WP5 – Networking, Communication and Dissemination

Project Success/Impact Brochure

MaRINET2

Deliverable 5.12

Project Success/Impact Brochure

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1. Project Success/Impact Brochure

The purpose of producing this deliverable is to communicate the key achievements of MaRINET2 and to showcase a set of case studies from the testing projects undertaken via the project.

Two formats were selected for this publication. Firstly, a more traditional brochure format, available both in PDF and printed hard-copy. In addition to this, a dedicated 'mini-site was created' to present the information in an appealing and accessible online format.

The information for the brochure was collected from project partners and users, as outlined in the following section.

1.1 Content curation and input from users and partners

1.1.1 Survey of MaRINET2 users

A survey was created and sent to all users who have participated in testing programmes via MaRINET2. In addition to basic company information, the survey asked users to provide the following details:

- Testing location
- Testing dates
- TRL at start and end of testing
- Advances made during testing
- Achievements
- Future plans

21 replies were received in total from MaRINET2 users. In some cases the same users responded twice, as they had completed two testing programmes during the project lifetime. In these cases, both case studies were included, as these were typically at different test infrastructures, with different testing objectives.

Respondents were also asked to provide images and videos to support the written information received.

1.1.2 Input from project partners

In addition to the case studies, the publication provides an overview of the project's Transnational Access programme and showcases some of the other project activities, such as the short-courses, virtual access and e-infrastructure.

Information about each of these activities was gathered from project reporting and consultation with relevant project partners.

* due to a public holiday in many parts of Europe on 1 November, those partners in affected countries were asked to publicise the 3rd call launch on 31 October (the call date itself remained unchanged).

1.2 Brochure design and formats

1.2.1 Brochure design

The brochure, entitled 'Success stories from the MaRINET2 project: Unlocking the energy potential of our oceans' can be found in annex to this document.

The brochure's structure and design were developed in conjunction with a graphic designer, incorporating the visual identity of the MaRINET2 project.

The case studies were organised according to technology category, namely wave energy, tidal energy, wind energy and cross-cutting technologies.

The responses from the survey were compiled and edited to improve readability and consistency. Each case study was presented on a double-page and comprised:

- a photo of the testing being carried out;
- key information about the project, supported by icons;
- a summary of the technology and testing undertaken;
- an explanation of the achievements and how MaRINET2 participation contributed; and
- an overview of the developer's future plans.

1.2.2 Brochure formats and distribution

The brochure was produced in both a web-adapted PDF file, which can be downloaded from the main project website and the dedicated mini-site, and a printed brochure format. The latter was distributed at the annual Ocean Energy Europe Conference & Exhibition, held in Brussels in December 2021. It will also be distributed at other relevant in-person events, following the end of the project.

1.3 Dedicated mini-site

1.3.1 Mini-site: a digital tool

In addition to the traditional brochure format, a mini-site was set up to showcase the project's achievements and case studies. This decision was made for two reasons. Firstly, due to the Covid-19 pandemic, the majority of in-person events were cancelled and there would be fewer opportunities than usual to distribute a hard-copy version.

Secondly, because a mini-site presents the information in a much more engaging and accessible way than a PDF file, which relies on readers downloading it and is less easy to navigate. It also allows the modification and addition of information post-publication.

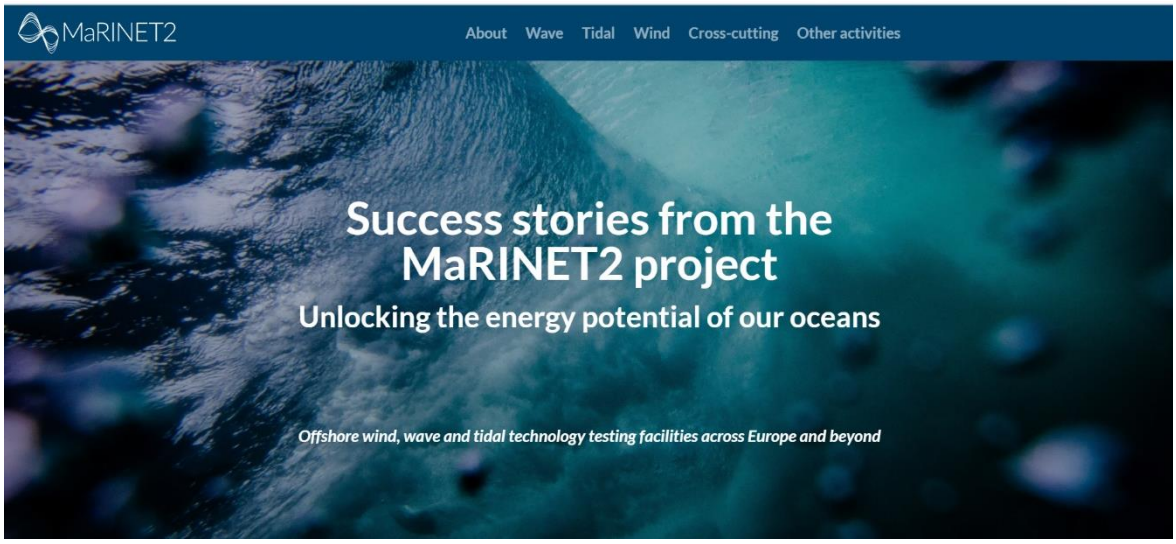
1.3.2 'Scrollytelling' format

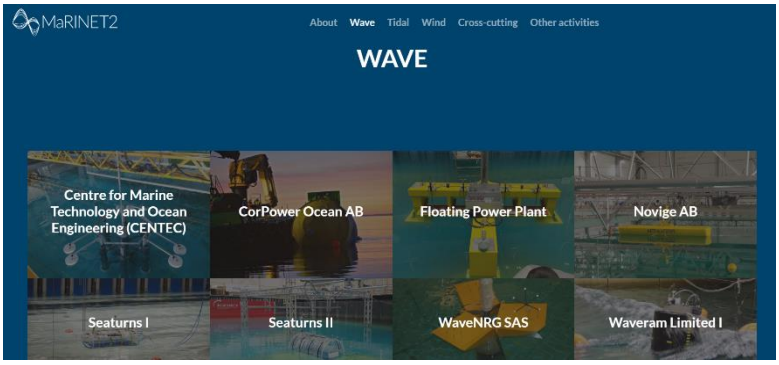
In recent years, 'scrollytelling' sites have become more and more popular. This format is typically a more interactive than a standard webpage and has a greater emphasis on visual content. As the viewer scrolls down the page, new content (text, images, videos) appears.

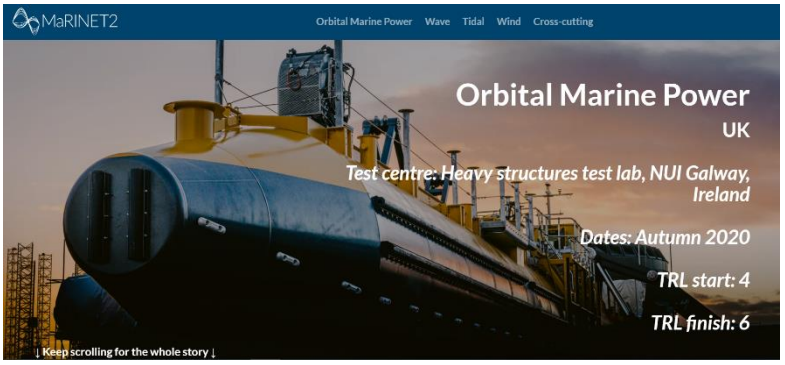
OEE researched different options available for creating a scrollytelling mini-site, and selected Shorthand. The choice was made based on cost, functionality and ease of setup.

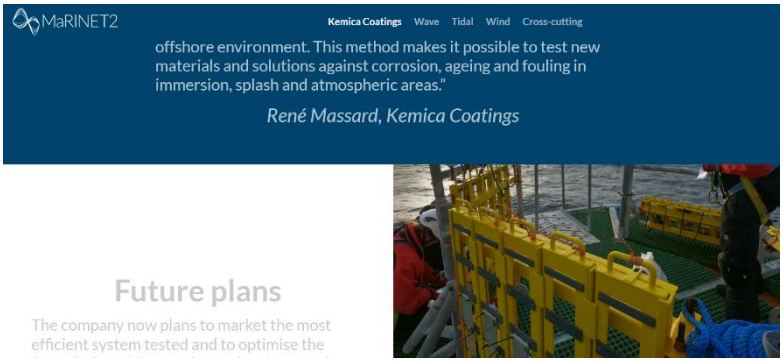
The mini-site can be found here: https://marinet2.shorthandstories.com/marinet2-success-stories/index.html

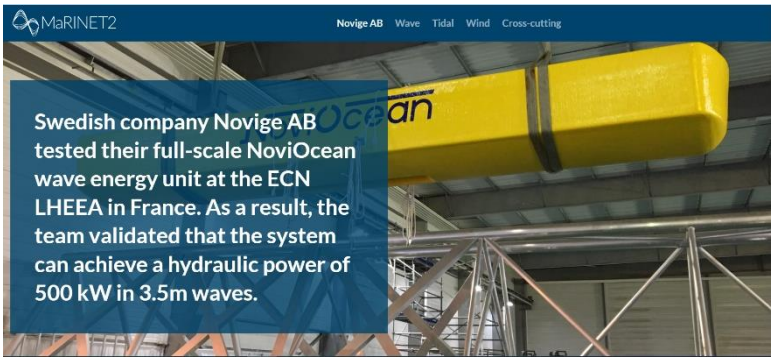
Below are some screenshots of the mini-site, which has been designed in line with the MaRINET2 project's visual identity.











1.3.3 Dissemination of the mini-site

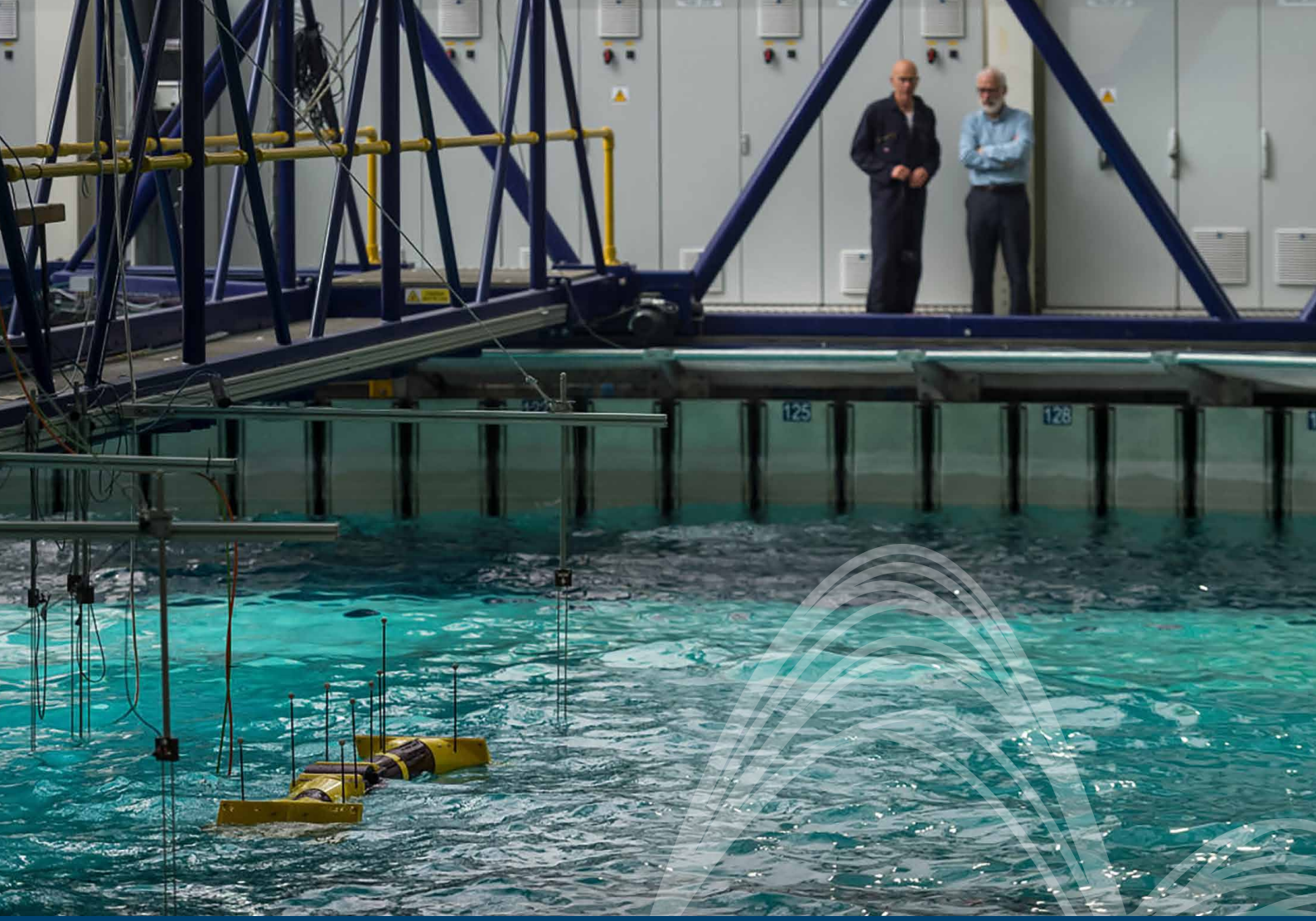
The mini-site is highly visible on the homepage of the main project website and is also included in the site's main menu.

