TETHYS ENGINEERING BLAST

17 December 2021

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

New PRIMRE Factsheet

Did you know that *Tethys Engineering* is one of seven Knowledge Hubs within the Portal and Repository for Information on Marine Renewable Energy (PRIMRE) ecosystem? To learn more about PRIMRE and the other Knowledge Hubs, check out the new PRIMRE Factsheet!

OPIN Survey

The Ocean Power Innovation Network (OPIN) is conducting a survey on current practices for corrosion protection of offshore reinforced concrete structures. The results will be analyzed and compiled in an OPIN report on future paths to reduce corrosion costs for offshore renewables.

Horizon Europe Update for UK Applicants

If you're a UK-based researcher or innovator, you can now apply to most Horizon Europe funding opportunities on the same terms as EU-based applicants. The UK government recently announced a new financial safety net for successful UK-based applicants. Learn more here.

EnergyTech University Prize

The US Department of Energy's (DOE) Office of Technology Transitions recently launched the EnergyTech University Prize, a collegiate competition challenging multidisciplinary student teams to develop and present a business plan that leverages DOE national laboratory-developed and other energy technologies. The Explore Phase will close on 31 January 2022.

Calls for Papers

Frontiers In Energy Research is accepting submissions for several Research Topics, including "Development of Advanced Methods for Offshore Integrated Wind-Wave Power Generation Devices" (due 28 January 2022) and "Next Generation Offshore Facilities: Offshore Renewable Energy" (due 10 February 2022).

Energies is accepting submissions for several Special Issues, including "Offshore Energy Transition Towards Carbon Neutrality" (due 7 February 2022), "Advanced Development on Solar, Wind and Tidal Energy" (due 10 February 2022), and "Innovation in Grid Connection and Control of Offshore Renewable Energy Systems" (due 25 February 2022).

Funding & Testing Opportunities

The US DOE is providing $54 million for small businesses pursuing climate and energy research and development projects through its Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) programs. Letters of intent for the SBIR/STTR Phase 1 Release 2 are due by 5:00pm EST (10:00pm UTC) on 3 January 2022.

The Horizon Europe Framework Programme recently launched several funding opportunities, including, "Demonstration of wave energy devices to increase experience in real sea condition" (proposals due 5 January 2022), "Next generation of renewable energy technologies" (proposals due 23 February 2022), and "Innovative foundations, floating substructures and connection systems for floating PV and ocean energy devices" (proposals due 23 February 2022).

The European Maritime, Fisheries and Aquaculture Fund has launched a Call for Proposals to support strategic collaboration in the Atlantic, Black Sea, and Western Mediterranean. Proposals for Topic 1, "Innovative multi-use projects combining offshore renewable energy with other activities and/or with nature protection in the Atlantic", are due 12 January 2022.

Upcoming Events

Upcoming Webinar

Sandia National Laboratories' Water Power program is hosting a webinar, "FOSWEC Digital Twin: A Virtual Real-Time Model of As-Built Wave Energy Hardware," on 17 December 2021 from 11:00am-12:30pm MST (6:00-7:30pm UTC). The webinar will showcase a "digital twin" model that captures the dynamics of the Floating Oscillating Surge Wave Energy Converter (FOSWEC) and the sensor/actuator interface of the hardware. Register here.

Upcoming Conferences

The Global Underwater Hub is hosting Subsea Expo, a subsea exhibition and conference, on 22-24 February 2022 in Aberdeen, Scotland. Register for free here.

The American Geophysical Union, the Association for the Sciences of Limnology and Oceanography, and The Oceanography Society are hosting the 2022 Ocean Sciences Meeting from 27 February to 4 March 2022 online. Registration is now open here.

The Basque Energy Cluster and Ocean Energy Europe (OEE) have teamed up to host a joint event on 18-20 October 2022 in Donostia-San Sebastián, Spain, combining the International Conference on Ocean Energy and OEE's Conference & Exhibition (ICOE-OEE 2022).

New Documents on *Tethys Engineering*

Cost-optimal wave-powered persistent oceanographic observation – Dillon et al. 2022

> Historically, energy constraints have limited the spatial range, endurance and capabilities of ocean observation systems. Recently developed wave energy conversion technologies have the potential to help overcome these limitations by providing co-located and persistent power generation for ocean observations, enabling new opportunities for ocean research. In this paper, we develop the first techno-economic model for wave-powered ocean observation systems and use the model to study system characteristics and cost drivers. Our model utilizes time-domain simulation and optimization to identify cost-optimal system characteristics and to estimate capital and operational costs. Using our model, we evaluate the use of wave energy to power a 200 W ocean observation system deployed for five years at five unique geographic locations.

