Interreg
2 Seas Mers Zeeën
MET-CERTIFIED
European Regional Development Fund

Development of International Standards and Certification schemes for Marine Energy Technologies

Deliverable D1.8.3

Report on organised site visits for potential clients

Project No. 2S01-020

With the financial support of

Author

NAME [USE TABLE-TITLE]	ORGANISATION [USE TABLE-TITLE]
Pieter Mathys	Ghent University

Revision history

REVISION	DATE	AUTHOR	ORGANISATION	DESCRIPTION
1.0	27/01/19	Marijke Mahieu	Ghent University	Revision
1.1	31/03/20	Marijke Mahieu	Ghent University	Revision_final

Table of contents

Table of figures

0. Introduction

The role of the Business Developer in the MET-CERTIFIED project is to identify and coordinate business opportunities in the 2Seas region to increase the impact during and after the project period (cfr. Application Form).

One way of handling this is by organising interesting site visits for potential clients.

The MET-CERTIFIED project consortium has organised 7 site visits for potential clients, showing businesses the opportunities for testing through test site visits and through the promotion of certification and test services for wave and tidal energy technologies, by managing the business case of testing certification solutions.

This deliverable is finalised and has achieved more than the expected result (achieved value of 7 instead of expected 6).

1. Site visit to DMEC facilities

September 2017 – MET-CERTIFIED partners and IECRE members

On 27 September 2017 the project consortium made a site visit to the DMEC test facilities, the Tocardo headquarters and the RED-Stack Salinity Gradient plant on Afsluitdijk.

The site visit programme was as follows:

- Visit to Breezanddijk to see REDStack from a distance/the flyover: www.redstack.nl (under the supervision of CEO Rik Siebers)
- Presentations @ DMEC and view of the array of Tocardo tidal stream turbines
- Visit to Fishflow Innovations: fishflowinnovations.nl

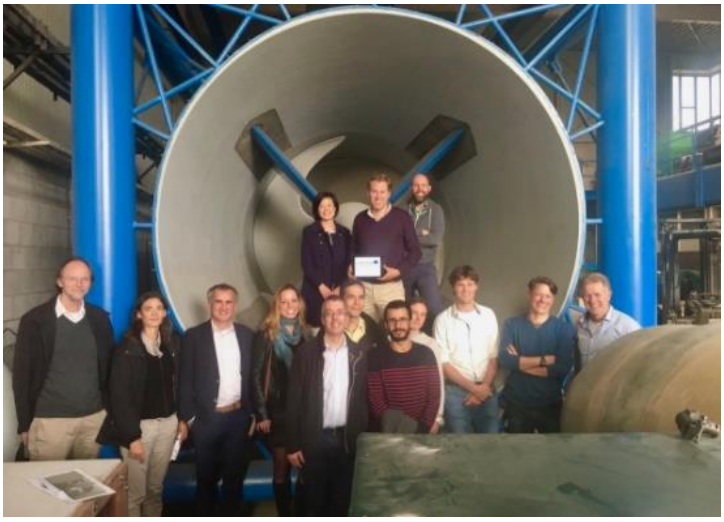

FIGURE 1 - SITE VISIT AT THE FISHFLOW CONSTRUCATION WORKSHOP WITH MET-CERTIFIED PROJECT TEAM AND IEC-RE REPRESENTATIVES

FIGURE 2 - SITE VISIT AT THE TOCARDO DEN OEVER AFSLUITDIJK (SHOWING T1 TIDAL TURBINES) WITH MET-CERTIFIED PROJECT TEAM AND IEC-RE REPRESENTATIVES

2. Combined Cornwall test sites visits

June 2018

At 21 June 2018 the Marine Tech Expo took place in Plymouth, UK. The day before, 20 June, the MET-CERTIFIED project organised a visit to 3 test sites for a total of 8 interested parties:

- DMaC (Dynamic Marine Component test facility)

- FabTest (Falmouth Bay Test site)

- Plymouth COAST laboratory (Coastal, Ocean And Sediment Transport lab)

The programme was as followes:

8.30: @DMaC, H&S inductions (30 min)

9.00: Presentation about DMaC and FaBTest (60 min)

11.00: Boat trip to FabTest (from Customs House Quay Falmouth) + 30 min margin (90 min)

12:30: Return to Customs House Quay Falmouth and Lunch near Customs House Quay

13.20: walk to Falmouth Town railway station (10 min)

13.50: train to Plymouth

16.05: start visit Plymouth COAST lab (55 min)

17.00: end of visit

During this jam-packed 24 hours, MET-CERTIFIED project partners (Ghent University & DMEC) met representatives of the University of Exeter, Wave Energy Scotland, Carnegie UK, Wave Ventures, Interreg 2 Seas and Plymouth University, all sharing the same enthusiasm for marine energy resulting in interesting discussions about the role of test facilities in certification, risk mitigation and making the technology bankable. Furthermore, Paula Machlachlan of the Interreg 2Seas JS from Bristol attended these visits, which was much appreciated by the project team and attendees.

