

TETHYS ENGINEERING BLAST



9 September 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!

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Announcements

UMERC Survey

The University Marine Energy Research Community (UMERC) is conducting its [Annual Survey](#) to understand how foundational research for marine energy in the United States can be supported and integrated into the needs for the marine energy sector.

Joint Industry Projects RFI

The University of Washington, Oregon State University, and University of Hawai'i are [requesting information](#) related to joint industry projects to advance marine energy technology, with an emphasis on technologies for U.S. Navy applications. Responses to this RFI will be used to determine interest and eligibility in responding to a subsequent request for proposals that will support industry partners. Responses are due 14 September 2022.

INORE BECS

The International Network on Offshore Renewable Energy (INORE) has announced a [Call for Blue Energy Collaborative Scholarships \(BECS\) Proposals](#), targeted at INOREans from Latin America, Africa, and Asia. If you have a research project that can provide collaborative work with other INOREans, the grant can be used for travel expenses and accommodation at the institution where the work will take place or be presented. Applications are due 31 October 2022.

Calls for Abstracts

Energy Technology Partnership (ETP), an alliance of 14 Scottish universities, has opened the [Call for Abstracts](#) for the ETP Annual Conference 2022 through 16 September 2022. The ETP Conference will take place on 1 November 2022 in Edinburgh, Scotland.

The [Call for Abstracts](#) for the [33rd International Ocean and Polar Engineering Conference \(ISOPE\)](#) is now open through 20 October 2022. Manuscripts will be due for review by 20 January 2023. ISOPE 2023 will take place 19-23 June 2023 in Ottawa, Canada.

The [Call for Abstracts](#) for the [42nd International Conference on Ocean, Offshore and Arctic Engineering \(OMAE 2023\)](#) is now open through 24 October 2022. OMAE will take place on 11-16 June 2023 in Melbourne, Australia.

Funding & Testing Opportunities

The U.S. Testing and Expertise for Marine Energy Research (TEAMER) program is now accepting [Request For Technical Support \(RFTS\) 8](#) applications through 14 October 2022. Developers can apply for support in numerical modeling and analysis, bench/lab or tank/flume testing, and open water activities. Visit the [TEAMER website](#) for RFTS updates.

The European Commission has launched the [LIFE Programme 2022 Calls for Project Proposals](#) for nature conservation, environmental protection, climate action, and clean energy transition projects. Application deadlines vary, but most are due between September and November 2022.

WEAMEC (West Atlantic Marine Energy Community) has opened a [Call for Projects](#) to support eligible French researchers with writing and structuring marine energy projects that will be carried out by academic members of the community. Applications are due 30 November 2022.

Student & Employment Opportunities

Pacific Northwest National Laboratory is seeking a [Postdoctoral Researcher](#) to conduct coastal modeling, including for numerical predictions of waves, tidal streams, ocean currents, and salinity gradients for marine energy assessments. Applications are due 14 September 2022.

Environmental Research Institute is recruiting for a [Research Fellow in Electronic Engineering](#) to lead development, upgrade, and deployment of autonomous marine multi-sensor platforms to investigate the environmental effects of large-scale offshore renewable energy. Applications are due 19 September 2022.

Ghent University is looking for a [Post-doctoral Assistant](#) to conduct numerical modelling of wave-structure interactions with applications in the field of coastal engineering and offshore renewable energy. Applications are due 11 October 2022.

Boston Government Services is seeking a [Marine Energy Data Scientist/Analyst](#) who will help directly support the U.S. Department of Energy's (DOE) Office of Energy Efficiency and Renewable Energy Water Power Technologies Office (WPTO) in project management activities.

Upcoming Events

Upcoming Webinars

The Portal and Repository for Information on Marine Renewable Energy ([PRIMRE](#)) is hosting a webinar to highlight the release of the new [Marine Energy Projects Database](#), which provides a catalog of devices, projects, and test sites around the world, on 20 September 2022 from 8:00-9:00am PDT (3:00-4:00pm UTC). Register [here](#).

PRIMRE is also hosting a webinar, “Wave Hindcast Webinar: High-resolution regional hindcast datasets for wave energy resource characterization in US coastal waters”, on 27 September 2022 from 8:00-9:00am PDT (3:00-4:00pm UTC). During this webinar, the Marine Energy Resource Characterization Team will discuss the overall effort and highlight some technical details and challenges. Register [here](#).

The U.S. DOE WPTO is hosting a webinar, “WPTO R&D Deep Dive: Lessons Learned from Instrumenting and Deploying Composite Tidal Turbine Blades”, on 27 September from 3:00-4:00pm EDT (7:00-8:00pm UTC). During the webinar, a team from NREL will share best practices, including what equipment, techniques, and tools worked for the project. Register [here](#).

