9 October 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 Series

Pacific Northwest National Laboratory, National Renewable Energy Laboratory, and Sandia National Laboratories will be hosting the second of 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. The second webinar, at 8:00am PDT (3:00pm UTC) on 28 October 2020, will highlight new features of existing *PRIMRE* Knowledge Hubs: Signature Projects, the *Tethys Engineering* Photo Library, and the PRIMRE aggregate search. Register here. A recording of the first webinar, which highlighted new sites and tools developed within PRIMRE (MRE Technology Database, MRE Software, and Telesto) is now available here.

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 DOE laboratories and other DOE/WPTO-approved facilities. Applications are due by 5:00pm EST (10:00pm UTC) on 4 December 2020.

<u>Funding/Testing Opportunities</u>

The [Marine Renewables Infrastructure Network (MaRINET2)](#) has opened its fifth and final call for fully funded access to a world-leading network of testing and research infrastructures in Europe. An open call for [virtual access](#) to data sets and a free-of-charge [training programme](#) are also available through the project. Applications are due 16 October 2020. A webinar recording to assist candidates with their application and share updates on the process is available [here](#).

The Massachusetts Clean Energy Center (MassCEC) recently released a [Request for Proposals](#) as part of its [Catalyst Program](#), which provides grants of up to $65,000 to researchers and early-stage companies looking to demonstrate initial prototypes of their clean energy technologies. Proposals are due 19 October 2020 at 11:59pm EST (3:59am UTC+1).

The European Space Agency (ESA) Space Solutions, in partnership with the Dutch Marine Energy Centre (DMEC), has released an open competition [Invitation to Tender](#) for teams looking to investigate the technical feasibility and economic viability of space-based applications in support of MRE solutions, and define a roadmap for services implementation and demonstration.

Upcoming Events

<u>Upcoming Workshops</u>

The Ocean Power Innovation Network (OPIN) is hosting an online workshop, "[Challenges and Solutions for Improved Durability of Materials](#)", on 22 October 2020 at 12:00pm UTC. The workshop will provide an update on the latest advances in materials and manufacturing related to applications in harsh environments. Register [here](#).

Marine Scotland Science will now be hosting the [Scottish Shelf Waters Reanalysis Service (SSWRS) Launch Event](#) online on 3 November 2020. The SSWRS is a 25 year hindcast of the Scottish Shelf Model (SSM) and will include variables such as hourly horizontal current velocities and water elevation fields, as well as daily mean files (de-tided) of three-dimensional currents, temperature, and salinity, all on the original unstructured model mesh. The launch event will include information about the SSM reanalysis service, how to get started with the SSWRS, and the potential applications of the service, as well as provide an opportunity to network with other users.

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](#).

<u>Upcoming Webinars</u>

Morbihan Hydro Energies is hosting the [third](#) of a series of six supply chain seminar events as part of the TIGER (Tidal Stream Industry Energiser) project on 13 October 2020 at 8:00am

UTC. As part of [Sea Tech Week](), this webinar will focus on growing the supply chain for cost effective, reliable tidal turbine composite blades, tools, and sensors. Register [here]().
Ocean Energy Europe (OEE) is hosting its [2030 Ocean Energy Vision Launch]() on 13 October 2020 at 1:30pm UTC. The online event, "Sea Change: Rolling out a new ocean energy industry in Europe by 2030", will focus on the sector's plans for deployments, cost reductions, and industrial growth between now and 2030. Register [here]().

The Oceanic Platform of the Canary Islands (PLOCAN) is hosting a [webinar](), "Progress in cost-effective wave energy harvesting for isolated systems and islands", on 15 October 2020 at 10:00am UTC. Register [here]().

The Inn2POWER project is hosting the first of a five-part webinar series on offshore testing facilities in the North Sea Region on 21 October 2020 at 8:00am UTC. The webinar will feature presentations on the Blue Accelerator in Belgium, FabTest in the United Kingdom, and DanWEC in Denmark. Register [here.]()

The European Marine Energy Centre (EMEC) is hosting the [fourth]() supply chain seminar event as part of the TIGER project on 21 October 2020 at 12:00pm UTC. This webinar, facilitated by Hydroquest, will raise awareness of anti-fouling and anti-corrosion resistance of tidal turbines and explore areas for collaboration to reduce maintenance costs. Register [here]().