A social media campaign has also been developed to raise awareness of the mini-site and the project's successes as a whole. A newsletter focussingon this publication and the other outputs of the project was sent to the MaRINET2 mailing list.

Users and project partners were also asked to include a link and information about the success stories mini-site and publication on their own websites and social media feeds.

The Shorthand subscription allows hosting of the site on the platform until September 2022. After this, the contents of the site can be migrated to the main project website as an archive, forming part of the project's legacy.

Annex 1. Brochure



Success stories from the MaRINET2 project

Unlocking the energy potential of our oceans

November 2021

MaRINET2

Partners

Photo Cover: Mocean-Malcolm Cochrane

Table of contents

Introduction

Evolving from the successful EU-funded MaRINET Infrastructures Network, MaRINET2 has at its heart a vision of unlocking the energy potential of our oceans. This iteration of the project has been working since 2017 to ensure the integration and enhancement of leading European research infrastructures specialising in research, development and testing of Offshore Renewable Energy (ORE) systems.

ORE is an important source of clean energy that can generate economic growth and employment, increase energy security and boost competitiveness and technological innovation. The realisation of this potential depends on the accelerated development, deployment and grid integration of reliable, efficient technologies for harvesting ORE, which in turn requires robust testing in dedicated facilities with specialised expertise.

MaRINET2 has been proud to provide a platform for the ORE sector to develop through its five transnational access calls, training courses, e-infrastructure and virtual access service.

Here you can discover a selection of the testing projects that were made possible through MaRINET2. Each demonstrates the contribution made to advancing cutting-edge ORE technologies, and each embodies the transnational spirit of the project by bringing test centres and developers from different countries together.

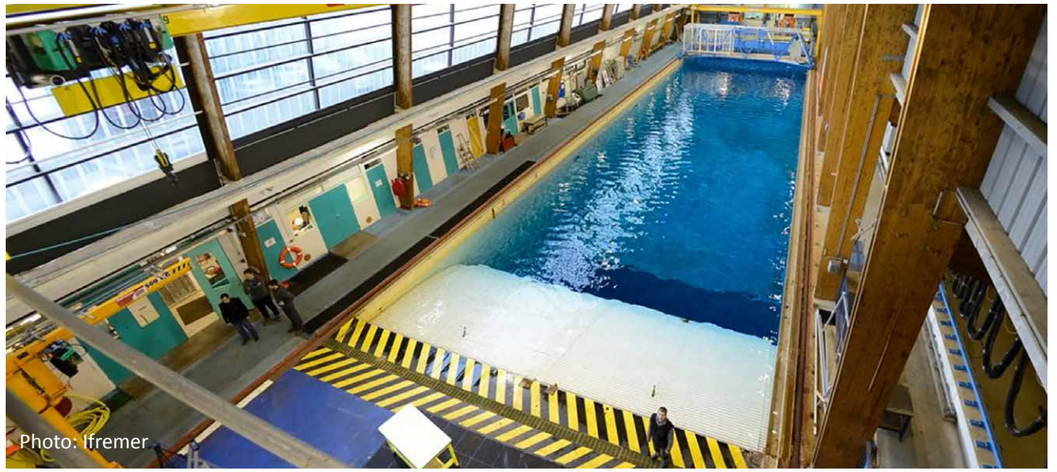


Photo: Ifremer

Photo: MARIN

Short-course training programme

To deliver the project's objective of offering high-quality training, a series of ten short-courses were held from June 2018 until September 2021.

The free-of-charge courses ran for between two and five days, and were targeted at industry and academic researchers in the ORE sector. Courses were organised and given by MaRINET2 project partners, and focused on three main technology areas: wave energy, tidal energy and offshore wind.

A total of 1,200 participants from 65 countries attended the trainings. The topics covered included, integrated tank testing, hydrodynamics of fixed and floating offshore wind turbine foundations, reliability and risk analysis of ORE technologies as well as test and verification processes from tanks to the sea.

The first seven courses were held at different facilities belonging to the MaRINET2 partners, with hands-on training offered to around 20 people per course. The final three courses were held online, due to travel restrictions in place at the time. While it wasn't possible to offer the hands-on aspect of the training, these webinars reached a wider audience from all over the world.

Courses organised and given by MaRINET2

A total of
1,200
Participants
From
65
Countries

ATTENDED THE TRAINIGS

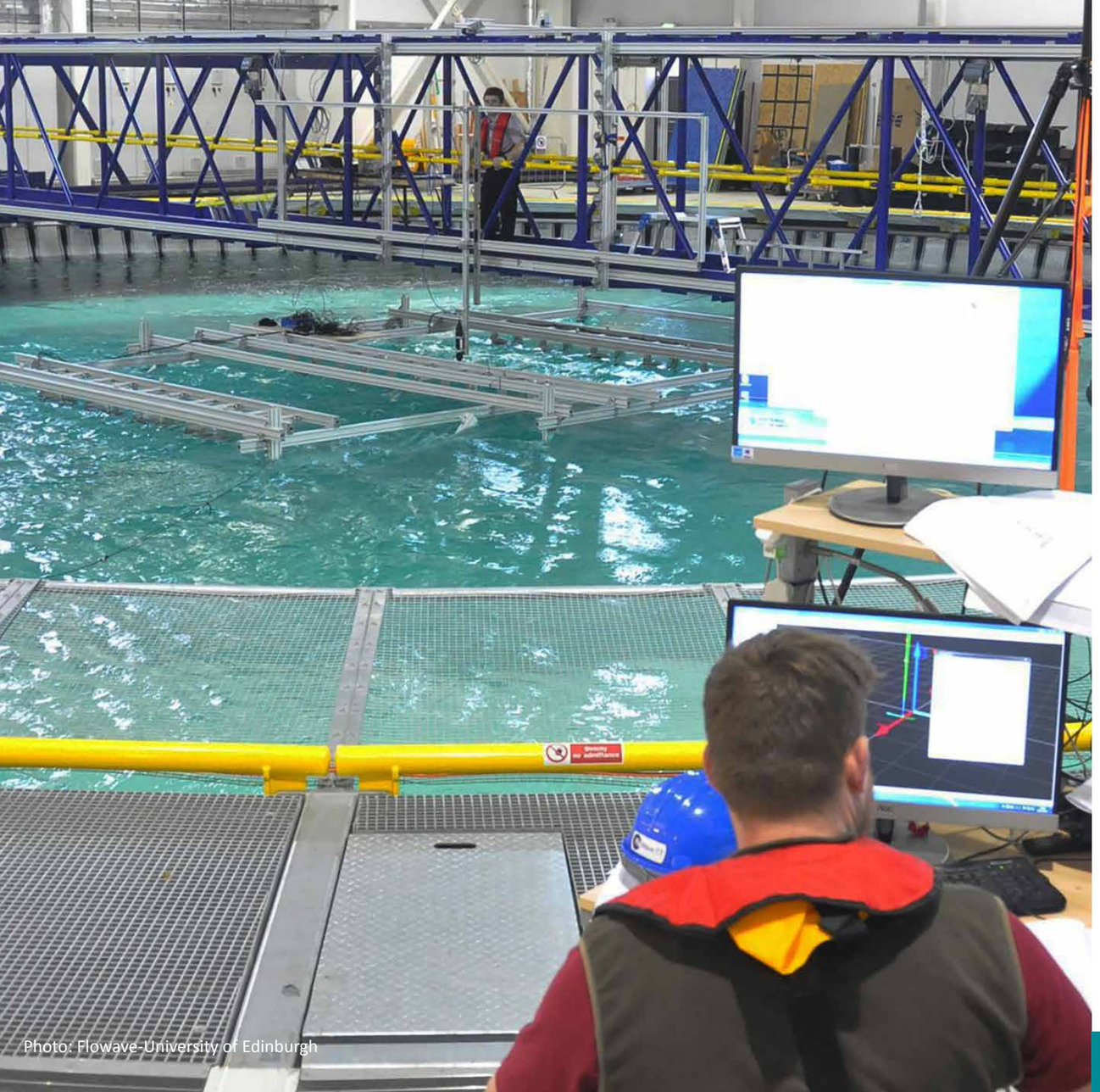


Photo: Flowave-University of Edinburgh

Virtual access service

The MaRINET2 Virtual Access programme (VA) aimed to provide developers of ORE technologies free-of-charge access to relevant and useful resources. Three different services were made available to developers conducting research in the fields of wind and wave energy.

Ifremer's HOMERE wave hindcast database provided a relevant dataset for wave resource characterisation and engineering studies related to the design of marine structures, including offshore energy converters.

CENER's Windbench platform is a repository for the verification and validation (V&V) of wind farm models. An overarching goal of the platform is to share common V&V procedures across wind energy disciplines to improve interdisciplinary research for the development of models of different fidelity levels.

NTNU's Skipheïa met station contains two 100-metre met masts providing data collected by ultrasonic anemometers. Access to its extensive database of wind conditions measured over a period of 6+ years was offered as part of MaRINET2.

E-infrastructure

The MaRINET2 project team created and implemented its own e-infrastructure to preserve and share the data generated by the project activities. A Virtual Research Environment (VRE) was set up, allowing information and research results to be easily shared by teams which spanned institutions and countries.

The VRE brought together datasets from MaRINET2's 'round-robin' activities, environmental monitoring and modelling, and transnational testing programmes. This enabled the project team to broadcast MaRINET2 data towards e-infrastructures such as SeaDataCloud, ENVRI, DIAS and EOSC, facilitating trans-disciplinary work.

This activity was underpinned by a data preservation policy that is compliant with international standards (Research Data Alliance) and European standards for marine data (SeaDataNet). A new 'node' was created for the project to share its in-situ environmental monitoring data on SeaDataNet, and OntoStack was employed to ensure the project used standardised terminologies in its datasets.

The project also outlined several data and metadata use cases in order to demonstrate the use of the MaRINET2 e-Infrastructure and its components in practice.

