

TETHYS ENGINEERING BLAST



26 August 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

PRIMRE Highlight: Marine Energy Atlas

The [Marine Energy Atlas](#) is an interactive mapping tool powered by high-resolution datasets that enables users to explore U.S. wave, tidal, riverine current, ocean current, and ocean thermal resources. Learn more [here](#). The Marine Energy Atlas is one of seven Knowledge Hubs within the [Portal and Repository for Information on Marine Renewable Energy \(PRIMRE\)](#).

REDi Video

The U.S. Department of Energy (DOE) Water Power Technologies Office (WPTO) and National Renewable Energy Laboratory (NREL) recently launched Renewable Energy Discovery (REDi) Island, an educational 3D-animated experience. Watch the [REDi Tidal Town](#) video to learn more about how tidal energy technologies may help power coastal and remote communities.

PNNL RFI

Pacific Northwest National Laboratory (PNNL) is requesting information from developers, owners, and/or manufacturers of tidal or river current energy turbines (CETs) capable of deployment and operation in the tidal channel adjacent to PNNL-Sequim's Marine and Coastal Research Laboratory. The information gained from this [Request for Information](#) (RFI) may inform the specification and procurement of a CET. Responses are due 26 August 2022.

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.

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.

Calls for Papers

The *Journal of Marine Science and Engineering* is accepting submissions for several Special Issues, including “[Marine Wind and Other Ocean Energy Key Technologies](#)” (due 20 September 2022), “[Wind and Wave Climate](#)” (due 15 October 2022), and “[Recent Advances in Wave Energy Resource Assessment](#)” (due 30 November 2022).

Energies is accepting submissions for several Special Issues, including “[Tidal Turbines II](#)” (due 2 November 2022), “[Renewable Offshore Energies](#)” (due 8 November 2022), and “[Wind and Wave Energy Resource Assessment and Combined Utilization](#)” (due 4 November 2022).

Funding & Testing Opportunities

The European Commission has launched the Innovation Fund's second [Call for Small Scale Projects](#) in renewable energy, energy-intensive industries including substitute products, energy storage, and carbon capture, use and storage. Applications are due 31 August 2022.

The European Marine Energy Centre (EMEC) is [looking for local Orkney partners](#) who are interested in applying for the [Social Innovation Challenge](#), a funding programme to support innovative social enterprise solutions to challenges faced by individuals, communities, and the environment. Expressions of interest are due 2 September 2022.

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.

The U.S. DOE Office of Energy Efficiency and Renewable Energy, on behalf of WPTO, has released a [Notice of Intent](#) to issue a Funding Opportunity Announcement entitled “Marine Energy Systems Innovation at Sea”. More information coming soon.

Student & Employment Opportunities

University of Plymouth is inviting applications for a [PhD studentship](#) focused on experimental and numerical approaches for investigating the design and performance of hybrid coastal structures that provide coastal protection and clean energy. Applications due 29 August 2022.

Ghent University is looking for a [Project Officer - Measurement and Control Systems](#) to support the operational start of the Coastal & Ocean Basin in Ostend, Belgium, including the design, installation, and operation of the data acquisition network. Applications are due 30 August 2022.

The Polytechnic University of Bari is inviting applications for a [PhD position in Fluid Mechanics](#) to work on a hydrodynamic study of marine energy current turbines. Applications are due 5 September 2022.

EMEC is recruiting a:

- [Marine Bio-Acoustician](#) to develop and support delivery of EMEC’s environmental monitoring services. Applications are due 9 September 2022.
- [Electrical Engineer](#) to assist with the management of EMEC high and low voltage systems, including electrical connections and marine energy device performance testing.
- [Senior Metocean Engineer](#) to be the metocean and oceanographic subject matter expert.
- [Hydrogen R&D Engineer](#) to implement EMEC’s hydrogen R&D programme.

PNNL 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.

Columbia Power (C·Power) is looking for an [Electrical Engineer](#) with power electronics and/or power systems experience who can help the company continuously improve its Autonomous Offshore Power Systems (AOPS) and bring its products to market.

Marine Power Systems (MPS) is seeking an [Operations Manager](#) to support the company in the set-up and management of its Operations Department and the development of MPS's novel business model specifically tailored to the needs of offshore renewable energy hardware.

Upcoming Events

Upcoming Webinars

The International Network on Offshore Renewable Energy (INORE) and Society for Underwater Technology Young Engineers & Scientists (SUT YES!) are hosting a webinar on marine renewable energy in Costa Rica and Columbia on 29 August 2022 from 8:00-9:30am CST (2:00-3:30pm UTC). Register [here](#).