In collaboration with the Oceansgate Marine Technology Webinar Series, EMEC is also hosting the [fifth]() supply chain seminar event as part of the TIGER project on 28 October 2020 at 11:00am UTC. This webinar, facilitated by Offshore Renewable Energy (ORE) Catapult, will raise awareness of reliability and condition monitoring techniques and potential future applications of machine learning. Register [here]().

EMEC is also hosting the [sixth]() supply chain seminar event as part of the TIGER project on 30 October 2020 at 12:00pm UTC. This webinar, facilitated by Minesto, will focus on onshore and offshore mobilization and logistics, aiming to integrate cross-sector supply chain capability and innovation into the development of world leading tidal energy projects. Register [here]().

Upcoming Conferences

[Global OCEANS 2020: Singapore - U.S. Gulf Coast]() will feature a mix of live and on-demand events available to all registrants between 5-30 October 2020. Register [here]().

The [Offshore Energy Exhibition & Conference (OEEC)]() will be held in a digitally enhanced format from 27-28 October 2020. The modified format will feature a combination of virtual and in-person activities at the RAI Amsterdam Convention Centre. Register [here]().

New Documents on *Tethys Engineering*

[Performance enhancement of submerged wave energy device using bistability]() – Schubert et al. 2020

The performance of a submerged cylindrical point absorbing wave energy converter was explored under the addition of different nonlinear stiffness (bistable) conditions. The limitations of previous studies were addressed by incorporating higher-fidelity modelling. For wave energy converters, most theoretical models with bistability were limited to one-degree-of-freedom, neglect nonlinearities such as viscous drag, and are excited by unrealistic sinusoidal waves. Such simplifications lead to neglecting features such as modal interactions. The presented model investigated a three-degree-of-freedom submerged point absorber with bistability subjected to regular and irregular waves.

[Experimental analysis of dual coaxial turbines in skew](#) – **Metoyer et al. 2020**

Ocean currents are a potentially reliable source of renewable energy, but the complications associated with deploying current energy conversion (CEC) devices in deep water make harvesting that energy a challenge. One promising approach is to use tethered axial-flow CECs composed of one or more pairs of coaxial counter-rotating turbines. However, a dual-rotor system moored in unsteady water by a flexible tether is likely to experience a condition, called skew, where the axis of rotation is not aligned with the direction of flow. A lab-scale turbine was constructed to investigate the effect of skew on fluid power conversion of a coaxial CEC.

[Investigating Polymer Fibre Optics for Condition Monitoring of Synthetic Mooring Lines](#) – **Gordelier et al. 2020**

Synthetic mooring lines are becoming a popular alternative to conventional chain mooring systems. For marine renewable energy devices, they have been considered as an enabling technology for this nascent sector, given their reduced costs and ease of deployment. However, the extreme operating environment has led to an increased interest in the 'in-situ' condition monitoring of these mooring lines. This paper considers the use of polymer fibre optic technology and the optical time domain reflectometry (OTDR) technique for the condition monitoring of synthetic mooring lines.

[New insights into position optimisation of wave energy converters using hybrid local search](#) – **Neshat et al. 2020**

This research investigates the optimisation of the placement of oscillating buoy-type wave energy converters. In a wave farm, buoy positions strongly determine the farm's output. Optimising the buoy positions is a challenging research problem due to complex and extensive interactions (constructive and destructive) between buoys. This research focuses on maximising the power output of the farm through the placement of buoys in a size-constrained environment, and we propose a new hybrid approach mixing local search, using a surrogate power model, and numerical optimisation methods.

[Stochastic Modeling of Tidal Generation for Transient Stability Analysis: A Case Study based on the All-Island Irish Transmission System](#) – **Jonsdottir et al. 2020**

The renewable energy currently generated in the Irish system is almost entirely supplied by wind power plants. However, in the sea around Ireland there is a significant tidal energy potential. This paper provides a comparison of these two renewable energy sources, namely wind and tidal, in terms of short-term variability and its impact on the dynamic behavior of the system. With this aim, stochastic models of the short-term variability of these two energy sources are proposed. Simulation results indicate that tidal generation leads to larger frequency variations than those caused by wind generation.