Success stories

Case studies from the MaRINET2 trans-national testing access programme

Photo: COAST-University of Plymout

DEVELOPER

Centre for Marine Technology and Ocean Engineering (CENTEC), Portugal

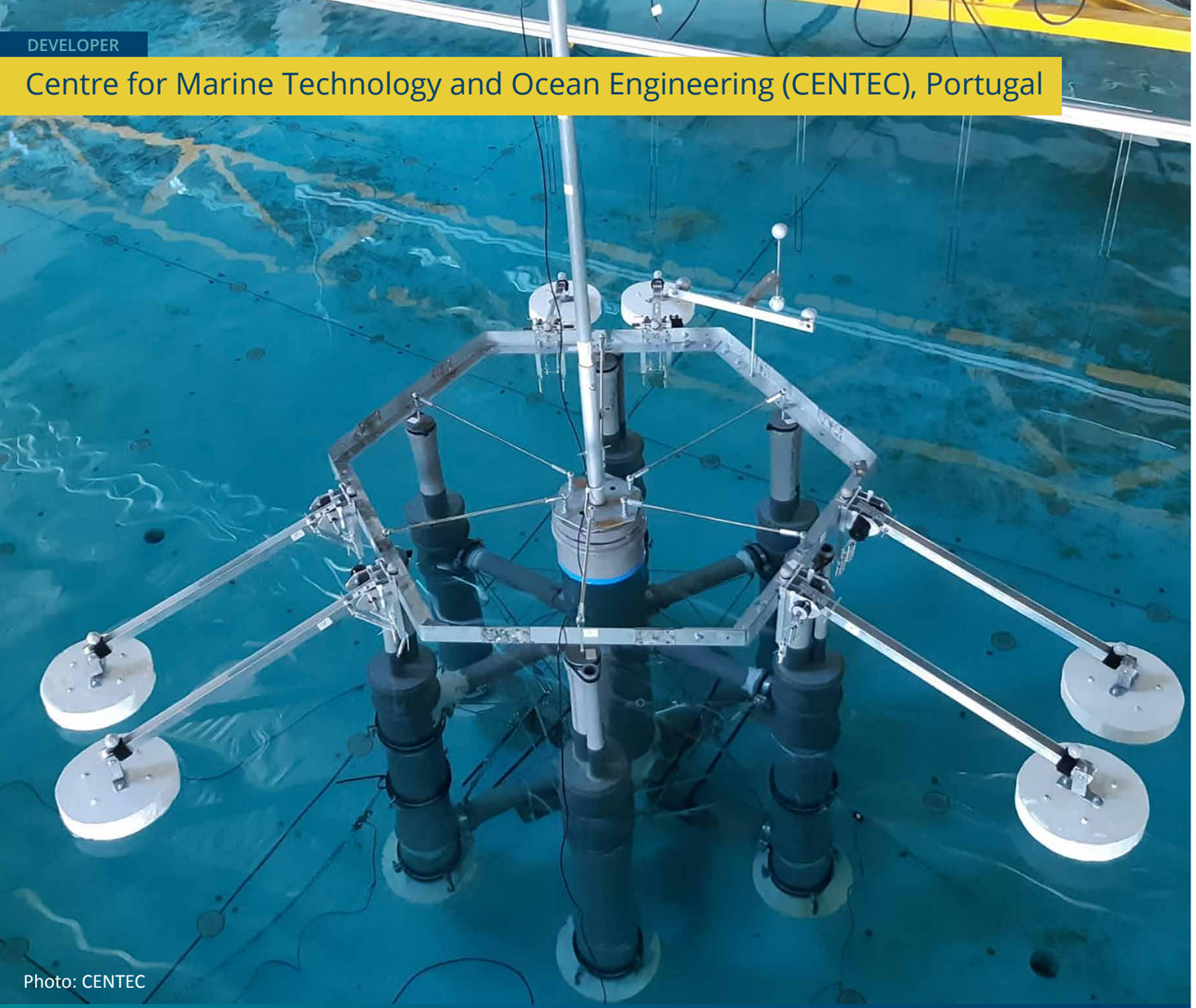


Photo: CENTEC

At the MaREI test facility in Ireland, Portuguese company CENTEC combined its high rated power wind turbines on floating platforms with technology to harvest energy from waves. During the project, an array of wave energy converters was mechanically attached to the platform and used to reduce pitch motion as tightly as possible.

ACHIEVEMENTS

"The team does not have proper national testing facilities and the tests abroad are very expensive. Moreover, the team did not have the experience or skills to perform them. MaRINET2 allowed us to start the initial validation of the concept while keeping a smooth learning curve. We also had the opportunity to meet and exchange ideas with other researchers." **José Manuel Ferreira Gaspar, CENTEC.**

Testing showed that pitch motions may be reduced due to mechanical coupling and Power Take Off damping. Inclination, free decay, regular and irregular wave testing was performed for different array and damping configurations, with and without simulation of the wind thrust by means of a mass pulley system. MaRINET2 gave the team the resources it needed to develop the concept and to contribute to the development of offshore renewable energies.

FUTURE PLANS

The next steps for the team are to optimise the Power Take Off damping and stiffness (not yet tested) in order to achieve Technology Readiness Level 3 and then 4, where the passive control of the wave energy converter motions is replaced by an active one. The objective is to extract maximum energy from waves while a tight control of the platform pitch is performed.

CENTEC's long term objective is to get funding for a 1:2 to 1:10 scale model, achieve Technology Readiness Levels 5 and 6, and demonstrate the advantages of the proposed design and control solution in more realistic sea and wind conditions.

KEY INFORMATION

TEST CENTRE
Ocean Basin - LIR National Ocean Test Facility (MaREI), Ireland

DATES
July – August 2019

TECHNOLOGY READINESS LEVEL
Start TRL 2
Finish TRL 2

DEVELOPER

CorPower Ocean AB, Sweden

Photo: CorPower Ocean

KEY INFORMATION

TEST CENTRE
Flowave, Scotland

DATES
October 2018

TECHNOLOGY READINESS LEVEL
Start TRL 3
Finish TRL 3

Laboratory tests at Flowave in Scotland allowed Swedish company CorPower Ocean AB to test mooring system alternatives to a mooring design that has been used for half-scale ocean testing. Testing focused on storm conditions and the experiment was designed to provide validation data for a mooring simulation code under development at the Chalmers University of Technology. This code will enable a more precise representation of slack and snap incidents than standard software is able to give.

ACHIEVEMENTS

"The MaRINET2 programme allowed for more advanced and extensive laboratory testing in a project that would otherwise be much limited in terms of laboratory time, staff and instrumentation. We were able to explore a wide range of design alternatives." **Jørgen Hals Todalhaug, CorPower Ocean AB.**

FUTURE PLANS

The test results will guide the development of the mooring design for CorPower Ocean technology, as well as validation data for the Moody mooring simulation code.

DEVELOPER

Floating Power Plant, Denmark

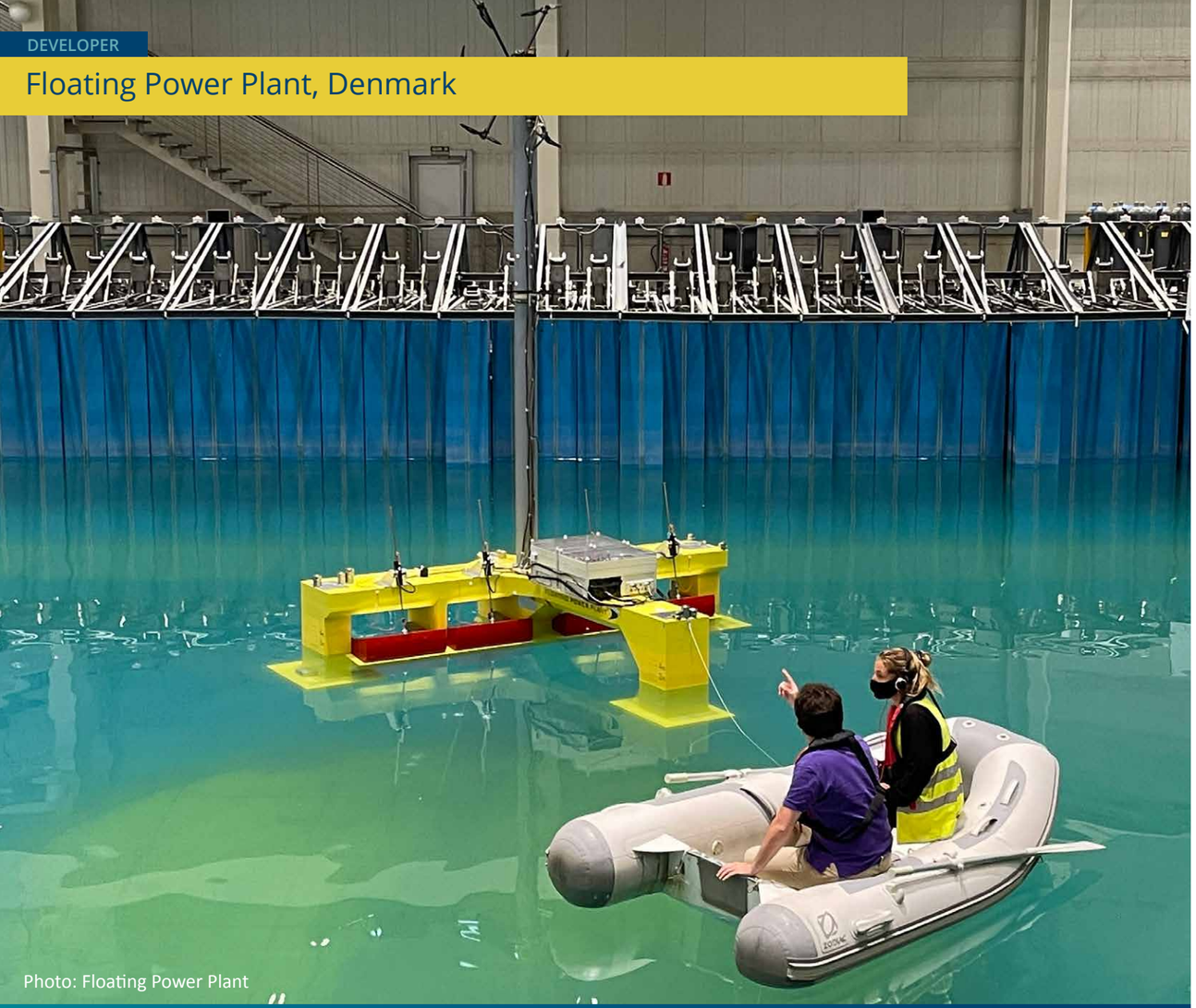


Photo: Floating Power Plant

KEY INFORMATION

TEST CENTRE
IH Cantabria, Spain

DATES
June – July 2021

TECHNOLOGY READINESS LEVEL
Start TRL 4-5
Finish TRL 4-5

Danish company Floating Power Plant tested its wave energy technology at IH Cantabria in Spain. Using this facility allowed the team to demonstrate the technology in realistic conditions at a large-scale testing facility. They were also able to obtain data to validate and calibrate their numerical model including the motion response of the total PNS Device and the Wave Energy Converter (WEC) power output. Tests provided the design basis for a commercial demonstration at the Oceanic Platform of the Canary Islands (PLOCAN).

ACHIEVEMENTS

"MaRINET2 funded three weeks of testing in the large wave basin at IH Cantabria. This large-scale testing allowed Floating Power Plant to obtain much better results than could have otherwise been achieved at smaller (and cheaper) facilities." **Morten Egedal, Floating Power Plant.**

FUTURE PLANS

Further tests are planned in wave basins. Further development and tests at a larger scale are needed before the WEC is ready for commercialisation.

