TETHYS ENGINEERING BLAST

10 February 2023

Tethys Engineering is an online knowledge hub that facilitates the exchange and dissemination of information on the technical and engineering aspects of marine energy, as part of the *PRIMRE* universe. 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

Tethys Engineering Blast → *PRIMRE* Blast

In order to highlight more of the data, information, and resources available within the *Portal and Repository for Information on Marine Renewable Energy (PRIMRE)*, we will be rebranding the *Tethys Engineering* Blast as the *PRIMRE* Blast in the coming weeks. We will continue to include all the regular content but will expand the newsletter to include content from the other *PRIMRE* Knowledge Hubs as well. Please reach out to tethys@pnnl.gov if you have any questions.

Marine Energy Performance Metrics

The U.S. Department of Energy's National Renewable Energy Laboratory, Pacific Northwest National Laboratory, and Sandia National Laboratories recently launched a new Marine Energy Performance Metrics page on *PRIMRE*. The collection of metrics encompasses those that are commonly used for evaluating marine energy systems and can serve as a reference for device developers, researchers, regulators, and other stakeholders.

Calls for Abstracts

The Call for Abstracts for the 9th International Ocean Thermal Energy Conversion Symposium is now open. Email your title, authors, and abstract (<500 words) here. The event will take place 4-5 May 2023 in Houston, Texas, U.S., alongside the Offshore Technology Conference.

The Call for Abstracts for the 15th European Wave and Tidal Energy Conference Series (EWTEC 2023) has been extended to 11 February 2023. Full papers will be due 27 May 2023. EWTEC will take place on 3-7 September 2023 in Bilbao, Spain.

The Call for Academic Posters for the All-Energy Conference & Exhibition is open through 28 February 2023. All-Energy will take place 10-11 May 2023 in Glasgow, Scotland.

The Partnership for Research in Marine Renewable Energy (PRIMaRE) has opened the Call for Abstracts for the 10th PRIMaRE Conference through 10 March 2023. The conference will take place on 27-28 June 2023 in Bath, England.

The Pan American Marine Energy Conference (PAMEC) Association is now accepting Expressions of Interest to submit an extended abstract for presentation at PAMEC 2024 through 15 March 2023. Extended abstracts will be due 26 June 2023. PAMEC will take place on 22-24 January 2024 in Barranquilla, Colombia, with pre-conference workshops on 19-20 January 2024.

Funding & Testing Opportunities

The Basque Energy Agency has opened the Call for Tenders for its TurboWave Pre-Commercial Public Procurement program for the development of air turbines that will be implemented in the Mutriku wave power plant. Applications are due 16 February 2023.

The U.S. Testing and Expertise and Access for Marine Energy Research (TEAMER) program, sponsored by the U.S. Department of Energy's Water Power Technologies Office and directed by the Pacific Ocean Energy Trust (POET), is now accepting Request for Technical Support 9 applications until 3 March 2023. Open Water Support applications may be submitted at any time.

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

Student & Employment Opportunities

Allegheny Science & Technology (AST) is looking for a Marine Energy Environmental Scientist to help lead development of an environmental research portfolio of a federal agency research program and collaborate as needed with inter-agency and intra-agency groups focused on issues of environmental impacts of marine energy.

Net Zero Atlantic is seeking fulltime Project Managers to support the successful delivery of projects in our renewable energy research portfolio. Applications are due 10 February 2023.

The European Marine Energy Centre (EMEC) is seeking a Hydrogen Engineering Technician to assist our Operations Team with the specification, operation, and maintenance of EMEC's hydrogen assets. Applications are due 20 February 2023.

Upcoming Events

Upcoming Webinar

ETIP Ocean, the European Technology & Innovation Platform for Ocean Energy, is hosting a webinar, "Go/no-go decision in Horizon Europe demonstration projects" on 15 February 2023 at 10:00am UTC. The webinar will highlight the activities that must be completed ahead of the go/no-go decision for ocean energy projects. Register here.

Upcoming Conferences

The 12th Annual North Carolina Renewable Ocean Energy Symposium will take place 20-21 March 2023 in Wanchese, North Carolina, U.S. Register here by 24 February 2023.