NREL has rescheduled its webinar, “New Functionality and Water Power Technologies Office Wave Hindcast Data in the [Marine Energy Atlas](#)”, to 30 August 2022 from 11:00am-12:00pm MDT (5:00-6:00pm UTC). Register [here](#).

Sandia National Laboratories is hosting the “[SWEPT \(Sandia Wave Energy Power Take-off\) Lab Virtual Launch Party](#),” on 30 August 2022 from 1:00-1:45pm MDT (7:00-7:45pm UTC). The event will feature a virtual tour and explanation of Sandia's wave energy testing and research capabilities. Register [here](#).

The Hawai'i State Energy Office and RENEW REBUILD HAWAII are hosting an online panel discussion on Ocean Thermal Energy Conversion (OTEC) on 2 September 2022 from 2:00-4:00pm HST (5:00-7:00pm UTC). Register [here](#).

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 University Marine Energy Research Community (UMERC) and the Marine Energy Technology Symposium (METS) are hosting a joint [UMERC+METS 2022 Conference](#) on 13-14 September 2022 in Portland (US). The conference agenda is now available. Register [here](#).

Directly after the UMERC+METS 2022 Conference, the Pacific Ocean Energy Trust is hosting the [Ocean Renewable Energy Conference \(OREC\) 2022](#) on 14-15 September 2022 in Portland (US). The conference agenda is now available. Register [here](#).

New Documents on *Tethys Engineering*

[State-of-the-art review and future trends of development of tidal current energy converters in China](#) – Si et al. 2022

Although several review papers have covered the evolution of tidal current energy converters (TCECs) in China since the 1980s, a comprehensive update of the past decade has not been systematically reported, which might be of significant interest to researchers, developers, and investors worldwide. In this paper, we present the state-of-the-art TCEC technological developments in China in terms of scale, efficiency, reliability, and other innovations. Their technology readiness level and problems are also discussed. It is found that TCEC development in China has been diverging toward two different directions: large-sized turbines for grid connection and small-scale turbines for diverse applications in marine environments.

[Mini-DAQ: A lightweight, low-cost, high resolution, data acquisition system for wave energy converter testing](#) – Bosma et al. 2022

As part of the development process, scaled testing of wave energy converter devices are necessary to prove a concept, study hydrodynamics, and validate control system approaches. Creating a low-cost, small, lightweight data acquisition system suitable for scaled testing is often a barrier for wave energy converter developers' ability to test such devices. This paper outlines an open-source solution to these issues, which can be customized based on specific needs. This will help developers with limited resources along a path toward commercialization.

[Enhanced salinity gradient energy harvesting with oppositely charged bacterial cellulose-based composite membranes](#) – Sheng et al. 2022

Restricted by the inherent properties of the materials, the membranes used for harvesting the salinity gradient energy generally suffer from low ion selectivity, weak permeability or high internal resistance, which heavily limit the output power density. In this work, the integration of one-dimensional bacterial nanofibers and two-dimensional nanosheets is projected to be an effective novel strategy for composite membranes with strongly enhanced output power density by balancing ion selectivity and permeability. Composite

membranes as negatively charged bacterial cellulose/graphene oxide and positively charged bacterial cellulose/layered double hydroxide were used as osmotic power generators.

Investigating the flow dynamics and turbulence at a tidal-stream energy site in a highly energetic estuary – Thiébaud et al. 2022

Measurements of an upward-looking Nortek Signature 1000 kHz five-beam acoustic Doppler current profiler are used to evaluate the mid-depth kinetic power density of the flow, energy-spectra of the velocity, turbulence intensity and an approximate turbulent kinetic energy budget at an estuarine tidal-stream energy site. The kinetic power density is 7 times higher during ebb tide than flood tide. Results reveal a strong influence of the bathymetry features and headland in the level of turbulence. A production-dissipation balance is demonstrated during the flooding stages of the tide whereas the ebbing stages of the tide exhibits a strongly unbalanced dissipation and production.

Wave energy converter array layout optimization: A critical and comprehensive overview – Yang et al. 2022

The production efficiency and optimal control of wave energy converter (WEC) array are mainly based on array layout, thus it is crucial to establish a reliable mathematical model for the WEC array layout optimization. So far, a lot of research has been done on the modeling and methods of WEC array layout optimization. However, the existing reviews are either incomplete in the classification of modeling methods, or incomplete in a collection of optimization methods, especially lacking detailed evaluation. This paper aims to comprehensively summarize various WEC models and related approaches for WEC array layout optimization. Note that over 80 related pieces of literature have been carefully analyzed and summarized.

