TETHYS ENGINEERING BLAST

7 May 2021

Tethys Engineering is an online knowledge base that facilitates the exchange and dissemination of information on the technical and engineering aspects of marine energy. 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 marine energy community, please send it to tethys@pnnl.gov for consideration.

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 almost over! 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. Apply by 11:59pm MDT on 7 May 2021.

Calls for Papers

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.

The *Journal of Marine Science and Engineering* is inviting submissions for several Special Issues, including "Recent Advances in Marine Renewable Energy" (due 31 May 2021), "Numerical Analysis and Monitoring Techniques of Offshore and Coastal Structures and the Marine Environment" (due 20 June 2021), and "Advancements in Marine Renewable Energy and Renewable Powered Marine Vehicles" (due 31 July 2021).

Energies is inviting submissions for several Special Issues, including "Innovation in Grid Connection and Control of Offshore Renewable Energy Systems" (due 30 June 2021), "Wave Energy Converters (WECs)" (due 30 June 2021), and "Reliability of Marine Energy Converters" (due 31 August 2021).

Funding & Testing Opportunities

The U.S. 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 third Request for Technical Support (RFTS) through 9 May 2021. Beginning with RFTS 3, TEAMER will allow for longer access periods of up to nine months to complete an RFTS. The access period for RFTS 3 will be from roughly September 2021 through June 2022.

The International Network on Offshore Renewable Energy (INORE) has extended the submission deadline for the 2021 Call for Blue Energy Collaborative Scholarship, sponsored by Ocean Energy Systems (OES). Submissions are now due by 14 May 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.

Student & Employment Opportunities

Aquatera is recruiting an experienced Environmental/Energy Data Analyst and Manager to work on its Economic Value of Ocean Energy (EVOLVE) project, which is exploring the contribution that marine based renewables can make to Europe's future energy systems. Applications are due 10 May 2021.

Swansea University's College of Engineering is seeking a Research Assistant to contribute to the SELKIE project. Specifically, the position will involve research in drone video remote sensing of tidal currents and a novel converging beam ADCP sensor for currents and turbulence. Applications are due 15 May 2021.

Dalhousie University is inviting applications for a fully funded PhD project in collaboration with Canadian National Research Labs researchers. The objective of the research project is to study local transient loads on tidal turbines and turbine blades exerted by representative tidal flows. Applications are due 21 May 2021.

Lancaster University is seeking a Senior Research Associate in Wave Energy Converter Experimental and Computational Modelling to join a research project entitled, "Novel High Performance Wave Energy Converters with advanced control, reliability and survivability systems through machine-learning forecasting (NHP-WEC)". Applications due 26 May 2021.

The University of Plymouth is seeking a Research Fellow in Flexible Materials to work on research related to material testing, characterisation, and numerical modelling of fibre reinforced polymeric composites for wave energy devices, as well as a Research Fellow in Hydrodynamics to work on research related to the hydrodynamics testing and analysis of wave energy devices. Both positions will support the Flexible Responsive Systems in Wave Energy (FlexWave) project. Applications are due 31 May 2021.

The Pacific Marine Energy Center (PMEC) at Oregon State University is recruiting a Post-Doctoral Scholar to support its marine energy research, development, and testing programs. Specifically, the position will support projects on sub-surface wave energy resources, upscaling wave energy converter (WEC) performance characteristics, and numerical and physical modelling of scaled WECs. Applications are due 1 June 2021.

Upcoming Events

Upcoming Workshops

The U.S. DOE's National Renewable Energy Laboratory and the Hydropower Foundation are hosting a STEM to Marine Energy Dialogue Workshop on Educational Resources at 3:00pm MST (9:00pm UTC) on 18 May 2021. Register for free here.

The Marine Alliance for Science and Technology for Scotland (MASTS), Environmental Interactions of Marine Renewables (EIMR) conference series, and Marine Scotland are hosting an online workshop entitled, "Passport to the oceans of the future: delivering marine energy through science & policy", from 2:30-5:30pm BST (1:30-4:30pm UTC) on 27 May 2021. Register for free here by 5:00pm BST (4:00pm UTC) on 26 May 2021.

Upcoming Courses

In collaboration with the Marine Renewables Infrastructure Network for Enhancing Energy Technologies (MaRINET2), WavEC Offshore Renewables is organizing an online short course entitled, "Installation and O&M of Offshore Renewable Energy Systems", on 11-12 May 2021. Register for free here.

As part of the Ocean Power Innovation Network (OPIN), the West Atlantic Marine Energy Community (WEAMEC) is organizing an online Masterclass on Mooring and Installation on 30 June and 1 July 2021. Register for free here.

Upcoming Webinars

OPIN is hosting a webinar, "Funding Opportunities for Collaborative Innovation", at 11:00am BST (10:00am UTC) on 10 May 2021. This webinar looks at some of the opportunities to support European collaboration in ocean energy and the clean energy transition, with a case study of one company's approach. Register here.