The 2nd International Ocean Data Conference will take place on 20-21 March 2023 in Paris, France and online. Register here by 17 February 2023 to attend in person.

New Documents on *Tethys Engineering*

Characterizing the Marine Energy Test Area (META) in Wales, UK – Neill et al. 2023

> With lack of convergence on any single wave or tidal technology, test centres have a unique role in the marine renewable energy industry. Test centres facilitate real testing at sea for devices and components at various Technology Readiness Level, reducing the time, cost, and risks faced by marine energy developers. META is a £2.7M project managed by Marine Energy Wales, consisting of eight test areas in Pembrokeshire, Wales. Although various datasets have been collected from the META test areas over the last decade, and some aspects of these data have been published in various reports, the data has not been gathered together, systematically analysed and critically assessed – the aim of this study. Here, we describe and interpret the various META datasets, including multibeam, acoustic Doppler current profiler, and wave buoy data.

Toward the Instrumentation and Data Acquisition of a Tidal Turbine in Real Site Conditions – Murray et al. 2023

> The National Renewable Energy Laboratory manufactured, instrumented, and deployed thermoplastic composite blades and a data acquisition system (NDAQ) on one of Verdant Power's Gen5d 5 m diameter tidal turbines in New York's East River. The thermoplastic blades had internal strain gages, and the NDAQ was a stand-alone system for monitoring and recording the strain and angular position of the blades. The turbine with thermoplastic blades operated and produced power successfully for 3 months, contributing energy to the New York City electric grid. The NDAQ hardware, instrumentation, and structure all survived the deployment and were still functional upon retrieval of the system, but no data were collected.

Heat transfer mechanism of cold-water pipe in ocean thermal energy conversion system – Mao et al. 2023

> Ocean thermal energy is clean and renewable. In recent years, many scholars have focused on improving the generation efficiency of the ocean thermal energy conversion system. To the best of our knowledge, the majority of the scholars focus on equipment improvement and working fluid optimization, and few study how to reduce the outlet temperature of cold-water pipes. This paper establishes a numerical model, which is solved by the finite volume method, to analyze the temperature distribution and heat transfer characteristics of cold-water pipes during pumping. The influence of cold-water pipe materials, wall thicknesses, flow rates, and insulation layer thicknesses on outlet temperature is explored. In addition, this paper qualitatively gives performance optimization recommendations based on technical and economic indicators.

Representative linearised models for a wave energy converter using various levels of force excitation – Farajvand et al. 2023

> In guiding the progression, development, and operation of wave energy converters (WECs) in a more efficient way, mathematical analysis and understanding of the dynamic process is essential. Mathematical WEC models, obtained either by numerical analysis or physical modelling, form the basis of most (model-based) energy maximising control strategies available in the literature, where experimental design and system identification methodology directly impact the resulting model. This study, using an experimental-based WEC model (which can be used for linear control design), investigates the dynamic behaviour of a WEC by analysing the dominant poles of the system, generated using fully nonlinear computational fluid dynamics (CFD)-based numerical wave tank (NWT) experiments.

Development and validation of an AI-Driven model for the La Rance tidal barrage: A generalisable case study – Moreira et al. 2023

> In this work, an AI-Driven (autonomous) model representation of the La Rance tidal barrage was developed using novel parametrisation and Deep Reinforcement Learning (DRL) techniques. Our model results were validated with experimental measurements, yielding the first Tidal Range Structure (TRS) model validated against a constructed tidal barrage and made available to academics. In order to proper model La Rance, parametrisation methodologies were developed for simulating (i) turbines (in pumping and power generation modes), (ii) transition ramp functions (for opening and closing hydraulic structures) and (iii) equivalent lagoon wetted area. Furthermore, an updated DRL method was implemented for optimising the operation of the hydraulic structures that compose La Rance.

