

# TETHYS ENGINEERING BLAST



**12 February 2021**

[Tethys Engineering](#) is an online knowledge base that facilitates the exchange and dissemination of information on the technical and engineering aspects of marine renewable energy (MRE). The bi-weekly *Tethys Engineering Blast* highlights new publications in the [Tethys Engineering Knowledge Base](#); relevant announcements, opportunities, and upcoming events; and news articles of international interest. If you have specific content you would like circulated to the greater MRE community, please send it to [tethys@pnnl.gov](mailto:tethys@pnnl.gov) for consideration.

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## Announcements

### PacWave Request for Information Deadline Extended

The development of the [PacWave open ocean wave energy test facility](#) is proceeding rapidly and the South test site is scheduled to be operational in the Spring of 2023. The PacWave and Pacific Marine Energy Center (PMEC) teams have extended the deadline for their [Request for Information](#) (RFI) to solicit feedback from the wave energy technology research and development community, developers of related blue economy technologies, and other stakeholders. The information received will help the PacWave team understand how the facility can most effectively support testing needs. Responses are now due by 23 February 2021 and the submission deadline will not be extended further.

### ETIPP Community Technical Assistance

The National Renewable Energy Laboratory (NREL) is now accepting community technical assistance applications for the [Energy Transitions Initiative Partnership Project \(ETIPP\)](#), a partnership among U.S. Department of Energy (DOE) offices, national laboratories, and community organizations that will provide resources and access to on-the-ground support for remote and island communities in the U.S. seeking to transform their energy systems and lower their vulnerability to energy disruptions. Applications are due by 15 February 2021.

## Ocean Observing Prize

The U.S. DOE and National Oceanic and Atmospheric Administration (NOAA) are accepting applications for the [DEVELOP Competition](#) within the [Ocean Observing Prize](#)—a multi-stage prize that challenges innovators to integrate MRE with ocean observation platforms. The DEVELOP Competition comprises three contests—Design, Build, and Splash. Submissions for the Design Contest close at 5:00pm EST on 16 February 2021.

## Call for Abstracts

The [8th PRIMaRE \(Partnership for Research in Marine Renewable Energy\) Conference](#) is now accepting abstract submissions. Submissions are due by 30 April 2021. The 8<sup>th</sup> PRIMaRE Conference will be held online on 29-30 June 2021.

## Funding/Testing Opportunities

The European Commission has released a [Blue Economy Call for Proposals](#) to help advance market-readiness of new products, services, or processes, including MRE projects. Proposals are due by 5:00pm CEST (3:00pm UTC) on 16 February 2021.

The European Marine Energy Centre (EMEC) is [looking to contract](#) an MRE technology developer to act as an external advisor to the Ocean Energy Scale-up Alliance (OESA). Interested developers will need to deploy a wave or tidal energy technology at EMEC prior to March 2022, with learning from the preparations and deployment fed into the OESA project. The deadline for tenders is 19 February 2021.

The United Kingdom (UK) government recently launched the [Energy Entrepreneurs Fund \(EEF\)](#), a competitive funding scheme to support the development and demonstration of technologies, products, and processes in energy efficiency, power generation, and storage. Register your interest by 12:00pm GMT on 26 February 2021 and submit your applications by 30 March 2021.

The Centre for Advanced Sustainable Energy (CASE) is currently seeking applications from qualified consortia for research and development funding to support the decarbonization of the energy system in Northern Ireland. Developers working in ocean energy, including wave, tidal, and offshore wind, are eligible to apply. The [Call for CASE Project Applications](#) closes at 5:00pm GMT on 26 February 2021.

## Student/Employment Opportunities

Bombora Wave is seeking a [Senior Electrical Engineer](#) to support the development of the company's wave energy technology. Applications are due 19 February 2021.

The Offshore Renewable Energy (ORE) Supergen Hub and University of Southampton are recruiting for a [Research Fellow/Senior Research Fellow](#) to analyze current and future sites and ORE systems around the UK. Applications are due 19 February 2021.

