HYDRO INTERNATIONAL INTERVIEWS NEIL KERMODE, EMEC

"Lack of Understanding of Turbulence Remains a Hurdle"

Renewable energy is 'hot' these days. Many people think of wind farms on the horizon when they think of marine renewable energy. Marine energy can manifest itself in more shapes, including tidal and wave energy. These are more specific to a location but their potential can be surprising. The European Marine Energy Centre (EMEC) in the UK is a test centre for tidal and wave energy devices operating in an interesting area with wave and tidal potential. Read *Hydro International's* interview with Mr Neil Kermode, managing director of EMEC, to find out more.

Joost Boers, editorial manager, Hydro International

When talking about 'marine offshore renewables', most people think of wind farms. What is the potential of tidal and wave energy?

The Carbon Trust produced a report some years ago that indicated the UK had the potential to harvest 1/5th of its electricity from wave and tidal energy. To put that into context that is about the same as the UK nuclear fleet delivered last year.

Can you briefly explain the relevance of a tidal and wave energy test centre instead of developing for the operational locations?

There is a lot we don't know about marine energy and there are a lot of details to be worked out based on the individual devices being developed. So the test centre has sought to provide those elements that are likely to be common such as a grid connection, a leased site with resource, safe systems of work, stakeholder involvement, performance verification and a long list of services to help the developers deploy. By providing all this the developers can go and concentrate on their device whilst the test centre does the 'back office' work. This also means that the back office services can work for multiple developers, thus providing an efficiency that spans multiple projects. And crucially if a developer fails, as some will do, then the investment in the back office activities does not sit with them and is not lost.

In essence we provide incubator space to allow developers to learn their craft as quickly and efficiently as possible.

Why has did EMEC choose Orkney as test location site? What kind of hydrographic and oceanographic surveys were made to achieve this?

The selection of the sites was the result of multiple selection criteria. Hydrographically we sought sites with good wave resource in deep enough water close to the shore to minimise the length of cables. Other factors included the proximity to a good harbour to assemble the flotilla of vessels for deployment/servicing.

Bathymetry was obtained along with some cone penetrometer readings in sediment on site. Wave rider buoys have been on the wave site for 13 years and acoustic current profilers have been extensively deployed. More recently X-band radar has been used to look at water movement on the tidal site.

However, one major factor in the success of the centre to date has been the keenness of the supply chain to get involved. Orkney has seen the private and public sector really seek to welcome the industry by providing buildings, piers, vessels, divers and a myriad of expert mariners and generations of knowledge of the area.

Looking back, would you still make that choice?

Yes.

Can you describe the different situations that can be tested for a single tidal or wave energy generator at EMEC?

The sites are real world test facilities, so we have no control over the inputs. The maximum wave height recorded on the wave site has been 19m (more info) whereas the maximum tidal velocity is 4m/sec.

The machines are therefore designed for the conditions they will experience. However, the machines tend to be nursed along at the start as there are so many systems to check that no-one wants to just throw them out into the water and see how they get on. Regrettably the weather and tides rarely come in perfectly predictable and escalating strengths, so dodging in and out to get the conditions you want in the weather you can manage is always a challenge.

Would it make sense to use EMEC's location more prominently as a production site rather than just a testing facility?

Maybe one day. It depends when the industry and particularly the investors believe there is no value in testing. We believe that is some way off as most mature industries tend to have test facilities running in parallel with sales in order to enable product development.

When industry decides it knows all it needs to then we would probably be converted to production of energy rather than just knowledge and skill.

How does this test situation relate to operations of the equipment on their production sites with different characteristics?

At the moment the industry is still in its infancy, so there are not the 'standard' production sites to compare ourselves with. Come back and ask me in 5 years when we have some production work going on.

What evolution do you see in the characteristics of wave and tidal energy generators?

