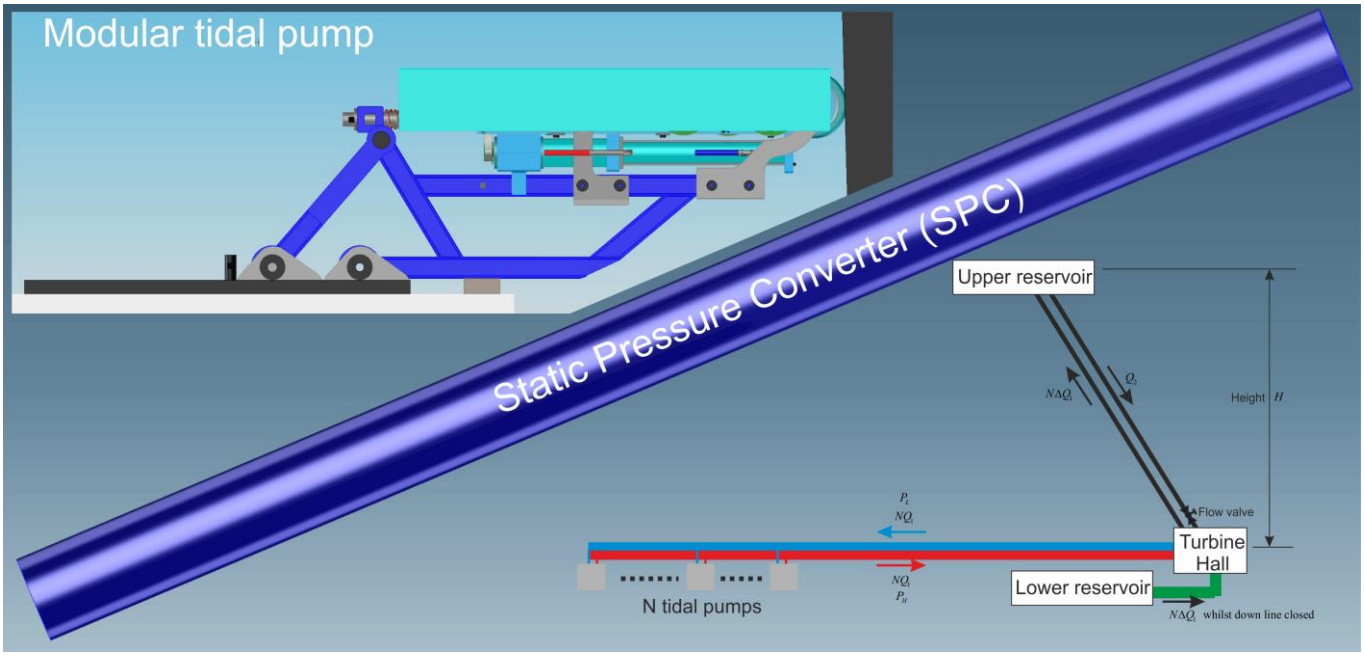
Organisation: SPC-Tidal

SPC Tidal Height Change Energy Proposal: Brief Description

Document: 170322_1



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Objective of this document

To convey to interested parties a new concept which utilises renewable energy to produce on demand generation of electricity, with a view to obtaining proposals to further develop the completed research work and build a working system to prove the design concept.

Key Design Criteria

1. To collect and store the renewable energy drawn from the rise and fall movement of "large" vessels created by tidal height change and by the loading and unloading of cargo.
2. To uncouple energy storage and electric power generation.
3. To minimise the destructive impact of salt water on machinery.
4. To design a system that is modular and totally land based.
5. To utilise the energy collected to drive turbines to produce on demand or peak load electricity.

The renewable energy source: Tidal height change

The tidal flow around the UK coast is both reliable and amenable to long term forecasting. The tide manifests itself as a sea level water height change over a period of roughly six hours in one direction. The complete cycle from high water back to high water is completed in approximately twelve hours. During any month, the tide is said to be in a state of neaps or springs. Each of these states lasts approximately two weeks. As an example, the height difference corresponding to minimum neaps or maximum springs at Torbay lies in the region of 3m and greater than 5m, respectively. In the Bristol Channel the height rises are more than double this.

It is evident that the unloading and loading of vessels, especially large ones, can be included in the tidal concept. Many meters of height change occur during these manoeuvres on "large" vessels. Further, the 'locking 'of vessels, such as occurs in canals, will provide a rapid 'tidal' effect.

The Proposal

In order to accommodate the diverse tidal ranges and vessel movement, it is preferable that the modular Tidal Power Generator Unit (TPGU) is flexible in the sense that only the instantaneous movement up or down needs to be considered. Neither the maximum tidal height variation nor direction should be of critical importance in the operating principle of the machine. Clearly, the overall tidal height change influences both the total energy produced and the machinery flexibility requirement.

The tidal height change can be considered as a source of renewable energy and may be characterised as one of low energy density. In order to generate a reasonable quantity of energy, it is necessary to involve large floating objects. If the tidal-energy company has to financially invest in the construction of such devices then the economic viability of tidal power generation becomes untenable. Making use of large vessels arriving in port eliminates this financial disadvantage.

A further consideration relates to vessel movement timetables. They will not necessarily dock at convenient times corresponding to those for which additional power generation is required. This problem is removed by introducing power storage. The electrical power generation can then be arranged at the behest of the consumer, whilst storage follows its own independent path. The power storage is the key to converting the low tidal energy density to a much higher energy density.

