TETHYS ENGINEERING BLAST

28 August 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

Tethys Engineering Peer Review Survey

As part of the international community working to advance the marine renewable energy industry, we would like to hear from you! We ask that you please fill out a brief survey (~3 min) by 31 August 2020 to help us evaluate and guide further development of *Tethys Engineering*.

Funding/Testing Opportunities

The MaRINET2 project, which offers free access to a world-leading network of testing and research infrastructures for offshore renewables across Europe, will open its fifth and final call for free testing access from 1 September 2020 until 16 October 2020.

Interreg North-West Europe's Ocean DEMO (Demonstration Programme for Ocean Energy Pilot Farms and Supporting Technologies) project opened its 3rd Call for Applications. 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 centers. Applications close 18 September 2020 at 7:00pm CEST (5:00pm UTC). An informational webinar is now available.

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 (3:59pm UTC).

Employment Opportunities

The University of Southampton is seeking applicants for a PhD Studentship in responsive mooring systems for floating renewable energy facilities. Applications are due 31 August 2020.

The European Marine Energy Centre (EMEC) is seeking an Engineering Technician, Technical Project Manager, and Stakeholder Engagement Officer. Application due dates vary.

CorPower Ocean is seeking a Senior Composite Manufacturing Engineer to lead all composite related tasks in the construction and testing of their full-scale wave energy converter.

Upcoming Events

Upcoming Webinar

WaveEC Offshore Renewables will be hosting a webinar entitled, "High-Performance Computational Modelling and Data Science Capabilities for a Renewable Blue Ocean", on 18 September 2020 at 2:30pm WEST (1:30pm UTC). Register here.

Upcoming Workshop

The Dutch Marine Energy Centre (DMEC) and European Space Agency (ESA) will be hosting a virtual workshop, "Marine Energy meets Space", on 8 September 2020 at 11:00am CEST (9:00am UTC). The workshop is the first opportunity for marine energy and space companies to explore cross-sectoral cooperation opportunities within an upcoming tender. DMEC and ESA will also be hosting a webinar on 15 September 2020 at 11:00am CEST (9:00am UTC) to inform participants on how to apply to the tender. Both events are online and free to register here.

Upcoming Conference

The Economist Events' World Ocean Tech and Innovation Summit, hosted by Canada's Ocean Supercluster in collaboration with the Province of Nova Scotia and the Halifax Partnership, will take place in Halifax, Canada from 14-15 October 2020. Register your interest here.

New Documents on *Tethys Engineering*

Performance characteristics of shrouded horizontal axis hydrokinetic turbines in yawed conditions – Shahsavarifard and Bibeau 2020

> During operations, river and tidal hydrokinetic turbines encounter changes in flow direction that decrease their performance. Evaluating hydrokinetic turbines in yaw

conditions contributes to estimating turbine performance, power stability, and power delivered to the grid. Water tunnel tests using a 19.8 cm diameter horizontal axis model turbine in yaw operation show the performance reduction using three designs: no shroud, a convergent-divergent shroud, and a diffuser shroud. Experimental results obtained at three Reynolds numbers of 1.38×10^5, 1.77×10^5, and 2.17×10^5 show that the output power decreases in off-axis flows for all designs investigated. The reduction is initially negligible up to a 10° yaw angle, but then increases with increasing the yaw angle.

Detecting parametric resonance in a floating oscillating water column device for wave energy conversion: Numerical simulations and validation with physical model tests – Giorgi et al. 2020

The wave energy sector has faced enormous technological improvements over the last five decades, however, due to the complexity of the hydrodynamic processes, current numerical models still have limitations in predicting relevant phenomena. In particular, floating spar-type wave energy converters are prone to large undesirable roll and pitch amplitudes caused by a dynamic instability induced by parametric resonance. This paper presents the validation of results from a numerical model, capable of detecting parametric resonance, using experimental data. Experiments were carried out for a scaled model of the Spar-buoy OWC (Oscillating Water Column) device at a large ocean basin.

A New Seafloor Hydrothermal Power Generation Device Based on Waterproof Thermoelectric Modules – Xie et al. 2020

Submarine hydrothermal fluids contain substantial energy, and temperature differences with the surrounding cold seawater can provide energy for seabed observations and submarine operations. This study proposes a novel hydrothermal power generation device comprising a thermoelectric converter and an energy management system. Herein, a waterproof module with high-temperature and high-pressure resistance was designed. Heating and pressurization tests were performed to verify the structure's feasibility. The overall structure of the system based on the module was then designed, and laboratory performance tests were conducted.

Design and comparative survey of high torque coaxial permanent magnet coupling for tidal current generator – Park et al. 2020

This paper presents design and comparative study of high torque coaxial permanent magnet couplings (CPMC) for the use in a tidal current generation (TCG) system. Two different models such as a radial flux-CPMC (RF-CPMC) with magnet retaining rings and a flux concentrating-CPMC (FC-CPMC) with inner and outer rotor yoke changed by retaining rings are analyzed to find the best model under certain design constraint conditions to achieve a minimum pull-out torque of 1.0 kNm. Moreover, the effect of the electromechanical characteristics such as the radial force, stress and deformation are analyzed for both models.