A novel spiral wound module design for harvesting salinity gradient energy using pressure retarded osmosis – Abdelkader et al. 2023

Pressure retarded osmosis (PRO) is an evolving form of a renewable energy process which utilizes the salinity gradient energy from two solutions of different concentrations. One of the main problems limiting the application of PRO is the low performance of the commercially available spiral-wound modules which have poor flow distribution and high pressure drop. The present paper proposes a new spiral-wound module design for PRO application. The performance of the new module design was investigated numerically and compared with the available one. Compared to the available module, the power density of the new design was higher by 25% and 15% at draw concentrations of 35 g/kg and 60 g/kg respectively, while there was a 35% decrease in the pressure drop.

News & Press Releases

ORPC deploys next-gen RivGen hydrokinetic system – Offshore Energy

Ocean Renewable Power Company (ORPC) has deployed its modular RivGen power system for trials at its test site in Maine in the United States. ORPC's modular RivGen device has been deployed at One North site in Maine, located at the former Great Northern Paper Mill, and established in collaboration with nonprofit organization Our Katahdin. Developed for use in grid-connected markets, ORPC's modular RivGen system is said to be suitable for applications in large rivers, for electrical vehicle (EV) charging networks, hydroelectric facilities, irrigation canals and bridges, piers, breakwaters and flood controls systems. ORPC said earlier it will work One North to evaluate the site as a future hydrokinetic testing facility and a location to demonstrate contemporary use cases such as EV charging.

Minesto initiates collaboration with experienced local tidal site developer in the Philippines – Minesto

Minesto recently signed a collaboration agreement (MoU) that outlines goals, roles, and responsibilities of a strategic collaboration with experienced Philippines-based tidal project developer, Poseidon Renewable Energy Corporation. The Philippines is one of the largest markets for deployment of tidal and ocean current energy farms and the need for renewable electricity is increasing. In late 2022, changes in legislation were made to facilitate and promote a shift in the energy mix towards more renewable energy development with higher foreign investment involvement. Leveraging on the legislation improvement, Minesto has signed a Memorandum of Understanding with Filipino tidal site developer, Poseidon Renewable Energy Corporation, with the intention to collaborate on establishing tidal energy with Minesto's technology in the Philippines.

GKinetic secures planning permission for hydrokinetic turbine array in Ireland – Offshore Energy

Limerick City and County Council has granted planning permission to local clean energy developer GKinetic to deploy three of its hydrokinetic turbines just upstream of Thomond Weir in the heart of Limerick City in Ireland. The aim of the project is to generate clean

energy from the River Shannon which will be used by a local renewable energy community (REC) and contribute towards a 'positive energy block' as part of the +CityxChange project. The turbines will generate a predictable supply of clean energy at a time when energy prices and volatility have never been higher on the agenda. The end goal is that REC will come together and own and operate the turbines and the energy produced and will put Limerick on the global map as a pioneer of clean energy generation from free-flowing water.

Nova Innovation Announces Scaling Back of Enlli Tidal Project – Nova Innovation

In 2020 Nova Innovation secured funding from the Welsh Government for environmental consenting and developing the technical design of its Enlli tidal energy project. The aim of the ground-breaking project was to install five 100 kW turbines on the seabed in Bardsey Sound off the Llyn Peninsula, Wales. Due to a range of site-specific factors, including revenue support limitations and grid and cable routing constraints, the project will be mothballed from March 2023. This has been a difficult decision, but the issues identified mean it is not currently economically viable to develop a project there. If the grid on the Llyn is strengthened, the tidal project in Bardsey Sound would become viable and offer significant opportunities for local regeneration in the future.

Carnegie makes progress on MoorPower demonstration project – Offshore Energy

Carnegie Clean Energy has made significant advancements on the development of MoorPower demonstration project, whose aim is to introduce a CETO-derived wave energy product for the aquaculture sector. Carnegie's CETO-derived MoorPower technology is designed to deliver sustainable energy supply for vessels moored offshore – such as barges in the aquaculture sector – by harnessing wave energy and therefore reducing their reliance on diesel. During the last three months of 2022, the company acquired a barge to be used for the MoorPower scaled demonstrator. The barge is currently undergoing works to prepare it for installation of the MoorPower system. According to the company, the procurement, assembly and manufacture will continue throughout early 2023, in preparation for onshore testing and on-the-water deployment expected around March.