The European Technology and Innovation Platform for Ocean Energy (ETIP Ocean) & European Energy Research Alliance (EERA) Ocean Energy Joint Programme is hosting a webinar, "Connecting Your Kit: Quick & Reliable Connections", at 10:00am BST (9:00am UTC) on 11 May 2021. During the webinar, three experts will discuss their solutions for innovative connectors and how they help increase reliability and reduce the levelized cost of energy of the whole device. Register here.

The Portal and Repository for Information on Marine Renewable Energy (*PRIMRE*) is hosting a webinar, "Marine Energy Data Pipeline", at 11:00am PDT (6:00pm UTC) on 11 May 2021. During the webinar, the Marine Energy Data Pipeline team, led by the Pacific Northwest National Laboratory, will introduce the development of an open source time series data utility that can be used to convert raw data to a standardized format. Register here.

The Oregon Regional Accelerator & Innovation Network (Oregon RAIN) is hosting a panel discussion about ocean energy in the U.S. Pacific Northwest at 12:00pm PDT (7:00pm UTC) on 12 May 2021. During the panel, regional experts from the Pacific Marine Energy Center, Pacific Ocean Energy Trust, and Washington Maritime Blue will discuss ocean energy solutions, progress, and challenges. Register here.

The Selkie Project, which aims to support the marine energy sector in Wales and Ireland, is organizing a 'Meet the Expert' event series focused on providing business support for companies looking to diversify into the marine energy sector. The first event, at 9:00am UTC on 20 May 2021, will help your business understand how to bid for tenders in Wales, register and navigate the Sell2Wales.gov.wales website, and create a profile for your business. Register here.

New Documents on *Tethys Engineering*

Wave resource characterization at regional and nearshore scales for the U.S. Alaska coast based on a 32-year high-resolution hindcast – García-Medina et al. 2021

> A wave resource characterization was performed for the southern coast of Alaska based on a 32-year hindcast covering the period from 1979 to 2010. The characterization closely followed International Electrotechnical Commission (IEC) Technical Specifications. An unstructured-grid Simulating WAves Nearshore (SWAN) model, which had an approximate spatial resolution of 300 m within 30 km from the nearest shoreline, was developed. Extensive model validation and error characterization was performed. The model was found to perform well with an average absolute percent error of 8.6% in significant wave height, averaged over 18 buoys.

Surface Characterisation of Kolk-Boils within Tidal Stream Environments Using UAV Imagery – Slingsby et al. 2021

> High-flow tidal stream environments, targeted for tidal turbine installations, exhibit turbulent features, at fine spatio-temporal scales (metres and seconds), created by site-specific topography and bathymetry. Bed-derived turbulent features (kolk-boils) are thought to have detrimental effects on tidal turbines. Characterisation of kolk-boils is therefore essential to inform turbine reliability, control, and maintenance strategies. Unmanned aerial vehicle (UAV), or drone, imagery offers a novel approach to take precise measurements of kolk-boil characteristics (distribution, presence, and area) at the surface. This study carried out sixty-three UAV surveys within the Inner Sound of the Pentland Firth, Scotland, UK, over four-day periods in 2016 and 2018.

Salinity gradient power by reverse electrodialysis: A multidisciplinary assessment in the Colombian context – Roldan-Carvajal et al. 2021

> This paper evaluates the implementation of salinity gradient power (SGP) based on reverse electrodialysis (RED) in the Caribbean region of Colombia, specifically at the Magdalena River mouth (MRM). Our multidisciplinary approach comprises technical, technological, and technology diffusion assessments (market analysis). We estimate the theoretical energy potential in the MRM from spatial and temporal measurements of the physical and biochemical properties of the waters. Thereafter, we compare the power output of a tailored RED prototype using synthetic solutions and untreated natural waters from MRM. Finally, we propose a dynamic model for RED diffusion in Colombia.

Unveiling the potential of using a spar-buoy oscillating-water-column wave energy converter for low-power stand-alone applications – Oikonomou et al. 2021

> Applications including the offshore aquaculture, remotely operated vehicles, data acquisition systems, and desalination can be either supplemented or completely powered by renewable energy. The spar-buoy oscillating-water-column wave energy converter concept, typically studied for large scale wave energy production, can be re-designed to meet the power requirements of such applications, which results in a much smaller device working outside resonance conditions under typical sea states, and therefore with a smaller energy conversion efficiency. Experimental results are presented for a 1:10th scale model of a spar-buoy oscillating-water-column, undertaken in a wave channel.

