. 9 Measuring the head. If you add a+b+c+d you will find the head from X to Y

To find the head you need to calculate the vertical drop of the water, but, of course, it won't be dropping vertically, it will be flowing down a slope (see figure 9).

This is the power available in the first place. If you actually built a system to generate electricity you would not get this much power out because the machinery is never 100 per cent efficient. Energy is lost as friction in the pipes and turbine, and as heat in the generator and electrical cables. Usually the overall efficiency is 50-60 per cent.

Tidal Power

History

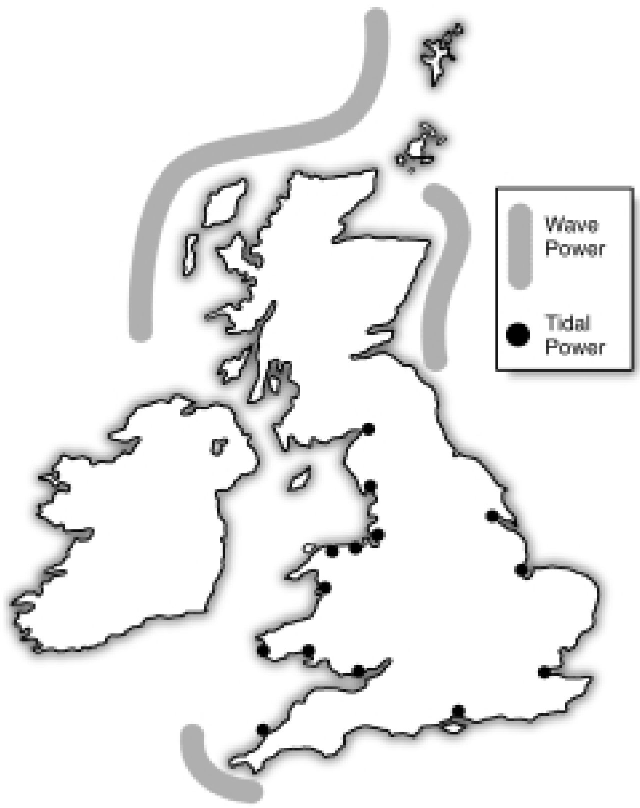
There are examples of the use of tidal power from hundreds of years ago. In the Middle Ages, tidal mills used water from a head pond which filled at high tides. The water flowed through a gate, driving a wheel. There was a mill on London Bridge in the 17th century which got half its power from the tidal movements of the river between the arches of the bridge.

Tidal power systems

Large-scale tidal schemes involve building a barrage (a type of dam) across an estuary where the rise and fall of the tide is very high. At the mouth of the river Rance, St. Malo, France, the first large-scale modern scheme has been working since 1969. It produces 500 GWh of electricity per year – which is 92 per cent of the power available from the tidal flow at that point.

There are a number of sites suitable for tidal power schemes in Britain (see figure 10). The Energy Technology Support Unit estimate that if tidal schemes were installed on all the reasonably practical river estuaries they could generate over 50 TWh per year of electricity, equivalent to 20 per cent of the present electricity consumption in England and Wales. A two-basin scheme at the Bristol Channel site could have a capacity of

Fig. 10 Map showing potential sites for wave and tidal power around the British Isles



up to 12 million megawatts, and provide about six per cent of our present electricity needs. Recent advances in turbine design and in methods of building barrages have brought costs down.

In the long term the electricity would be cheap and the energy payback would be very good, because the system would be in use for a very long time. There is, however, some destruction of the environment around the site during the building and, once the system is in use, the habitats of wading birds are reduced. This impact has to be set against two issues. One is the effect on birds of the air pollution caused by generating electricity by burning fossil fuels and how the birds might therefore benefit if we replace some of the fossil fuel burning with tidal systems. The other is the fact that if climate change due to pollution leads to a rise in sea levels then the habitats of those wading birds in the estuaries will, at best, change and at worst, disappear altogether.

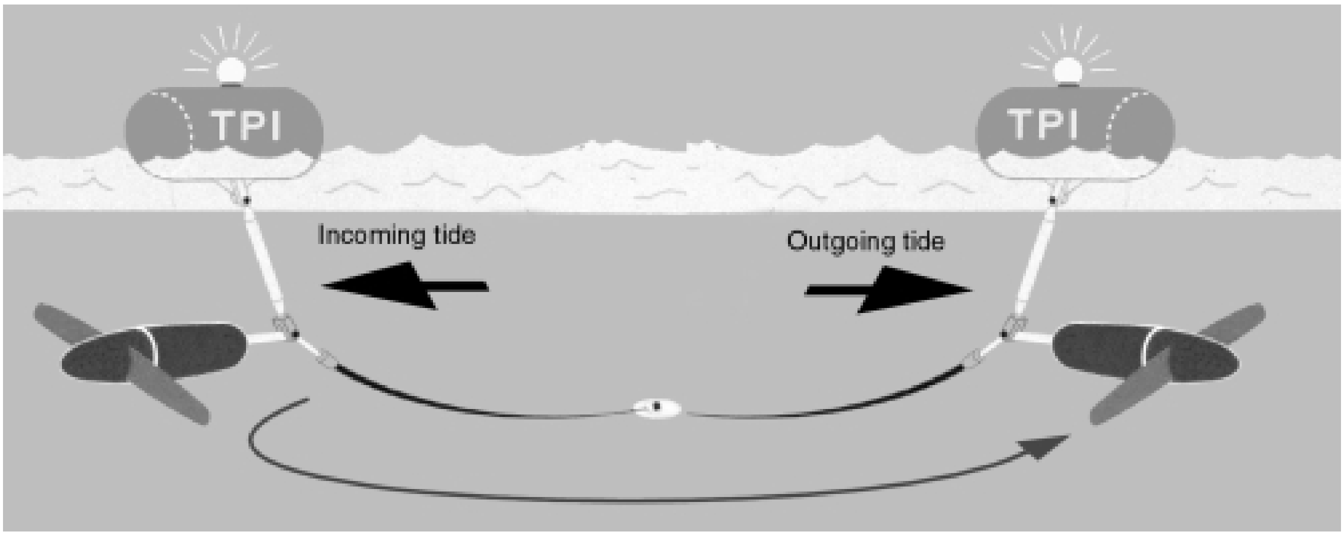


Fig. 11 A tidal stream system providing electricity for a light on a buoy

A small-scale tidal power system is being tried out in a sea loch in Scotland. The device being used looks rather like the top of a wind generator but with two blades. It is lowered into the water and rotates as the tide flows in and out past it, also swinging around when the direction of the tide changes (see figure 11).

It is much easier to manage the mains electricity system if you can predict when the power will be available and if the amount of power available does not vary enormously. A significant advantage of tidal power is that it is extremely predictable and we know the times and dates of tides well in advance. Tides ebb and flow twice a day and it is possible to generate power as the water flows upriver as