DEVELOPER

Novige AB, Sweden

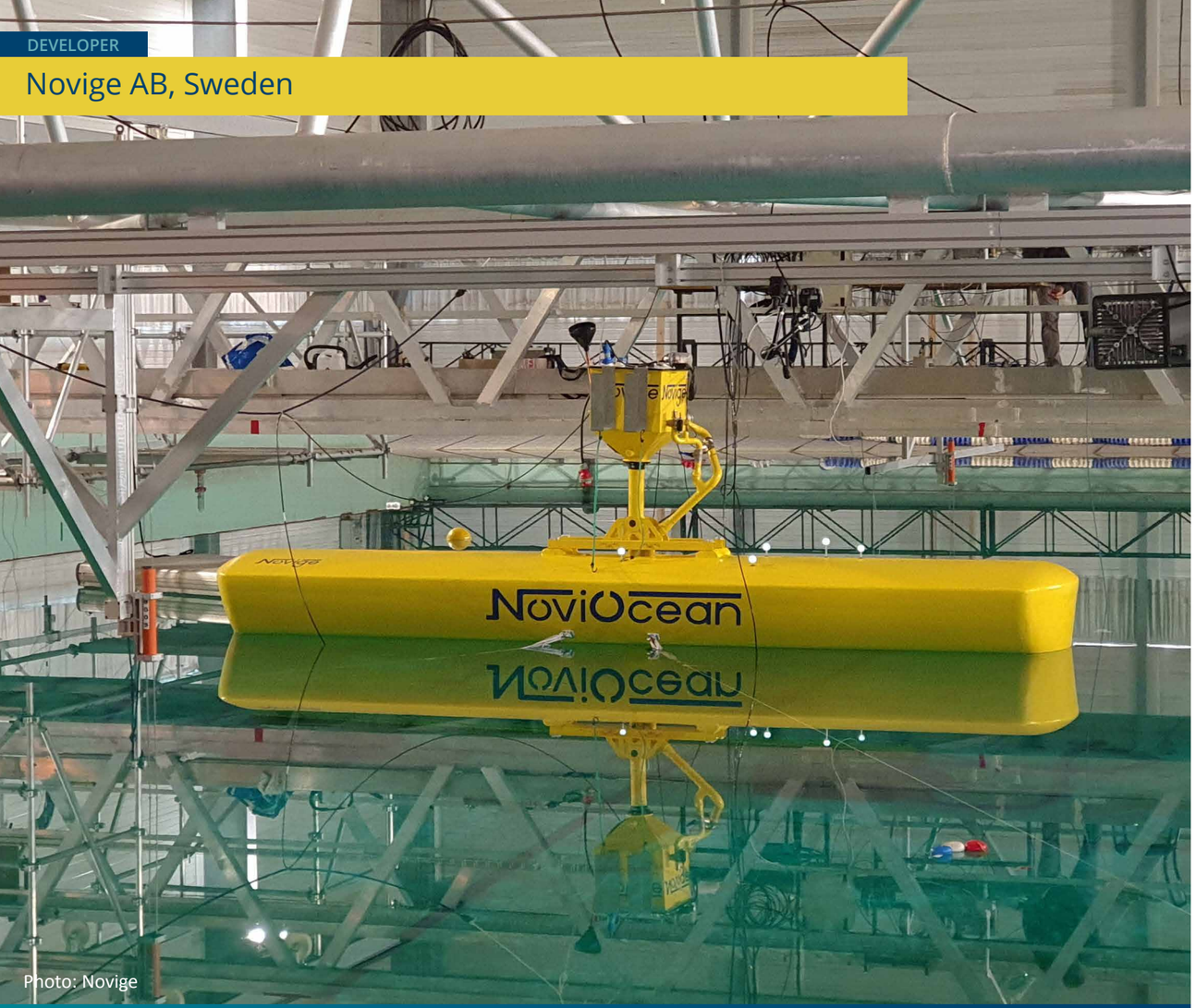


Photo: Novige

KEY INFORMATION

TEST CENTRE
ECN LHEEA, France

DATES
June – July 2021

TECHNOLOGY READINESS LEVEL
Start TRL 5
Finish TRL 6

Swedish company Novige AB tested their full-scale NoviOcean wave energy unit at the ECN LHEEA in France. As a result, the team validated that the system can achieve a hydraulic power of 500 kW in 3.5m waves. They also demonstrated that the current asymmetrical floating structure design is an improvement on the previous design since equal front and back mooring loads could be achieved. The new 1:5 scale float can achieve up to 1,200 kg lifting. Compared to the mooring loads, a ratio of 20 to 1 can be expected, which is exceptionally positive and unheard of in the wave energy industry.

ACHIEVEMENTS

"Testing via the MaRINET2 programme allowed us to identify important improvement points in our design and helped us more clearly define our short- and medium-term design and testing strategies both for continued dry-testing in our test rig at KTH university, as well as for the full-scale model. This would have been difficult to achieve without the access to testing facilitated by the MaRINET2 programme." **Jan Skjoldhammer, Novige AB.**

The team also verified their previously established numerical estimations and third-party wave2wire model, and evaluated the new floating structure design and necessary improvements.

FUTURE PLANS

Novige AB now plans to start the design processes for the full-scale pre-commercial unit, while the 1:5 scale unit will be continually improved and tested to provide insights for a better design and smarter manufacturing. The 1:5 scale prototype will be deployed in open waters by late 2021 for long-term performance evaluation. The full-scale unit is planned to be constructed, deployed, and demonstrated in a suitable European open sea site during 2022-2025.

DEVELOPER

Seaturns, France (I)

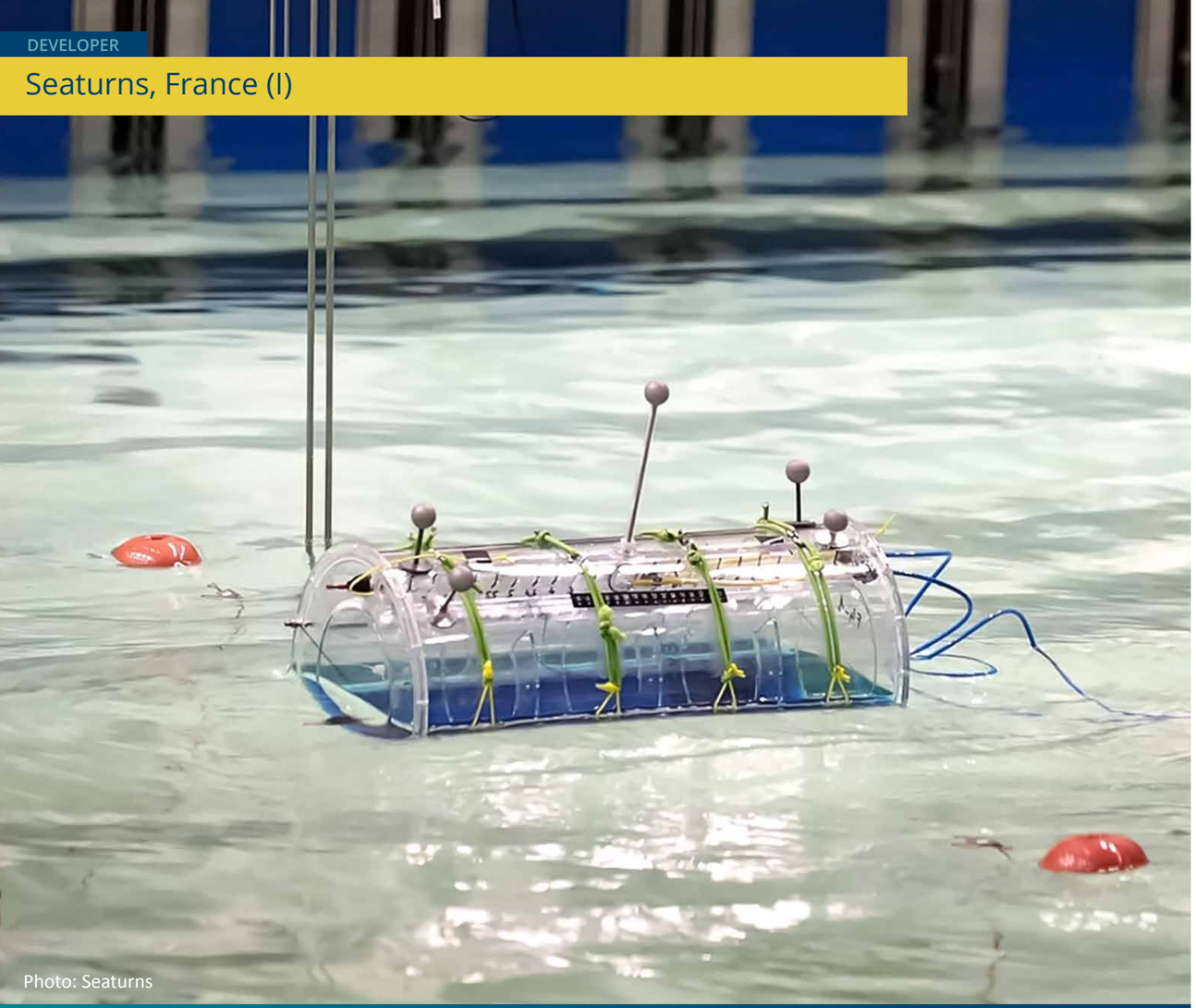


Photo: Seaturns

French company Seaturns carried out tank tests on its wave energy converter technology at Aalborg University in Denmark.

ACHIEVEMENTS

During MaRINET2 supported testing, the wave energy converter was significantly de-risked by testing the mooring in directional seas and checking the possibility of having multiple devices on a single mooring line without significant problems. Both tests returned positive results.

Researchers were able to obtain valuable data to validate and calibrate the numerical model of the device. They also gained a better qualitative understanding of the device's dynamics and sea-keeping properties in heavy seas. The effect of many parameters was identified and optimised configurations were selected.

"Thanks to the MaRINET2 programme, the Seaturns project has entered a European dimension and won other calls. The programme enabled us to rapidly increase the Technology Readiness Level of our technology without the need for fundraising. It also introduced us to the Aalborg University team and allowed us to prepare a common tender for a European call." **Vincent Tournerie, Seaturns.**

The first stage of the configuration of the single device is now complete. Sufficient data has been gathered to evolve the conceptual design and start work on the first sea going prototype. In 2020, new tests were conducted at a 1:10 scale at IH Cantabria wave basin, under MaRINET2. A realistic Power Take-Off was integrated and a new mooring configuration showed very good results. A 4-floater configuration was also successfully tested at Porto University wave basin in 2020.

FUTURE PLANS

In the future, the team hopes to identify multiple device configurations.

KEY INFORMATION

TEST CENTRE
Aalborg University wave basin, Denmark

DATES
February – March 2020

TECHNOLOGY READINESS LEVEL
Start TRL 2
Finish TRL 3

DEVELOPER

Seaturns, France (II)