Offshore Renewable Energy Catapult (ORE Catapult) is recruiting a [Programme Manager](#) for the Tidal Stream Industry Energiser (TIGER) project. Applications are due 19 February 2021.

Pacific Northwest National Laboratory (PNNL) is currently seeking a [Coastal and Marine Sciences Technical Intern](#) to join projects within one of three focus areas: (1) understanding the national laboratories' role and the unique place they have to accelerate work in coastal and marine ecosystems; (2) research and development of technologies focused on monitoring coastal ecosystems; and (3) MRE technologies and powering the blue economy. Applications are due by 25 February 2021.

Marine Power Systems is seeking a [Lead Engineer](#) and an [Electrical and Control Engineer](#) to join its offshore renewable energy device development team, as well as a [Project Manager](#) to lead the delivery of its full-scale WaveSub wave energy converter prototype.

Aquatera is seeking a [Senior Consultant](#) with an engineering background and marine renewable energy expertise to join its newly established Aquatera Sustainability Ireland team.

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## Upcoming Events

### Upcoming Course

The University of Strathclyde, in conjunction with the National Subsea Research Initiative and Subsea UK, has announced a new foundation-level course focusing on offshore renewable energy on 25-26 February 2021. The course will focus on the technical and business aspects of the offshore renewables sector, examining the full lifecycle. Register [here](#).

### Upcoming Workshop

The Supergen Offshore Renewable Energy (ORE) Hub and the Offshore Robotics for Certification of Assets (ORCA) Hub will host a virtual cross-discipline workshop entitled [Robotics for Offshore Renewable Energy: Surveying, Inspection and Maintenance](#) from 2:00-4:30pm GMT on 23 February 2021.

### Upcoming Webinars

NREL, Sandia, and PNNL will host the second in a series of webinars on new developments in the [Marine and Hydrokinetic Toolkit \(MHKiT\)](#), an open-source software package developed in Python and Matlab that includes modules for ingesting, quality controlling, processing, visualizing, and managing marine energy data. Register [here](#) for the webinar on 18 February 2021 at 12:00pm EST (5:00pm UTC), which will focus on MHKiT-Matlab and include Matlab demonstrations. It is recommended that attendees [preinstall MHKiT and its dependencies](#) so they can follow along during the webinar.

The European Technology and Innovation Platform for Ocean Energy (ETIP Ocean) will host a [webinar](#) on the standardization and certification of ocean energy at 2:00pm UTC on 18 February

2021. The webinar will focus on the experiences and learnings of a developer, a certifier, and a technical expert. Register [here](#).

As part of its webinar series, the Selkie Project will host a [webinar](#) on skills in the marine energy sector at 10:00am UTC on 23 February 2021. The webinar will outline the importance of a skilled workforce in coastal communities, highlight the skills shortages and the needs of the marine energy industry, and gather suggestions on how to address gaps. Register [here](#).

In collaboration with the Tidal Stream Industry Energiser (TIGER) project, the Multi-model Investigation of Tidal Energy Converter Reliability (MONITOR) project will host a [webinar](#) from 11:00am-12:30pm GMT on 24 February 2021. The event will focus on improvements to reliability modelling for tidal turbines, drawing on numerical and laboratory models, as well as real case studies. Register [here](#).

The International Energy Agency (IEA) Technology Collaboration Programme on Ocean Energy Systems (OES) is hosting a webinar entitled “[Evaluation and Guidance Framework for Ocean Energy Technology](#)” on 2:00pm GMT on 24 February 2021. This webinar will introduce the concept and content of the Evaluation and Guidance Framework that resulted from collaborative work led by the European Commission and delivered by Wave Energy Scotland, the U.S. DOE, and a number of other representatives from the OES Executive Committee. Register [here](#).

The U.S. DOE’s Water Power Technologies Office (WPTO) will host its Semiannual Stakeholder Webinar from 3:30-5:00pm ET (8:30-10:00pm UTC) on 1 March 2021. During the webinar, program managers and technical leads from across WPTO will provide updates on WPTO activities, partnerships, and programs, and discuss upcoming priorities. Register [here](#).

