

TETHYS ENGINEERING BLAST



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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

NHA State of Marine Energy Survey

The National Hydropower Association (NHA) has launched a 10-minute [State of Marine Energy Survey](#) to help the association understand the state of U.S. development, challenges facing the sector, and where investment is needed to advance commercialization. The survey is open to all marine energy professionals based in the U.S. and closes on 1 July 2021.

Public EMEC Consultation

The European Marine Energy Centre (EMEC) has opened a consultation on the Decommissioning Programme for the [AWS Ocean Energy Archimedes Waveswing](#), and would like to invite stakeholders and members of the public to provide responses by 28 June 2021.

Funding & Testing Opportunities

The U.S. Department of Energy's (DOE) Office of Energy Efficiency and Renewable Energy recently announced its intent to issue a Funding Opportunity Announcement in summer 2021 to support open water research and development at the PacWave South test site. Please refer to the full [Notice of Intent](#) for additional information.

The [Pacific Marine Energy Center \(PMEC\)](#) is inviting applications for [collaboration grants](#) to facilitate short-term, on-site research opportunities in the U.S. The grants will allow graduate and undergraduate students to participate in marine energy projects underway at PMEC partner universities—Oregon State University, the University of Washington, and the University of Alaska Fairbanks. Applications are due by 30 June 2021.

BlueSwell, a collaboration between the New England Aquarium and SeaAhead, is now accepting applications for the second cohort of its [BlueSwell Incubator](#). The program is designed to help with the creation and growth of startups that have the potential for significant impact on ocean sustainability and global resilience. Applications close at 5:00pm EDT (UTC) on 1 July 2021.

In collaboration with Innovate UK, the UK Department for Business, Energy and Industrial Strategy 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.

Innovate UK has also launched another round of [Smart Grants](#) for eligible UK organizations to apply for a share of up to £25 million for game-changing and commercially viable research and development (R&D) innovation. Applications are due by 11:00am BST (10:00am UTC) on 25 August 2021.

Interreg North-West Europe recently launched the [4th Ocean DEMO](#) (Demonstration Programme for Ocean Energy Pilot Farms and Supporting Technologies) [Call for Applications](#). Successful applicants will receive free access to test their ocean energy products in real sea environments at the project's network of test centers. Applications are due 10 September 2021.

Student & Employment Opportunities

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

The Pacific Northwest National Laboratory (PNNL) is seeking a [Post Doc Research Associate](#) to conduct marine energy modeling research and simulate the effects of tidal or ocean current energy extraction on physical and biogeochemical processes. Applications due by 26 June 2021.

PNNL is also seeking a [Post Masters Research Associate](#) who will work primarily on projects associated with developing marine energy projects for coastal communities and other small-scale markets, such as aquaculture, mariculture and ocean observing. Applications due by 9 July 2021.

The Delft University of Technology (TU Delft) is seeking candidates for a [PhD in Variable Wave Energy Converter Farms](#). This position will investigate wave structure interactions in large scale wave energy converter farms with different geometries, leading to the design of tools and methodologies. Applications due by 1 September 2021.

Upcoming Events

Upcoming Courses

The RENOVABLES project, which seeks to foster strategic cooperation between the Euroregion's socio-economic stakeholders to drive the blue economy around the Bay of Biscay, is hosting two online courses. On 21 June 2021, Dr. Josh Davidson will lead a course on numerical wave tank testing for marine renewable energy devices. On 22 June 2021, Dr. João C. C. Henriques will lead a course on the development of the spar-buoy oscillating water column wave energy converter at the Instituto Superior Técnico. Learn more and register [here](#).

The DTOceanPlus project is hosting two online training sessions to demonstrate its suite of second-generation advanced design tools for the selection, development, and deployment of ocean energy systems. On 1 July 2021, the team will demonstrate the Deployment tool, focusing on site characterization and station keeping, and the Assessment tool, focusing on environmental and social acceptance. On 6 July 2021, the team will demonstrate the Stage Gate tool, with links to other tools. Learn more and register [here](#).

Upcoming Webinars

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. Register [here](#) for the third event at 9:00am UTC on 22 June 2021, where law firm Stephenson Harwood will discuss contracting and real cases in the areas of design risk and fitness for purpose. Register [here](#) for the fourth event at 9:00am UTC on 24 June 2021, where law firm LK Shields Solicitors will discuss 'Irish Offshore Renewable Projects: Legal Considerations in a Developing Market'.

The International Energy Agency (IEA) Ocean Energy Systems (OES) is hosting the second webinar in its series focused on ocean energy projects and key policies in IEA-OES member countries at 11:00am UTC on 24 June 2021. The webinar will provide an outlook on the latest initiatives and projects in the UK, Spain, and Denmark. Register [here](#).