Identification of nonparametric thermodynamic model and optimization of ocean thermal energy conversion radial inflow turbine – Liu et al. 2022

Turbine is one of the key components of ocean thermal energy conversion system, and its aerodynamic performance and geometric structure directly affect the performance of the system. At present, the design methods of radial inflow turbines can be roughly divided into three categories: trial method, best velocity ratio method and screening method, which follow no concrete rules and are not comprehensive, and rely mostly on the designers' experience. This study proposes a fully data-based non-parametric model identification and optimization method for ocean thermal energy conversion radial inflow turbines is proposed, and takes the 25 kW R134 working fluid turbine of the ocean thermal energy conversion system as an example for verification and analysis.

News & Press Releases

CorPower Ocean's C4 Wave Energy Converter completes dry test program – CorPower Ocean

CorPower Ocean's first commercial scale C4 Wave Energy Converter has completed a rigorous one-year on-land testing program, following a final 'Ironman' endurance exercise. The dry test campaign was performed on a purpose built test-rig at CorPower Ocean's headquarters in Stockholm, Sweden, where the company has developed the world's largest dry-test facility for Wave Energy Converters. Using simulated wave loading from the 7.2MW test rig, the C4 device has been tested in conditions representing several ocean sites around the world, culminating with a final 'Ironman' phase involving continuous operation and exposure to full range storm loading.

Israel's Electric Authority Sets Feed-in Tariff for Eco Wave Power's EWP-EDF One Project, which Enables the Commencement of the Official Grid Connection Works by The Israeli Electric Company – Eco Wave Power

Eco Wave Power is pleased to announce that the Israeli Electric Authority (IEA) has set an official Feed-in Tariff ("FIT") for the Company's newly-installed wave energy pilot project ("EWP-EDF One Project") at the Port of Jaffa in Tel Aviv, Israel. With the FIT in place, the Israeli Electric Company (IEC) commenced operations to officially connect the EWP-EDF One wave energy project to Israel's energy grid. Once connected, the EWP-EDF One Project will represent the first time in the country's history that electricity produced by the power of waves will be transmitted to Israel's national electric grid. Additionally, Eco Wave Power will soon commence installation on its first U.S. location of its wave energy technology at AltaSea at the Port of Los Angeles.

1.8 MWh Battery System Successfully Energised in Orkney Isles – Invinity Energy Systems

Invinity Energy Systems is pleased to announce that it has successfully delivered, installed and energised a 1.8 MWh VS3 flow battery system at the European Marine Energy Centre (EMEC) hydrogen R&D facility on the island of Eday in the Orkney Islands, UK. Comprising 48 Invinity VS3 battery modules, with a combined capacity equivalent to the daily energy consumption of over 210 UK households, this innovative project will see Invinity's flow batteries integrated with tidal generation to optimise green hydrogen production at EMEC's hydrogen production plant. Tidal generation is predictable yet variable, with two high and two low tides occurring each day.

Massachusetts tidal test site gets license extension – Offshore Energy

The Bourne Tidal Test Site (BTTS), located at Cape Cod Canal in Massachusetts, has received approval from the US Army Corps of Engineers (USACE) for the renewal of license for tidal energy technology testing. The Marine Renewable Energy Collaborative of New England (MRECo), the organization in charge of site development, said the renewed license will allow the site to perform extended test of a new tidal energy technology developed by Littoral Power Systems, starting in October. This test will allow

MRECo to demonstrate the capability of BTTS to provide a controlled test environment in ocean waters for new hydrokinetic technologies, according to the organization.

Marine energy is moving into the mainstream: “Sustainability is part of our DNA” - IEC e-tech

Jonathan Colby, the Chair of the International Electrotechnical Commission (IEC) Technical Committee (TC) 114: Marine energy - Wave, tidal and other water current converters, talks to *e-tech* about the challenges of developing standards for a rapidly evolving sector and how sustainability is a founding principle for the whole industry. The TC 114 community has recognized the need for standards that are more adapted to commercial-scale deployments. The lessons learnt from applying the standards in the real world have had an impact. Several priorities are identified in our new strategic business plan and relate to open water and commercial scale deployments.