TETHYS ENGINEERING BLAST

17 July 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.

Announcements
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Announcements

MHKiT (Marine and Hydrokinetic Toolkit) v0.2.0 Released

MHKiT is open-source MRE software, developed in Python and MATLAB, that includes modules for ingesting, quality controlling, processing, visualizing, and managing data. MHKiT v0.2.0 has been released, including new power and loads modules. MHKiT v0.2.0 is publicly available on GitHub, or via a pip install. For more information about MHKiT, refer to the online documentation. MHKiT is developed as a collaboration between the National Renewable Energy Laboratory, Pacific Northwest National Laboratory, and Sandia National Laboratories.

WEC-Sim (Wave Energy Converter SIMulator) v4.1 Released

WEC-Sim is an open-source code for simulating wave energy converters, developed in MATLAB/SIMULINK, with the ability to model devices that are comprised of rigid bodies, joints, power take-off systems, and mooring systems. WEC-Sim v4.1 has been released, including new features like passive yaw and updated WEC-Sim applications. WEC-Sim is publicly available on GitHub, and more information about WEC-Sim is able on the software's online documentation. WEC-Sim is a collaboration between the National Renewable Energy Laboratory and Sandia National Laboratories, funded by the U.S. Department of Energy's Water Power Technologies Office.

Request for Information

The U.S. TEAMER (Testing Expertise and Access for Marine Energy Research) Network Director is seeking input regarding open water testing needs to determine what type of assistance may be supported by the TEAMER program. If open water testing is something that your company may be interested in pursuing, we ask that you please send us a short description containing the following:

- the type of testing that may be requested,
- the location of preferred open water test site (if known),
- ancillary equipment that you would need the test site to provide to conduct open water testing (if known), and
- anticipated duration and timeline of testing.

Please send all responses to the TEAMER@pacificoceanenergy.org by 17 July 2020 with the subject line, "TEAMER Open Water RFI – (company name)".

Call for Abstracts

The American Geophysical Union (AGU) is now accepting abstracts for the AGU Fall Meeting 2020, which will be held virtually from 7-11 December 2020. Please consider submitting an abstract to Session GC065 (Renewable Energy: Marine and Hydrokinetic), which will focus on the science, technology, and policy issues of MRE, including wave, current, tidal, riverine, and ocean thermal energy conversion. Studies focusing on device performance evaluation, resource assessment and forecasting, grid integration, and system planning are all of interest and international and early career researchers are particularly encouraged to submit. Abstracts submissions are due 29 July 2020.

Funding/Testing Opportunities

The TEAMER program, sponsored by the DOE and directed by the Pacific Ocean Energy Trust, is accepting applications for its 1st Request for Technical Support application period. Applications are due by 5:00pm ET (9:00pm UTC) on 31 July 2020.

TEAMER is also accepting applications to add new facilities (both physical test infrastructure as well as expertise capabilities such as modelling and analysis services) to the TEAMER Test Facility Network. Facilities looking to apply are asked to submit the facility questionnaire by 17 July 2020 in order to be considered available for the 2nd Request for Technical Support testing and assistance period. See the New TEAMER Facility Process page for more information on how to apply as a facility.

Employment Opportunities

The European Marine Energy Centre (EMEC) is seeking a Marine Energy Development Manager to identify, develop, and secure opportunities for EMEC to grow its portfolio of wave, tidal, and floating wind projects. Applications are due at 1:00pm BST (12:00pm UTC) on 22 July 2020.

CorPower Ocean is seeking a Senior Composite Manufacturing Engineer to take the main responsibility for all composite related tasks in the construction and testing of their full-scale wave energy converter. The role is based in their Portuguese entity in Viana do Castelo.

CorPower Ocean is also seeking an Intern who will be responsible for Factory Acceptance Testing (FAT) of the mechanical systems and modules (structure, gearbox, etc.) of their full-scale dry test rig. The internship is part of the HiWave-5 wave demonstration project, funded by the Swedish Energy Agency.

Upcoming Events

Upcoming Workshop

As part of the OPIN (Ocean Power Innovation Network) project, WEAMEC (WEst Atlantic Marine Energy Community) will be hosting a free, online masterclass on 16-17 September 2020. The training will provide developers, operators, and technology providers with background knowledge in mooring systems for offshore renewable floating farms (wind, wave, tidal). Register here.

Upcoming Conferences

The 2020 Institute of Electrical and Electronics Engineers' Power & Energy Society General Meeting will be held as a virtual event on 3-6 August 2020. Register here.

The American Society of Mechanical Engineers' 39th International Conference on Ocean, Offshore & Arctic Engineering will be held as a virtual event on 3-7 August 2020. Register here.

New Documents on *Tethys Engineering*

Lessons learnt from the design, installation and initial operations phases of the 6MW 4-turbine tidal array in Scotland's Pentland Firth – Black & Veatch 2020

> MeyGen Phase 1A is a 6MW demonstration tidal stream energy array comprised of four 1.5MW tidal turbines in the Inner Sound of Scotland's Pentland Firth. The project formerly entered its 25-year operations phase in April 2018. As the first multi-MW tidal array, MeyGen Phase 1A is a trail blazer for the industry. The lessons learnt throughout the design, construction and initial operations phases of the project, relevant to other tidal energy installations, are presented here. Since the project has only been operational for 24 months, the lessons included here are drawn from the initial project phases; long-term conclusions on project performance and impact are not yet available.

Thermodynamics of the OWC chamber: Experimental turbine performance under stationary flow – Moñino et al. 2020

Among the different devices designed to extract energy from waves, the Oscillating Water Column (OWC) operating an air turbine has been one of the most studied in recent years. The aim of this paper is to study the polytropic exponent associated to the thermodynamic process that takes place through the turbine in a non-idealised environment. A real gas model is applied, considering the influence of the moisture in the air chamber. Experimental data from a simplified OWC chamber set up under stationary flow are interpreted within the frame of an analytical real gas model.

