CASE STUDY: BENEFITS OF REAL SEA TESTING AT EMEC

EMEC is best known for providing full-scale grid-connected wave and tidal test berths. But there are many things to learn from real sea testing at an earlier stage of technology development, and that's why EMEC created two new test sites – Scapa Flow wave test site and Shapinsay Sound tidal test site - in less energetic conditions.

These non-grid connected sites provide a more flexible sea space so marine energy developers and suppliers can learn from real sea testing at reduced risk and cost.

NAUTRICITY'S EXPERIENCE AT EMEC'S SHAPINSAY SOUND TEST SITE

Nautricity used the EMEC Shapinsay Sound site to test the CoRMaT tidal energy converter. Robbie Macdonald, Project Engineer, shares his experience:

1. **What was the aim of your project?**

To test the mooring system - specifically the stability of the system using the Hydrobuoy technology. From a technical perspective we were interested in: how the hydrodynamics of both the hydrobuoy and turbine performed and how they interacted with each other, developing handling and installation procedures, developing straightforward deployment and recovery practices and establishing the best configuration for the mooring system for the device.

2. **Why did you choose EMEC?**

It was much more straightforward and quicker to gain the necessary permissions and consents to deploy because outline consents were already in place and we weren't exporting electrical power to the grid. At this stage of the project, we didn't have the time to invest in a potential site development program and to secure the necessary permissions and consents, so the Shapinsay Sound site seemed like the perfect solution to that.

We were also interested in using the site because there were relatively longer windows of slack water, providing longer intervention periods and because the flow speeds were relatively moderate compared to the more energetic sites. This allowed us to test our technology at full scale within the environmental conditions it is designed to operate in.

3. **Were the site conditions challenging enough to learn things from?**

The site was certainly challenging enough, we had plenty of flow to test what we wanted to test and the reduced tidal flow meant we could do it at a lesser cost than if we were to go straight into the high energy sites. It was also a relatively sheltered site that we could work in even when it was too rough to work at the other sites that EMEC provide.

We found that one tidal direction was stronger than the other – we could use this to our advantage because it meant there was one tide that gave us a longer working window, then the other tide provided sufficient tidal flow to test the movements and components we needed to test.

4. **How has testing contributed to technology development?**

In terms of testing the operations of the technology we've been through 3 scale prototype testing programs before this one. The first being a 1/20th scale tank test model which tested the principles of the contra-rotating rotors, the next being a larger 1/8th scale device we tested in sea trials in the Clyde Estuary and the Sound of Islay, then into the Thames for a continuous period of testing, and then there is the full scale device tested at EMEC. The principle of undertaking these tests was to break up the components of the complete system, into individual components that we could test safely and easily. Alongside the testing carried out in Shapinsay Sound we were also carrying out more detailed electrical testing on an identical CoRMaT device in Norway. The reason we tested in two separate programs was to separate the hydrodynamics testing of the system from the electrical testing of the system, and then once we are satisfied with both of those components they'll be combined to test a fully operational system.

5. **What did you learn from real sea testing?**

We gained a good understanding of how to handle the device, both on and offshore; we gained a good understanding of how the device operates when it's on the mooring system; we tested and validated our deployment and recovery techniques; and we tested our theoretical models in a real sea environment – a verification/ validation process.

6. **Any challenges you successfully overcame?**

Being able to deploy and recover the system in a very short period of time – it was installed in less than 30 minutes and recovered within 20 minutes. That was a real achievement, and being able to recover both the turbine and the mooring system in a single day was also a big achievement. Also, the fact that the device survived for 2 months at sea with no major issues coming to light was comforting.

We came up against a lot of challenges throughout the development cycle, some relating to the deployment of the device, which couldn't have been foreseen – I think we managed to overcome these challenges in a very short period of time during the deployment process and when the device was on the quayside prior to being deployed.

7. **How will this testing inform what you do next?**

The testing has been used to validate the models we've developed. The deployment and recovery strategy will be revisited and reviewed and updated so that we can execute these tasks within shorter time frames, in shorter tidal windows and in more adverse weather conditions.

8. **What would your advice be to other technology developers at earlier TRLs?**

My advice would be to try and get an early understanding on the handling of the full scale device and all the implications of this, be it weight or physical size, early on in the design process, and use this to inform your development, installation and operational programs. Consider the deployment techniques as early as possible, so that when you go to deploy the device you don't have to modify the installation procedures, and you can use purpose designed components built in to the system to aid deployment.

9. **Anything else you would highlight from your experience?**

We found the local supply chain in Orkney was good, and the supply chain worked together really well. We had one supplier on a certain aspect of the deployment, but they were quite happy to use their contacts within the local community to bring in additional support as and when it was needed, which was a bonus that you don't benefit from in a more industrialised location for example. A lot of the suppliers that we did use had worked in the marine renewables sector before due to all the activity around EMEC in Orkney so they already knew some of the challenges, and were happy to share some of their experience.

For further details on Nautricity, visit: http://www.nautricity.com/

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