Rewarding Learning

A2 LEVEL

FACT FILE

Environmental Technology

For first teaching from September 2014

For first award in Summer 2015

Emerging Technologies:
Wave and Tidal Power

environmental technology

FACT FILE

environmental technology

Emerging Technologies: Wave & Tidal Power

Specification Content

Students should be able to:

- discuss why producing energy from waves and tides is a priority concern for Northern Ireland;
- identify the constraints on developing wave and tidal technology, for example limited availability of suitable sites and high cost of development;
- compare and contrast the two major generating methods for tidal power: – tidal stream generators, for example SeaGen, Strangford Lough; and – tidal barrage, for example Rance Estuary, France;
- outline the operational processes in two main types of wave energy converters: point absorber and attenuator, for example Pelamis;
- describe the environmental impact of tidal and wave energy devices, with reference to marine life and habitat, toxic pollution, visual and noise impact and conflict with other sea users;

Course Content

Obtaining energy from the sea is important for the economy of Northern Ireland given the size of the available renewable resource for several reasons. Amongst these are:

- Northern Ireland currently imports 92% of its energy;
- carbon savings and hence meeting renewable energy targets, set by government;
- increased security of supply; and
- additional employment opportunities.

There are however, considerable constraints on the development of energy from wave and tidal sources. Chief amongst these are:

- The high cost of development; and
- The availability of suitable sites.

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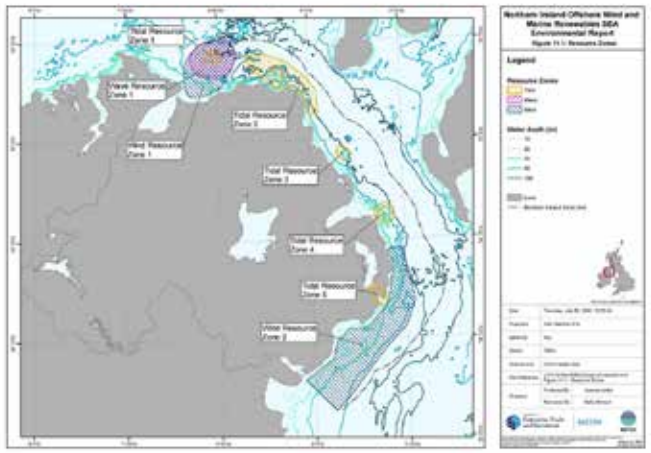
The diagram to the left shows possible sites for the development of wave and tidal energy generation as identified by DEFRA. Each presents its own challenges in terms of:

- Local geography;
- Existing use; and
- Environmental concerns.



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More details can be found from http://jncc.defra.gov.uk/PDF/0955_Explanatory_Summary.pdf

Tidal Power is mainly generated using two specific techniques:

- Tidal stream generators; and
- Tidal barrage generators.

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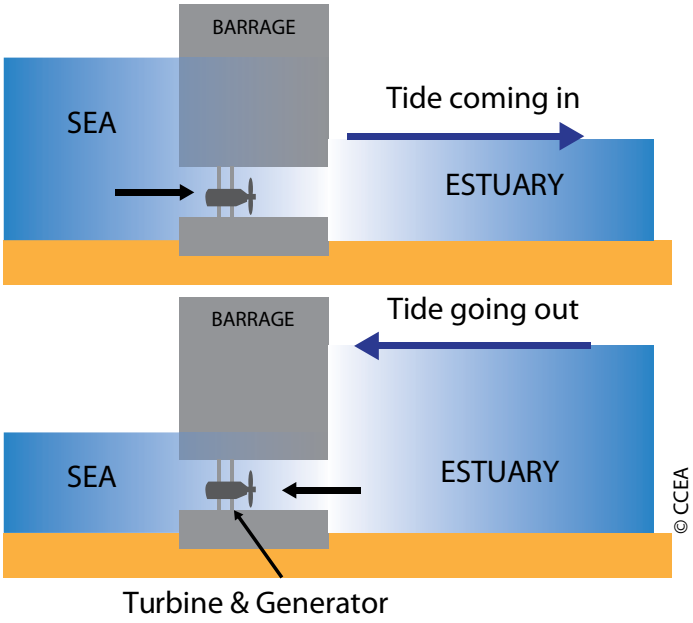
A tidal stream generator such as the one located on Strangford Lough operates using what are essentially underwater turbines. These use the energy provided by fast

moving sea currents or tidal streams which appear when the tide is moving in and out. These can be seen on the photograph to the right. The turbines rotate in the normal way and this in turn operates a generator so producing electricity.

