TETHYS ENGINEERING BLAST

17 June 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!

Announcements

Tethys Engineering Events Calendar

The *Tethys Engineering* Events Calendar highlights key marine energy events from around the world, including conferences, workshops, webinars, and more. If you would like to recommend an event to add to the calendar or highlight in the Blast, please email tethys@pnnl.gov.

Marine Energy Data Pipeline

The Marine Energy Data Pipeline effort, led by Pacific Northwest National Laboratory, recently released the latest version of the data ingestion pipeline, Tsdat, which helps users read, process, quality control, and convert raw data to standard formats. To learn more about Tsdat and it architecture, visit the Portal and Repository for Information on Marine Renewable Energy (PRIMRE) to view a recent webinar recording. For more information, email tsdat@pnnl.gov.

Call for Papers

The Wave Energy Converter Simulator (WEC-Sim) team is accepting submissions for a Special Issue on "New Challenges in Software for Marine Energy Applications" in *Energies* through 31 January 2023 (but an extension can be granted, if necessary).

Calls for Abstracts

The Call for ePosters for Environmental Interactions of Marine Renewables (EIMR 2022) has been extended through 13 July 2022. EIMR will take place 4-6 October 2022 online.

The Call for Abstracts for the 2nd GloFouling Research & Development Forum on Biofouling Prevention and Management for Maritime Industries is now open through 31 July 2022. Submit your 250-word max abstract to glofouling@imo.org. The conference will take place on 11-14 October in London, UK.

Funding & Testing Opportunities

The US Department of Energy (DOE) and National Alliance for Water Innovation has released a Pilot Program Request for Proposals to design, build, and test pilot-scale desalination and water-reuse treatment systems that treat non-traditional water. Concept papers due 29 June 2022.

The International Union for Conservation of Nature has launched a new Blue Natural Capital Financing Facility Call for Proposals and is looking for coastal Nature-based Solutions and Green-Gray Infrastructure projects with potential to combine conservation and/or restoration of ecosystems with the selective use of conventional engineering. Applications are due 3 July 2022.

The Testing and Expertise for Marine Energy Research (TEAMER) program, supported by the US DOE, is now accepting Request For Technical Support (RFTS) 7 applications through 16 July 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 is launching 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.

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

The European Marine Energy Centre (EMEC) is looking for an Acoustic Engineer to develop and support delivery of EMEC's environmental monitoring services, including acoustics, for clients and within national and internationally funded projects. Applications due 24 June 2022.

The Environmental Research Institute (ERI) is recruiting for an Energy Systems Modeller with interest in net-zero aviation, renewable energy, and socioeconomics to improve understanding of the energy requirements of net-zero aviation. Applications are due 4 July 2022.

The Bath Beacon in Zero-Carbon Offshore Power is inviting Expressions of Interest from researchers who would like to be hosted at the University of Bath as a Marie Skłodowska Curie Actions European Postdoctoral Fellow. Applications are due 14 July 2022.

The Pacific Regional Institute for Marine Energy Discovery (PRIMED) at the University of Victoria is seeking a Junior Research Engineer - Hydrodynamic Modelling and Wave Energy Technology R&D to work closely with PRIMED's wave energy resource assessment team.

Upcoming Events

Upcoming Course

As part of the PORTOS (Ports Towards Energy Self-Sufficiency) project, the University of Plymouth is hosting an online Training Course on Economics, Policies, and Legal Framework on Marine Renewable Energy from 4-6 July 2022. Register for free here by 30 June 2022.

Upcoming Webinars

The RENOVABLES project is hosting a webinar, "Artificial Intelligence for Marine Renewables: Use Cases in Marine Energy Generation Using Deep Learning", from 4:00-5:00pm CEST (2:00-3:00pm UTC) on 20 June 2022. Register here.

Mercator Ocean International is hosting a webinar, "Marine Data for Policies", from 10:00am-12:00pm CEST (8:00-10:00am UTC) on 21 June 2022. The webinar will provide an overview of the Copernicus Marine Service and how it can support European Union Policies. Register here.

Ocean Energy Systems (OES), an International Energy Agency Technology Collaboration Programme, is hosting a webinar, "Ocean Energy Outlook in India, Republic of Korea and Singapore", on 22 June 2022 from 8:00-9:00am UTC. During the webinar, delegates from three OES Member Countries will highlight ocean energy projects and key policies. Register here.

