Going with the flow

A Tyneside company is developing a novel power-generating device that captures energy from tidal streams or rivers. The device makes extensive use of off-the-shelf technologies.

Oceanflow's Strangford Narrows prototype Evopod (above) and (right) a view of what's happening below the surface

Energy captured from ocean tidal streams is a promising future source of electricity. Unlike windpower, tidal streams are predictable and offer a reliable source of energy (except when the tide is turning). Also, because water is more than 800 times denser than air, the power that can be converted to electricity is much greater than with a similarly sized wind turbine.

Several different tidal steam energy concepts are being developed – most of them designed to be mounted out of sight on the seabed. But a North Shields company called Oceanflow Energy is developing a semi-submerged floating device with a simple mooring system that allows it to maintain an optimum heading into the tidal stream. This device, called an Evopod, generates power using one or more underwater turbines suspended below the floating structure.

Oceanflow argues that the Evopod design overcomes some of the key worries over seabed-mounted tidal stream turbines. As a floating device, it imposes minimal disturbance on sensitive seabed ecosystems and its turbines rotate at such slow speeds (10–20 rpm) that they are unlikely to be a threat to marine wildlife. In addition, the novel mooring system has a tight operating envelope, reducing the area from which shipping needs to be excluded.

Unlike fixed seabed-mounted devices, the Evopod does not need lengthy, expensive and risky installation operations. It has been designed for efficient operation in exposed sea areas where waves co-exist with tidal currents. Basic maintenance can be performed from a boat but, if necessary, the turbine assembly can be disconnected from its mooring system and removed for maintenance in a sheltered area.

Another attraction of the floating technology is that it can be used in harsh deep-water sites where the bulk of the UK's tidal energy resource is found. The system has been designed to survive extreme wave conditions.

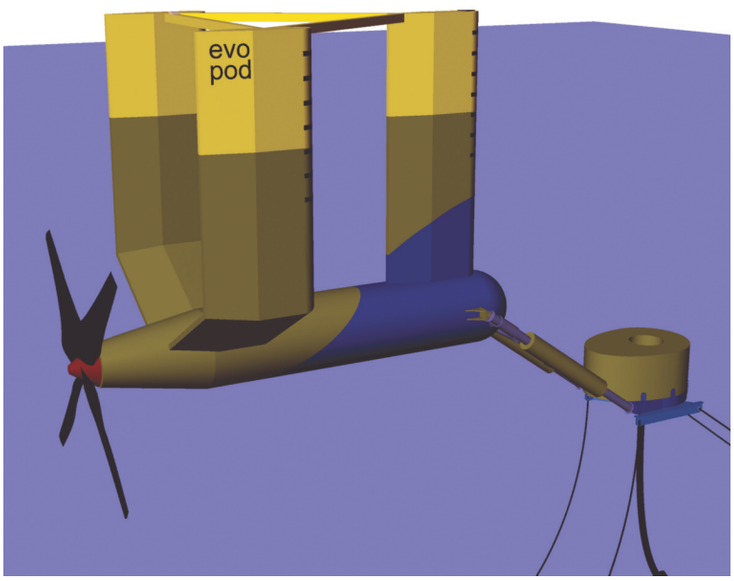
Oceanflow estimates that a seabed area of one square kilometre could support enough Evopods to supply the energy needs of up to 40,000 homes. If replacing power from a coal-fired power station, this would reduce carbon dioxide emissions by 110,000 tonnes per annum.

As well as capturing energy from tidal streams, the Evopod could also tap energy from rivers and ocean currents.

Evopod uses a proprietary system to segregate the power export umbilical from the mooring lines. Its power train (gearbox, generator and controls) makes maximum use of standard wind turbine components, while the marine parts (shaft, seals, stern bearing and power export swivel) all use standard marine components.

An important milestone in the development of the Evopod was reached in March this year when a 1:10 scale single-turbine version moored in Strangford Narrows, Northern Ireland, fed power into the local electricity network. This is thought to be the first time that a semi-submerged tethered tidal stream turbine has exported power to the shore.

Power from the Strangford Narrows turbine is exported via a slipring supplied by



MacArtney Underwater Technology installed in the buoy. The turbine uses a fixed-pitch turbine driving a FuturEnergy permanent magnet generator via a ZF gearbox supplied by Heason Technology. The power control and data capture system uses a Mastervolt Windmaster inverter drive.

To measure the torque and rotational speed of the turbine, Oceanflow Energy has been using Sensor Technology's TorqSense strain transducer. Torque is a critical measurement in this application because it indicates the power that can be derived from the system as well as revealing stresses on the turbine. Data logged on board the energy system can be transmitted to the shore allowing Oceanflow to monitor the system's performance remotely.

The data gathered from the prototype has helped Oceanflow to design a larger 35kW version due to be deployed in Scottish waters later this year.

Oceanflow has also tested a 1:40 scale model twin-turbine design in Newcastle University's flume tank. A full-scale version would use twin 1.2MW generators, each coupled to a 16m-diameter three-bladed turbine. This system would generate a combined output of 2.4MW in water flowing at speeds of 3.2m/s or faster.

Part of the cost of developing the Evopod system has come from a grant from One North East, the regional development agency for North East England. □