# 6 November 2020

*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 for consideration.

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## Announcements

PRIMRE Webinar Recordings Available

Pacific Northwest National Laboratory, National Renewable Energy Laboratory, and Sandia National Laboratories recently held a two-part webinar series to present new developments on the Portal and Repository for Information on Marine Renewable Energy *(PRIMRE)*, a centralized access point that enhances the accessibility and discoverability of information relevant to MRE development and operations in the U.S. Recordings of the webinars are now available here.

New Report on Powering the Blue Economy

In this report, The Economist Intelligence Unit examines the past, present and future of energy innovation for the blue economy. The report looks at the energy needs of different ocean economy sectors, assesses groundbreaking innovations and outlines an enabling environment for energy innovation within the blue economy. Based on three case studies and in-depth interviews with 30 energy and blue economy experts, this report provides valuable insights for all stakeholders working to develop new, clean solutions for the blue economy and beyond.

New Wave Energy Converter Tool

Sandia National Laboratories recently released the Wave Energy Converter (WEC) Design Optimization MATLAB Toolbox (WecOptTool), which allows users to perform WEC device design optimization studies while leveraging different control strategies. The tool features a pseudo-spectral solution method capable of dealing with both constraints and nonlinear dynamics, allowing users to find the best possible power capture performance within system constraints (e.g., maximum power take-off force).

## Selkie Project O&M Survey

The Selkie Project is developing an open source Operations and Maintenance (O&M) decision-support tool for the MRE industry and is seeking industry input to identify what strategies the tool should be able to test and gather information to form generic case-studies. The survey will be open until 1 December 2020.

## WPTO-MHK Graduate Student Research Program

The Oak Ridge Institute for Science and Education (ORISE) is now accepting applications for the WPTO-MHK Graduate Student Research Program, which is designed to provide graduate thesis research opportunities in marine and hydrokinetics (MHK) at U.S. Department of Energy (DOE) laboratories and other Water Power Technologies Office (WPTO) approved facilities. Applications are due by 5:00pm EST (10:00pm UTC) on 4 December 2020.

## EWTEC Abstract Submission Deadline Extended

The University of Plymouth has extended the abstract submissions for the 14th European Wave and Tidal Energy Conference (EWTEC 2021) until 1 December 2020. EWTEC 2021 will be held in Plymouth, UK from 5-9 September 2021.

## Calls for Papers

The *Journal of Ocean Technology* is inviting the submission of technical papers, essays, and short articles for its Spring 2021 Special Issue on Renewable Ocean Energy. Submissions are due 13 November 2020.

The *Journal of Marine Science and Engineering* is accepting manuscript submissions for a number of upcoming Special Issues. Submissions for "Hybrid Systems for Marine Energy Harvesting" are due 30 November 2020. Submissions for "Dynamic Instability in Offshore Structures" and "Waves and Ocean Structures" are due 5 January 2021.

## Funding/Testing Opportunities

The TEAMER (Testing Expertise and Access for Marine Energy Research) Program, which provides MRE developers with access to a network of U.S. testing facilities, will begin accepting applications for its second round of Requests for Technical Support (RFTS) on 9 November 2020. Applications will be due by 18 December 2020.

The TEAMER Network Director is also accepting applications for additional facilities to join the TEAMER Test Facility Network for RFTS round 3 and beyond. Potential facilities (both physical infrastructure as well as expertise capabilities, such as modeling and analysis services) should submit an application by 4 December 2020.

The European Commission has released a Call for Proposals focused on innovative land-based and offshore renewable energy technologies and their integration into the energy system. Submissions are due by 5:00pm CEST (3:00pm UTC) on 26 January 2021.

Employment Opportunities

GKinetic is currently recruiting for a Lead Engineer to join its team as it enters the next phase of commercial pilot projects and deployments. Applications are due by 1:00pm UTC on 9 November 2020.

The Dutch Marine Energy Center (DMEC) is currently recruiting for a Business & Innovation Advisor to assist its clients in the MRE sector. Applications are due by 27 November 2020.

Mocean Energy is currently recruiting for an Assistant Project Manager with a technical background to assist current project managers (applications due by 13 November 2020) and a Commercial Manager to help reach near-term commercial milestones and drive long-term strategy (position open until filled).

Ocean Renewable Power Company (ORPC) is currently recruiting for an Electrical Engineer to focus on the design of the electrical and control systems for ORPC's hydrokinetic devices and their connection to electrical grids.

Ocean Power Technologies is currently recruiting for several positions, including Senior Mechanical Engineer, Electrical Engineer, and Senior Project Manager. View all available positions here.

Oscilla Power is currently recruiting for two Hydrodynamicists/Test Engineers to assist in validating its concepts and innovations through numerical and physical models of its technology.