[Assessing marine operations with a Markov-switching autoregressive metocean model](#) – **Paterson et al. 2020**

This article presents a metocean modelling methodology using a Markov-switching autoregressive model to produce stochastic wind speed and wave height time series, for inclusion in marine risk planning software tools. By generating a large number of stochastic weather series that resemble the variability in key metocean parameters, probabilistic outcomes can be obtained to predict the occurrence of weather windows, delays and subsequent operational durations for specific tasks or offshore construction phases. A model selection process is presented for both weather parameters across three locations, and a personnel transfer task is used to contextualise a realistic weather window analysis.

News & Press Releases

[RivGen® Power System Now Longest Operating Current Energy Converter in U.S.](#) – **Ocean Renewable Power Company (ORPC)**

ORPC has concluded summer inspection and maintenance of its RivGen® device, re-deployed it and resumed operations sending power to the Igiugig, Alaska, community grid. The project has achieved over 7 million revolutions of the marine hydrokinetic (MHK) turbine to produce power during its 10 months of operation, making the RivGen Power System the longest operating current energy converter in the U.S. During this initial period of operation, the RivGen device survived a mid-winter frazil ice occurrence, was subjected to mobile debris without observed negative effects, and had significant amount of ice flow over it from spring break up of Alaska's largest lake.

[Testing of RWPower's seawater pumping device successfully resumed at PLOCAN's test site](#) – **The Oceanic Platform of the Canary Islands (PLOCAN)**

On October 1st, 2020, the deployment of a seawater pumping prototype powered by wave energy and developed by the Norwegian company RWPower, was performed again at the PLOCAN test site (Canary Islands, Spain). With this deployment, the test period, which started in January 2020, has been resumed after some design improvements. The survivability of the device at sea will be tested and estimations of the prototype's pumping capacity depending on the prevailing wave height will be obtained. A potential

application of this device is the pumping of seawater into desalination plants located near the coast without the need of electric power.

[Bureau Veritas validates OceanQuest power curve](#) – **Offshore Energy**

French tidal energy developer HydroQuest has obtained certification for its 1MW tidal turbine's power curve from classification society Bureau Veritas. The tidal turbine OceanQuest, deployed in Paimpol-Bréhat, meets the requirements of the IEC 62600-200 standard evaluating the performance of the measurement of the power of tidal energy converters. After 12 months of effective operations, the turbine was still fully operational and started its second year of operations. The new generation of HydroQuest tidal turbines will be one of the most powerful with a nominal power of 2.5MW and will first feature in a 10MW pilot farm in Le Raz-Blanchard, Normandy.

[Minesto's Holyhead Assembly Hall is now fully operational](#) – **Minesto**

Minesto's Assembly Hall located in Holyhead, Wales is now fully operational, serving as the hub of Minesto's engineering and operational activities. The construction of the Assembly Hall was managed by Stena Line and the building was handed over to Minesto in spring, equipped with a loadout quay and an external storage area. The building is specifically designed for Minesto and contains a capable overhead gantry crane required for the complete assembly, testing and maintenance of Deep Green kite system components. The Assembly Hall is now the centre of engineering activities relating to Holyhead Deep site.

[Unusual approach to tunnel testing of blades by NEMMO project](#) – **The Next Evolution in Materials and Models for Ocean Energy (NEMMO) Project**

A scale model of a tidal turbine is being tested in SSPA's cavitation tunnel, in order to verify the efficiency of the blades and provide data for improved blade design. The tests measure thrust and torque, while varying the rotational speed of the blades with an electrical motor. Blade pitch angles within a range of 12-18 degrees are tested across a range of rotational speeds. As this turbine is designed to operate at oblique current angles, the entire model is rotated horizontally to simulate the current at angles of attack between 0-20 degrees, which is a quite unusual feature to test in cavitation tunnels.