We have seen an awakening to the potential that small generators offer. Initial ideas had focused on grid scale generators, but more recently the potential to supplant diesel generation in remote communities/locations has become more attractive. In parallel, we have seen a number of larger scale tidal projects continuing to make progress, so there is something of a divergence into two market niches developing.

Looking at current sites in use, could they be improved?

I believe fatigue will be the biggest limitation on tidal devices and understanding meaningfully the variability of turbulence spatially and temporally is as yet impossible. The fluctuating and differential loads placed on a spinning body in turbulent water are enormous. The gyroscopic loads induced by the movement of the rotating equipment are similarly challenging. So quantifying them to allow the response to them to be codified remains a challenge.

What hydrographic or oceanographic characteristics need more attention during selection or operation of tidal and wave energy sites?

Over time I believe the industry will reduce the number of critical elements as it gets better at its craft. However, at present the underwater visibility remains important during installation and recovery operations. Some sites have water that is opaque due to the sediments and velocity and I don't envy people trying to work in these conditions.

The lack of understanding about turbulence intensity remains a hurdle.

The interaction of the industry with existing industries also needs to be better developed. All the evidence so far is that the devices are attractors of fish and it is believed they enhance the biomass potential, however, this needs to be systematically proved.

The levels of macro-trash and marine debris is presently not understood. Will the presence of damaging lumps of material (logs, ice, old shipping containers, discarded nets) prove to be a threat to tidal turbines? What is the distribution of such material across the globe and throughout the water column?

How is marine energy being taken up, worldwide? How can countries improve the marine energy potential?

EMEC has seen a number of countries take an interest in marine energy in recent years and Orkney has seen a constant stream of visitors from around the world come to see what is going on here. Their needs are driven by different forces ranging from a desire to re-task existing industries, grid supply and more recently from island communities fed up with running diesel generation.

Companies like Aquatera based here in Orkney have been able to use the islands' experiences of marine energy to help the strategic planning needed to make the most of the resources. Many countries only have sketchy ideas of the scale of the resources they have in their waters, so assaying the estate is a task on the critical path. However, understanding the usability of the resources requires experience of the marine energy sector.

Other countries are also seeking to build their own test centres and EMEC has been pleased to help. Although nationally driven activities, the test centres have met at symposia we have organised in order to exchange ideas and hopefully help the sector develop internationally. As an internationally dispersed resource EMEC has always seen this requiring an international response.

What is needed (internationally) to improve the acceptance and use of marine energy?

Nothing succeeds like success. So sharing the experience of successes is critical to building the confidence needed to do this in the challenging environment of the oceans and coastal waters. The more deployments are seen and understood the greater will be the call for them from the public and politicians and the greater the market for the devices.

What additional message do you have for the readers of* Hydro International*?

I don’t believe making marine energy work is optional. We know we are accelerating towards a rapidly deteriorating, polluted atmosphere that is starting to fight back against our onslaught. As we over-crowd the globe we know we need to do something about an energy source that is not going to make the earth uninhabitable.

I believe marine energy has the potential to play a part in a sustainable energy mix. It is well suited to island locations as they are often reliant on expensive diesel imported at great cost. There will be many different designs and approaches taken before we kit out our tool box with the machines and skills we will need to make the most of the restless energy of the seas. Already we have shown this is possible; what we need to do now is learn to do it well. Having the kit is part of the answer, but knowing the water environment is equally crucial. It is going to be an interesting journey.

Neil Kermode is a Fellow of the Institution of Civil Engineers and a Chartered Environmentalist having worked in municipal engineering and the Environment Agency. As an active SCUBA diver he dived all over the UK. This combination of environmental awareness, large engineering experience and empathy with working at sea led him to become MD of EMEC in 2005. He grew EMEC from 4 to 20 people and oversaw the deployment of 16 technologies from 9 countries. Neil speaks widely on marine energy, is a member of assorted industry groups and is a passionate advocate for a sustainable, carbon free energy future.

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