Upcoming Workshop

The Supergen Offshore Renewable Energy Hub is hosting the Tidal Turbine Benchmarking Project's Opening Workshop from 11:00am-1:00pm BST (10:00am-12:00pm UTC) on 30 June 2022. The project aims to benchmark and improve mathematical and engineering models for blade fluid mechanics and loading of tidal stream turbines in steady and unsteady flows. The workshop will release geometry data and test conditions, including instructions on how to participate and the data deliverables for participation in the blind prediction exercises.

Upcoming Conference

The Partnership for Research in Marine Renewable Energy (PRIMaRE), a consortium of marine renewable energy experts across higher education, research, and industry in the UK, is hosting the 9th PRIMaRE Conference on 6-7 July 2022 in Cornwall, UK. Register here.

New Documents on *Tethys Engineering*

A feasibility assessment for co-locating and powering offshore aquaculture with wave energy in the United States – Garavelli et al. 2022

> Aquaculture, an industry that has typically relied on diesel for power, is expected to grow globally, presenting an opportunity to reduce greenhouse gas emissions by switching to renewable sources as it expands. As the aquaculture industry moves further offshore and is situated in more energetic environments, the prospect to co-locate offshore aquaculture with wave energy increases. To improve understanding of this potential, a feasibility assessment was completed to estimate the energy needs and wave resource required to power offshore finfish aquaculture operations. The study found it is possible to power offshore aquaculture operations entirely with wave energy. A spatial analysis was then performed to assess the suitability of co-locating offshore finfish aquaculture and wave energy off California and Hawaii.

Design and optimization of a bidirectional rim-generator turbine runner: Hydraulic performance optimization and structure strength evaluation – Luo et al. 2022

> As a type of reliable renewable energy, tidal energy has great potential for development. But its technology is behind other renewable energy sources. One of the constraints is the efficiency and stability of tidal turbine. The objective of the present work is to optimize a rim-generator turbine runner by improving hydraulic performance and stress level. A multi-objective optimization based on the response surface methodology is adopted during the optimization process so that an optimal runner blade can be identified. Both the blade shape and the number of the blade are determined. The numerical method is verified by comparing with the experimental test, and the numerical results show good agreement with the experimental results.

TIGER Report - Tidal stream technology and project development: Interim lessons learnt – Baldock Energy Limited 2022

> The TIGER (Tidal Stream Indsutry Energiser) project was launched in October 2019 and will be completed in 2023. The TIGER project will build cross-border partnerships to develop new tidal stream energy (TSE) technologies, test and demonstrate them at a number of project locations (mainly around the Channel region), and use the learning from these developments to make a stronger case for cost-effective TSE deployments as part of the France/UK energy mix. The aims of TIGER include the leveraging in of other funding for the actual installation of future TSE arrays at TIGER project locations, as important as obtaining the necessary consents within TIGER, which has been supported by the design work within TIGER. The project will deliver new designs for turbines with improved performance and lower cost, and for infrastructure and ancillary equipment.

Hydrodynamic performance of a horizontal cylinder wave energy converter in front of a partially reflecting vertical wall – Li et al. 2022

> Based on linear potential flow theory, this study investigates the hydrodynamic performance of a horizontal cylinder wave energy converter (WEC) in front of a wall. The wall is assumed to be a partially reflecting vertical one, and the circular cylinder is fully submerged and restricted to only heave motion. The structural hydrodynamic quantities, including wave excitation force, added mass coefficient and radiation damping coefficient, are estimated using the well-known wide-spacing approximation, and the wave energy capture performance of the device is investigated. The estimation only requires solving the problems of water wave diffraction and radiation by a submerged horizontal cylinder in an open fluid domain, which can be analytically solved using the multipole expansion method.

Blockage Corrections for Tidal Turbines—Application to an Array of Turbines in the Alderney Race – Dirieh et al. 2022

> Constrained vertically by the water depth and laterally by neighbouring turbines, the flow within a tidal farm is subjected to blockage effects that influence the performance of individual devices. The Betz limit can, therefore, be exceeded as demonstrated by Garrett and Cummins. Thus, beyond a significant blockage ratio, blockage effects should be considered when assessing the energy production of a tidal farm. The actuator disk method is particularly suited to simulate the flow field within an array of turbines under realistic tidal flow conditions. However, the implementation of actuator disks in coastal numerical models relies on relationships that neglect the blockage effects on the thrust and power of devices. We propose here an actuator disk formulation corrected to integrate these effects.

