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INTRODUCTION

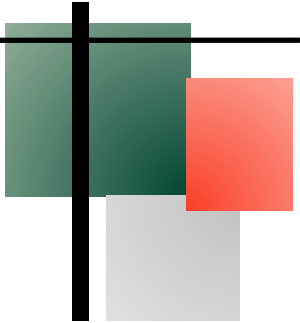
Tidal energy has an important role to play in certain locations. It offers benefits in that it is a dependable energy source at known times of the day. Traditional tidal energy schemes required the construction of barrage, leading to a high capital cost and a range of environmental issues. Whilst large amounts of power could be provided it was constrained to a short period before low and high water.

Recently run of tide energy extractors have been developed and these provide a lower capital cost and negligible environmental impact.

Tidal energy is normally used for the generation of electricity and Cussons products reflect this. One of the costs of wind and wave energy is the infrastructure cost of building a power line from an offshore wind/wave structure to the shore. The use of a run of tide turbine on the same structure can greatly improve the economics.

Cussons Technology Ltd provides a range of tidal energy products to permit realistic experiments in run of tide and barrage schemes. Many interesting engineering challenges are presented in the understanding of tidal power. The considerations include

- ◆ Energy available from a water stream
- ◆ Potential energy of water
- ◆ Reynolds numbers and dynamic viscosity
- ◆ Aerofoil lift and drag
- ◆ The use of lift to generate torque
- ◆ Relative angles and velocities
- ◆ Flow patterns and measurement



CUSSONS RENEWABLES TIDAL ENERGY RANGE

- ◆ Use of guide vanes in a fluid stream

One of the attractions of tidal energy is that it is an immediate application of engineering principles in a working machine.

Cussons provides a comprehensive range of instrumentation. Data can be recorded manually or through the use of data acquisition kits.

P6390 Run of Tide Turbine

Cussons offers a run of tide turbine generator module, able to measure torque and thrust generated from a water turbine. When used in open water blades of up to 1.2m diameter can be used, but shorter blades can be used effectively in artificial channels and river flows.



The module comprises of a small variable speed motor configured to act as a power generator, mounted on a shaft free to slide axially within ball bearings. The blades are mounted on a hub and allow the angle of attack to be adjusted and set with reasonable accuracy. The unit is provided with a control box that displays current, voltage and tidal turbine rotation speed. Thrust and torque are measured by load cells operating off the drive shaft and motor casing. Speed is measured by pulse counting.

A range of variable pitch tidal turbine blades is available as options, including

- P6391 tidal blades suitable for low Reynolds number airflows,
- P6392 twisted momentum blades and
- P6393 straight momentum blades.

The hub is designed to accept blades of a student's design. Cussons can manufacture blades to a customer's specification if required.

The tidal turbine can be used externally with natural tide or river flow, suspended from a boat or with the Cussons large water flow channel P6410.



Tidal barrage schemes have generally used an impeller wheel turbine to convert the large flow of medium head water as effectively as possible. Cussons Modular turbine test set system provides a range of different water turbine sets for use on its bench. A range of impeller turbine wheels and Pelton wheels are also available.

P6290– Francis Turbine Test Set



P6395 Barrage Scheme

The majority of tidal schemes have been created using a barrage to trap a head of water after the tide has come in, releasing the water through the turbine after the tide has ebbed.

The design of duct work to the water turbine is an important factor in the efficiency of turbine design, and raises important learning issues in patterns of flow.

Cussons barrage caisson scheme P6395 is designed to allow a variable head of water to be passed through a duct into a turbine pocket. The pocket is designed to accept the Cussons multi head pitot static tube "wake rake". This will measure the velocity and absolute pressure of the flow through the pocket, and can be indexed to different angles within the pocket. More advanced studies can be met by the use of a multi angle pitot tube, that allows the rotational component of water flow to be measured.

A variety of caisson guides are available as P6396, whilst others can be manufactured by the user. The tidal turbine can be configured to run within the pocket with the appropriate conversion kit.

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