TETHYS ENGINEERING BLAST

3 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 Survey

As part of the international community working to advance the marine energy industry, we would like to hear from you! We ask that you please fill out a brief, 3-minute survey by 9 June 2022 to help us evaluate and guide further development of *Tethys Engineering*.

MHKDR Survey

The *Marine and Hydrokinetic Data Repository (MHKDR)* team is also conducting a brief, 3-minute survey to help evaluate and guide further development of the *MHKDR*. Please respond to the survey by 9 June 2022.

Calls for Papers

The *Journal of Marine Science and Engineering* is accepting submissions for several Special Issues, including "Tidal and Ocean Current Energy" (due 20 July 2022), "Wave, Tidal and Offshore Wind Energy Site Assessment and Monitoring" (due 1 August 2022), and "Marine Wind and Other Ocean Energy Key Technologies" (due 20 September 2022).

Energies is accepting submissions for several Special Issues, including "New Challenges in Software for Marine Energy Applications" (due 31 July 2022) and "Recent Advances in Marine and Offshore Renewable Power Generation Technologies" (due 31 August 2022).

Funding & Testing Opportunities

The Interreg North-West Europe Programme has launched its first Call for Projects in the 2021-2027 period, and is looking for transnational cooperation initiatives that can deliver concrete results for the North-West Europe area. The Call for Projects will close on 15 June 2022.

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

The US Testing and Expertise for Marine Energy Research (TEAMER) program is now accepting Request For Technical Support (RFTS) 7 applications through 16 July 2022. Applications will be reviewed quarterly and those submitted after the due date will be considered for the next RFTS. Visit the TEAMER website for more details.

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.

Student & Employment Opportunities

The University of Hull is recruiting two Lecturers in Renewable Energy to join the Energy and Environment Institute and deliver masters level teaching alongside other staff from across the University. Applications are due 3 June 2022.

MaREI, the Science Foundation Ireland Research Centre for Energy, Climate, and Marine is seeking a Tidal Energy Research Fellow to join the Sustainable and Resilient Structures Research Group based at National University of Ireland, Galway. Applications due 5 June 2022.

The Environmental Research Institute at the University of the Highlands and Islands (ERI-UHI) is looking for a Marine Acoustic Engineer to lead development of an integrated system for marine mammal mitigation from offshore developments (e.g. windfarm, oil & gas, harbour construction, etc.) on marine mammals. Applications due 13 June 2022.

The School of Marine and Atmospheric Sciences at Stony Brook University is looking to hire a Glider Technician to help monitor oceanographic conditions on the continental shelf and support wind farm developments. Applications are due 15 June 2022.

Oneka Technologies is seeking applicants for multiple positions, including Chief Operating Officer, Process/Desalination Engineer, Mechanical Drafter-Designer, Mechanical Engineer in Digital Simulation, and Installation Site Coordinator. View all available positions here.

Upcoming Events

Upcoming Webinars

The Marine Energy Data Pipeline effort, led by Pacific Northwest National Laboratory (PNNL), recently released the latest version of Tsdat, a data ingestion pipeline that can be used to read, process, run quality control, and convert raw data to standard formats. To learn more about Tsdat and its architecture, join the "Marine Energy Data Pipeline Updates" webinar on 14 June 2022, from 12:00-1:00pm PDT (7:00-8:00pm UTC). A recording will be made available on the Portal and Repository for Information on Marine Renewable Energy (PRIMRE).

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.

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 Conferences

Scotsman Conferences is hosting the Highlands and Islands Green Energy Conference on 8 June 2022 in Inverness, Scotland.

The Pan American Marine Energy Association is hosting the Pan American Marine Energy Conference (PAMEC 2022) on 19-22 June 2022 in Ensenada, Mexico, with workshops on 17-18 June 2022. Register here.

The Partnership for Research in Marine Renewable Energy (PRIMaRE) and University of Exeter are hosting the 9th PRIMaRE Conference on 6-7 July 2022 in Cornwall, UK. Register here.

