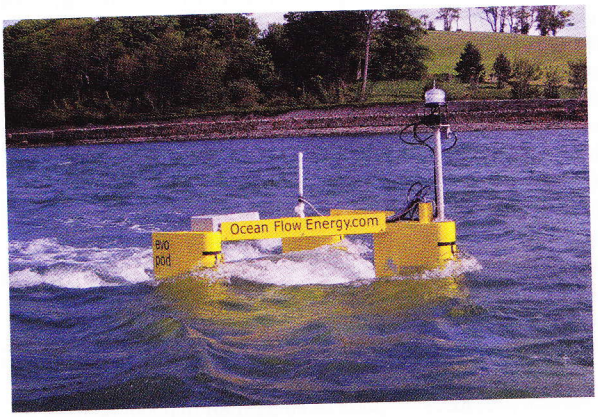
Researching tidal energy generation

When Ocean Flow Energy needed to run a reliable transducer under the sea during trials of its tidal energy capture device, it turned to **Sensor Technology** for the torque measurement solution



Evopod is a semi-submerged, floating, tidal energy capture device

Research into alternative methods of generating energy is ongoing across the world, and one example is being developed by Ocean Flow Technology with the aim of providing dependable and affordable energy. The Tyne and Wear based company's Evopod is a semi-submerged, floating, tidal energy capture device that has a simple mooring system that enables it to maintain optimum heading into the tidal stream. The technology offers clean, green, energy.

The device also overcomes tidal stream turbine installation concerns. For example, as it is a floating tethered device it imposes minimal disturbance on sensitive seabed ecosystems, and its single turbine rotates at such low speeds (10 – 20rpm) that they are likely to be a low threat to marine wildlife. Its mooring solution employs a tight envelope to reduce the size of the exclusion zone for shipping.

A milestone was reached this March 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 the Queen's University Marine Laboratory.

Torque and speed measurement

According to the company, a seabed region of one square kilometre can support enough Evopods to supply all the energy needs of up to 40,000 homes, reducing carbon dioxide emissions by 110,000 tonnes per annum if replacing power from a coal-fired power station.

The devices use a fixed pitch turbine driving a permanent magnet generator through a gearbox. Power control and data capture are essential for reliable energy generation.

As an effective sensing solution was needed to measure the torque and rotational speed of the turbine, Ocean Flow Energy turned to Sensor Technology which supplied its TorqSense strain transducer.

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

With the TorqSense transducer, surface 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.

As well as being logged on board, the date is transmitted back to the shore for remote monitoring.

Roger Cox, Ocean Flow Energy design engineer, said: "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.

"They are now being considered for our larger scale mono-turbine and twin turbine units. A 1/40th scale model of our twin turbine unit 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."

Sensor Technology
T: 01869 238400
www.sensors.co.uk

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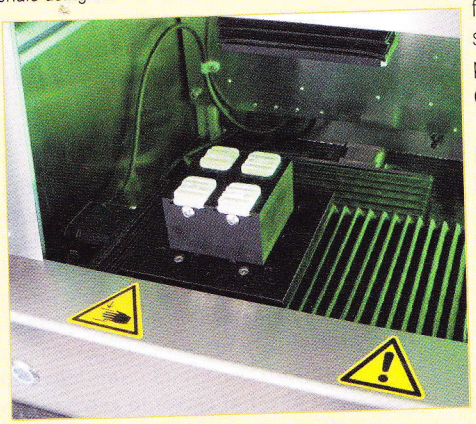
Confocal chromatic measurement benefits dental research

Developed to detect and profile the surfaces of materials using the non-contact confocal measuring technique, Certiga - Engineering Solutions' KF-30 automatic measurement system then displays the results three-dimensionally. Its benefits mean it is being used by Munich polyclinic in dental research to measure the biting surfaces of implants and to analyse the resulting abrasions.

With the system, the surface is displayed visually using a CCD camera and the desired area marked in the 'live' image. Up to eight surfaces can be measured automatically.

To ensure high precision measurements, the company has used Micro-Epsilon's optoNCDT 2401 confocal sensor, which enables a resolution of up to 0.12μm to be achieved. As the colour, which is in the focal point, is used for distance information, confocal sensors have a very small measuring spot that enables measurements on particularly small objects, ensuring even fine scratches on a surface can be measured.



The optoNCDT 2401 confocal chromatic measuring system comprises a controller and a sensor. A fibre optic cable, up to 50m in length, connects these two components.

The system consists of an LED-based controller, a fibre optic cable and one of the sensor heads from the series 2400/2401/2403, or the 2402, said to be world's smallest confocal sensor. It is also able to measure in narrow apertures, small gaps and cavities.

Micro-Epsilon
T: 0151 355 6070

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www.micro-epsilon.co.uk