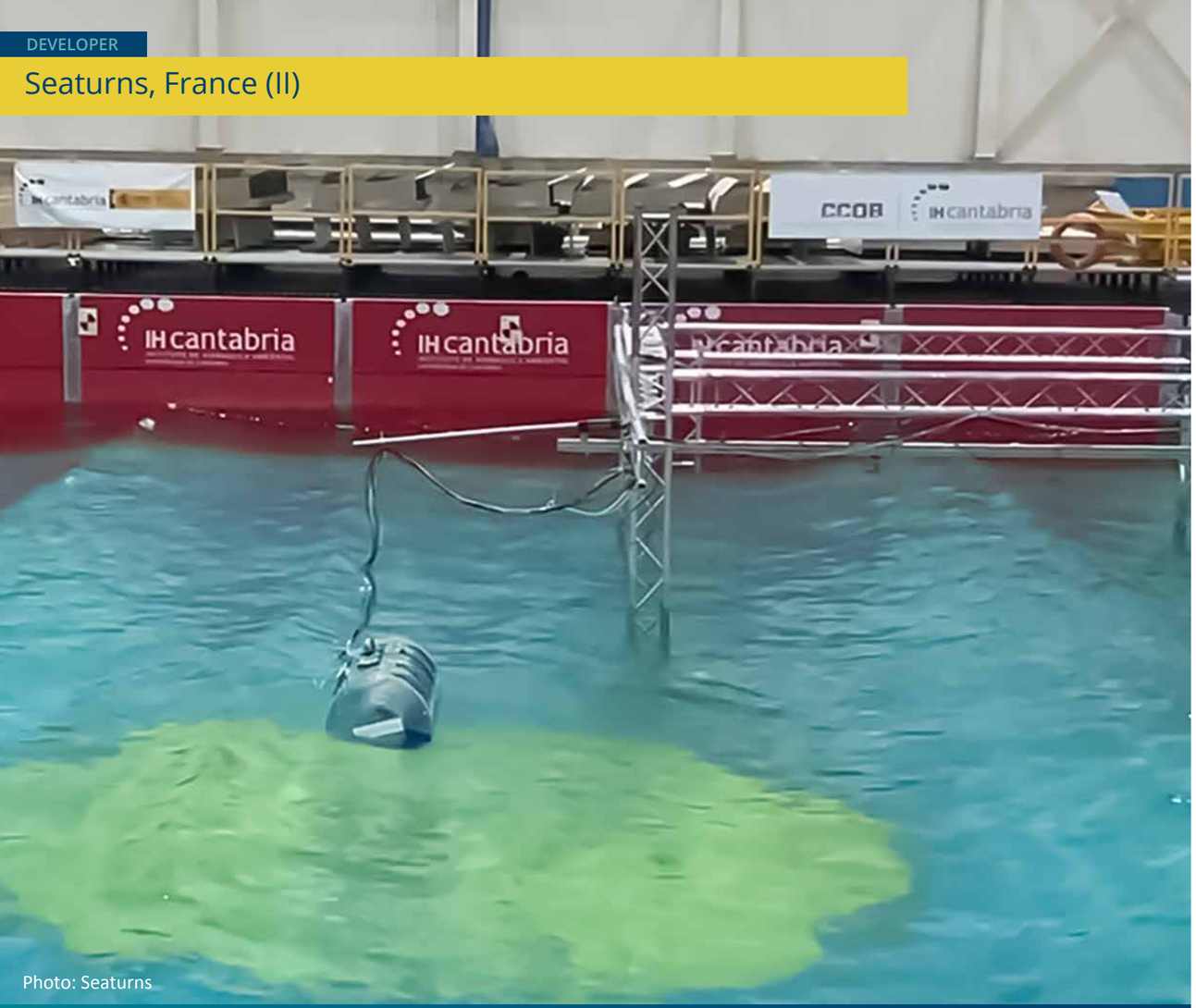


Photo: Seaturns

KEY INFORMATION

TEST CENTRE
Cantabria Coastal and Ocean Basin, Spain

DATES
May – June 2021

TECHNOLOGY READINESS LEVEL
Start TRL 3
Finish TRL 3-4

At the IH Cantabria tank in Spain, French company Seaturns carried out successful tests on its wave energy technology. The team carried out its first demonstration of an air turbine (realistic Power Take Off), and it identified a mooring configuration with very high potential.

ACHIEVEMENTS

Valuable data were obtained to validate and calibrate a numerical model of the device which is currently under development.

"Thanks to the MaRINET2 programme, Seaturns has validated the system and its performance at 1:10 scale. The programme enabled us to rapidly increase the Technology Readiness Level of our technology without the need for fundraising. It also improved our knowledge of tank testing, which will be very useful for a future application to a European call." **Vincent Tournerie, Seaturns.**

FUTURE PLANS

Seaturns is now raising funds to finance the design, manufacture and tests at sea of a prototype. Meanwhile, the company is also preparing a tender for a European call on sea trials.

DEVELOPER

WaveNRG SAS, France

Photo: WaveNRG

KEY INFORMATION

TEST CENTRE
University of Plymouth - COAST Ocean Basin, UK

DATES
July 2019

TECHNOLOGY READINESS LEVEL
Start TRL 1
Finish TRL 4

Tests carried out under MaRINET2 at the COAST Ocean Basin in the UK allowed French company WaveNRG SAS to validate the design of a new prototype of a floating wave and tidal stream device. They optimised the device's construction parameters including the float mooring system, where chains are attached to the float hull, column length and the setup of elementary turbines. The team also checked the functioning of the device when equipped with an increasing number of elementary turbines to form a long vertical turbine. They proved that the device can extract power from tidal currents via its extended vertical turbine column, and also function as a Wave Energy Converter (WEC), thanks to the pendulum motion induced by the force of the waves.

ACHIEVEMENTS

"Our small company would not be able to cover the costs of testing. Through this research, we were able to demonstrate that our wave - tidal stream energy converter is efficient and inexpensive. We believe that these results will help us to find investors to build a full-scale offshore demonstrator." **Slawomir Klukowski, WaveNRG.**

The turbine's generator is located above the sea surface, meaning that all the components used to generate electricity and inject current in the terrestrial electrical network will come from the wind turbines of equivalent power. Even in the case of a failure, there is no need to take the generator out of the sea bed. Two of WaveNRG's floating devices of 1 MW with a mass of 60 tons each will operate as a floating offshore wind turbine of 2MW with a mass of 6000 tons.

FUTURE PLANS

Thanks to MaRINET2, the technology will reach Technology Readiness Level 8 within four years.

DEVELOPER

Waveram Ltd (formerly Swirl Generators Ltd), Ireland (I)

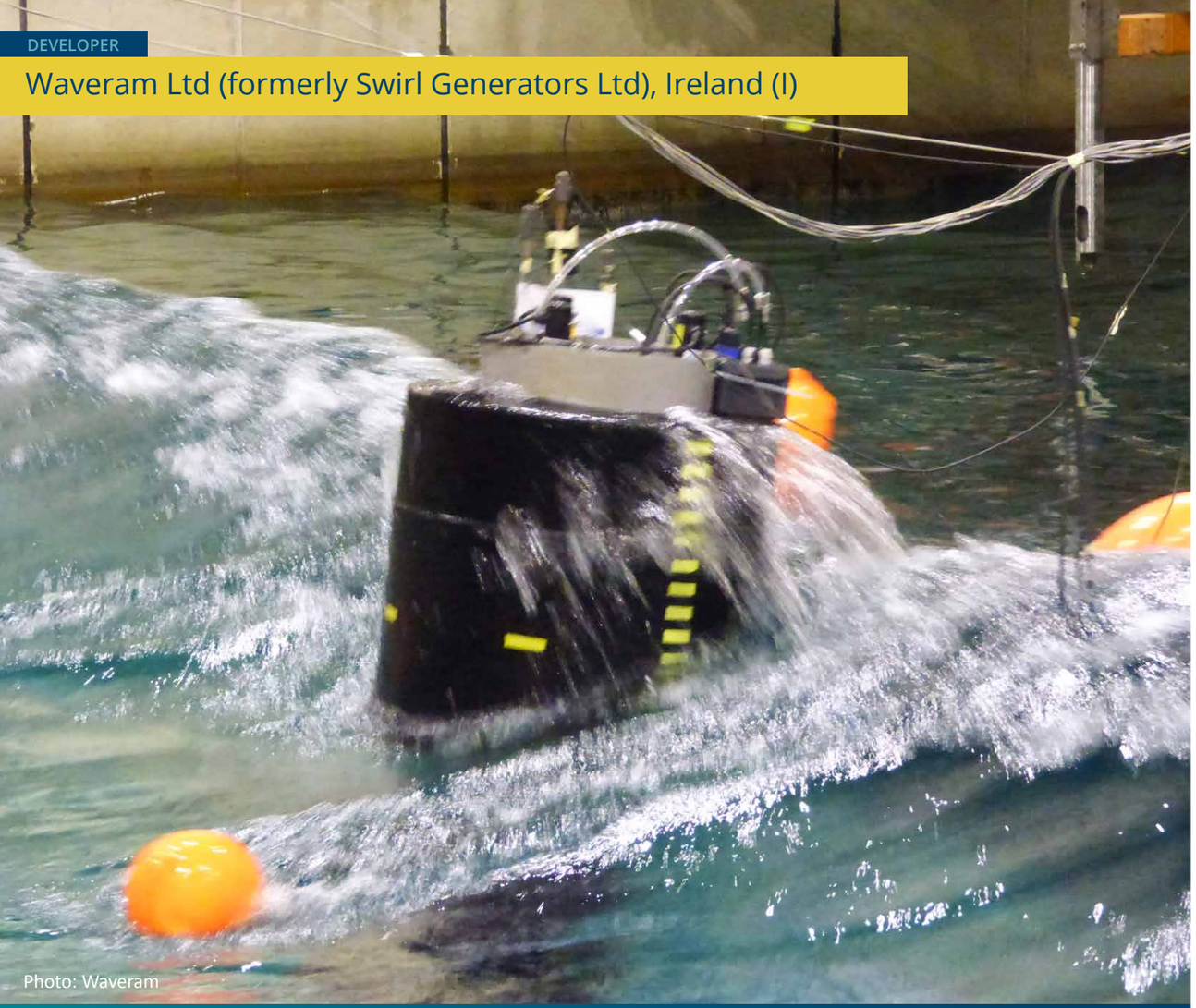


Photo: Waveram

MaRINET2 allowed a joint Irish, Spanish and Portuguese OCEANERA-NET team to carry out tests on a heaving buoy point absorber designed for use in utility-scale offshore arrays in deep water.

ACHIEVEMENTS

During testing at Oceanide in France, the scale model showed good stability and heave response. Numerical models (including an ANSYS CFX numerical tank) were validated, giving greater confidence in power matrices, mass ratios and dynamic load cases. Findings from these and other tests at ECN Nantes and FIHAC, Santander have led to big improvements in the original concept.

"MaRINET2 support made it possible to complete these tests, a crucial element in our joint Irish, Spanish and Portuguese OCEANERA-NET contract." **William Dick, Waveram Limited.**

FUTURE PLANS

The heaving buoy point absorber has been extensively modelled and tank-tested (over 600 tests and more are planned) and R&D is continuing in parallel on the Power Take-Off and control systems. Extended sea trials of a reduced-scale unit with fully autonomous control, probably at the Biscay Marine Energy Platform (BiMEP), will now precede pre-commercial tests of a 2MW unit at the Atlantic Marine Energy Test Site (AMETS) in Ireland.

KEY INFORMATION

TEST CENTRE
Oceanide BGO FIRST, Port de Bregallon, France

DATES
November 2017

TECHNOLOGY READINESS LEVEL
Start TRL 3
Finish TRL 3

DEVELOPER

Waveram Ltd (formerly Swirl Generators Ltd), Ireland (II)

Photo: Waveram

During MaRINET2, Waveram Limited tested a heaving buoy absorber which is intended for use in utility-scale arrays in deep water zones such as the Atlantic in North-West Europe.

ACHIEVEMENTS

At the Mutriku Breakwater in Spain, researchers tested the remote monitoring of sensor data and the operation of valves, which will be required for control systems. Different types of sensor were evaluated, measuring a variety of signals, including air pressure and velocity, water column movement, temperature, and humidity. All except the chosen velocity sensors provided useful data. The power backup system functioned as required, keeping systems running during short power outages, as detected in the alarm log file. The SCADA (Supervisory Control And Data Acquisition), linked to the office in Dublin, functioned well.

"MaRINET2 facilitated access to the Mutriku Breakwater, the ideal site for testing sensors and remote control systems in a relevant environment." **William Dick, Waveram Limited.**

FUTURE PLANS

The heaving buoy point absorber has been extensively modelled and tank-tested (over 600 tests and more are planned) and R&D is continuing in parallel on the Power Take-Off and control systems. Extended sea trials of a reduced-scale unit with fully autonomous control, probably at the Biscay Marine Energy Platform (BiMEP), will now precede pre-commercial tests of a 2MW unit at the Atlantic Marine Energy Test Site (AMETS) in Ireland.

KEY INFORMATION

TEST CENTRE
Mutriku Breakwater, Spain

DATES
March – May 2019

TECHNOLOGY READINESS LEVEL
Start TRL 3-4
Finish TRL 4-5

DEVELOPER

Magallanes Renovables S.L, Spain (I)

Photo: Magallanes Renovables

KEY INFORMATION

TEST CENTRE
EMEC full scale tidal, Scotland

DATES
November 2019 – June 2020 and February 2020 – May 2020

TECHNOLOGY READINESS LEVEL
Start TRL 6
Finish TRL 7

MaRINET 2 funding allowed Magallanes Renovables S.L to test their tidal energy technology, the ATIR platform, at the European Marine Energy Centre Ltd (EMEC) full-scale tidal test site for an additional six months. During this time, the team significantly increased knowledge on key variables, parameters and equipment in different tidal cycles and weather conditions while generating electrical energy.