The site visits gave a better understanding of the potential of test facilities to detect and mitigate technical issues early on. The informal setting on site allowed open discussions on the role of test facilities for marine energy with regard to standardization, certification, and accreditation. Awareness within test facilities is rising, but as the market currently is still premature, engagement within certification schemes can be improved, in order to capitalize on the experience in test facilities and gain investment trust.

2.1.1. Dynamic Mooring Test Facility – Falmouth (Exeter Uni)

After a safety briefing on the A&P terminal of Falmouth, DMaC project manager Pete Halswell of Exeter University welcomed us at DMaC, where (synthetic) ropes or mooring lines and power cables can be tested on fatigue as well as ultimate strength tests. The test device allows to put the moorings under stress in 4 degrees of freedom:

- The length actuator allows a static force of 45 tonnes or a dynamic force of 30 tonnes;
- The X and Y displacements allow free bending with a displacement of 30° and a frequency of 0.25 Hz;
- And finally torsion along its length axis.

This can be done both in dry and wet conditions, which is a significant advantage of this test facility. The data acquisition is based on the National Instruments Compaq Rio platform, which makes it very modular. DMaC is ISO-9001 accredited and also part of the Marinet-2 programme, where testing is facilitated. Peter H. also explained the “Exeter tether”, a dynamic mooring system which has shock absorbing capabilities, in order to reduce stresses on the anchoring points of e.g. floating tidal energy devices.

FIGURE 3 – DMAC TEST RIG - SHOWING THE SET-UP OF A DESTRUCTIVE TENSILE STRENGTH OF A SYNTHETIC MOORING LINE

Peter demonstrated a destructive test of a synthetic mooring line that snapped at approximately 15 tons of static load. The mooring line didn't snap completely, and still retained 6 tons. Getting insight on both fatigue loads and ultimate limit state loads is of extreme importance in floating energy devices. What couldn't be captured on the pictures or in the video is the smell of the ropes: due to the internal friction along the fibres, the mooring line heats up very quickly, which produces a particular smell.

We concluded the visit with a short discussion on why standardisation (62600-10 moorings and tidal scale testing 62600-202) provides mutual benefits.

Pete Halswell, DMAC Project manager of Exeter University

"We had a successful and enthusiastic site visit of DMaC test facility with detailed discussions on testing of MEC devices and components, and the importance of certification to increase reliability. I personally think certification is a vital step in proving reliability of marine energy, which in turn reduces running cost and insurance costs."

2.1.2. FabTest site – offshore test site visit – Falmouth Bay (Exeter Uni)

After the DMaC visit, George Crossley, test site manager of FaBTest, University of Exeter, invited us on a pilot boat to sail to the 2.8km^2 zone with 4 non-grid connected test births for wave energy. This is considered to be a relatively sheltered "nursery" site, but make no mistake as the extreme wave climate here is still high, with waves up to 9m. Depths vary from 20 to 40m.

After a short sailing of approximately 10 minutes into Falmouth bay, we arrived at site, where Marine Power Systems had recently installed their wave energy device (submerged) and supporting/DAQ buoy. Previously, Fred Olsens Lifesaver and Polygen have been testing there.

FIGURE 4 - SITE VISIT AT THE FALMOUTH BAY NURSERY SITE, WHERE MARINE POWER SYSTEMS WAS TESTING THEIR SUBMERGED DEVICE

George indicated that the collaboration with the University of Exeter and the harbour authority (including e.g. the local marine contractors) provided the best of both worlds in terms of effective and efficient support for this site.

The fact that this site is pre-consented allows wave energy developers to focus on their core business, instead of going through the time-consuming and sometimes cumbersome consenting procedures.

FaBTest provides wave early developers with a very important TRL6-7 test facility, in order to gain on-site experience in real sea conditions.

