TETHYS ENGINEERING BLAST

2 December 2022

Tethys Engineering is an online knowledge hub 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. Email tethys@pnnl.gov to contribute!

Announcements

Contribute to *Tethys Engineering*

If you have any new publications (e.g., journal articles, conference papers, workshop reports, theses), relevant announcements, funding or job opportunities, or upcoming events, please email tethys@pnnl.gov to contribute them to the Knowledge Base, Events Calendar, and/or *Tethys Engineering* Blast newsletter!

ORISE Applications

The U.S. Department of Energy (DOE) Water Power Technologies Office (WPTO) and Oak Ridge Institute for Science and Education (ORISE) recently opened applications for the next cohort of students for the Marine Energy Graduate Student Research Program. The program is accepting applications from master and doctoral students with a marine energy-focused research thesis and/or dissertation at a U.S. institution. Applications are due 2 December 2022.

SULI & CCI Applications

The U.S. DOE Office of Science is now accepting applications for the Science Undergraduate Laboratory Internships (SULI) program and the Community College Internships (CCI) program. Interns will work directly with national laboratory scientists and engineers that support the DOE mission. The application deadline is 10 January 2023.

Calls for Abstracts

The Call for Abstracts for OCEANS 2023 Limerick Conference & Exhibition is now open through 20 December 2022. The event will take place on 5-8 June 2023 in Limerick, Ireland.

American Clean Power is accepting submissions for panel and poster presentations opportunities at CLEANPOWER 2023 Conference & Exhibition through 30 December 2022. The event will take place on 22-25 May 2023 in New Orleans, U.S.

The Call for Abstracts for the 15th European Wave and Tidal Energy Conference Series (EWTEC 2023) is now open through 28 January 2023. Full papers will be due 27 May 2023. EWTEC will take place on 3-7 September 2023 in Bilbao, Spain.

Funding & Testing Opportunities

The U.S. DOE'S WPTO has released a $10.3 million funding opportunity, "Marine Energy Systems Innovation at Sea", to accelerate the development and testing of marine energy technologies with a focus on wave and ocean current. Concept papers are due 2 December 2022.

ProtoAtlantic is now accepting applications for the ProtoAtlantic Customized Scale Start-Ups Support Program at the Lir-National Ocean Test Facility in Ireland. The program will provide free facilities access to marine technology (wave, wind, tidal, floating solar, biotechnology, robotics) developers across the Atlantic Area. Applications are due 23 December 2022.

The U.S. DOE has opened applications for the Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) Program, which offers grants to small businesses to support technological innovation. Letters of intent are due 3 January and applications are due 21 February 2023.

The European Commission has launched two new Calls for Proposals under the European Maritime, Fisheries and Aquaculture Fund aimed at supporting careers and regional projects for a sustainable blue economy in European Union sea basins. Proposals are due 31 January 2023.

The European Commission has also launched the third call for large-scale projects under the European Union Innovation Fund. The call is open for projects located in European Union Member States, Iceland, and Norway until 16 March 2023.

Student & Employment Opportunities

University of Southampton is offering a PhD opportunity to develop efficient deep water anchoring systems for floating offshore renewables. Applications are due 9 December 2022.

European Marine Energy Centre is seeking a Senior Electrical Engineering to manage operations of its electrical systems. Applications are due 19 December 2022.

Floating Power Plant is looking for a Hydrodynamicist & Numerical Modeller, with expertise in Matlab, Simulink, and wave energy converters, to join its team.

Upcoming Events

Upcoming Webinars

The West Atlantic Marine Energy Community, Centrale Nantes, National Renewable Energy Laboratory, and Sandia National Laboratories are co-hosting a webinar at 5:00pm CET (4:00pm UTC) on 5 December 2022. The webinar will include a presentation and tutorial for the online Technology Performance Levels assessment tool for wave energy converters. Register here.