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## **New Documents on *Tethys Engineering***

### **[An International Evaluation and Guidance Framework for Ocean Energy Technology](#) – Hodges et al. 2021**

This document is an output of IEA-OES Task 12, an activity funded by the members of the International Energy Agency (IEA) Ocean Energy Systems (OES) Technology Collaboration Programme (TCP). The scope of this document includes technology associated with utility-scale electricity generation from ocean waves and tidal streams. This document intends to support international efforts by presenting a framework for technology evaluation and guidance of engineering activity, ensuring that decision-makers have consistent information available to them. The framework breaks the development process into six stages, from concept creation to commercialization. The activities and evaluations presented in the stages reflect the increasing knowledge, confidence and funding required as a technology matures.

### **[Holistic Marine Energy Resource Assessments: A Wave and Offshore Wind Perspective of Metocean Conditions](#) – Robertson et al. 2021**

While often considered independently, there are significant technical advantages to co-deployment of wave and offshore wind technologies, and will be future competition for limited marine real estate, so there is a distinct need to development holistic assessments of these offshore resources. Currently, offshore wind and wave energy resource assessments have been conducted as independent parallel processes, with little interaction with regard to best practices, lessons learnt, or opportunities to create compatible methodologies for future utilization by the broader marine energy sector. Based on the latest technical specifications from the International Electrotechnical Commission, and the highest fidelity publicly available datasets, the offshore wind and wave conditions at the PacWave site off Oregon, USA were quantified.

### **Experimental Assessment of Flow, Performance, and Loads for Tidal Turbines in a Closely-Spaced Array – Noble et al. 2020**

Tidal stream turbines are subject to complex flow conditions, particularly when installed in staggered array configurations where the downstream turbines are affected by the wake and/or bypass flow of upstream turbines. This work presents, for the first time, methods for and results from the physical testing of three 1/15 scale instrumented turbines configured in a closely-spaced staggered array, and demonstrates experimentally that increased power extraction can be achieved through reduced array separation. A comprehensive set of flow measurements was taken during several weeks testing in the FloWave Ocean Energy Research Facility, with different configurations of turbines installed in the tank in a current of 0.8 m/s, to understand the effect that the front turbines have on flow through the array and on the inflow to the centrally placed rearmost turbine.

### **Ocean thermal energy conversion (OTEC) system boosted with solar energy and TEG based on exergy and exergo-environment analysis and multi-objective optimization – Malik et al. 2020**

The primary goal of the current study is thermodynamic and environmental modeling and multi-objective optimization of a new hybrid energy system. The suggested ocean-based energy conversion system consists of an organic Rankine cycle (ORC), a solar flat plate collector, a proton exchange membrane (PEM) electrolyzer boosted with thermoelectric generator (TEG) module. Exergy and exergo-environmental as two powerful tools are employed to the precise assessment of the suggested system. To achieve the best performance of the integrated system, multi-criteria optimization with different objective functions is carried out. As the results of the parametric analysis indicate, defined objective goals have an appropriate conflict with changing decision variables, which is necessary in multi-criteria optimization.

### **Far-Field Maximal Power Absorption of a Bulging Cylindrical Wave Energy Converter – Ancellin et al. 2020**

The maximal power that is absorbed by a wave energy converter can be estimated from the far-field behavior of the waves that are radiated by the device. For realistic estimates, constraints must be used to enforce restrictions on the set of admissible motions when

deriving the maximal absorption width. This work is dedicated to the numerical computation of the maximal absorption width under constraints for devices with several non-trivial degrees of freedom. In particular, the method is applied to a model of SBM Offshore's S3 wave energy converter, a bulging horizontal cylinder. The results are compared with a more classical approach, which consists of computing the linear dynamic response of the wave energy converter interacting with the waves.

