

TETHYS ENGINEERING BLAST



21 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.

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Announcements

Tethys Engineering Photo Library

Did you know the [Tethys Engineering Photo Library](#) hosts over 400 photos and illustrations of marine energy projects and devices? The images have been graciously provided by over 40 developers worldwide and are available for free, third-party use, though attribution should be given to the developer. Check them out now, or email tethys@pnnl.gov if you would like to contribute!

Funding & Testing Opportunities

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.

In collaboration with Innovate UK, the Department for Business, Energy and Industrial Strategy (BEIS) launched an opportunity for businesses in England, Wales, and Northern Ireland to bid for funding from the [Industrial Energy Transformation Fund](#) (IETF). Applications for the [Phase 1: Spring 2021](#) IETF close on 14 July 2021.

The Basque Energy Agency, Ente Vasco de la Energía (EVE), recently launched the [Call for Applications](#) for its €2.5 million aid program, which aims to promote the demonstration and validation of emerging marine renewable energy technologies within the Basque Country. The call will remain open until 29 October 2021, or until the budget is exhausted.

Student & Employment Opportunities

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.

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 4 June 2021.

The University of Manchester is recruiting for a [Post-Doctoral Research Associate](#) to undertake wave, multi-body, mooring interaction modelling and experimental investigation for WECs. Applications are due 21 June 2021.

Upcoming Events

Upcoming Workshops

The Ocean Power Innovation Network (OPIN) is hosting an online workshop, "[Opportunities for Ocean Energy to Power Aquaculture](#)", at 11:00am BST (10:00am UTC) on 27 May 2021. The workshop aims to identify the opportunities and challenges that may lie in targeting the aquaculture sector as a key market for ocean energy technologies. Register [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 Webinars

The OceanSET project and the European Technology and Innovation Platform for Ocean Energy (ETIP Ocean) is hosting a webinar, "[Ocean energy progress in Europe](#)", at 11:00am CEST (9:00am UTC) on 26 May 2021. During the webinar, speakers from OceanSET, the European Commission, and Ocean Energy Europe will provide an update of ocean energy activities across Europe and outline how the sector could evolve toward meeting deployment goals. Register [here](#).

The U.S. Department of Energy's (DOE's) National Renewable Energy Laboratory (NREL) and Water Power Technologies Office are hosting a webinar at 12:00am EDT (4:00pm UTC) on 27 May 2021 to introduce the recently upgraded [Marine Energy Atlas](#), a data and visualization platform that houses the highest resolution publicly available long-term wave hindcast data set that covers the East Coast, West Coast, Alaska, and Hawaii. 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. During the second event, at 9:00am UTC on 10 June 2021, Renewable Risk Advisers will run through a number of accidents and failures in recent projects and how to minimize risk. Register [here](#) and view the full event series [here](#).

The Tidal Stream Industry Energiser (TIGER) project is hosting two Tidal Stream Supply Chain “Meet the Buyer” webinars for project and technology developers in France and the UK to share the details of their forthcoming development and procurement plans. Register [here](#) for the [French sites webinar](#) at 9:30am BST (8:30am UTC) on 10 June 2021. Register [here](#) for the [UK sites webinar](#) at 9:30am BST (8:30am UTC) on 15 June 2021.

ORE Catapult is hosting a webinar, [“Subsea Cables: The Cutting Edge Of Innovation And Opportunity”](#), at 1:00pm BST (12:00pm UTC) on 10 June 2021. During the webinar, in-house experts and guest speakers will introduce cutting-edge areas of research underway, new technologies for failure prediction, and disruptive insurance solutions for the subsea market. Register [here](#).

ETIP Ocean & the European Energy Research Alliance (EERA) Ocean Energy Joint Programme are hosting a webinar, “Installation & Marine Operations”, at 2:00pm BST (1:00pm UTC) on 15 June 2021. During the webinar, speakers will present their experiences gained in wave and tidal energy deployments and share tips on getting your device in the water. Register [here](#).