George Crossley, test site manager of FaBTest, University of Exeter

" It was exciting to be able to welcome a highly motivated group of marine energy experts from around the 2SEAS region of Europe to the Falmouth Bay Test site. The trip out into Falmouth Bay, where the Marine Power Systems WaveSub is installed, inspired in-depth discussion and collaboration in research, demonstrating Cornwall's ability to

meet the needs of industry and emphasising the vision of Interreg to share and build knowledge and relationships across Europe."

2.1.3. Coast lab Plymouth

Our last stop was at the Plymouth Coast Lab. This wave basin allows for wave generation with perpendicular or parallel currents. Martyn Hann explained the test facility and the research performed for wave energy and the upcoming market of floating wind.

A wave energy scale model was being tested during our visit, but due to confidentiality, no further information could be shared. Martyn explained an image recognition system with multiple cameras that logs the exact position of the (floating) wave scale model, in order to fully monitor the 6 degrees of freedom.

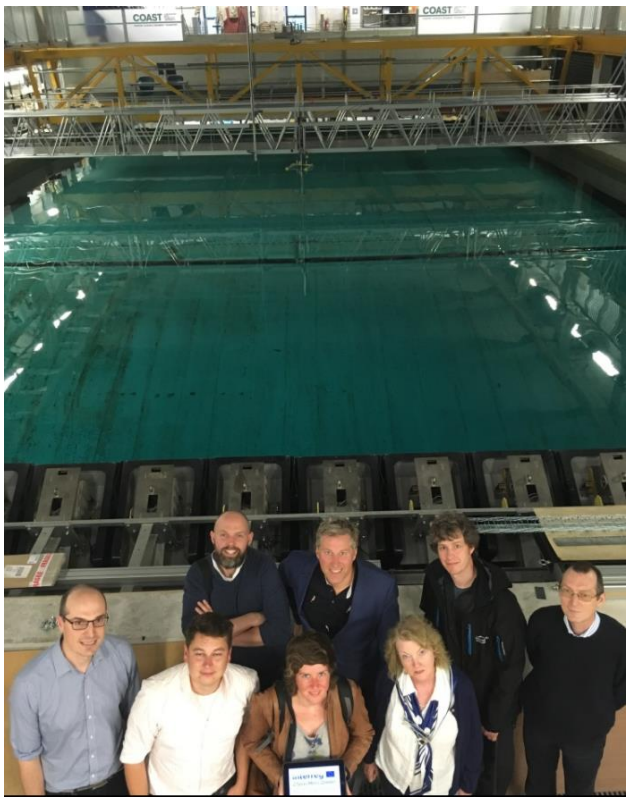

FIGURE 5 - SITE VISIT AT THE PLYMOUTH COAST LABORATORY

We concluded our visit with at the smaller scale flumes, where fundamental research was performed to gain insight in the combined effects of landslide in conjunction with a tsunami. Alongside, research was performed to quantify the residual movement of microplastics (and the effect of particle size on the Stokes drift). This clearly indicates that this test facility allows to address multiple societal challenges whether it's renewable energy, ocean litter or coastal defence.

3. Flowave test site Edingburgh

October 2018, site visit of OEE 2018

Following the OEE conference, delegates were invited to participate in a visit to the FloWave Ocean Energy Research Facility.

The heart of FloWave is a 25m diameter basin, with a working depth of 2m. Containing more than 2.4 million litres of water the test tank is divided into upper and lower volumes, separated by a 1m thick moveable floor. The upper test

volume is circumferentially ringed by 168 absorbing wave makers, whilst the lower volume contains the twenty-eight flow-drive units that can simultaneously and independently drive current across the upper test volume in any relative direction, with maximum current velocities of 1,6 metres per second.
The rising tank floor and 5t overhead crane enable quick and easy installation of individual devices, or arrays of wave or tidal current generators, and the fast settling time between tests combine to enable very efficient, effective and data-intensive test campaigns.

Conceived for cutting-edge collaborative academic and industrial research into wave and tidal current interactions, the FloWave Ocean Energy Research Facility is an essential tool to ensure technologies and projects perform 'right first time' and are de-risked as much as practical before cutting steel or going offshore.

During the visit, FloWave staff explained and demonstrated the capabilities of the test tank, as well as the advantages it offers for testing innovative ocean energy technologies. At the end of the visit, MET-CERTIFIED gave a presentation on the project and on the importance of the accreditation of test centers and the certification of developers. Furthermore, Jamie Grimwade of FloWave is already active in the TC-114 (eg. The MT 62600-1).