ACHIEVEMENTS

"The amount of data collected will allow further work in the field of preventive and predictive maintenance, lowering maintenance costs for the technology and tidal energy, in which Magallanes Renovables will be one of the main players in the marine renewable sector," **Fabio Represas, Magallanes Renovables S.L.**

FUTURE PLANS

Looking to the future, the team plans to develop and deploy 20 floating platforms in the pilot array in Morlais, Wales from 2024 onwards. To achieve that goal, future optimisation and fine-tuning of the technology will be carried out at the EMEC.

DEVELOPER

Magallanes Renovables S.L, Spain (II)

Photo: Magallanes Renovables

KEY INFORMATION

TEST CENTRE
EMEC full scale tidal, UK

DATES
August 2021

TECHNOLOGY READINESS LEVEL
Start TRL 7
Finish TRL 8

During MaRINET2, Magallanes Renovables S.L carried out an analysis of underwater acoustic data to characterise the acoustic output of the ATIR tidal turbine deployed at the European Marine Energy Centre Ltd (EMEC) tidal energy test site. The findings of the study suggest that, when the device is not generating, the frequencies at which maximum Sound Pressure Level occur fall below the hearing thresholds of certain marine mammals such as harbour porpoise. However, the frequencies fall within the hearing range of grey seals and harbour seals.

ACHIEVEMENTS

"The acoustic characterisation would have not been possible using our own resources. Without the technical expertise and capabilities of EMEC, this study would not have been possible to achieve."
Fabio Represas, Magallanes Renovables S.L.

FUTURE PLANS

The team will continue to demonstrate the minimal environmental impact caused by tidal turbine noise, in order to show the effectiveness of the system without any impact on fauna and flora.

DEVELOPER

Orbital Marine Power, UK

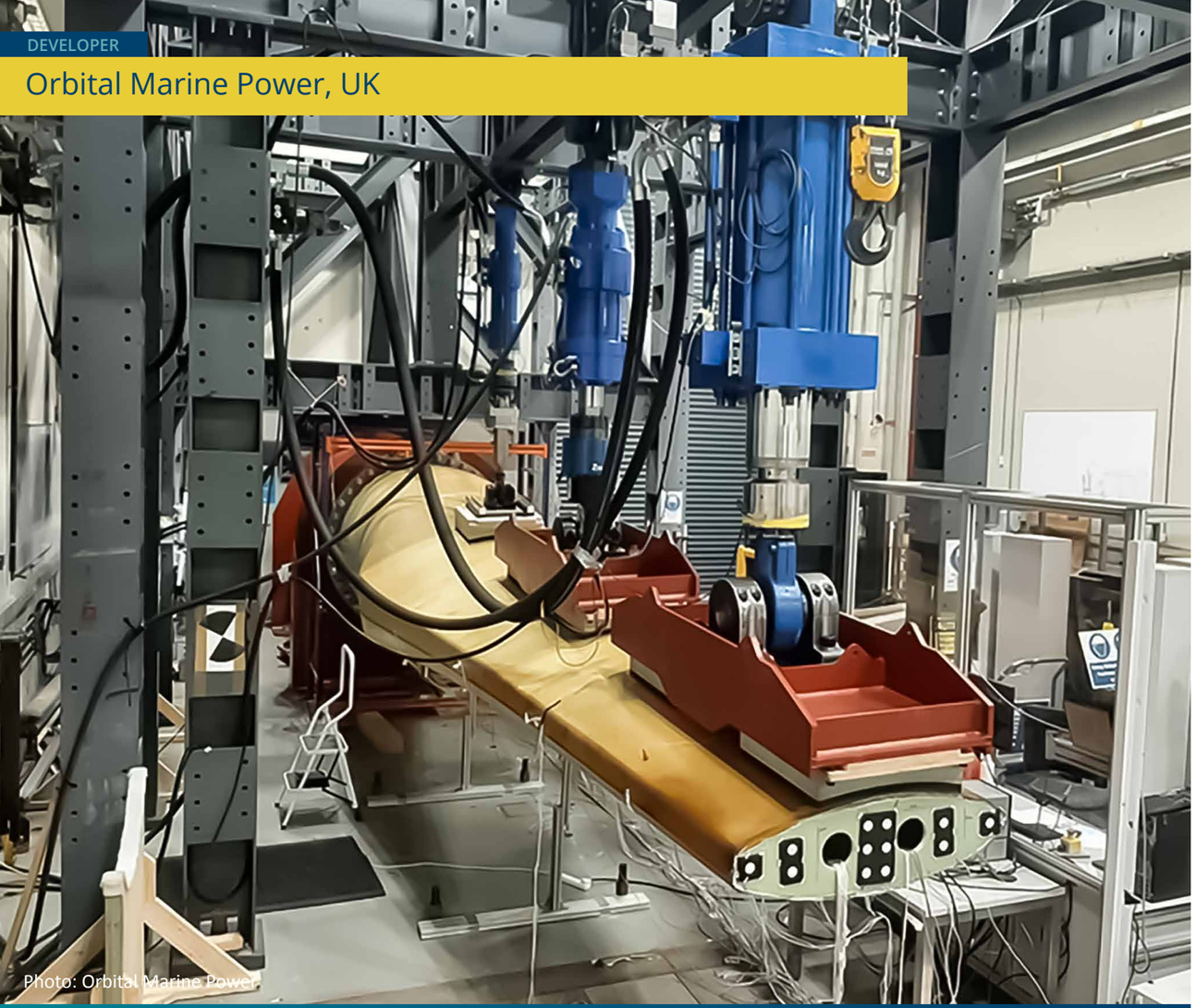


Photo: Orbital Marine Power

MaRINET2 allowed Orbital Marine Power to validate the design and manufacture of a composite tidal blade at NUI Galway's Heavy Structures test laboratory in Ireland. The team carried out full scale static and fatigue test loading that represented extreme and lifetime loadings. They also gained a greater understanding of the design drivers for tidal turbine blade testing through collaboration with NUI Galway.

ACHIEVEMENTS

"Without access to test facilities under MaRINET2, the effort required to set up a full-scale static and fatigue blade test would not have been practical." **Finlay Wallace, Orbital Marine Power.**

FUTURE PLANS

As part of the operational phase of Orbital Marine Power's O2-2000 turbine, the team will continue to operate composite blades in the marine environment. They will collect loading and performance data to use in future blade tests, to help reduce design risks, over-design, and drive down the technology's Levelised Cost of Energy.

KEY INFORMATION

TEST CENTRE
Heavy structures test lab, NUI Galway, Ireland

DATES
Autumn 2020

TECHNOLOGY READINESS LEVEL
Start TRL 4
Finish TRL 6

DEVELOPER

Sabella, France

Photo: Sabella

KEY INFORMATION

TEST CENTRE
CNR-INSEAN circulating water channel, Italy

DATES
April – May 2018

TECHNOLOGY READINESS LEVEL
Start TRL 6-7
Finish TRL 6-7

At CNR-INSEAN in Italy, French company Sabella carried out new tests which included the turbine's foundations. The team were able to fully characterise the efficiency of the whole system, how the foundation impacts the turbine's performance and the foundation's sensitivity to flow incidence and stream velocity. The manufacturing of an instrumented platform that supports the foundation allowed Sabella to easily rotate the turbine in the stream and to measure the forces applied at the foot of the machine.

ACHIEVEMENTS

"Testing via the MaRINET2 programme allowed Sabella to fully characterise a complete turbine with its foundation, and to lift uncertainties on how the foundation impacts turbine performance in different current directions. The platform manufactured for these tests allowed the measurement of the forces applied at the foot of the foundation and an easy rotation of the turbine, thus enabling Sabella to test a lot of different configurations. These tests could not have been carried out on a full-scale prototype."
Erwann Nicolas, Sabella.

FUTURE PLANS

The D10 full scale prototype, on which the model was based, will be re-immersed as part of the ICE project in the Fromveur Strait, near Ushant Island. Two D12 turbines will then be installed on the same site as part of the PHARES multi-energy project. Led by AKUO Energy, this project will combine a tidal pilot farm with onshore renewable energy systems (wind and solar) and storage units. By covering over 80% of Ushant's energy needs, it will demonstrate the viability of a 'fuel free island' model that Sabella plans to replicate for other off-grid communities.

DEVELOPER

SCHOTTEL HYDRO, Germany (I)

Photo: SCHOTTEL HYDRO

KEY INFORMATION

TEST CENTRE
Structures Research Laboratory of the Ryan Institute and School of Engineering at the National University of Ireland Galway, Ireland

DATES
March 2021

TECHNOLOGY READINESS LEVEL
Start TRL 5
Finish TRL 7

At the Structures Research Laboratory in Ireland, German company SCHOTTEL HYDRO carried out fatigue testing on its tidal energy technology. The team validated its intended 20 year design life – a significant advance for the technology achieved through the MaRINET2 project. Researchers also collected a large amount of valuable data that will be used to validate and optimise the design tools.

ACHIEVEMENTS

MaRINET enabled 'accelerated lifetime testing' during which rotors are subject to conditions equivalent to 20 years of operation in the field in just a matter of weeks.

"By proving that the rotor can withstand the loads over a full service life, the MaRINET2 programme contributed decisively to the de-risking of tidal energy technology and the first commercial projects."
Nicholas Kaufmann, SCHOTTEL HYDRO.

FUTURE PLANS

Rotor blades identical to those tested under MaRINET2 are now installed at Sustainable Marine's new 420kW PLAT-I 6.40 floating tidal energy platform in the Bay of Fundy, Nova Scotia, Canada, forming part of the world's first floating tidal energy array. The device is currently undergoing commissioning and testing in Grand Passage before it is deployed to Fundy Ocean Research Centre for Energy (FORCE).

DEVELOPER

SCHOTTEL HYDRO, Germany (II)

Photo: SCHOTTEL HYDRO

KEY INFORMATION

TEST CENTRE
Large Cavitation Water Channel of Istituto di Ingegneria del Mare (CRN-INM), Italy

DATES
July 2021

TECHNOLOGY READINESS LEVEL
Start TRL 3
Finish TRL 4

During MaRINET2, German company SCHOTTEL HYDRO tested a new rotor design at the Large Cavitation Water Channel in Italy. The team successfully validated the hydrodynamic performance of the new rotor design through model scale tests. Measurement data recorded throughout the project now constitute a database of turbine performance, pictures and acoustic probes linked to defined operating points which will help inform further design improvements.

ACHIEVEMENTS

"MaRINET2 enabled the demonstration of the performance of a new rotor design in a world class facility. Validation of the hydrodynamic properties in model scale tests significantly de-risks the development process of a new rotor blade prior to building the first full-scale prototypes and the development of tidal energy." **Nicholas Kaufmann, SCHOTTEL HYDRO.**

FUTURE PLANS

SCHOTTEL HYDRO built the first full scale prototypes of the new rotor design. They will now carry out fatigue tests to validate the strength over the targeted design life and full-scale field tests to demonstrate the performance of the new rotor design in a real operational environment.