Upcoming Conferences

Bangor University is hosting the [8th Partnership for Research in Marine Renewable Energy \(PRIMaRE\) Conference](#) online on 29-30 June 2021. Register for free [here](#).

Plymouth is hosting its third [Marine Tech Expo](#) virtually on 12-13 July 2021. Sign up for the newsletter [here](#) to receive instructions for how to join the event.

New Documents on *Tethys Engineering*

[Multi-Criteria Evaluation of Potential Australian Tidal Energy Sites](#) – Marsh et al. 2021

Most tidal energy site studies concentrate on resource size; few examine other factors that may be of equal or even greater importance in determining site feasibility for tidal turbine array deployments. These factors include aspects such as electrical grid proximity, water depth, the location of marine protected areas, pre-existing users, environmentally

significance regions and other restrictions. Using these factors, a more holistic approach to site selection was conducted for Australian waters using a Multi-Criteria Evaluation (MCE) process. This MCE method uses standardized factors combined with weighted linear combinations to calculate a site suitability index, where each factor is multiplied by a weight of relative importance.

Geometry assessment of a sloped type wave energy converter – Giannini et al. 2021

Oscillatory wave energy converters of the sloped type may allow absorbing power from ocean waves efficiently if a valid optimal design is used. In earlier studies, the optimized geometry for the CECO device was defined by implementing a simplified frequency-domain model. In this paper, that geometry is evaluated against the former one by taking into consideration a more realistic modelling approach and assessment scenario. The two geometries were benchmarked through a time-domain model, which allows taking into account realistic sea states and the use of end-stops to limit the amplitude of CECO motions. It was concluded that the optimized geometry allows extra energy production for most of the irregular sea states evaluated (45% more annual energy production).

Performance Evaluation Concept for Ocean Thermal Energy Conversion toward Standardization and Intelligent Design – Yasunaga et al. 2021

Ocean thermal energy conversion (OTEC) uses a very simple process to convert the thermal energy stored mainly in tropical oceans into electricity. This research theoretically recognizes the unique characteristics of the energy conversion system and summarizes the appropriate performance evaluation methods for OTEC based on finite-time thermodynamics and the equilibrium condition of the heat source. In addition, it presents the concept of normalization of thermal efficiency for OTEC and exergy efficiency based on the available thermal energy in the ocean defined as the transferable thermal energy from the ocean and the equilibrium condition as the dead state for exergy.

Spatial evolution and kinetic energy restoration in the wake zone behind a tidal turbine: An experimental study – Chen et al. 2021

In the case of tidal turbine arrays, the spatial evolution pattern of turbine wakes affects the power performance of other turbines and the hydrodynamic environment of adjacent turbines. However, the evolution mechanism is unclear, particularly in terms of wake energy restoration process. Therefore, we investigated the wake spatial evolution mechanism of a tidal current turbine experimentally. The experiment used a porous disc to simulate the turbine rotor based on the equivalence principle of force. An acoustic Doppler velocimeter and a strain gauge measured the time-varying velocities and flow loads, respectively. The momentum loss generated a wake zone in the downstream with enhanced turbulence originating from the boundary shear layer.

Cost-Benefit Analysis of a Hybrid Biophysical Approach to Wave Energy Extraction: Bio-Oscillator – Hildebrand et al. 2021

A cost-benefit analysis (CBA) is described for a novel wave energy converters (WEC) design based on a marine hybrid bio-structure—a combination of macroalgae, shellfish or other species on a built frame. The Bio-Oscillator design utilises a hard “skeleton” (e.g., carbon fibre, wood) on which biological organisms (e.g., shellfish, large macroalgae) are grown. As waves pass by, the load generated by the oscillating drag and inertia is transferred through mooring lines to power takeoff technology. This novel approach essentially reverses the typical marine engineering view that “bio-fouling is bad” and instead leverages off the added-drag of biological growth on structures.