# Upcoming Events

Upcoming Workshops

As part of MaRINET2, the University of Edinburgh and WavEC Offshore Renewables are organizing a short-course on reducing uncertainty in techno-economic analysis of ocean energy from 17-19 November 2020. Register here.

DTOcean+ will be hosting a free online workshop at 1:30pm CET (12:30pm UTC) on 2 December 2020 as part of the Ocean Energy Europe Conference & Exhibition. The workshop

will give a general overview of the DTOcean+ software suite of tools, which will be released mid-2021 following validation by industrial partners in the consortium.

Upcoming Webinars

The European Technology and Innovation Platform for Ocean Energy (ETIP Ocean) & European Energy Research Alliance (EERA) Ocean Energy Joint Programme will be hosting a webinar, "Demonstration of tidal stream devices - blades & rotors", at 2:00pm UTC on 17 November 2020. The webinar will feature speakers from Orbital Marine, Sabella, and Magallanes Renovables. Register here.

The Ocean Power Innovation Network (OPIN) will be hosting a webinar, "Converting to offshore – From the test tank to the sea", at 12:30pm UTC on 18 November 2020. The webinar will feature speakers from EMEC, Wave Energy Scotland, and Verdant Power. Register here.

Upcoming Conferences

The Maritime Alliance's BlueTech Week 2020 will be held online from 16-20 November 2020. Register here.

Oceanology International will be held online from 1-4 December 2020. Register for free here.

The WavEC Annual Seminar 2020, Portugal and Canada: Advancing the Blue Economy through Intercontinental Collaboration, will be held online from 9-10 December 2020. Register for free here.

Event Update

The National Hydropower Association (NHA) recently announced the decision to move Waterpower Week (WPW) 2021 and the International Conference on Ocean Energy (ICOE) 2021 to an all-virtual platform. The events are still planned for 28-30 April 2020.

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# New Documents on *Tethys Engineering*

**High-resolution hindcasts for U.S. wave energy resource characterization** – **Yang and Neary 2020**

> The marine and hydrokinetic (MHK) industry is at an early stage of development and has the potential to play a significant role in diversifying the U.S. energy portfolio and reducing the U.S. carbon footprint. Wave resource characterization is an essential step for regional wave energy assessments, Wave Energy Converter (WEC) project development, site selection and WEC design. The present paper provides an overview of a joint modelling effort by the Pacific Northwest National Laboratory and Sandia National Laboratories on high-resolution wave hindcasts to support the U.S. Department of

Energy's Water Power Technologies Office's program of wave resource characterization, assessment and classifications in all US coastal regions.

## [Prediction of the fouling penalty on the tidal turbine performance and development of its mitigation measures](#) – Song et al. 2020

To guarantee a highly efficient tidal turbine operating in the real sea environment for an enduring long period is of critical importance to the power production and hence the cost of energy. However, this performance is under the threat of marine biofouling and the biofouling effect on tidal turbine systems are barely known neither quantified. This paper focuses on the study of the roughness effect due to biofouling on the performance of a tidal turbine. A Reynolds Averaged Navier-Stokes model based Computational Fluid Dynamics (CFD) was developed to predict the effect of biofouling on a full-scale turbine. A roughness modelling that involves modified wall-functions in the CFD model was used representing the surface roughness caused by barnacle fouling.

## [Potential for conversion of thermal energy in electrical energy: Highlighting the Brazilian Ocean Thermal Energy Park and the Inverse Anthropogenic Effect](#) – Valente de Souza et al. 2020

The present study focuses on Ocean Thermal Energy Conversion (OTEC) technology, which presents the greatest potential for energy exploitation from the oceans and which generates a range of by-products. The South Atlantic Ocean presents the potential to support OTEC plants, with emphasis on the region called Brazilian Ocean Thermal Energy Park, with a total coverage area of $1,893,000.00$ km$^2$ and an operating potential of up to 376 OTEC plants. Results of this work indicate that the park operation in maximum capacity can generate energy at a nominal power of 41.36 GW, and remove 60.16 GW or 60.16 GJ/s of ocean heat and 8.13 kg/s or 256.37 Tg/year of atmospheric $CO_2$.

## [Review of Systems Engineering (SE) Methods and Their Application to Wave Energy Technology Development](#) – Ruiz-Minguela et al. 2020

The design of effective and economically viable wave energy devices involves complex decision-making about the product based on conceptual design information, including stakeholder requirements, functions, components and technical parameters. The great diversity of concepts makes it extremely difficult to create fair comparisons of the relative merits of the many different designs. Systems engineering can provide a suitable framework to overcome the obstacles towards a successful wave energy technology. The main objective of this work is to review the well-established systems engineering approaches that have been successfully implemented in complex engineering problems and to what extent they have been applied to wave energy technology development.