Openhydro are an Irish company who manufacture tidal turbines. The company is located in Greenore at Carlingford Lough. Logon to their website at www.openhydro.com/technology to view some animations of tidal turbines.

A tidal barrage operates in a way similar to a hydro-electric dam but on a much smaller scale. It requires the construction of a barrage across an estuary with gates and turbines built into the wall of the dam. As the tide flows in, the gates are open, and the turbines are operated so producing electricity. At the high point of the tide the gates are closed, and the water is held until the level outside the gates has fallen to a significant amount e.g. 5 metres. The water is then released so operating the turbines and producing electricity.

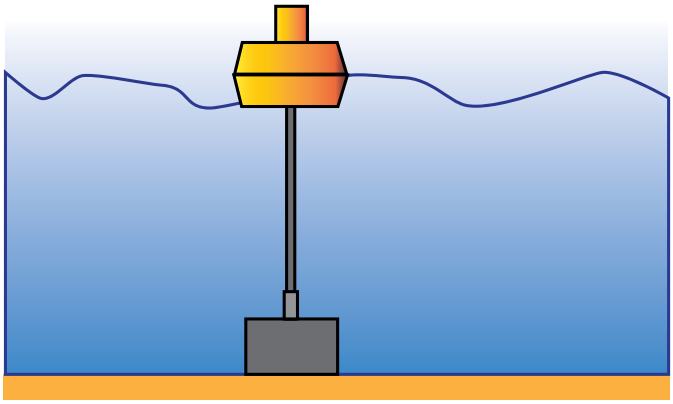


Tidal stream generators have some advantages compared to tidal barrages in that they:

- Are cheaper to build;
- Are generally assumed not to have as significant an environmental impact as tidal barrages; and
- As the turbines turn relatively slowly they do not have a significant effect on sea life.

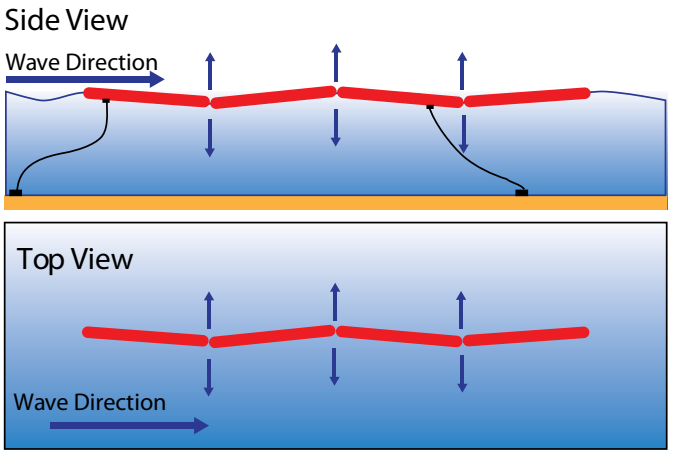
Wave energy converters can be classified into several groups two of which are:

- Point absorber systems; and
- Attenuator systems.



A **point absorber** device is essentially a floating shape similar to a buoy which is connected to components that move up and down, relative to each other due to the rising and falling of waves. This mechanical energy is used to drive an electrical generator. The electrical energy is then transferred down a cable to a connecting junction on the seabed where several other point absorber devices can be connected together and linked to the shore through a single underwater cable. The device itself can either float or be anchored to the sea floor. An animated version of the above image can be viewed at; www.emec.org.uk/marine-energy/wave-devices/

An **attenuator** device on the other hand is aligned on the surface of the water in a direction parallel to the motion of the waves. A well known example of this type of wave power generator is the Pelamis which consists of a series of long cylindrical shaped devices which float on the surface and are connected to each other by hinges and are anchored to the sea bed.



As the cylindrical parts follow the motion of the waves they drive hydraulic rams in the various sections which are connected together, which in turn drive electrical generators. The electricity can then be combined from the different sections of the structure and sent to the shore via a cable. Further information on Pelamis can be obtained at; www.pelamiswave.com

Both tidal and wave power systems can have a number of environmental impacts e.g.:

- Influence on marine life and habitat;
- Toxic pollution;
- Visual and noise impact; and
- Potential conflict with other sea users.

Activity

Using the links shown above, or others of your choice, research the possible environmental impact of the development of wave and tidal power. Produce a PowerPoint presentation which provides a balanced view of both sides of the debate.