Control strategy of load following for ocean thermal energy conversion – Li et al. 2022

> Ocean thermal energy conversion (OTEC) provides a feasible solution for sustainable and stable power supply in remote islands. In this paper, a thermodynamic model of the OTEC system is developed to study the dynamic response of power output and superheating degree to manipulated variables. Afterward, a control strategy of load following for the island OTEC system is proposed. Finally, two controllers, MPC and PI, are designed and compared under fast and slow load changes as well as disturbance rejection test. The results indicate that the power output of OTEC system is sensitive to the speed of working-fluid pump, reaching the adjustment range of 14.7 kW when the nominal speed decreases by 30%. In addition, model predictive control (MPC) shows better performance in both rapid and slow load-change modes.

News & Press Releases

Sustainable Marine Powers Up Tidal Energy in Nova Scotia – Sustainable Marine Power

Sustainable Marine has officially powered up its tidal energy operation in Canada and is delivering clean electricity to Nova Scotia's power system. The company declared that its system in Grand Passage is ready to commence commercial operation on June 9, making it the first to deliver in-stream tidal power to the grid in Canada. After years of testing, the company has proven it can effectively deliver reliable, green energy to the grid while making a meaningful impact to the community here in Nova Scotia. Sustainable Marine is striving to deliver the world's first floating tidal array at FORCE (Fundy Ocean Research Centre for Energy). This project will be delivered in phases, drawing upon the knowledge gained and lessons learned in Grand Passage.

CorPower Ocean unveils commercial scale products to unleash utility scale wave farms – CorPower Ocean

CorPower Ocean recently unveiled the CorPower C4, its first commercial scale Wave Energy Converter and CorPack clusters, providing the building blocks for utility scale wave farms. The event is being broadcast online to an international audience from the Space Arena in Stockholm, Sweden. It comes as the wave energy developer prepares to deliver its flagship HiWave-5 Project in northern Portugal, with ocean deployment planned later this year. The new CorPower C4 device will ultimately form part of a four-system wave array, off the coast of Aguçadoura, Portugal, creating one of the world's first grid-connected wave farms. The CorPower C4, with 300kW power rating, represents the world's most compact wave energy system in relation to power output.

International Standards Are More Important (and Interesting) Than Most People Think: Newly Published Marine Energy Standards Mark the Industry's Coming of Age – National Renewable Energy Laboratory

Imagine you arrive in your Paris hotel room. You look for an outlet to charge your phone so you can search for the nearest bakery, but wait—that socket looks a little odd. What is going on? "That's the best example of where standards have really failed," said Jonathan Colby, the chair of the International Electrotechnical Commission's committee on marine energy standards, called Technical Committee 114 (TC 114). "Now, it's way too late," he continued. "Who's going to change all the electrical outlets globally?." That irreversible jumble is what Colby and TC 114 aim to avoid for a different kind of electrical conduit—nascent marine energy technologies, which could soon generate renewable energy from ocean and river currents, waves, tides, or even shifts in salinity or water temperature.

Slow Mill wave energy generator hits the water – Offshore Energy

Dutch wave energy company Slow Mill Sustainable Power has reached the milestone of deploying its wave energy generator into the water after constructing and testing the device. "Despite two years of slow pace pandemic progress, we managed to construct piece by piece of the device, transport it to the harbour, assemble it, build in the operational systems and dry test it", the company said in a recent update on social media. Slow Mill added that the device, Slow Mill – 40, will be installed at sea in front of the Dutch coast in June or July, depending on tides and weather. This will be another

milestone for the company's Slow Mill – 40, which is said to be the first-ever Dutch demonstration device for wave energy.

STRUCTeam and Ocean Energy Develop Composite Wave Energy Device with Sustainability – Renewable Energy Magazine

STRUCTeam, the engineering specialists are now extending their strategic insights to the application of composites in wave power with renewables company, Ocean Energy, and technical partners 3A Composites Core Materials and Sicomin. Ocean Energy approached STRUCTeam for support with a Horizon European Framework Program, an EU funding initiative. The overarching objective of the proposal is to secure a sustainable and competitive energy supply through renewable applications. The proposition centers around the development of an Oscillating Water Column (OWC), named the 'OE12 Buoy'. The wave energy convertor is designed to glide on the ocean surface and extract power from the motion of the water, this power is then converted into electricity.