As part of its R&D Deep Dive Webinar Series, the U.S. DOE Water Power Technologies Office (WPTO) is hosting a webinar, [“Underwater Observations – Monitoring the Environment around Marine Energy Devices”](#), at 3:30pm EDT (7:30pm UTC) on 24 June 2021. The webinar will focus on the [Triton Initiative](#), which is researching various environmental monitoring technologies and methods to understand how different types of stressors caused by marine renewable energy devices can be tested. Register [here](#).

The U.S. DOE WPTO is also hosting its [Semiannual Stakeholder Webinar](#) at 3:30pm EDT (7:30pm UTC) on 15 July 2021. During the webinar, the new Acting Director of WPTO will share water power highlights from the President's Fiscal Year 2022 budget request, and program representatives will highlight ongoing programs and open opportunities. Register [here](#).

Upcoming Conferences

Ocean Energy Europe is hosting an online conference, [Target 2025 – Empowering Europe to deliver on its ocean energy ambitions](#), on 22 June 2021. During the conference, leading EU policymakers will share their vision for the ocean energy sector and discuss priorities to turn the EU Strategy on Offshore Renewable Energy into action. Register for free [here](#).

The American Society of Mechanical Engineers is hosting the [40th International Conference on Ocean, Offshore and Arctic Engineering \(OMAЕ 2021\)](#) on 21-30 June 2021. The online conference will feature several symposia, keynote lectures, and short courses. Register [here](#).

The Supergen programme is hosting the [Supergen Net Zero Conference](#) online on 1-3 September 2021. During the event, the Supergen Hubs will be showcasing their research and holding cross-cutting panel discussions on various topics. Register for free [here](#).

New Documents on *Tethys Engineering*

[On the benefits of negative hydrodynamic interactions in small tidal energy arrays](#) – Topper et al. 2021

A typical assumption of existing techno-economic models of tidal energy converter (TEC) arrays is that TECs positioned to minimise negative hydrodynamic interactions will maximise economic return. That the number of TECs within an array should be chosen to maximise the annual energy production, follows from this assumption. To examine the validity of these assertions for small, area-constrained arrays, a hypothetical model of the relationship of levelised cost of energy (LCOE) to the mean mechanical annual energy production is developed. To test this model, a contemporary optimisation algorithm is added to the advanced ocean energy techno-economic simulation tool ‘DTCOcean’ and applied to arrays of TECs constrained by a 2 ha deployment area.

[Using machine learning to derive spatial wave data: A case study for a marine energy site](#) – Chen et al. 2021

Ocean waves are widely estimated using physics-based computational models, which predict how energy is transferred from the wind, dissipated, and transferred spatially across the ocean. Machine learning methods offer an opportunity to predict these data with significantly reduced data input and computational power. This paper describes a novel surrogate model developed using the random forest method, which replicates the spatial nearshore wave data estimated by a Simulating WAVes Nearshore (SWAN) numerical model. By incorporating in-situ buoy observations, outputs were found to match observations at a test location more closely than the corresponding SWAN model. Furthermore, the required computational time reduced by a factor of 100.

Off-design performance of closed OTEC cycles for power generation – Giostri et al. 2021

The present study illustrates the development of a detailed model to estimate the part-load performance of an ammonia closed OTEC system for on-shore installations. A previously published Matlab® suite is extended by accounting for off-design conditions in terms of variable seawater temperature and mass flow on the cycle performance. The off-design behavior of each component is thoroughly discussed, with particular attention devoted to the single-stage axial-flow turbine, whose performance maps are obtained by means of three-dimensional CFD simulations. Moreover, a sensitivity analysis is assessed in order to identify the best design parameters (i.e. warm seawater temperature and cold seawater mass flow rate) that minimize the LCOE for the given location.

3D printing: rapid manufacturing of a new small-scale tidal turbine blade – Rouway et al. 2021

The 3D printing technology used for small tidal and wind turbines has great potential to change and overcome certain weaknesses in traditional manufacturing techniques. In rural areas and isolated communities, small turbine systems could be locally fabricated and assembled by using additive manufacturing machines and also can be employed to decrease residential energy consumption. The objective of the paper is to study the thermomechanical performance of 3D printing of a small-scale tidal turbine blade and their process using Digimat-AM because more research efforts are needed in this area. In this work, the tidal turbine blade is printed by using the selective laser sintering method with polyamide 12 and polyether ether ketone polymers reinforced by carbon beads and glass beads.

