TETHYS ENGINEERING BLAST

9 April 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 for consideration.

<div align="center">

Announcements   New Documents

Upcoming Events   News & Press Releases

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Announcements

Marine Energy Collegiate Competition

The application period for the U.S. Department of Energy's (DOE's) 2022 Marine Energy Collegiate Competition (MECC): Powering the Blue Economy is now open. The MECC encourages multidisciplinary teams of undergraduate and graduate students to unlock the power of the ocean, rivers, and tides to develop, design, and test the technologies that build resilient coastal communities and provide power at sea. Applications will close 7 May 2021. Register here for the MECC Applicant Webinar at 2:30pm MDT (8:30pm UTC) on 22 April 2021.

EuropeWave Prior Information Notice

Wave energy developers interested in participating in EuropeWave's Pre-Commercial Procurement can now register their interest, ask questions, and provide feedback. The tender will open in June 2021. A Prior Information Notice has been published online and a free webinar will be held on 14 April 2021 at 9:00am UTC to provide an overview of the project and explain the innovative 'stage-gate' design of the procurement process.

<u>MTS Scholarships Available</u>

The Marine Technology Society (MTS) is accepting [applications](#) for scholarships available to students attending full-time marine-related undergraduate and graduate programs. Applications are due 15 April 2021.

<u>Calls for Abstracts</u>

MTS and IEEE (Institute of Electrical and Electronics Engineers) Oceanic Engineering Society are now accepting abstract submissions for the [Global OCEANS 2021 Conference & Exhibition](#). OCEANS 2021 will take place 20-23 September 2021 in San Diego, California (US) and virtually. Abstracts are due 19 April 2021.

The Partnership for Research In Marine Renewable Energy (PRIMaRE) is now accepting abstracts for the [8th PRIMaRE Conference](#). Submissions are due by 30 April 2021. The 8th PRIMaRE Conference will take place online on 29-30 June 2021.

<u>Calls for Papers</u>

The *Journal of Marine Science and Engineering* is accepting submissions to several Special Issues, including "[Mooring Systems of Floating Offshore Structures for Emerging Industries](#)" (due 15 May 2021), "[Recent Advances in Marine Renewable Energy](#)" (due 31 May 2021), and "[Numerical Analysis and Monitoring Techniques of Offshore and Coastal Structures and the Marine Environment](#)" (due 20 June 2021).

Energies is accepting submissions to several Special Issues, including "[Feedback Control of Wind and Water Turbines](#)" (due 30 April 2021), "[Marine Renewable Energy Technology](#)" (due 11 May 2021), "[Innovation in Grid Connection and Control of Offshore Renewable Energy Systems](#)" (due June 2021), "[Wave Energy Converters (WECs)](#)" (due 30 June 2021), and "[Turbomachinery, Energy and Environmental Technologies](#)" (due 30 June 2021).

Frontiers in Marine Science is inviting contributions to a Research Topic entitled, "[Novel Technologies for Assessing the Environmental and Ecological Impacts of Marine Renewable Energy Systems](#)". Abstracts are due 26 May 2021 and manuscripts are due 26 November 2021.

<u>Funding & Testing Opportunities</u>

The Interreg Atlantic Area's Blue-GIFT has extended the deadline for the [Third Call for Applications](#) to test MRE technologies at the project's test sites. This access will allow developers to perform low cost tests and validation of their floating offshore wind, wave, tidal, or floating solar energy technologies in real sea environments. Applications now close at 5:00pm UTC on 23 April 2021.

The [Testing Expertise and Access for Marine Energy Research (TEAMER) program](#), sponsored by the U.S. DOE and directed by the Pacific Ocean Energy Trust, is now accepting applications for its Request for Technical Support (RFTS) 3. RFTS 3 applications will be accepted through 9

May 2021. Register here for an informational webinar at 1:00pm PDT (8:00pm UTC) on 12 April 2021.

The U.S. Northeast Sea Grant Consortium, in partnership with the National Oceanic and Atmospheric Administration's Northeast Fisheries Science Center and the U.S. DOE's Wind Energy Technologies Office and Water Power Technologies Office, is seeking proposals to improve understanding of the effects of ocean renewable energy development on coastal communities, including the fishing industry. Pre-proposals from eligible Northeast researchers are due 14 May 2021 and full proposals are due 16 July 2021 by 5:00pm EDT (9:00pm UTC).

The Ocean Startup Project has launched its second Ocean Startup Challenge, which will provide funding to support innovators who are leveraging Canadian ocean assets and capabilities to develop solutions to ocean industry challenges, including offshore energy. Applications close 1 June 2021. Register here for an info session at 9:00am PDT (4:00pm UTC) on 14 April 2021, or here for an info session at 11:00am PDT (6:00pm UTC) on 6 May 2021.

Student & Employment Opportunities

The Pacific Marine Energy Center at Oregon State University is looking for a PhD student to assist in the co-design, numerical modelling, and physical testing of numerical wave energy converters designed for underwater vehicle recharge and sub-surface operation. Applications are due by 15 April 2021.