Performance of Reverse Electrodialysis System for Salinity Gradient Energy Generation by Using a Commercial Ion Exchange Membrane Pair with Homogeneous Bulk Structure – Altiok et al. 2021

Salinity gradient energy is a prominent alternative and maintainable energy source, which has considerable potential. Reverse electrodialysis (RED) is one of the most widely studied methods to extract this energy. Despite the considerable progress in research, optimization of RED process is still ongoing. In this study, effects of the number of membrane pairs, ratio of salinity gradient and feed velocity on power generation via the reverse electrodialysis (RED) system were investigated by using Fujifilm cation exchange membrane (CEM Type 2) and FujiFilm anion exchange membrane (AEM Type 2) ion exchange membranes.

News & Press Releases

Expanded Data Sets and a Smooth-Sailing User Experience: Meet Marine Energy Atlas – National Renewable Energy Laboratory (NREL)

The promise of marine energy is seemingly boundless—and thanks to a recently upgraded tool powered by new high-resolution data sets, users can pinpoint promising sites. Developed by NREL's resource characterization team and funded by the U.S. DOE's Water Power Technologies Office, the Marine Energy Atlas (formerly MHK Atlas) will support everything from project siting to device design via access to uniquely high-resolution and spatially comprehensive data sets. The recently released Marine Energy Atlas features several new upgrades to modernize and streamline the user-friendly interface while supporting higher-resolution data.

Mocean Energy Blue X Arrives in Orkney Prior to Sea Trials at EMEC – European Marine Energy Centre (EMEC)

Mocean Energy's Blue X wave energy prototype has been unloaded at Hatston Pier, Kirkwall, Orkney in advance of sea trials which will take place at the EMEC this summer. The 20-metre long, 38-tonne wave machine has been fabricated wholly in

Scotland and was transported by road from Rosyth to Aberdeen and then by ship to Orkney. In the coming days Blue X will undergo trials in Kirkwall Harbour prior to being towed anticlockwise around Orkney to Copland's Dock, Stromness. The machine will then be deployed at EMEC's Scapa Flow test site for sea trials initially, and then later will move to the grid-connected wave test site at Billia Croo.

Perpetuus Tidal Energy Centre and Orbital Marine Power join forces to harness tidal power off the Isle of Wight – Orbital Marine Power

Perpetuus Tidal Energy Centre (PTEC) has signed a pivotal agreement with Orbital Marine Power, Ltd., developers of the world's most powerful tidal turbine, the Orbital O2, to bring the Isle of Wight a step closer to producing tidal energy. PTEC has gained offshore consents to place tidal turbines in the sea off the south coast of the Isle of Wight, and Orbital is the first company to sign up, with an initial target deployment of up to 15 MW by the end of 2025. Each of Orbital's 2 MW O2 turbines can generate sufficient clean, predictable electricity to power around 2,000 UK homes and offset approximately 2,200 tonnes of CO2 production per year.

MPS Set Sights on Pre-Commercial Multi-Megawatt Array at EMEC, Orkney – Marine Power Systems (MPS)

MPS have signed a berth option agreement with EMEC in Orkney, Scotland. The option agreement gives MPS first refusal to a berth at EMEC's grid-connected revenue generating Billia Croo wave test site for the deployment of two multi-megawatt WaveSub wave energy converters. The project represents MPS' first planned deployment of a commercial scale array and will support the ongoing development of the device and its functionality to ensure that the commercial arrays delivered at increasing scale represent the most robust, reliable and cost-effective devices on the market. The project will also deliver further research and development around manufacturing and deployment at commercial scale.

3D Modeling Helps Optimize the Power Output from Seabased's Generators – Seabased

The beauty of 3D modeling is that you can see what's happening on the inside of a complex system, as well as on the outside. 3D, hydrodynamic CFD modeling offers a good way to understand in precise detail how a linear generator responds to a buoy moving through different waves. Seabased engaged the University of Edinburgh to use their powerful 3D tool to model the direct drive linear generator's response to different kinds of waves. The results enable Seabased to better optimize its wave-to-grid system by maximizing the power generation achievable from multiple generators connected to one electrical system.