Pelamis on crest of a wave in marine power

▶ Firm's key role in first commercial wave farm

▶ Portuguese plan to cut energy imports

Elisabeth Jeffries

A British company will play the lead role in the start-up of the world's first commercial wave farm this week off Póvoa de Varzim, northern Portugal.

Pelamis Wave Power, an Edinburgh-based producer of marine power equipment, has supplied three of its wave devices to Babcock & Brown, the developer, which is about to switch on the first stage of an eventual 20MW project, enough to power 13,500 homes.

Max Carcas, Pelamis's business development director, described the commissioning as "a real milestone, putting us in a good position for demonstrating the technology and propelling the sector forward".

Though initially modest in capacity, the Portuguese project is significant because it goes beyond the prototype or concept-testing that is in progress at other sites in Europe, North America and South Africa. It involves the Portuguese Government rolling out a €1.5 billion (£1 billion) 550MW wave power plan.

Costs should fall as investors benefit from the experience gained during the first phase, leading to further generations of more efficient machines and, it is hoped, a competitive technology within ten years.

With its long coastline, Portugal has a potentially strong energy resource on hand and wants to cut its 85 per cent dependency on energy imports by investing in marine power. "We don't have coal, but we have waves," Rui Barros, the project manager, said.

The plan means that Portugal is likely to be the marine energy sector's most important sponsor for some time. The country has chosen to alleviate the costs and risks born by newer renewable energy technologies through a guaranteed price for the electricity, paid by utilities.

The renewables obligation certificate (ROC), Britain's mechanism for encouraging renewables development, has not worked in the same way and has been directed towards the less capital-intensive technologies, leading to the spread of onshore wind farms, for example.

Scotland may be well placed to host Britain's first commercial site. The Scottish Executive has leapfrogged a reform of the ROC scheme that is due to start in 2009 in the rest of Britain and introduced changes in April.

"The system is set at the right level to enable investment to come forward in Scotland," Mr Carcas said.

ScottishPower, npower and E.ON, the German energy company, are among the utilities interested in wave power. ScottishPower plans to pay for further wave power device-testing in Orkney from next year, while E.ON may buy seven Pelamis devices to use at Wave Hub, a Cornish test centre.

In most of Britain, the sector has had difficulty in gaining acceptance, although the planned restructured ROC system will make a big difference by doubling the incentives for wave power, while also helping to develop investment in a broader range of renewable energy types.

Critics argue that it is more expensive than most of those other sources, although Mr Carcas argued that "opening costs are substantially below where wind started 25 years ago" and that wave power is only three or four years behind offshore wind.

According to the Carbon Trust, the marine sector as a whole needs a commitment of £400 million by 2015 on top of current grants and the ROC scheme, but would bring in between £300 million and £900 million in annual revenue by 2030, allowing an export industry to develop along the lines of solar energy in Germany or wind in Denmark, both of which have been very successful.

"We'll see how it plays out," Michael Hay, head of offshore renewables at the British Wind Energy Association, said. "It could be that manufacturing itself will develop here, though I'm not sure there's enough conviction. But if not, we'll still make returns through intellectual property."

Devices produced by the Edinburgh-based Pelamis harness the relentless power of waves to generate electricity

Cashing in on the 'Christmas' energy rush

Wave power is more predictable than wind energy, with condition forecasts possible three days ahead *(Elisabeth Jeffries writes)*.

It is also a more concentrated form of energy than most other renewable energy sources.

However, it is less predictable in the long term than tidal energy. Wave power is also seasonal and nearly half of the annual energy produced by it becomes available between December and February.

Since the water's surface is sometimes calm, the variability of the energy is an important issue. As with wind and other energy sources, it is necessary to provide a "spinning reserve" — or back-up generation of energy, available when needed — to make up for lulls.

Moreover, there are environmental conditions to overcome. The Pelamis system must withstand the force of the elements at their worst.

Pelamis units are fixed by a system of weights and floats designed to keep the device facing oncoming waves. Each device is about the length of four train carriages and lies semi-submerged, partly visible on the water's surface.

Its articulated structure is composed of cylindrical sections linked by hinged joints. The wave-induced motion of these joints is resisted by hydraulic rams, which pump oil through hydraulic motors which, in turn, drive generators to produce electricity.

Power is fed down a single cable to a junction on the seabed. Several devices can be connected together and linked to shore through a single seabed cable. The resistance of the rams can be varied according to the sea conditions to maximise generating capacity.

Ideally, the Pelamis system is moored in waters approximately 50m-60m in depth (often 5km-10km from the shore). This would allow access to the potential of larger swell waves, but avoid the costs involved in a longer submarine cable if the device was located further out to sea.