The European Technology & Innovation Platform for Ocean Energy and the Demonstration Programme for Ocean Energy Pilot Farms and Supporting Technologies are hosting a webinar at 2:00pm UTC on 14 December 2022. During the webinar, Mocean Energy, AWS, and CorPower Ocean will share lessons learnt from wave energy deployments. Register here.

Upcoming Conferences

The 30th Annual Coastal Futures Conference will take place on 25-26 January 2023 in London, UK and online. Register here.

Oceanology International Americas will take place on 14-16 February 2023 in San Diego, CA, U.S. Register here.

The U.S. Advanced Research Projects Agency-Energy (ARPA-E) is hosting the ARPA-E Energy Innovation Summit on 22-24 March 2023 in Washington, D.C., U.S. Register here.

New Documents on *Tethys Engineering*

Marine renewable energy for Arctic observations – Branch et al. 2022

> Arctic observations are becoming increasingly valuable as researchers investigate climate change and its associated concerns, such as decreasing sea ice and increasing ship traffic. Networks of sensors with frequent sampling capabilities are needed to run forecast models, improve navigation, and inform climate research. Sampling frequency and deployment duration are currently constrained by battery power limitations. In-situ power generation using marine renewable energy sources such as waves and currents can be used to circumvent this constraint. In this study, we describe the wave and current resources in the Arctic, outline the electricity generation developments that are needed to utilize the resources, and suggest use cases.

Development and deployment of a credible unstructured, six-DOF, implicit low-Mach overset simulation tool for wave energy applications – Domino & Horne 2022

> An unstructured, low-Mach, balanced-force, volume of fluid methodology is coupled to an implicit, six-DOF overset formulation for the simulation of wave-based renewable energy devices. We propose an overlapping unstructured mesh construct that affords a wave energy converter (WEC) geometry to move freely about a background domain. A control volume finite element (CVFEM) numerical discretization, which includes novel residual-based stabilization, is developed. Credibility of this simulation tool is established by code verification, which demonstrate design-order numerics on linear and quadratic conformal and overset meshes, and model validation.

Growth of ocean thermal energy conversion resources under greenhouse warming regulated by oceanic eddies – Du et al. 2022

> The concept of utilizing a large temperature difference (>20 °C) between the surface and deep seawater to generate electricity, known as the ocean thermal energy conversion (OTEC), provides a renewable solution to fueling our future. However, it remains poorly assessed how the OTEC resources will respond to future climate change. Here, we find that the global OTEC power potential is projected to increase by 46% around the end of this century under a high carbon emission scenario, compared to its present-day level. The augmented OTEC power potential due to the rising sea surface temperature is partially offset by the deep ocean warming.

Fluid–Structure Interaction Modeling of Structural Loads and Fatigue Life Analysis of Tidal Stream Turbine – Zhang et al. 2022

> Developing reliable tidal-energy turbines of a large size and capacity links to preservation of the structural safety and stability of the blades. In this study, a bidirectional fluid–structure coupling method was applied to analyze the hydrodynamic performance and structural characteristics of the blade of a tidal-stream turbine. Analyses were conducted on the transient and stable structural stresses, fatigue, and deformations under the influence of water depth and turbine rotational speed. The performance predictions with and without fluid–structure coupling are similar to measurements. The water-depth change has little effect on the stress and deformation change of the blade, while the turbine-speed change has the most significant effect on it.

Optimisation of Control Algorithm for Hydraulic Power Take-Off System in Wave Energy Converter – Andersen et al. 2022

> Wave energy converters are still a maturing technology and, as such, still face a series of challenges before they can compete with already-established technologies. One of these challenges is optimising the amount of energy extracted from the waves and delivered to the power grid. This study investigates the possibility of increasing the energy output of the existing hydraulic power take-off system of a wave energy converter made by Floating Power Plant during small-scale testing of their hybrid wind and wave energy

platform. This system consists of a floater arm that rotates an axle when displaced by the waves. When the axle rotates, two hydraulic cylinders are actuated, displacing oil to run through a hydraulic motor driving an electric generator.