Geotechnical Approach to Early-Stage Site Characterisation of Shallow Wave Energy Sites – Heatherington et al. 2021

Marine renewable energy is still in its infancy and poses serious challenges due to the harsh marine conditions encountered for wave or tidal installations and the survivability of devices. Geophysical and hydrodynamic initial site surveys need to be able to provide repeatable, reliable, and economical solutions. An oscillating water column wave energy converter is to be installed on the west coast of King Island, Tasmania. The location is in a high-energy nearshore environment to take advantage of sustained shoaling non-breaking waves of the Southern Ocean and required site-specific information for the deployment. We provide insight into scalable geophysical site surveys capable of capturing large amounts of data within a short time frame.

Marinet2 Deliverable 2.7: Final guidelines for test facilities – Corlay et al. 2021

This guideline provides recommendations to testing bodies involved in marine renewable energy (MRE) development, addressing appropriate standards and documentation to support testing of MRE technologies. This deliverable constitutes an output of Work package 2 of the Marinet2 project dedicated to gathering the experience of the international partners in testing and technology assessments. For each of the sections, a

general description of the relevant recommendations and guidelines will be provided as well as references to the international standards relevant to the subject. Each section will also include deliverables from other projects susceptible to assist test facilities in the relevant tasks.

News & Press Releases

[Mocean Energy Blue X Wave Machine Starts Sea Trials at EMEC](#) – EMEC

The prospect of generating clean energy from waves moved a step closer as Mocean Energy commenced testing of their Blue X wave energy prototype at EMEC in Orkney. In the last few days the 20-metre long, 38-tonne wave machine has been towed from Kirkwall to EMEC's Scapa Flow test site where it has been successfully moored and commissioned for initial sea trials. Later this summer the Blue X will be moved to EMEC's grid connected wave test site at Billia Croo on the west coast of Orkney, where it will go through its paces in more rigorous full sea conditions. Next year, the wave pioneers plan to connect the device to a subsea battery which will be used to power a remotely operated autonomous underwater vehicle – with potential applications offshore.

[Funding for Twelve New Marine Energy Research and Development Projects](#) – U.S. DOE

The U.S. DOE recently announced \$2.4 million in funding for twelve new Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) marine energy research and development projects. The Office of Energy Efficiency and Renewable Energy's WPTO selected these small business projects, from nine different states, based on their proposals and ability to impact the future of marine energy. The twelve selected small businesses will receive Phase I Release 2 grants of up to \$200,000 to explore the technical feasibility of innovative solutions in marine energy. These solutions will support decarbonization of the electricity and maritime transportation sectors, and will provide additional tools in combating climate change.

[Pioneering UMACK mooring and anchoring project partners with University of Dundee](#) – CorPower Ocean

A novel marine mooring and anchoring project aiming to improve the operation efficiency of ocean energy devices is recruiting expert support from the University of Dundee. The UMACK (Universal Mooring, Anchor & Connectivity Kit) Project has teamed up with the University's Geotechnical Engineering Group to aid the development of a new 'vibro-installed' anchor system for Marine Energy applications. The new anchor solution developed will form part of a high-capacity mooring system supporting wave energy developer, CorPower Ocean, with their first commercial scale demonstration project, HiWave-5, launching in Portugal later this year. The €3.7m Project will also now benefit from the University's world-leading experimental and physical testing facilities, developed as part of the Scottish Marine and Renewable Test Centre.

Blue-GIFT backs three more marine renewable energy technologies – Blue-GIFT

The Interreg Atlantic Area funded Blue-GIFT programme has awarded recommendations for support to three marine renewable energy projects under its third and final call to test and validate technologies in real sea environments. Two technology developers were recommended for support to access the SEENEOH test site, these include French tidal energy developer EEL Energy, whose design is inspired by bio-mimicry, and Dutch tidal energy company Hydrokinetic Power Generation Systems (HPGS), who will trial their vertical axis tidal turbines at the site. The third technology developer recommended for support is RW Power AS, a Norwegian company who will test their floating offshore wind powered desalination pump at the PLOCAN test site.

Advanced controls boost CETO wave device performance – Offshore Energy

Carnegie Clean Energy has improved the performance of its CETO wave energy device through the implementation of advanced controllers, increasing the energy extracted for 27%. Advanced control has been one of the core innovation streams pursued by Carnegie's team over the last 18 months with multiple advanced controllers being developed internally and with partners. The control algorithm has the critical function of tuning CETO to each incoming wave, to maximise extracted power, as well as minimise extreme responses. These controllers instruct the power take-offs to set the tension in CETO's mooring lines which are resisting the wave forces imposed on the buoy. When set optimally, CETO can extract considerably more energy from each wave.