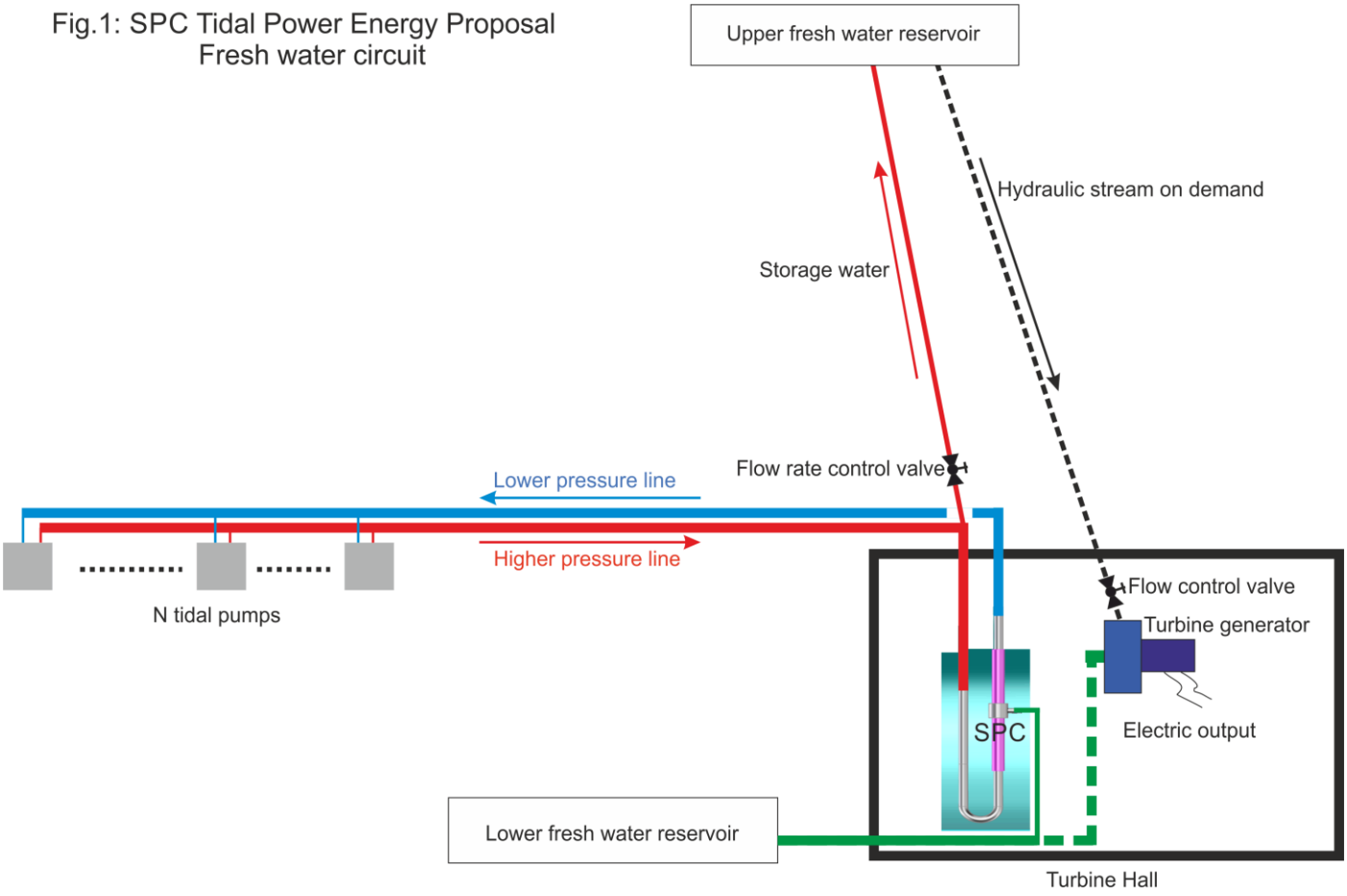
The present concept proposes to store the tidal energy produced in the form of fresh water reserves. This can be achieved by reservoir storage at a convenient height above the electric power turbine generator or by injection into a pressurised reticulation system. The civil works and other considerations associated with reservoir construction can be very capital intensive. Once again it is proposed to use existing infrastructure. Wherever there is a concentration of inhabitants in the UK an adequate pressurised water supply is mandatory. The new TPGU proposal would feed fresh water under pressure into the existing water reticulation system and extract from the accumulated total as, and when, required so as to drive the electric power generating turbine.

Mode of operation

Referring to Fig.1, a number of modular tidal pumps are mounted on piers and docks some distance from the turbine hall. Each modular tidal pump, when attached to a vessel, will contribute hydraulic power for circulating the fresh water along the higher pressure line to drive the Static Pressure Converter (SPC) device. The SPC draws in fresh water from the lower fresh water atmospheric reservoir and pressurises the input to that of the lower pressure line. This pressurisation is essential to reduce the torque required to drive the tidal pumps. The flow rate control valve on the storage water line adjusts the input volume that the SPC draws from the lower reservoir.

When electrical power is required at peak load periods the flow control valve in the turbine hall is opened and the generation begins. At the end of the peak load period the flow control valve is closed. The SPC continues without stopping to return the water that has been turbined back to the upper reservoir.

Fig.1: SPC Tidal Power Energy Proposal
Fresh water circuit



Modular tidal pump

The modular tidal pump converts the vertical height variation into a rotary motion without recourse to any electrical or electronic device. The rotary motion drives an eccentric pump that circulates the fresh water within the closed fresh water circuit. The modular tidal pump could be mass produced in units of nominal operating capacity of, say, 100, 1000 or 10,000 ton application. As an example, a vessel of 6,500 tons displacement would be serviced by seven 1,000 ton modules, or a single 10,000 ton module.

Document list

1. 170322_1_1: SPC Tidal Height Change Energy Proposal: Brief Description
2. 170322_2: SPC Tidal Height Change Energy Proposal: Concept
3. 170322_3: SPC Tidal Height Change Energy Proposal: SPC Characteristics