Upcoming Conferences

The Basque Energy Cluster and Ocean Energy Europe are jointly hosting the [International Conference on Ocean Energy & Ocean Energy Europe \(ICOE-OEE 2022\)](#) on 18-20 October 2022. Register [here](#).

Marine Renewables Canada is hosting the [Marine Renewables Canada 2022 Conference](#) on 22-24 November 2022 in Halifax, Nova Scotia. The event will focus on how offshore wind, tidal, wave, and river energy can help power a sustainable and inclusive future in Canada and globally.

New Documents on *Tethys Engineering*

[Comparison of dense optical flow and PIV techniques for mapping surface current flow in tidal stream energy sites](#) – McIlvenny et al. 2022

Marine renewable energy site and resource characterisation, in particular tidal stream energy, require detailed flow measurements which often rely on high-cost in situ instrumentation which is limited in spatial extent. We hypothesise uncrewed aerial vehicles (UAV) offer a low-cost and low-risk data collection method for tidal stream environments, as recently techniques have been developed to derive flow from optical

videography. Here, two algorithms are tested: large-scale particle image velocimetry (PIV) using PIVlab and dense optical flow. The methods are applied on video data collected at two tidal stream energy sites (Pentland Firth, Scotland, and Ramsey Sound, Wales) for a range of flow and environmental conditions.

Wave energy assessment based on reanalysis data calibrated by buoy observations in the southern South China Sea – Li et al. 2022

This study assesses wave energy by combining long-term model reanalysis data with in situ observations in a multi-island region. A buoy was deployed in the center area of the southern South China Sea (SCS) for 16 consecutive months. Neural network models are introduced to calibrate the significant wave height and the mean wave period of the European Center for Medium-Range Weather Forecasts (ECMWF) ERA5 reanalysis data. Based on the calibrated reanalysis data, wave energy potential in the region is assessed. The results show relatively available wave resources from October to February in climatology, with an average energy density higher than 5 kW m^{-1} and an available level frequency higher than 50%. Wave energy potential is relatively poor in other months.

Multi-objective optimization of an open-cycle, ocean thermal energy conversion system with desalinization – Hernández-Romero et al. 2022

Developing technologies that can supply water and energy in a sustainable manner is essential in addressing resource scarcity of small communities. The main motivation of this article is to find, through the analysis of different study cases, the optimal design of an Open-Cycle, Ocean Thermal Energy Conversion (OC-OTEC) system. Specifically, we propose optimization formulations to determine the operation policy and sizing of the system while considering four conflicting objectives: minimizing the total annual cost, minimizing CO emissions, and maximizing the generation potential of the products derived from the operation of the OC-OTEC (water and energy). The formulation captures seasonal effects and restrictions on water and energy demands determined by the end-user as well as diverse technical, operational, and design restrictions.

Power density capacity of tidal stream turbine arrays with horizontal and vertical axis turbines – Ouro et al. 2022

Tidal and wind energy projects almost exclusively adopt horizontal axis turbines (HATs) due to their maturity. In contrast, vertical axis turbines (VATs) have received limited consideration for large-scale deployment, partly because of their earlier technology readiness level. This paper analyses the power density of turbine arrays comprising aligned and staggered configurations with decreasing turbine spacing of HATs and VATs with height-to-diameter aspect ratios from one to four at three real tidal sites. This study outlines the higher efficiency of tidal stream energy compared to other renewable energy resources, e.g. offshore wind farms, reaching power densities at least one order of magnitude larger, and that VATs counterbalance their smaller individual performance with improved array synergy as wake effects are limited.

Experimental study on a pitching wave energy converter with adjustable natural period – Cai et al. 2022

This paper proposed a pitching wave energy converter with adjustable natural period (called C-WEC), which is achieved by moving the movable mass block. A prototype was fabricated and tested in a wave flume to study the performance of the C-WEC. Free decay tests demonstrated that the natural period of the prototype can be adjusted between 1.60 s and 3.30 s. The wave flume tests showed that for regular and irregular waves, the prototype can capture high mechanical power and exhibit large response amplitude operator (RAO) as well as high capture width ratio (CWR) across a wide range of wave periods, avoiding poor performance in non-resonant states. The Froude scaling law was used to assess the annual average power of a 1:16th full-scale C-WEC in real seas off the Canary Islands based on the measured mechanical power in irregular waves.