The University of Plymouth is inviting applications for a 3.5-year MPhil/PhD studentship aimed at developing physical and numerical modelling tools to characterise the behaviour of dynamic export cables for floating offshore renewable energy farms. Applications are due 19 April 2021.

The National Renewable Energy Laboratory's Water Power team has an immediate opening for a Marine Energy Resource Assessment Researcher with several years of experience in physical oceanography and Python programming. Applications are due by 22 April 2021.

Upcoming Events

Upcoming Workshop

The Health and Safety Executive (HSE) and Supergen Offshore Renewable Energy (ORE) Hub are organizing a virtual Health and Safety Research in Offshore Renewables Workshop on 11 May 2021 from 2:00-5:00pm BST (1:00-4:00pm UTC). Register your interest in attending here by 5:00pm BST on 12 April 2021.

Upcoming Webinars

The U.S. DOE WPTO is hosting a *R&D Deep Dive Webinar Series* to share updates on tools, analysis, and emerging technologies to advance marine energy as well as next generation hydropower and pumped storage systems. Register here for "Leveraging the Advantages of

Additive Manufacturing to Produce Advanced Composite Structures for Marine Energy Systems" on 9 April at 1:00pm EDT (5:00pm UTC).

The International Energy Agency's (IEA's) Ocean Energy Systems (OES) is hosting a webinar series focused on ocean energy projects and key policies on IEA-OES Member Countries. The first webinar, "Ocean Energy Outlook in U.S.A, Canada and Mexico", will take place from 4:00-5:00pm UTC on 14 April 2021. Register here.

ETIP Ocean (The European Technology and Innovation Platform for Ocean Energy) is hosting a webinar on sharing data to attract investors at 10:00am UTC on 15 April 2021. During the webinar, ocean energy professionals will share their experience and discuss what type of information investors and public authorities are looking for. Register here.

The Portal and Repository for Information on Marine Renewable Energy (*PRIMRE*) is hosting two webinars for the Marine Energy Data Pipeline team, led by the Pacific Northwest National Laboratory, to discuss data standards and introduce the development of the new marine energy data pipeline. The first webinar, "Marine Energy Data Standards", will take place at 11:00am PDT (6:00pm UTC) on April 20, 2021 and will focus on recently developed data standards. Register here. The second webinar, "Marine Energy Data Pipeline", will take place at 11:00am PDT (6:00pm UTC) on May 11, 2021 and will focus on the demonstration of the open source time series data utility that can be used to convert raw data to standardized format. Register here.

The International Integrated Wave Energy Research group (IIWER) is hosting its second webinar at 9:00am PDT (4:00pm UTC) on 30 April 2021. During the webinar, Dr. Zhaoqing Yang from the Pacific Northwest National Laboratory will present on "Wave resource characterization at regional and nearshore scales using a multi-resolution modeling approach". Register here by 28 April 2021 to receive the meeting link.

Upcoming Conference

Energía Marina and its Marine Energy Research & Innovation Center (MERIC) are organizing an online international conference, Chile Riding the Blue Energy Wave, on 12-13 April 2021. Register for free here.

New Documents on *Tethys Engineering*

Nearshore wave energy resource characterization along the East Coast of the United States – Ahn et al. 2021

> A feasibility level nearshore wave energy resource characterization is conducted for the East Coast of the United States using a 32-year (1979 – 2010) hindcast from a high-resolution unstructured-grid Simulating Waves Nearshore (SWAN) model with a spatial resolution of 200 m along the coastline. Wave energy resource attributes including wave energy potentials, seasonal variability, frequency and directional spreading, and extreme sea states are characterized using a broad range of resource parameters from which

opportunities, risks, and constraints for wave energy conversion (WEC) projects are assessed.

[Experimental comparison of blade pitch and speed control strategies for horizontal-axis current turbines](#) – Van Ness et al. 2021

The majority of utility-scale horizontal-axis current turbines use either speed or pitch control to maintain a constant power output once the currents exceed a certain threshold: the turbine-specific "rated speed". In this study, we experimentally characterized power performance and turbine loading over a range of blade pitch settings and tip-speed ratios for a three-bladed horizontal-axis turbine. We then implemented a control strategy to maintain power output in time-varying currents using blade pitch control and compare the turbine performance under this control strategy to "overspeed" and "underspeed" control strategies for a fixed pitch turbine. The experiments were conducted with a laboratory-scale 0.45 m diameter turbine in an open channel flume with a 35% blockage ratio.

[TEMPO oxidized cellulose nanofibers-based heterogenous membrane employed for concentration-gradient-driven energy harvesting](#) – Xu et al. 2021

The concentration gradient between sea water and river water is widely regarded as a very significant sustainable energy resource because of its easy availability and abundant reserves. Therefore, it is necessary for rapid technical breakthrough of membrane engineering in order to capture this energy existing in the fluidic system. Herein, we develop nanofluidic device that can harvest osmotic energy and rectify ionic transport by directly prepared with a nanoporous TOCNs membrane and a conical variable-channel porous polyethylene terephthalate (PET) substrate membrane.