Compact Low-Velocity Ocean Current Energy Harvester Using Magnetic Couplings for Long-Term Scientific Seafloor Observation – Huang and Lyu 2020

A compact low-velocity ocean current energy harvester (LOCH) is developed to power undersea instrument platforms for long-term scientific seafloor observation. Noncontact magnetic couplings are used in the LOCH to eliminate friction and achieve reliable underwater sealing so that the LOCH can adapt the low-velocity ocean current and its energy transmission efficiency can be improved. The parameters of the magnetic couplings are optimized by the three-dimensional finite-element method (3D FEM). A laboratory experiment platform is designed; and the static and dynamic performances of the magnetic couplings with different parameters are tested.

International Electrotechnical Commission (IEC) Technical Specification (TS) 62600-3:2020 - Part 3: Measurement of mechanical loads – IEC 2020

IEC TS 62600-3:2020 describes the measurement of mechanical loads on hydrodynamic marine energy converters such as wave, tidal and other water current converters (including river current converters) for the purpose of load simulation model validation and certification. This document contains the requirements and recommendations for the measurement of mechanical loads for such activities as site selection, measurand selection, data acquisition, calibration, data verification, measurement load cases, capture matrix, post-processing, uncertainty determination and reporting.

An experimental assessment of analytical blockage corrections for turbines – Ross and Polagye 2020

In laboratory experiments involving wind or water turbines, it is often desirable to correct measured performance for the effects of model blockage. However, there has been limited experimental validation of the analytical blockage corrections presented in the literature. Therefore, the objective of this study is to evaluate corrections against experimental data and recommend one or more for future use. For this investigation, we tested a cross-flow turbine and an axial-flow turbine under conditions of varying blockage with other non-dimensional parameters, such as the free-stream Reynolds and Froude numbers, held approximately constant.

Charge-Free Mixing Entropy Battery Enabled by Low-Cost Electrode Materials – Ye et al. 2019

The mixing entropy battery (MEB) uses battery electrodes to convert salinity gradient energy into electricity in a four-step process: (1) freshwater exchange; (2) charging in freshwater; (3) seawater exchange; and (4) discharging in seawater. Previously, we demonstrated a proof of concept, but with electrode materials that required an energy investment during the charging step. Here, we introduce a charge-free MEB with low-cost electrodes: Prussian Blue and polypyrrole. Importantly, this MEB requires no energy investment, and the electrode materials are stable with repeated cycling.

News & Press Releases

Companies secure £1.4 million to develop quick connection systems for wave energy – Wave Energy Scotland

Four projects, led by Apollo, Blackfish Engineering Design, Nova Innovation and Quoceant, will share just under £1.4 million for projects that aim to bring down the cost of wave power. The teams have secured funding from Wave Energy Scotland (WES) to develop quick connection systems to improve the installation efficiency and infrastructure of wave power devices. The teams aim to develop their designs during the second stage of the programme, working with partners to test and model the technology prior to scale testing in the future.

EMEC Supports KIOST Tidal Test Site in Korea – EMEC

The Korea Institute of Ocean Science and Technology (KIOST) has contracted the European Marine Energy Centre (EMEC) to support the development of its tidal energy test site at Jang-Juk Strait near Jindo Island, Korea. The signed agreement strengthens the relationship between the two organizations and sees EMEC use its experience and knowledge as a tidal test site operator to advance the Korean test site development. KIOST are developing a grid-connected tidal energy test site development on the Jang-Juk Strait in the southwestern sea of Korea. The Korea Tidal Current Energy Centre site, which will have a 4.5 MW grid capacity, is expected to be operational by 2022.

Tank Testing Commenced to Validate Carnegie's Wave Predictor – Carnegie Clean Energy

Carnegie has commenced its planned wave tank testing campaign at the Cantabria Coastal and Ocean Basin in Spain in order to generate detailed physical wave data that will be used to validate Carnegie's machine learning based Wave Predictor. Carnegie previously announced the development of a machine learning based Wave Predictor capable of predicting the characteristics of waves that will reach the CETO Unit up to 30 seconds in the future. This is the first product in Carnegie's suite of control products using artificial intelligence which seek to increase the energy captured from the waves and thereby increase the annual electric power yield of a CETO Unit.

WPTO Announces $4.4M For Phase 2 Small Business Innovation Projects – Water Online

Today, U.S. Energy Secretary Dan Brouillette announced a $54.5m investment in Small Business Innovation Research and Small Business Technology Transfer research and development projects. The investment includes four projects from the Office of Energy Efficiency and Renewable Energy's Water Power Technologies Office (WPTO) that span four states and total nearly $4.4M in funding. Pliant Energy Systems, LLC, Ocean Renewable Power Company, Oscilla Power, Inc., and Resolute Marine Energy, Inc. are receiving Phase II Release 2 grants for innovations that demonstrate technical feasibility during the first phase of their research.

Wales on Route to a Clean Marine Energy Future – Bombora Wave Power

Early risers saw a sight to behold in Pembroke Dock as Bombora's bright yellow mWave wave energy converter 'cell module' structure travelled from the fabrication workshop of Altrad Services to the assembly workshop at Mainstay Marine Solutions. The first of its kind, full-scale 'cell module' is part of an innovative new marine energy solution being built and tested in Wales. The cell module is the first of four 15-meter-long, structures that form Bombora's 75-meter-long, subsea mWave. The cell module is a key component part of Bombora's 1.5 MW mWave Pembrokeshire Demonstration Project, which will be installed off the coast of Pembrokeshire in the first half of 2021.