A radial-grouping-based planning method for electrical collector systems in tidal current generation farms – Ren et al. 2021

> This paper proposes a radial-grouping-based planning method for the electrical collector systems (ECSs) to design the topology and select the cross-sections of ECS submarine cables in tidal current generation farms (TCGFs) while minimizing investment and operation costs. First, an angle-based radial-grouping method is proposed to group the tidal current turbines (TCTs) in a TCGF, considering their capacity limitations while avoiding the trans-region crossing of submarine cables. Second, an optimal planning

model is presented to determine the connection scheme for the TCTs within the same group in a TCGF. Third, an efficient solution method is developed by modifying a genetic algorithm with the Prufer number.

Linear vs non-linear analysis on self-induced vibration of OTEC cold water pipe due to internal flow – Adiputra & Utsunomiya 2021

This paper presents analytical and numerical analyses on self-induced vibration of Ocean Thermal Energy Conversion (OTEC) Cold Water Pipe (CWP) for a 100 MW-net OTEC power plant. The CWP is described as a vertically-hanged, top-tensioned riser subjected to internal flow effect (IFE) and ambient fluid effects (added mass and drag force). In the analytical analysis, two definitions of the drag force equation in the frequency-domain term and time-domain term are considered yielding a linear differential equation and a non-linear differential equation. The stability is assessed by discretizing the equations using Frobenius method and Galerkin Method and then plotting its eigenfrequencies or its eigenvalues in an Argand diagram.

News & Press Releases

2021 Marine Energy Collegiate Competitors Help Chart the Blue Economy Course – U.S. DOE Office of Energy Efficiency and Renewable Energy (EERE)

EERE recently announced the winners of the 2021 Marine Energy Collegiate Competition (MECC), and Kelly Speakes-Backman, the Acting Assistant Secretary for Energy Efficiency and Renewable Energy, recognized them during the closing plenary for the 2021 International Conference on Ocean Energy. Managed by the National Renewable Energy Laboratory on behalf of EERE's Water Power Technologies Office, the competition inspired multidisciplinary teams of undergraduate and graduate students to unlock the power of the ocean, rivers, and tides to create a business plan and develop, design, and test the technologies that build resilient coastal communities and provide power at sea.

Ground-Breaking €3.7M Marine Energy Mooring, Anchoring and Quick-Connect System Project Set for Atlantic Trials – UMACK Project

A new, ground-breaking mooring, anchoring and quick connect solution optimized for marine energy systems is set for Atlantic sea trials, following a range of laboratory and on-land test campaigns currently underway. The €3.7m UMACK (Universal Mooring, Anchor & Connectivity Kit) Project has developed a unique mooring and anchoring solution aimed at superseding widely used 'gravity-based' anchor solutions – reducing CAPEX, installation and O&M (Operational & Maintenance) costs by more than 50%. The UMACK solution also addresses fundamental challenges to improve the reliable operation of ocean energy devices in the harshest ocean conditions.

IMAGINE consortium makes progress on wave electro-mechanical PTO – Offshore Energy

> The IMAGINE (Innovative Method for Affordable Generation IN ocean Energy) project consortium has made headway on the manufacturing and assembly of the Electro-Mechanical Generator (EMG) power take-off (PTO) concept and the test rig, along with other project assessments and deliverables. Backed by Horizon 2020 funding, and project leader UmbraGroup's expertise in advanced aerospace engineering, the IMAGINE project seeks to develop and demonstrate the EMG PTO concept for various wave energy device types. Based on realistic requirements for wave energy devices, the project will design and fabricate a 250kW prototype for performance and lifetime bench testing.

Works on Sea Wall Nears Completion for the Landmark EWP-EDF One Wave Energy project – Eco Wave Power

> Pursuant to the engineering coordination permit from the Municipality of Tel-Aviv Jaffa Eco Wave Power is pleased to announce that it nears completion of the wall reinforcement works, meant to enable the installation of floaters on the sea wall of the Port of Jaffa, Israel. The EWP-EDF One wave energy project will include 10 floaters, connected to one conversion unit. Due to the onshore nature of the Eco Wave Power technology, the works on the sea wall and floaters installation will be straightforward and will not involve any works performed from the seaside. The EWP-EDF One conversion unit will be located on land, just like a regular power station, enabling an easy access for operation and maintenance.

Underwater Manta Kites for Tidal Power Harvesting – IEEE Spectrum

> Last year, ARPA-E (the Advanced Research Projects Agency–Energy), launched a $38 million program called SHARKS (Submarine Hydrokinetic And Riverine Kilo-megawatt Systems) with the goal of fostering the design of "economically attractive Hydrokinetic Turbines for tidal and riverine currents." Despite the word "turbine" right there, ARPA-E is funding any new technology that can squeeze power out of flowing water, including a novel underwater manta-inspired kite generator under development by SRI. SRI's Manta system relies on a relatively simple, manta-shaped kite made out of simple materials like foam and fiberglass.