DEVELOPER

DTU Wind Energy, Denmark

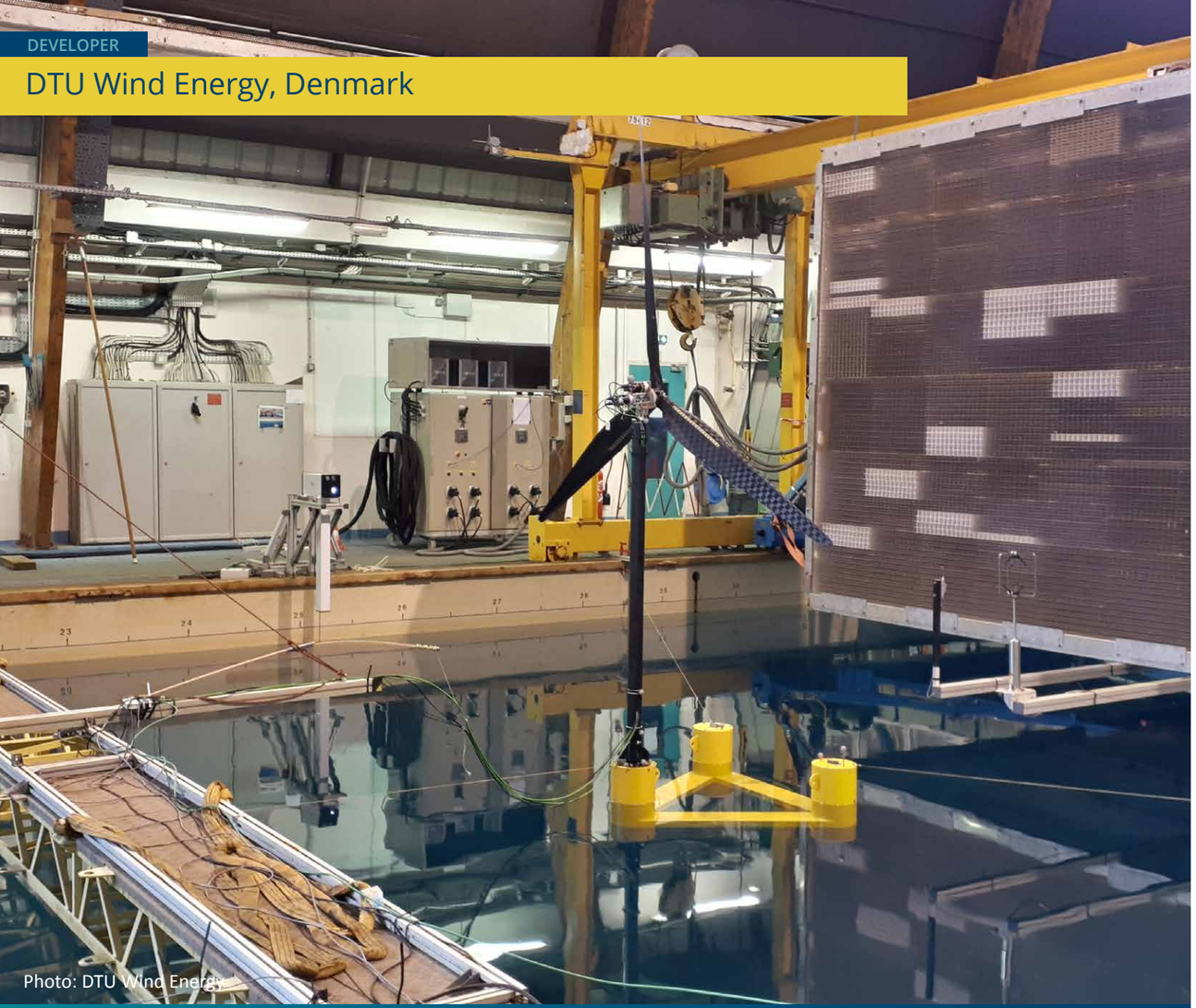


Photo: DTU Wind Energy

KEY INFORMATION

TEST CENTRE
IFREMER deep water wave tank, France

DATES
December 2019

TECHNOLOGY READINESS LEVEL
Start TRL 5
Finish TRL 6

At the IFREMER deep water wave tank in France, DTU Wind Energy researchers tested their floating offshore wind turbine for two weeks. The experiments resulted in a rich dataset of the hydrodynamic and aerodynamic responses of the wind turbine and floating structure. This is being used to validate engineering models for specific wind and wave cases and locations at sea. The team also had the opportunity to measure important features including mooring loads and motion of the platform in six degrees of freedom. Finally, DTU tested its wind turbine controller specifically designed for floating applications which use aerodynamic damping to counteract the platform motion.

ACHIEVEMENTS

"The facilities at IFREMER offered a unique environment to measure both wind and wave effects on our floating offshore wind turbine. MaRINET2 has connected technology from DTU, CENER, and IFREMER in a highly collaborative fashion." **Elliot Simon, DTU Wind Energy.**

FUTURE PLANS

The team's ultimate goal is to build and demonstrate a full-scale 10+ MW floating offshore wind turbine, and to advance wind turbine control methods which help alleviate the challenges experienced by the system.

DEVELOPER

Hitachi Metals Group GmbH, Germany

Photo: Hitachi Metals

KEY INFORMATION

TEST CENTRE
ORE catapult, UK

DATES
January to July 2021

TECHNOLOGY READINESS LEVEL
Start TRL 4
Finish TRL 4

Hitachi Metals Group GmbH completed comprehensive efficiency testing on their wind energy technology, which allowed researchers to plot output power vs. efficiency for the generator and power converter at each RPM. The team conducted thermal testing and achieved thermal stability over various loading conditions, as well as an indication of how sensitive efficiency and output power are relative to operating temperature. They validated machine mechanical endurance and integrity by successfully completing both unloaded and loaded overspeed and short circuit testing. They also completed an encoder offset sensitivity study at different loading conditions.

ACHIEVEMENTS

"We developed a full efficiency map that provides full generator operating characteristics, helping us to understand the pros and cons of ferrite based axial flux generators, as well as real test data that we can use to calibrate our electromagnetic programmes. This is crucial to scaling up the technology with confidence. The efficiency map allows us to calculate the Levelised Cost of Energy (LCOE) for real wind turbine rotor power curves." **Alexander Olpp, Hitachi Metals Group GmbH.**

FUTURE PLANS

The team will now validate electromagnetic programmes against the test data obtained. This will enable the scaling of designs and the modelling of LCOE with increased confidence. They will continue supporting ferrite-based axial flux technology, comparing it with alternative technologies. The objective is to get generators operating in real world conditions as soon as possible and continue to scale up to >15MW. The demand for rare earth magnets is likely to outstrip supply within five years, which will make a cost-effective ferrite-based solution an attractive proposition for the high growth offshore wind market.

DEVELOPER

X1 WIND, Spain

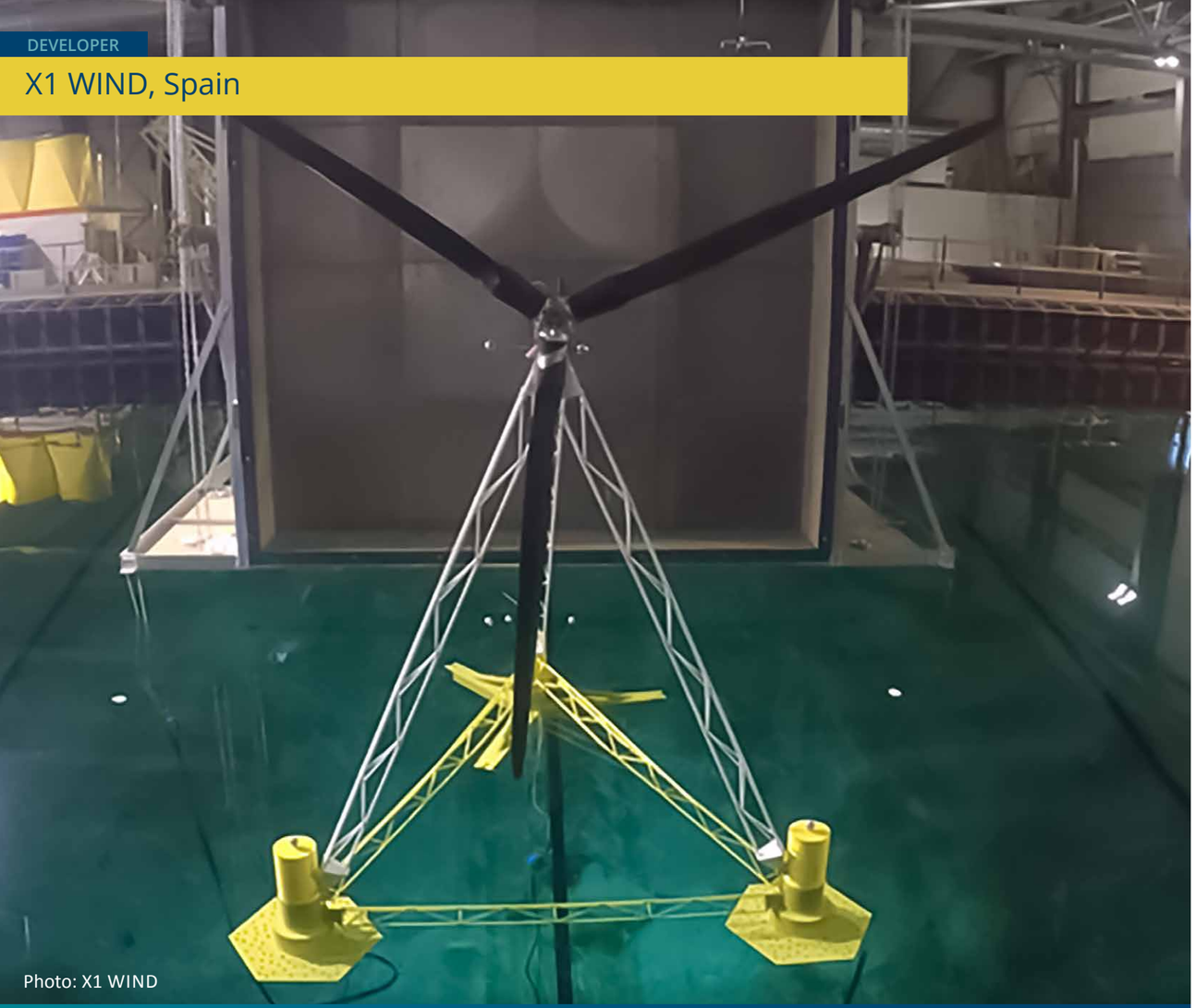


Photo: X1 WIND

KEY INFORMATION

TEST CENTRE
ECN Hydrodynamic and Ocean Engineering Tank, France

DATES
February 2019

TECHNOLOGY READINESS LEVEL
Start TRL 3
Finish TRL 4

With MaRINET2 support, X1 WIND carried out tests on the design of their wave generator design at the ECN Hydrodynamic and Ocean Engineering testing tank in France. They assessed transient decay, turbine performance in regular and irregular waves (including some extreme conditions) without wind, regular and irregular waves with wind and weathervaning tests. Irregular wave tests were run from two different directions 0 and 45º (to recreate a misalignment between wind and wave directions).

ACHIEVEMENTS

"The tests have proved the good level of stability of our technology, including new arrangements, under both wave and wind conditions." **Rocio Torres, X1 WIND.**

During testing, a model rotor was used to correctly reproduce aerodynamic thrust loading, enabling the team to assess aero-hydro interaction behaviour for the first time. This provided data that is extremely useful for validating numerical models and carrying out further calibration.

Researchers also proved the performance of the passive weathervaning system during weathervaning tests. They gathered vital information on yaw stability behaviour and possible solutions to correct small yaw misalignments during operation.

Overall, the results obtained will help to advance towards the optimisation of the design and eventually reach stage two (final design) validation.

FUTURE PLANS

Work on processing and studying the data obtained is now ongoing. Findings will then be used to adjust simulation tools and optimise the design of the turbine.

New part-scale tests (1:3 scale, with a fully operational wind turbine) have recently been carried out in a sheltered test site (PLOCAN) to validate the X1 WIND technology. The testing, also funded by the EU's Horizon 2020 programme, will demonstrate the efficiency of the device's structural design and mooring system.

DEVELOPER

Kemica Coatings, France

Photo: Kemica Coatings

KEY INFORMATION

TEST CENTRE
HarshLab, Spain

DATES
May 2019 – April 2021

TECHNOLOGY READINESS LEVEL
Start TRL 4-5
Finish TRL 8-9

At the HarshLab in Spain, French company Kemica Coatings tested their paint and varnish coatings used on offshore structures. Characterisation results obtained during the 14-month testing period under MaRINET2 showed that all coating systems showed good resistance to atmospheric and splash exposure.