Experimental Investigation of the Mooring System of a Wave Energy Converter in Operating and Extreme Wave Conditions – Sirigu et al. 2020

> A proper design of the mooring systems for Wave Energy Converters (WECs) requires an accurate investigation of both operating and extreme wave conditions. A careful analysis of these systems is required to design a mooring configuration that ensures station keeping, reliability, maintainability, and low costs, without affecting the WEC dynamics. In this context, an experimental campaign on a 1:20 scaled prototype of the ISWEC (Inertial Sea Wave Energy Converter), focusing on the influence of the mooring layout on loads in extreme wave conditions, is presented and discussed. Two mooring configurations composed of multiple slack catenaries with sub-surface buoys, with or without clump-weights, have been designed and investigated experimentally.

Hydrodynamic slip enhanced nanofluidic reverse electrodialysis for salinity gradient energy harvesting – Long et al. 2020

> Nanofluidic reverse electrodialysis offers an alternative way to harvest the widely-existing salinity gradient energy. In this study, we investigate the impacts of surface hydrodynamic slip modification on the ionic current rectification and salinity gradient energy conversion via a conical nanopore by thermodynamic analysis and numerical simulation. Results reveal that in the configuration where hydrodynamic slip modification is employed on the surface near the tip side, a small modification fraction contributes to the ionic current rectification due to significantly enhanced ion enrichment, while a larger hydrodynamic slip modification fraction goes against the ionic current rectification for deteriorated ion enhancement and induced counter-electric field concentration gradient near the base side.

News & Press Releases

EMEC Achieves World's First Ocean Energy RETL Designation – European Marine Energy Centre (EMEC)

> EMEC has been designated with Renewable Energy Testing Laboratory (RETL) status, the highest international designation for marine energy test laboratories. EMEC is the first RETL for ocean energy in the world. RETL designation is awarded by the International Electrotechnical Commission (IEC) – Renewable Energy System which operates a global certification system addressing three renewable energy sectors: solar photovoltaic, wind energy, and marine energy. RETL designation enables EMEC to perform tests to assess the power performance of tidal energy converters anywhere in the world in compliance with IEC Technical Committee 114 Technical Specifications.

Marine Power Systems on Track to Build a Full Scale Demonstrator Device in Wales – Marine Energy Wales

Following a successful crowdfunding campaign and obtaining funding from Welsh European Funding Office (WEFO), Marine Power Systems (MPS) is set to build their first commercial demonstrator device in Wales. Swansea-based MPS reached a £1.5m crowdfunding target in just two weeks after launching and then moved into overfunding, now at over £2m. They have also successfully obtained support from WEFO with £12.8m of European Union funding which has been supporting them with this phase since being awarded last year. MPS has developed a revolutionary, flexible technology that can be configured to harness wind power, wave power or combined wind and wave energy at grid scale.

PB3 PowerBuoy® Achieves New Operational Milestone – Ocean Power Technologies (OPT)

The PB3 PowerBuoy® operating in the Adriatic Sea has surpassed 600 days of continuous operation for Eni's Phase 1 resident autonomous underwater vehicle (AUV) project. Initially leased by Eni, one of the world's largest energy companies, in 2018 for an 18-month mission to convert wave energy into electricity for powering underwater vehicles, the PB3 PowerBuoy® lease was extended in March 2020 for an additional 18 months. To date, this PB3 PowerBuoy® has produced more than 2.7 MWh since it was deployed. The power takeoff – OPT's patented wave energy conversion system that converts ocean wave motion into rotary motion to drive a generator – has made more than 3.5 million cycles.

Cultivating Tomorrow's Water Power Professionals: DOE and NREL Launch STEM Hydropower and Marine Renewable Energy Portals – NREL

As part of the effort to recruit the best and brightest to the water power workforce, the U.S. Department of Energy's (DOE's) Water Power Technologies Office (WPTO) and the National Renewable Energy Laboratory (NREL) launched the Science, Technology, Engineering, and Math (STEM) education portals for water power technologies. The portals will help educators and students better understand water power technologies and their potential, as well as introduce them to exciting career opportunities within these sectors. The portals now offer a variety of features, such as: workforce data and analysis, day-in-the-life profiles, prizes and competitions, and water power site tours.

Ocean Energy Europe (OEE) calls for European target of 100MW by 2025 – OEE

The new EU Strategy on Offshore Renewable Energy must include a target of 100MW of ocean energy installed in Europe by 2025. This would be enough to power 100,000 European homes a year and would pave the way for installing 3GW by 2030 and 100GW by 2050. This target would provide the political impetus and incentives needed to maintain Europe's position as the global leader in ocean energy and create a new industry for Europe. Four priority actions are needed to achieve this, according to Ocean Energy Europe. First on the list is the formation of a pan-European alliance of EU decision-makers, national governments and industry representatives.