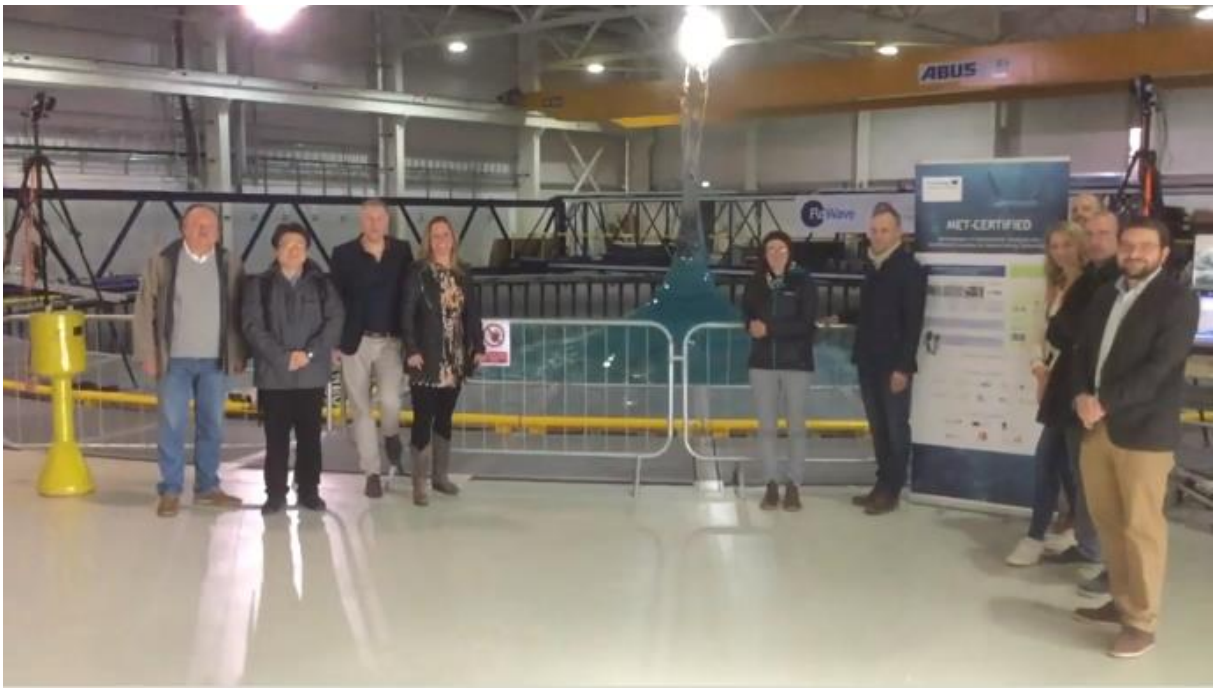

FIGURE 6 - SITE VISIT AT THE FLOWAVE TEST FACILITY. THIS VIDEO WAS SHARED ON LINKEDIN BY PIETER MATHYS AND HAS BEEN WATCHED OVER 500 TIMES.

4. Energy from water innovations in the province of North of Holland

April 2019, site visits during IEC TC114 meeting in Delft,NL

The plenary meeting of the IEC Technical Committee TC114, developing standards for marine energy convertors, was hosted by NEN in Delft (NL) in 2019.

From 8 to 12th April, over 60 experts from more than 10 countries convened at the Standardisation Institute for the Netherlands (NEN).

During day 3 of the IEC TC 114 plenary meeting in Delft, a site visit to energy from water innovations in the province of North of Holland was organised by bus by for delegates and invited guests to showcase several marine energy projects like Tocardo Tidal Power's mini-array at the DMEC test facilities and the RED-Stack pilot on the Afsluitdijk where power is generated from the difference in salinity gradient between sea water and fresh lake water.

4.1.1. Fish Flow Innovations

Director Gerard Mansanden welcomed delegates at in his production hall where visitors could see a ducted turbine with screw impellor.

FIGURE 7 - SITE VISIT AT FISH FLOW INNOVATIONS

4.1.2. Tocardo Tidal Turbines

The group visited the Tocardo offices in Den Oever. Over the past 10 years, Tocardo developed two-bladed, direct drive tidal current turbines. The bi-blade solution allows the blades to passively flip with changing tide directions.

4.1.1. Dutch Marine Energy Centre test facilities

Co-located at the Tocardo offices, DMEC manages a test site in two discharge channels in the Stevin Sluices gates complex. An array of 3 turbines could be viewed closely from an access bridge. Delegates were allowed access in smaller groups of 10-15, wearing life vests.

