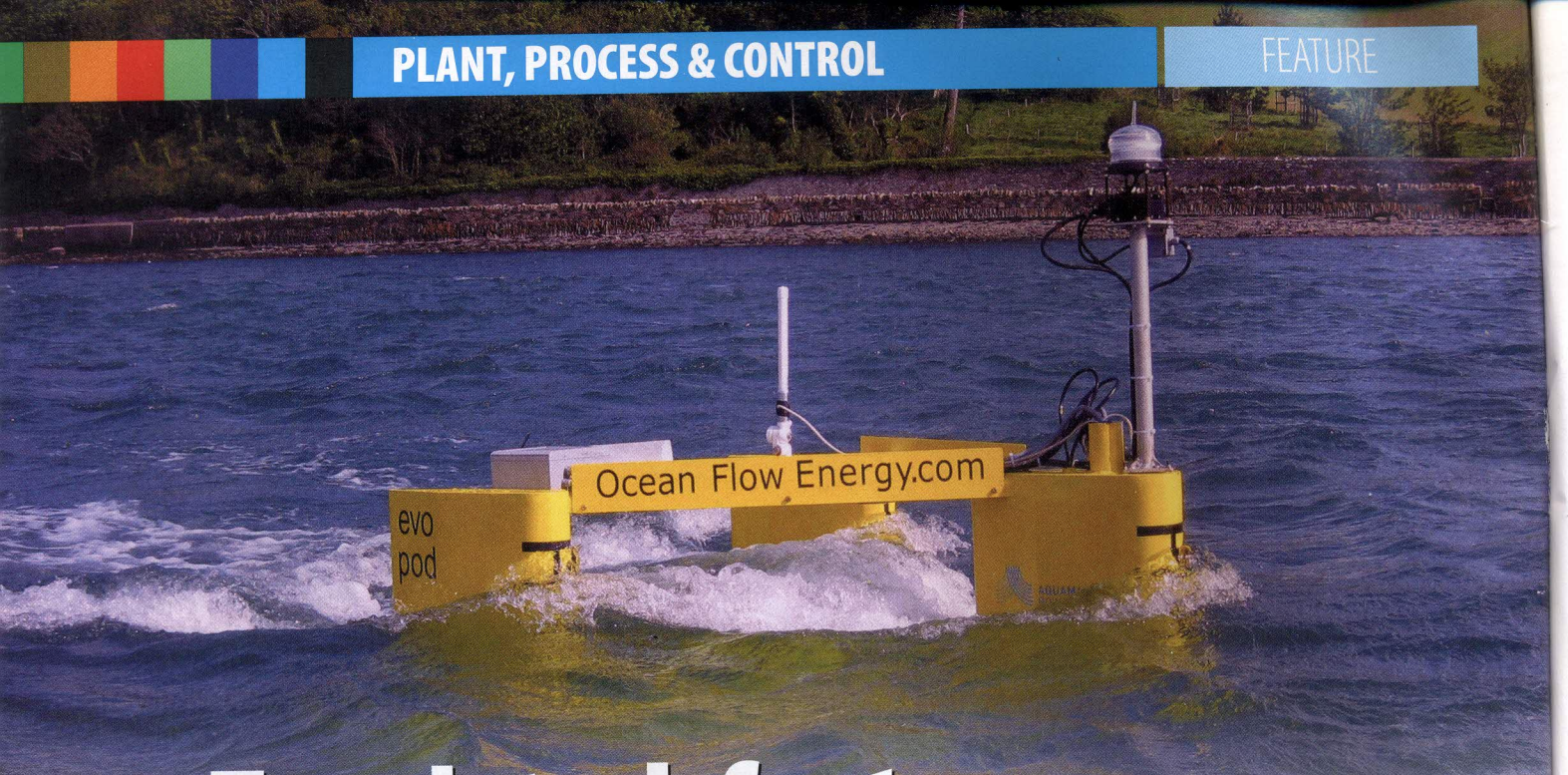


# Tough task for torque sensor

***Practically infinite reliability was the defining requirement when researchers wanted to run a TorqSense torque transducer under the sea as part of extensive trials of a green energy turbine***

Developed by Tyne & Wear based Oceanflow Energy, Evopod is a semi-submerged, floating, tethered tidal energy capture device. It uses a simple but effective mooring system that allows the free floating device to maintain optimum heading into the tidal stream. Installed as an individual device or as a tidal farm, the technology offers clean, green energy.

Evopod is said to overcome the key concerns that have been expressed for tidal stream turbine installations. As a floating tethered device it imposes minimal disturbance on sensitive seabed ecosystems and its single turbine rotates at such low speeds (10 to 20rpm) that they are likely to be a low threat to marine wildlife. Further, Evopod's novel mooring solution employs a tight envelope to reduce the size of the exclusion zone for shipping. A seabed region of one square kilometre can support enough Evopods to supply all the energy needs of up to 40,000 homes. This would reduce carbon dioxide emissions by 140,000 tonnes per annum if replacing power from a coal-fired power station.

An important milestone in the development of Oceanflow's Evopod technology was reached on the 6th March 2011 with the demonstration of grid connectivity by the company's 1:10th scale trials unit in Strangford Narrows Northern Ireland. The output from the Evopod can now be fed into the domestic mains circuit of Queen's University's Marine Laboratory.

The Evopod employs a fixed pitch turbine driving a permanent magnet generator through a gearbox. Power control and data capture are essential for reliable energy generation. For an effective sensing solution to measure the torque and rotational speed of the turbine, Oceanflow Energy turned to Sensor Technology and its TorqSense torque sensor.

Torque is a critical measurement as it indicates the power that can be derived from the system as well as giving an indication of the stresses on the turbine. But the marine environment and the nature of the turbine's operation places unique performance requirements on the sensing equipment.

Oceanflow Energy design engineer Roger Cox comments: "We had used TorqSense transducers before and had good experiences with them. We knew they were reliable in challenging applications, and would give us the quality data we needed as part of our proof of concept of the Evopod."

TorqSense is a surface acoustic wave (SAW) based device. In a TorqSense transducer, surface acoustic waves are produced by passing an alternating voltage across the terminals of two interleaved comb-shaped arrays, laid onto one end of a piezoelectric substrate. A receiving array at the other end of the transducer converts the wave into an electric signal.

The frequency is dependent upon the spacing of the teeth in the array and as the direction of wave propagation is at right angles to the teeth, any change in its length alters the spacing of the teeth and hence the operating frequency. Tension in the transducer reduces the operating frequency while compression increases it. To measure the torque in a rotating shaft, two saw sensors are bonded to a shaft at 45° to the axis of rotation. When the shaft is subjected to torque, a signal is produced which is transmitted to a stationary pick up via a capacitive couple comprising two discs, one of which rotates with the shaft, the other being static.

"Data is logged on board, but also transmitted back to shore so we can remotely monitor the operations," says Cox.

"We used TorqSense devices on the very first Evopod design to go into the sea, and they've been working reliably on our 1/10 scale test unit for five years," he continues. "They are now being incorporated on our larger scale units, including a 35kW version. We are also developing a twin-turbine version: 1/40th scale model has been tested in Newcastle University's flume tank with the support of a NEEIC grant. At full scale the unit would be fitted with twin 1.2MW rated generators, each coupled to a 16m diameter three-bladed turbine. The unit would generate its combined rated output of 2.4MW in flow speeds of 3.2m/s or above."