## [Rapid initial assessment of the number of turbines required for large-scale power generation by tidal currents](#) – Vennell et al. 2020

Large turbine farms in strong tidal flows could contribute significantly to the global demand for renewable energy. Key to developing large scale power generation is

determining how many turbines are required to deliver a given amount of power from proposed sites. Answering this question is computationally difficult, as large-scale power extraction changes the strength of the currents driving the turbines. This paper outlines an approach that can rapidly assess farm power output using an existing hydrodynamic model. The approach is used to assess how much of Cook Strait, New Zealand's 15,000 MW potential could be realized with current generation turbines.

[Recovery of salinity gradient energy in desalination plants by reverse electrodialysis](#) - **Tristán et al. 2020**

Salinity gradient energy (SGE) capture by reverse electrodialysis (RED) is an emerging technology to advance the phaseout of conventional water-intensive energy sources in desalination industry. This paper assesses SGE recovery potential of an up-scaled RED system in seawater reverse osmosis (SWRO) desalination plants. Using a detailed RED system's model (i) we conducted a parametric evaluation of feed's concentration, feed's flow rate, and temperature to identify the optimal working conditions of an industrial-scale RED unit; (ii) estimated SGE recovery of a RED plant in SWRO plants distributed worldwide, adopting a single-stage arrangement of the RED units; (iii) finally, to enhance energy yield, we examined different RED plant's layouts in a specific SWRO plant.

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# News & Press Releases

## [Ocean DEMO Awards Support to 12 Developers for 3rd Call](#) – European Marine Energy Centre (EMEC)

The European Union-funded Ocean DEMO project has awarded recommendations for support to 12 offshore renewable energy developers under its 3rd call. The awards will support developers on their path to commercialisation and ease the transition of ocean energy towards multi-device farms by providing free access to open sea test sites. Funded by Interreg North-West Europe, Ocean DEMO is a €13 million project aiming to accelerate ocean energy's transition from single prototype to multi-device farms by providing free access to world-leading test centres. Successful applicants will receive free access to test their ocean energy products and services in real sea environments at the project's network of test centres.

## [Three Verdant Power Tidal Turbines Deployed in New York City's East River](#) – Verdant Power

Verdant Power, a leading marine renewable energy (MRE) company, recently installed an array of three tidal power turbines at its Roosevelt Island Tidal Energy (RITE) Project site in the East River. The deployment came as the first U.S. licensed tidal power project. The RITE Project activity is a technology demonstration of Verdant Power's fifth-generation tidal power system and its novel TriFrame™ mounting system, which is the next step on a pathway to global commercialization and profitable commercial operations. This pre-commercial demonstration of the proprietary integrated system is

designed to optimize the economics of installation and maintenance over the system's 20-year life, and to prove performance.

## [Eco Wave Power Develops a Game-Changing Wave Energy Power Plant Verification and Maintenance Software](#) – **Eco Wave Power**

Swedish wave energy company, Eco Wave Power, used extensive analysis of the global wave energy industry and found a strong need for the possibility of real-time production verification. The ensuing research focused on developing a computer system connected to a wave measuring technology on the one side and to the wave energy conversion unit, on the other side. The aim of which will be to provide a complete and fast live report of the current efficiency status of production of each wave energy module in a wave energy power plant. The result will be the preventative-predictive and corrective smart Wave Power Verification (WPV) software, which will get its first trial launch in the EWP-EDF One project, which is financed by the Israeli Energy Ministry and EDF Renewables IL.

## [Wave Swell Energy advances 200kW wave energy demo](#) – **Offshore Energy**

The Australian company Wave Swell Energy has launched the substructure for its King Island wave energy demonstration project. The substructure is ready for its upcoming maiden voyage down the Tamar River, to Bell Bay, where the superstructure will be installed, Wave Swell Energy informed through social media. It will form part of the 200kW wave energy device that is expected to be deployed on King Island in Tasmania by the end of 2020. According to the company, the construction of the device is almost complete, with the unit commissioning expected to begin in the first quarter of 2021. Wave Swell Energy's technology is based on the well-established concept of the oscillating water column (OWC).

## [Microsoft AI for Earth Grant awarded to Carnegie's Wave Predictor Project](#) – **Carnegie Clean Energy**

Carnegie Clean Energy Limited recently announced that it has been selected to receive a Microsoft AI for Earth grant to support a project that uses artificial intelligence (AI) to enhance the capabilities of Carnegie's Wave Predictor and broadens its potential applications. Carnegie's project was chosen through a competitive global selection process. Microsoft's AI for Earth grants provide access to Microsoft resources to support projects that use artificial intelligence to change the way people and organisations monitor, model, and manage Earth's natural systems. Carnegie's AI for Earth grant provides Carnegie with a sponsored Microsoft Azure account and credits for Azure compute consumption up to $15,000 USD to be used within one year.