FIGURE 8 - TOCARDO TEST SITE/DMEC TEST FACILITY

4.1.2. RED-Stack pilot on the Afsluitdijk

RED-Stack is developing a unique technology to generate power from the difference in salinity gradient between sea water and lake water. The technology is called Reverse Electro-Dialysis (RED). Delegates viewed the pilot plant from a viewing point on a nearby dike. There was no access possible inside.

FIGURE 9 - RED-STACK PILOT ON AFSLUITDIJK

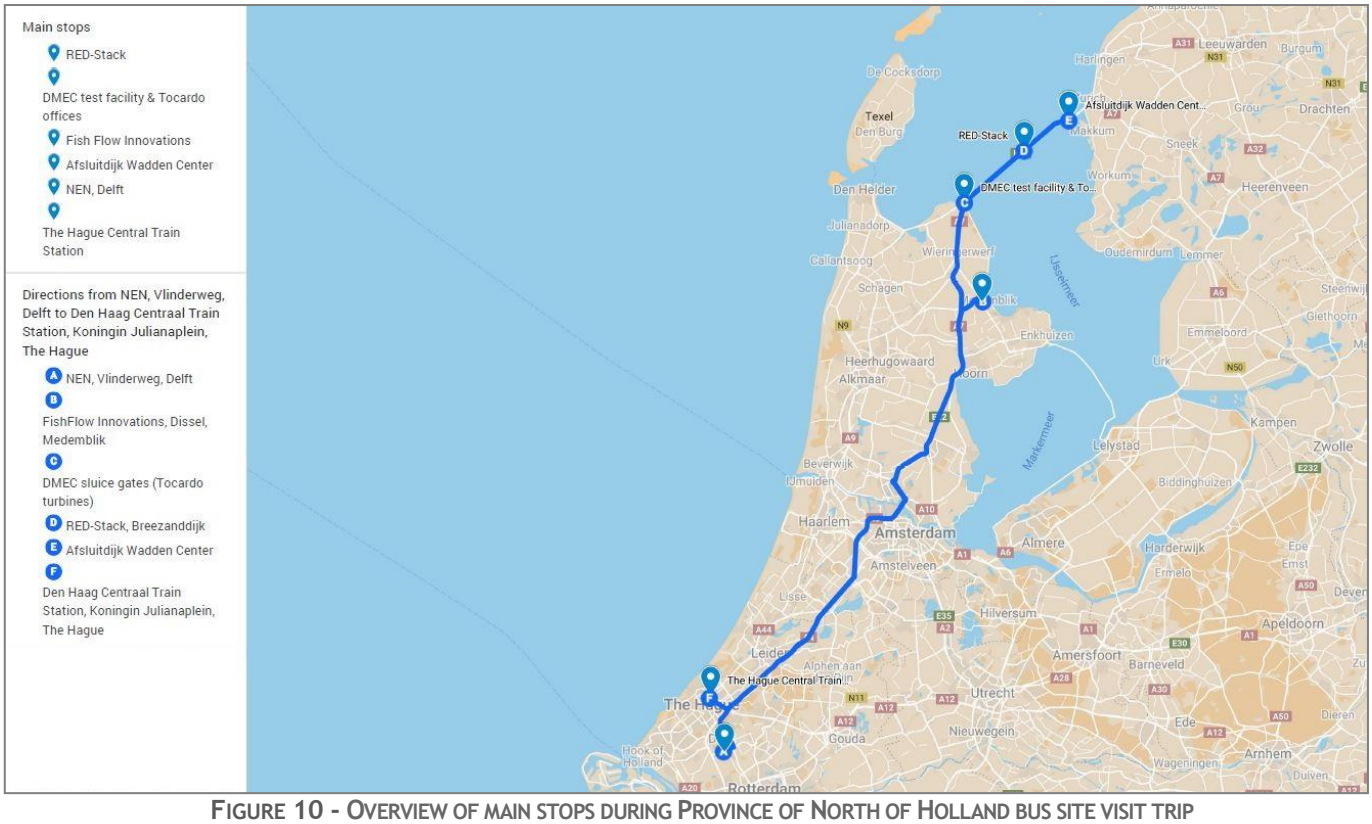

FIGURE 10 - OVERVIEW OF MAIN STOPS DURING PROVINCE OF NORTH OF HOLLAND BUS SITE VISIT TRIP

Note: Originally, site visits at PTEC and the TFS or UFS of Tocardo where envisaged, but this was not possible to delays and changes in the original work plan of MET-CERTIFIED.