### **Passivity-based Voltage Controller for Tidal Energy Conversion System with Permanent Magnet Synchronous Generator – Belhier & Achour 2020**

Nonlinear dynamical and time varying parameters of the permanent magnet synchronous generator (PMSG), make it difficult to control. This paper presents a new passivity-based control (PBC) of tidal turbine based PMSG, connected to the grid through a back-to-back converter. The control problem is challenging for at least two reasons. First, the dynamics of the conversion system are described by a highly coupled set of nonlinear differential equations and various uncertainties of the PMSG model. Second, it is preferable to operate this kind of systems at the point of maximum power, which is a nonlinear function. To this end, two kinds of control strategies have been used. A new passivity-based voltage controller (PBVC) design applied to the machine-side, that ensures asymptotic convergence to the MPPT is presented.

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## **News & Press Releases**

### **Eco Wave Power Secures Final Engineering Coordination Permit for Cement Works and Floaters Installation for the EWP-EDF One Project – Eco Wave Power**

In a significant regulatory milestone, Eco Wave Power recently announced that it secured the engineering coordination permit from the Municipality of Tel-Aviv Jaffa needed for the cement works and installation of ten floaters for the EWP-EDF One wave energy project in the Port of Jaffa, Israel. This permit allows Eco Wave Power to proceed with the actual installation of the project in the seaside of the breakwater, which shall include cement works for the breakwater's reinforcement and the installation of 10 floaters, on 30 linear meters of a pre-existing breakwater within the port, having an installed capacity of 100 KW. The works, which will be executed via a sub-contractor, are expected to be completed in the upcoming months.

### **Energy Department Announces Finalists to Advance to Next Stage of "Waves to Water" Desalination Prize – U.S. Department of Energy**

The U.S. Department of Energy recently announced 10 winners in the ADAPT stage of the Waves to Water Prize, a competition focused on using the power of waves to develop clean energy-powered desalination technologies to help provide potable water to communities in need. Over three years, the Waves to Water Prize provides innovators a pathway from initial concept to field-testing their wave energy-powered desalination devices. The prize will culminate in an open water test in April 2022, when competitors

will launch and test their devices at Jennette's Pier, in partnership with the Coastal Studies Institute. ADAPT is the third of the five-stage \$3.3 million Waves to Water Prize.

### **AW-Energy Oy Announces Wave Energy Strategy for Green Hydrogen Market Entry** – **AW-Energy Oy**

AW-Energy Oy recently announced that it is entering the commercial hydrogen market by introducing a combined WaveRoller® and HydrogenHub process for the production of green hydrogen. Its wave energy device when combined with other renewable energy sources, can enable significant green hydrogen cost reductions and is a viable solution in the drive to execute the world's clean energy hydrogen roadmap. It is estimated that green hydrogen could supply up to 25% of the world's energy needs by 2050 and become a US\$10-trillion addressable market by 2050. These projections are underpinned by emerging hydrogen-focused energy strategies of countries across the European Union and globally.

### **Better Cost Estimates Build Better Systems: NREL Updates SAM Wave and Tidal Tools** – **National Renewable Energy Laboratory (NREL)**

The System Advisor Model (SAM) is an open-source software that combines performance and financial analysis for a suite of renewable energy technologies such as photovoltaics, wind, geothermal, marine energy, and more. Since its launch in 2007, new SAM versions have been released yearly, adding to the collection of technologies and financing options it can accommodate. In early 2020, NREL added marine energy (ME) to the SAM toolkit, enabling the marine energy community to perform cost and performance analysis of a potential system quickly and consistently.

### **MaRINET2 Project Hits Milestone of €5M for Free Offshore Renewables Testing** – **MaRINET2**

The fifth and final MaRINET2 call results have been announced, bringing the project's total budget for free lab, tank and open-sea testing to €5 million. In all, MaRINET2 has provided more than 600 weeks of testing and support to over 170 technology developers from almost 20 European countries, as well as Australia, Canada, Brazil and the US. Under the last of the trans-national access calls, €1.2 million has been awarded to 30 offshore renewables projects. Despite some delays due to the Covid-19 pandemic, projects funded under previous calls are well underway, with the latest batch due to hit the water in the coming weeks.