New Documents on *Tethys Engineering*

Temporal complementarity of marine renewables with wind and solar generation: Implications for GB system benefits – Pennock et al. 2022

> Wave and tidal energy have the potential to provide benefits to power systems with high proportions of stochastic renewable generation. This is particularly applicable in combination with wind and solar photovoltaics, as the offsetting of these renewable resources results in more reliable renewable generation. This study utilises ten metrics to quantify the temporal complementarity and supply-demand balancing requirements of the energy mix in Great Britain, to investigate the potential magnitude of these system benefits. Wave and tidal generation profiles are created using historical resource data and hydrodynamic models.

Dynamics analysis of the power train of 650 kW horizontal-axis tidal current turbine – Liu et al. 2022

> Power trains are an important component of the tidal current energy conversion systems; however, the variable drive-torque and unbalanced moments produced by flow shear and turbulence cause power trains to vibrate. When the scale of the tidal current turbine increases, the vibration problem becomes prominent. The dynamic characteristics of power trains are complex. In this study, the power train of a 650 kW horizontal-axis tidal current turbine was studied. The power train adopted a low-speed-ratio semi-direct drive scheme proposed by Zhejiang University. A mathematical model of the power train was constructed. The influence of external excitations on dynamic characteristics was studied using simulations and sea trials.

An Assessment of the Financial Feasibility of an OTEC Ecopark: A Case Study at Cozumel Island – Tobal-Cupul et al. 2022

> The aim of this article is to show how an OTEC Ecopark could provide comprehensive, sustainable, and quality products that satisfy the diverse needs of coastal communities in Mexico. An offshore 60 MW hybrid Ocean Thermal Energy Conversion (OTEC) plant is proposed, which will provide products that will not only fulfill the water, energy, and food needs of the coastal communities, but also energize the local blue economy. An assessment of the financial feasibility of the plant as well as a comparative analysis against other forms of energy generation was carried out. The methodology section includes a market description, literature review for the technical design, methods for mitigating socio-environmental risks, and an analysis of operational risks.

Hydrodynamic characteristics of a hybrid oscillating water column-oscillating buoy wave energy converter integrated into a π-type floating breakwater – Cheng et al. 2022

> Combining multiple-types of Wave Energy Converters (WECs) and integrating them into in-development or pre-existing marine platforms can reduce the total Levelised Cost of Energy (LCoE) by sharing infrastructures and maintenance costs. The current study proposes an innovative multi-purpose solution by deploying an Oscillating Buoy device inside the chamber of an Oscillating Water Column (OWC) WEC integrated into a π-type floating breakwater. A fully non-linear time-domain model based on the Higher-Oder Boundary Element Method (HOBEM) is established to investigate the hydrodynamic performance of the proposed concept. The non-linear time-domain model is generalised to incorporate the OWC (aero and hydrodynamics coupling) and multi-body interaction.

Influence of pitching motion on the hydrodynamic performance of a horizontal axis tidal turbine considering the surface wave – Wang et al. 2022

> A CFD numerical method is established under the wave-current condition, used to analyze the hydrodynamic performance of a horizontal-axis tidal turbine based on floating platform with rotation and pitching motion. The inflow direction load, pitch moment and power coefficients with different depths of the blade tip-immersion, the

periods and amplitudes of the pitch, wave heights are obtained. The three coefficients have obvious periodically fluctuated with the pitching and wave frequencies, while the time mean of those have changed little with increasing of the depth of blade tip-immersion, wave height, pitch (wave) period and pitching amplitude.

Coupling Hydrodynamic and Energy Production Models for Salinity Gradient Energy Assessment in a Salt-Wedge Estuary (Strymon River, Northern Greece) – Zachopoulos et al. 2022

Salinity gradient energy (SGE) plants generate power from the mixing of salt water and fresh water using advanced membrane systems. In the Strymon River, under low-flow conditions, a salt wedge is formed, developing a two-layer stratified system, which could be used to extract SGE. In this paper, a novel study was implemented by coupling a 3D hydrodynamic model simulating the salt wedge flow, with the SGE model which assesses the net energy produced by a 1 MW SGE plant. Two scenarios were followed: (a) the optimal scenario, operating throughout the year by mixing salt water from the sea (38.1 g/L) and fresh water (0.1 g/L) from the river to produce 4.15 GWh/yr, and (b) the seasonal scenario, utilizing the salinity difference of the salt wedge.