Tests were carried out according to the standard ISO 12944-9:2018, “Paints and varnishes — Corrosion protection of steel structures by protective paint systems — Part 9: Protective paint systems and laboratory performance test methods for offshore and related structures”. Considering the samples exposed in the immersion zone, the corrosion at the scribe should be < 6 mm, so only some references pass the criteria.

ACHIEVEMENTS

“The project allowed us to test the ageing resistance of various coating systems at HarshLab to evaluate their performance in a real offshore environment. This method makes it possible to test new materials and solutions against corrosion, ageing and fouling in immersion, splash and atmospheric areas.”
René Massard, Kemica Coatings.

FUTURE PLANS

The company now plans to market the most efficient system tested and to optimise the formulation of the coating to develop one that can be applied in high thickness (400 microns) without defects.

DEVELOPER

Technology from Ideas, Ireland

Photo: Technology from Ideas

KEY INFORMATION

TEST CENTRE
Dynamic Marine Component Test Facility (DMaC), UK

DATES
February 2021

TECHNOLOGY READINESS LEVEL
Start TRL 2
Finish TRL 4

CROSS-CUTTING

Under MaRINET2, Irish company Technology from Ideas tested its D400 SeaSpring technology at the Dynamic Marine Component Test Facility in the UK. Rigorous testing allowed the company to validate the fabrication process for the SeaSprings. Lessons learned during the testing led to further improvements in the fabrication process.

ACHIEVEMENTS

Testing also allowed the team to validate their simulations for designing the polymer springs. These characterisation tests validated the force response, viscoelasticity, and conditioning of the SeaSpring.

"Facilities that can test the SeaSpring components are rare. Even rarer are facilities that can subject the SeaSpring to extreme sea conditions. MaRINET2 allowed us access to DMaC and Dr. Pete Halswell to test our component at an early stage, this has increased the development speed, validated our fabrication methods, and reduced our time to market." **Conor Casey, Technology from Ideas.**

FUTURE PLANS

The technology tested during MaRINET2 is the D400 SeaSpring that reduces mooring loads. The D400 has applications in aquaculture and larger versions of this project are going through certification with DNV and are planned for the tidal, floating offshore wind turbine and oil and gas markets.

DEVELOPER

University of Stavanger, Norway

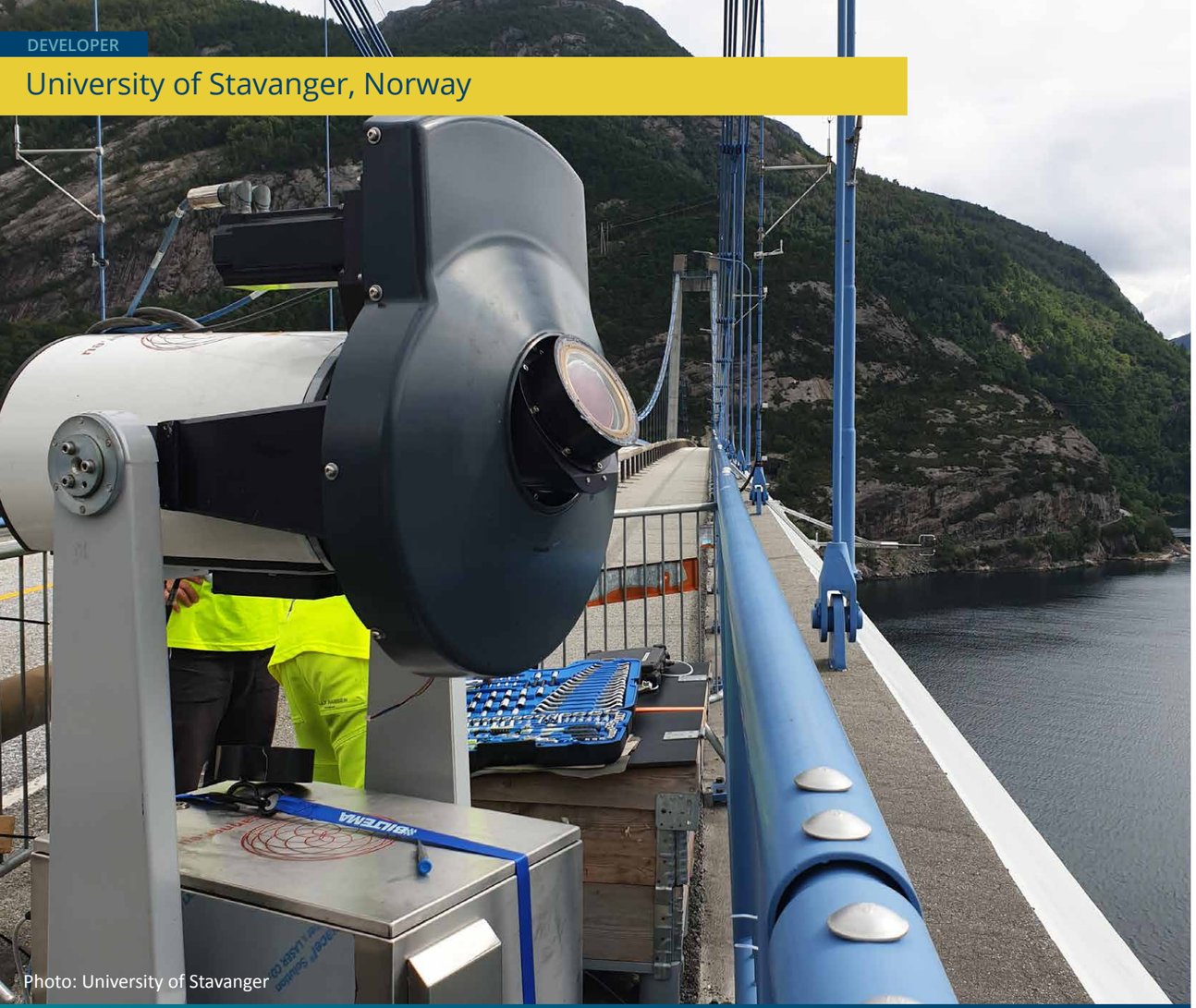


Photo: University of Stavanger

During MaRINET2 testing, laser-based, remote wind sensors were used to study wind gusts above the sea surface, in an area corresponding to an offshore wind turbine rotor. A novel measurement setup was developed to track variations of the natural, three-dimensional wind. The data reveals the extent to which wind gusts act in a synchronised manner across the virtual rotor area, important factors for the wind turbine loads, and realistic flow simulations in the design process. The measurements were made possible using a system of three coordinated scanning remote wind sensors (lidars), deployed from a long-span bridge as a measurement platform.

ACHIEVEMENTS

"The use of three lidars from a bridge platform made it possible to map the undisturbed wind flow in the marine environment in great detail. Such three-dimensional marine flow observations are not possible using anemometers on land-based masts or long-range laser sensors from shore. Short-range laser sensors from a floating buoy or an existing wind turbine cannot provide such data. The WindScanning system used was critical to simultaneously measure wind gusts in three dimensions."
Jasna Bogunovic Jakobsen, University of Stavanger.

FUTURE PLANS

The measurement data obtained through the project will be explored in detail, in particular the wind characteristics that are important when designing a wind turbine. The experience and knowledge gained through the MaRINET2 project will be transferred to new wind energy-related projects and wind-sensitive infrastructure. In these projects, field measurement data are vital to validate the computational models for structural response and wind energy production.

KEY INFORMATION

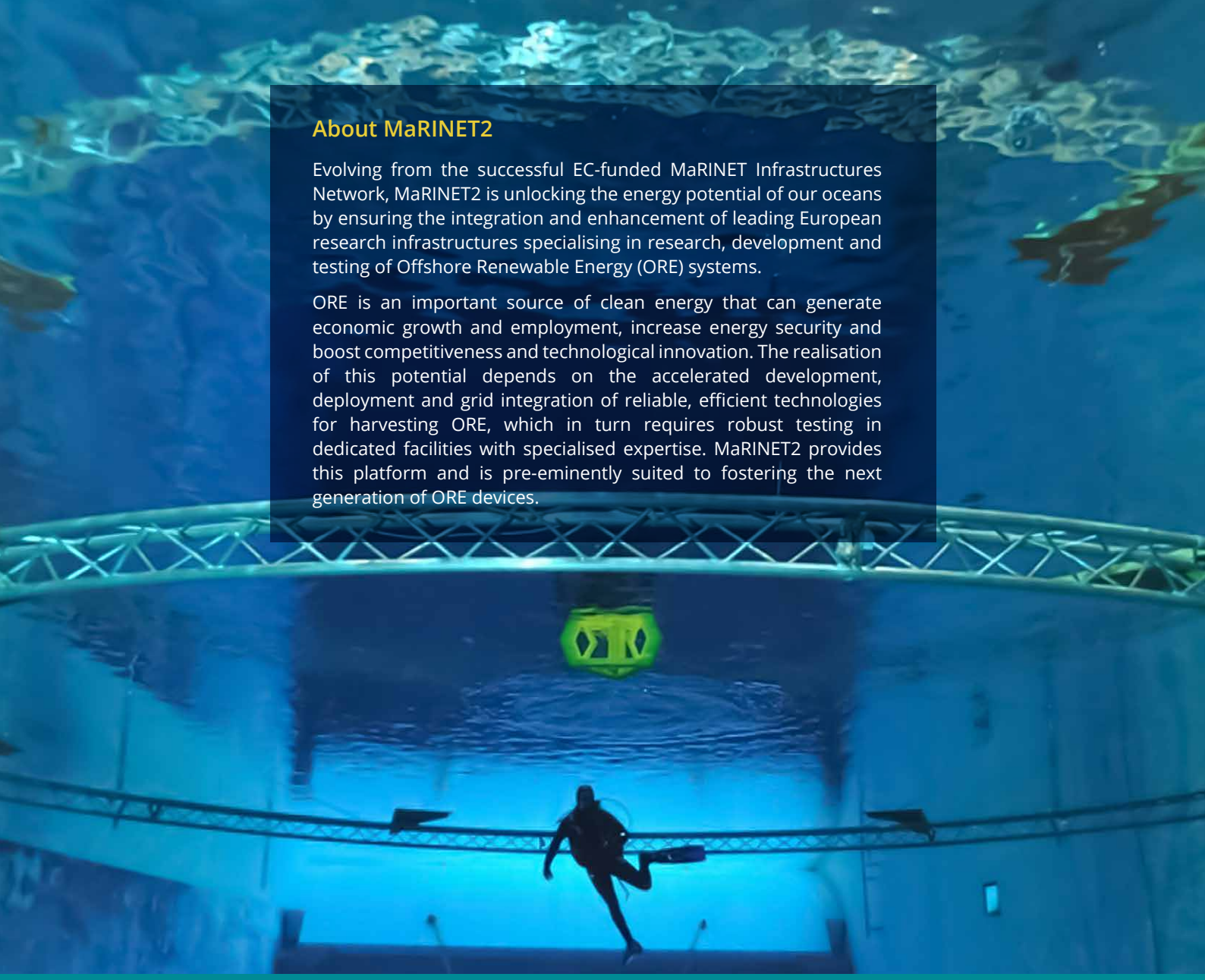
TEST CENTRE
DTU Windscanner, Denmark

DATES
August - October 2021

TECHNOLOGY READINESS LEVEL
Start TRL 5
Finish TRL 6

Success stories from the MaRINET2 project

Unlocking the energy potential of our oceans



About MaRINET2

Evolving from the successful EC-funded MaRINET Infrastructures Network, MaRINET2 is unlocking the energy potential of our oceans by ensuring the integration and enhancement of leading European research infrastructures specialising in research, development and testing of Offshore Renewable Energy (ORE) systems.

ORE is an important source of clean energy that can generate economic growth and employment, increase energy security and boost competitiveness and technological innovation. The realisation of this potential depends on the accelerated development, deployment and grid integration of reliable, efficient technologies for harvesting ORE, which in turn requires robust testing in dedicated facilities with specialised expertise. MaRINET2 provides this platform and is pre-eminently suited to fostering the next generation of ORE devices.

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WITH THE SUPPORT OF

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