Enhanced selective ion transport by assembling nanofibers to membrane pairs with channel-like nanopores for osmotic energy harvesting – Zhang et al. 2022

Nanofluid reverse electrodialysis (RED) is considered the most promising technology for harvesting osmotic energy. As materials used for RED, natural nanofluid materials are renewable but suffer from low power densities due to weak surface charge densities or irregular ion transport channels, while advanced materials from sophisticated manufacturing are too expensive. Here, a pair of novel natural nanofluid membranes with channel-like nanopores for highly improved selective ion transport were developed by assembling negatively and positively charged bacterial cellulose nanofibers via a space-confined flattened extrusion process.

News & Press Releases

EMEC Supplies Hydrogen to Rolls-Royce Jet Engine Ground Test – European Marine Energy Centre (EMEC)

Green hydrogen produced at EMEC's hydrogen production and tidal test facility has been used to fuel the ground test of a Rolls-Royce jet engine. The engine test was progressed through a partnership between Rolls-Royce and easyJet who, earlier this year, committed to working together on a hydrogen technology demonstrator programme. The companies confirmed they have set a new aviation milestone with the world's first run of a modern aero engine on hydrogen. The ground test took place at an outdoor test facility at Boscombe Down, UK, using a converted Rolls-Royce AE 2100-A regional jet engine. Green hydrogen for the test was supplied by EMEC, produced using renewable energy at their hydrogen production facility in Eday, Orkney, and then transported via ferry.

Consortium gets €3.5M boost to develop tropical storm-proof OTEC system – Offshore Energy

The European Union's key funding program for research and innovation, Horizon Europe, and UK Research and Innovation have awarded €3.5 million to a new consortium that aims to design an ocean thermal energy conversion (OTEC) system capable of surviving in tropical storm areas. The PLOTEC consortium was launched by seven partners across Austria, Italy, Portugal, Spain and the United Kingdom, specialising in OTEC, marine renewable energies, research and infrastructure, plastic composites engineering, renewable materials, policy, economics and environmental aspects and computational modelling tools.

Mocean Energy secures patent for its wave energy technology in China – Offshore Energy

Scottish company Mocean Energy has secured patent protection for its floating hinged raft wave energy technology in China. Mocean Energy is developing two wave energy technologies: Blue Star, a device that will power a range of subsea equipment, inspection and maintenance systems, and the Blue Horizon, a larger machine designed to generate grid-scale electricity. Both technologies are based on the same concept – a hinged raft with geometry, claimed to be unique and capable of improving performance by up to 300% compared to traditional hinged rafts, while also increasing survivability by being able to dive through large waves.

Brittany improves its Paimpol-Bréhat tidal test site – Tidal Stream Industry Energiser (TIGER)

Brittany has improved its Paimpol-Bréhat tidal test site to consolidate its international position. Thanks to the recent reconfiguration of the submarine link, the site now benefits from a three-phase alternating current connection, connectable out of the water. Connected to the French power grid, the test site, which is part of the European TIGER project, the largest INTERREG project ever launched, will be part of the new Open-C Foundation. It will be created by the end of the year, and its aim is to federate and animate the five French marine energy test sites, one of which is also Breton: Sainte-Anne-du-Portzic (floating wind and wave energy test site).

New Marine License for META – Marine Energy Test Area (META)

META, Wales' national marine test centre, is now able to accommodate more tidal turbines and larger mooring spreads, after successfully upgrading its Marine License. As the project moves into a new tranche of funding from Swansea Bay City Deal, part of the Pembroke Dock Marine Project, one of the key objectives is broadening testing capabilities for the open water sites to meet the needs of the evolving industry and wider blue economy. Working with a local team from leading environmental consultancy, Marine Space, to secure the license, META clients will now be able to test component parts at greater speeds and tidal device configurations with 3 turbine rotors – a design pathway many developers are following.