News & Press Releases

DOE Announces Winners of 2022 Marine Energy Collegiate Competition – US Department of Energy (DOE)

The US DOE recently announced the winners of the 2022 Marine Energy Collegiate Competition (MECC). Webb Institute emerged as the overall winner in this third annual competition. Alongside the 2022 MECC winners, DOE also announced the new wave of students who will compete in the inaugural Hydropower Collegiate Competition and 2023 MECC. The MECC calls on multidisciplinary teams of undergraduate and graduate students to propose new ideas for marine energy to capture the power of the ocean. The 17 student-led competing teams developed designs and business plans to power blue economy activities using a diverse range of marine-energy technologies.

Giant Deep Ocean Turbine Trial Offers Hope of Endless Green Power – Bloomberg

For more than a decade, Japanese heavy machinery maker IHI Corp. has been developing a subsea turbine that harnesses the energy in deep ocean currents and converts it into a steady and reliable source of electricity. The giant machine resembles an airplane, with two counter-rotating turbine fans in place of jets, and a central ‘fuselage’ housing a buoyancy adjustment system. Called Kairyu, the 330-ton prototype is designed to be anchored to the sea floor at a depth of 30-50 meters. In commercial production, the plan is to site the turbines in the Kuroshio Current, one of the world’s strongest, which runs along Japan’s eastern coast, and transmit the power via seabed cables.

During the Israel-Greece Conference Hosted by the Leading Financial Magazine- Calcalist, Inna Braverman, Founder and CEO of Eco Wave Power, Reveals Plans for a 1MW Project in Halki Island, Greece – Eco Wave Power

Inna Braverman, Founder and Chief Executive Officer of Eco Wave Power recently presented Eco Wave Power's innovative technology to an international collection of distinguished business leaders, senior government officials and investors at the annual Israel-Greece Conference. She presented the Company's newly planned project in the island of Halki in Greece. "Halki Island… plans on combining 1 megawatt of solar energy, 1 megawatt of wind energy and 1 megawatt of wave energy and the EU program New Energy Solutions Optimized for Island is providing funding for Eco Wave Power's feasibility study in the island that we expect to complete by the end of this year, which will enable the construction of the first ever grid-connected 1 megawatt array in Greece."

Wello and Taiwan's NTOU sign to deploy wave energy in Taiwan – Wello

Wello is excited to announce the signing of an MOU between Wello Oy and National Taiwan Ocean University's Centre for Ocean Energy Systems (NTOU) for the exploration, and deployment of Wello's wave energy converter in Taiwan. On Monday May 30th representatives from Wello and NTOU met in Keelung city, Taiwan to sign a document outlining the plans to deploy Wello's wave energy converter off the coast of Taiwan. In attendance of the signing ceremony were also the Ministry or Foreign Affairs, The Industrial Technology Research Institute (ITRI), the Keelung City Government, and representatives from Finland Trade Centre in Taiwan.

Floating solar, tidal energy plant goes online in China – PV Magazine

CHN Energy has connected a 100 MW floating solar plant to the grid in China's Zhejiang province. The array is linked to the country's largest tidal energy project, near the city of Wenling. The Jiangxia Experimental Tidal Power Station was commissioned in 1980 and is the fourth-largest system of its kind in the world. It consists of six dual-way tidal power generators with a combined capacity of 4.1 MW. The facility is owned and operated by Longyuan Power, which is a partially owned subsidiary of state-owned China Energy Investment. CHN Energy said the solar plant will have an annual power generation of 100 million kWh. It will meet the energy demand of around 30,000 residents.