[Towards Real-Time Reinforcement Learning Control of a Wave Energy Converter](#) – Anderlini et al. 2020

To improve the feasibility of wave energy, it is necessary to develop effective control strategies that maximise energy absorption in mild sea states, whilst limiting motions in high waves. Due to their model-based nature, state-of-the-art control schemes struggle to deal with model uncertainties, adapt to changes in the system dynamics with time, and provide real-time centralised control for large arrays of WECs. Here, an alternative solution is introduced to address these challenges, applying deep reinforcement learning (DRL) to the control of WECs for the first time. A DRL agent is initialised from data collected in multiple sea states under linear model predictive control in a linear simulation environment.

[FoDTEC (Forensic Decommissioning of Tidal Energy Converters) Final Summary Report](#) – Warren 2020

After the removal of the Tidal Generation Ltd tidal turbine foundation that was installed at the European Marine Energy Centre's Fall of Warness tidal test site, the FoDTEC (Forensic Decommissioning of Tidal Energy Converters) project has completed activities

to assess biofouling, corrosion, metallurgical defects and electrical connector longevity. The aim of the project is to provide feedback and design guidelines to the offshore renewable energy industry to improve the design of marine energy converters in relation to biofouling, corrosion protection, and the effects of long-term submersion in seawater. This report provides an overall summary of the work completed.

[Analysis and Development of Closed Cycle OTEC System](#) – **Acevedo et al. 2020**

In this chapter, we present the methodology for the selection of the working fluid, the environmental and working conditions for operation, and the development carried out for the design of a closed cycle OTEC prototype plant. This prototype uses the temperature difference between the cooler deep waters and the warmer surface waters of the Mexican Caribbean Sea to feed a thermal machine capable of generating 1 kW of electrical energy; and it works with an organic Rankine cycle, composed of a pump, a turbine, and two heat exchangers. The advances carried out in installing the prototype are also presented.

News & Press Releases

[Tidal Range Moves Back Up the Agenda in Wales](#) – **Marine Energy Wales**

Marine Energy Wales has been championing a fresh assessment of tidal range power generation in broad recognition of tidal range's unique multi-generational operating life, extensive co-benefits and contribution to Wales. Despite the immense potential of this form of power generation, proposed projects have to date faced a number of consenting and permitting roadblocks that have made it impossible to initiate and construct the tidal lagoon projects. In light of these past challenges Marine Energy Wales welcomes recent announcements from Welsh Government, that they are undertaking market engagement to gauge interest for a tidal range competition in Wales that would support the delivery of a first of its kind tidal lagoon project in Welsh waters.

[TechnipFMC and Bombora Form Strategic Partnership to Develop a Floating Wave and Wind Power Project](#) – **Bombora**

TechnipFMC, a global leader in the energy industry, and Bombora, a leading wave energy technology company, have formed a strategic partnership to develop a floating wave and wind power project in support of a more sustainable future. The partnership will initially focus on TechnipFMC and Bombora's InSPIRE project. With engineering work initiated in November 2020, the partnership is developing a hybrid system utilizing Bombora's mWave™ technology. The hybrid system demonstrator will deliver 6 megawatts of combined floating wind and wave power, followed by Series 1 and Series 2 commercial platforms which are expected to deliver 12 and 18 megawatts, respectively.

[Simec Atlantis in talks with UK government for MeyGen's next phase](#) – **Offshore Energy**

In an operational update, Simec Atlantis has informed about ongoing talks with the UK government regarding the support mechanisms necessary for the expansion of the MeyGen tidal energy project. Once operational, the project will be the largest tidal array ever built and continues to be both a pioneer and a flagship for both the industry and the technology globally. The UK government has indicated that it will announce the details of the support mechanisms this summer, with the auction round taking place towards the end of the year. Operationally, MeyGen continues to provide vital learning to help the design and development for the company's future projects. Currently, three of the turbines have been moved to the workshop in Nigg to allow the team to complete onshore service works.

[Smart Power Buoy: Wave Power Expands Recharge at Sea Possibilities](#) – **Marine Technology News**

While generations of innovators have attempted, to varying degrees of success, to harness the tremendous renewable power potential of waves, the Danish company Resen Waves contends it is able to do just that, in a scale to remotely power sea-based instruments and vehicles, and eventually all the way up to entire cities. The Resen Waves Smart Power Buoy is designed to harness the constant movement of waves to power autonomous machinery (AUVs) and instruments in the sea with clean, renewable, continuous energy while facilitating real-time, uninterrupted data communications. While working in the sea is never simple, Roland Boysen, CCO, contends that his company is cracking the code on generating power from waves safely, efficiently, and yes, simply.

[Research investigates effectiveness of flexible materials in wave energy devices](#) – **University of Plymouth**

Researchers have been awarded almost £1million to test the potential for flexible materials to be used in the design and manufacture of offshore renewable energy structures. The FlexWave project will explore whether types of rubber, composites and polymers can be effective in harnessing wave power and converting it into a renewable and sustainable source of energy. It will assess whether such materials are better at withstanding extreme storms and sea conditions, and pose less of a threat to environments in which they are placed. And it will explore if flexible materials can be more reliable, sustainable and cost effective than existing alternatives such as steel or concrete.