



Renewable energy from estuaries : free-stream and impounded barriers

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Global demand for 'renewable' energy sources includes renewed interest in tidal power. The impounded barrier scheme at La Rance in France, ('two-way', 240mW), has been operational since 1968, while a new scheme (one-way, flood mode, 260mw) in Korea is scheduled for completion in 2009. Extraction of tidal current energy via 'free-standing' devices (using both horizontal and vertical axis turbines) is also being developed. Twin horizontal-turbines mounted on a mono-pile rated at 1.2MW are now available while vertical-axis turbines rated up to 12 MW are being developed.

With increased capabilities of assimilating small scheme devices into regional electricity grids, the feasibility of such schemes needs to be examined alongside large-scale schemes traditionally associated with the Bay of Fundy, the Bristol Channel etc.

Here we examine the generic principles of the design, operation and environmental impacts of such schemes. For impounded schemes, the following characteristics are determined: (i) the fraction of maximum energy extracted, (ii) the duration of power production, (iii) the required installed capacity, (iv) net flow through turbines as a fraction of existing tidal prism, (v) the effective area of sluice gates and (vi) the rated turbine head as a fraction of tidal amplitude.

The above design characteristics are extended to examine the feasibility of tidal-stream energy both in isolation and in combination with impounded barriers. Related issues of : salinity intrusion, flushing rates, flood protection and sediment stability are also considered.