Scaled-up multistage reverse electrodialysis pilot study with natural waters – Simões et al. 2022

A multistage reverse electrodialysis system was studied at the REDstack research facility (the Afsluitdijk, the Netherlands) for over 30 days to describe the performance of such configuration under natural water conditions. The experiments were done with two $0.22 \times 0.22 \text{ m}^2$ stacks in series comprising 32 cell pairs (3.1 m^2 of membrane area) for stage 1 and 64 cell pairs (6.2 m^2 membrane area) for stage 2. The total gross power density at the available salinity gradient was stable at around $0.35 \text{ W}\cdot\text{m}^{-2}$. The total net power density, corrected for the initial pressure drop of the stacks, was $0.25 \text{ W}\cdot\text{m}^{-2}$ at an energy efficiency of 37 %. Throughout the operation, due to increased stack pressure drop, the actual total net power density lowered to $0.1 \text{ W}\cdot\text{m}^{-2}$. A distinct behaviour was found for multivalent ions in each stage.

News & Press Releases

CalWave Successfully Concludes Historic Wave Energy Pilot in California with Zero Intervention and 99% Uptime – CalWave Power Technologies

CalWave, a leader in wave energy development, has successfully concluded its open-ocean wave energy pilot after 10 months of continuous operation off the coast of San Diego. The project, which deployed in September 2021, was supported by a US Department of Energy award with the goal to demonstrate CalWave's scalable and patented xWave™ technology as a cost-effective, sustainable solution for energy generation. Not only does the demonstration represent California's first at-sea, long-duration wave energy project, but it also serves as a critical step toward proving wave power as a commercially viable renewable resource. The pilot device, named x1™, has now been recovered and decommissioned.

Sigma Energy deploys full scale WEC prototype – Ocean Energy Europe

After two and half years of intensive development, Sigma energija d.o.o. (Sigma Energy) is proud to announce the successful deployment of the full-scale Sigma WEC prototype offshore Bar in Montenegro. The 30-kW device was deployed in mid-July and shows extremely promising results. The deployment is the result of Sigma Energy's successful application to the public call 'Dopolnjevanje SME Instrumenta – Faza 2' (Supplement to SME Instrument – Phase 2) for co-funding the project of developing the Sigma WEC full-scale device. The investment is co-financed by the Republic of Slovenia and the European Union from the European Regional Development Fund. Watch the deployment video [here](#).

Minesto starts commissioning of second “Dragon 4” tidal energy power plant – Minesto

The second Dragon Class tidal energy power plant “Dragon 4” has now arrived at Minesto's grid-connected site in Vestmanna, Faroe Islands. This power plant commissioning has now commenced, and it will greatly benefit from previous configuration testing executed with the first unit. “As we are now commissioning the second “Dragon 4” unit, it's with vital experience of cost-efficient onshore and offshore operations. In Vestmanna, we have created a flexible setup, where a small team can assemble and launch the kite in a few hours, practically in all tidal conditions. This operating methodology can be transferred to any location,” says Dr Martin Edlund, CEO of Minesto.

Wave energy to ensure clear communication in the island of Hawaii – Offshore Energy

US-based wave energy developer Oscilla Power has partnered up with the State of Hawaii and the University of Hawaii to test a new wave energy-powered emergency communication system. The partners are testing a new way to provide 24/7 access to emergency communications systems for island residents by installing a communication equipment on Oscilla Power's Triton-C wave energy device, that will also supply power for the system. Hawaii's unique topography presents a challenge for emergency communication systems. With valleys and waterways separating counties, there are blind spots for communication signals and it is not practical to install a vastly expensive communication facility on every single ridge, according to Oscilla Power.

AltaSea CEO Terry Tamminen Arrives from LA for an Official Visit at Eco Wave Power's Newest Wave Energy Power Station in Israel Ahead of EWP's First US Pilot Station Arrival – Eco Wave Power

Eco Wave Power was pleased to host Terry Tamminen, President and CEO of AltaSea at the Port Los Angeles, at the Company's new EWP-EDF One wave energy power station at Jaffa Port, Israel, on Wednesday, September 7. This visit comes just weeks before the expected arrival of Eco Wave Power's first U.S. power station, to be located at AltaSea. The AltaSea pilot station will be the first U.S. location for Eco Wave Power's technology, which is already deployed in Israel. The Company plans further deployments in Spain, Portugal and other locations, completing the Company's 327.7 MW current

project pipeline. Eco Wave Power entered a collaboration agreement with AltaSea earlier this year and announced plans to install a first of its kind wave energy pilot in AltaSea's 35-acre campus located at the Port of Los Angeles, the nation's busiest seaport.