The effects of heave motion on the performance of a floating counter-rotating type tidal turbine under wave-current interaction – Huang et al. 2022

> Wave induced motions due to actual sea state conditions will impact the performance of floating counter-rotating type tidal turbines. The wave-current interaction is a significant factor in determining the heave motion of turbines. The present study aims at investigating the effects of heave motion on the performance of a floating counter-rotating turbine under wave-current interaction. In this study, the numerical method is used to study how the heave amplitude and frequency affect the main hydrodynamic coefficients of the turbine, including the power coefficient and thrust coefficient. The form of sliding mesh combined with overset mesh is adopted, and the heave motion of the turbine is realized by the movement of the overset mesh. The simulation results show that the heave motion has an adverse effect on the hydrodynamic performance of the counter-rotating tidal turbine.

Optimal design of radial inflow turbine for ocean thermal energy conversion based on the installation angle of nozzle blade – Chen et al. 2022

Ocean Thermal Energy Conversion (OTEC), as a new type of renewable energy, has huge development potential. Turbine is the most critical component in the ocean thermal energy conversion system, which directly determines the performance and energy conversion efficiency of the system. Therefore, the optimal design of turbines is very important to improve the efficiency of ocean thermal energy conversion. Based on the full consideration of the small temperature difference application characteristics of ocean thermal energy conversion and the special thermophysical properties of organic working fluids, this paper designs an ammonia working centripetal turbine with a power of 100 kW for OTEC applications, and then analyzes the effect of different geometric parameters on turbine performance.

Wave energy capture by an omnidirectional point sink oscillating water column system – Mayon et al. 2021

The Oscillating Water Column (OWC) is one of the most popular Wave Energy Convertor (WEC) technologies, but the energy conversion efficiency is still very low and is a bottleneck to limit its application and commercialization. A novel OWC system comprising of a cylindrical OWC WEC and a parabolic wave reflector was proposed and a revolutionary breakthrough in the hydrodynamic efficiency was obtained. To further validate this new concept, three independent model domain scenarios are developed using the open-source computational fluid dynamics software OpenFOAM. The first simulation model investigates the hydrodynamic efficiency of the OWC in open sea conditions and the second scenario investigates the performance of the OWC when it is located adjacent to a solid, vertical wall which is orientated perpendicularly to the incident wave direction.

A numerical investigation of tidal current energy resource potential in a sea strait – Burić et al. 2021

There is a growing research interest in tidal current energy, as it is more predictable when compared to wind and solar. Most past studies on tidal current energy focused on assessing the potential resource of sites with known fast tidal currents. Regions with less energetic tidal currents, but shallow waters for easy installation of energy infrastructure, have not been investigated. One potential tidal current energy location, which fits this categorization, is the strait of Novsko Ždrilo that connects the Novigrad Sea with the Adriatic Sea. In this study a high resolution 3D hydrodynamic model SCHISM was used to estimate the tidal current energy resource potential of this strait. The model results show that tidal current velocities are up to ten times higher than in the outer sea and vary spatially within the strait.

High energy recovery from salinity gradients in a concentration flow cell enhanced by bioelectrochemical currents – Lu et al. 2021

An enormous source of clean energy, called salinity gradient (SG) energy, exists from mixing waters with different salinities. Harvesting SG energy has attracted lots of attentions to develop efficient technologies. However, the power output is still limited. In

this study, a concentration flow cell (CFC) powered by a bioelectrochemical system, defined as a bio-CFC, was proposed to recover SG energy from synthetic seawater (30 g/L NaCl) and river water (1 g/L NaCl) efficiently. The maximum power density of the bio-CFC reached 42 ± 2 W/m2, which was three times higher than that of a single CFC (10.6 ± 0.1 W/m2). The significant improvement was attributed to the additionally developed capacitive potential, which was formed by the bioelectrochemical currents from degradation of the organics in wastewater.

News & Press Releases

Isle of Wight tidal power initiative gains full approval – Perpetuus Tidal Energy Centre

Planning permission was recently granted for the onshore elements of a ground-breaking tidal energy generation project: Perpetuus Tidal Energy Centre (PTEC). The Isle of Wight Council has unanimously approved the construction of a substation within the Southern Water Services compound to the west of Ventnor. This approval is a huge boost to the UK's renewable energy sector. PTEC now has all the consents in place to proceed with their proposal – England's first multi megawatt tidal stream power generation project. By placing tidal turbines in the sea off the south coast of the Isle of Wight, the project will supply predictable, renewable energy direct to the national grid. PTEC has already signed an agreement with technology developer Orbital Marine Power to deploy its innovative and proven O2 turbine with the project.

Biggest ever renewable energy support scheme opens – UK Government

The biggest ever round of the UK government's flagship renewable energy support scheme is now open to applications, with £285 million available a year for building the next generation of Great Britain's green energy projects. Renewable energy projects across Great Britain can now bid for funding in the fourth round of the Contracts for Difference scheme, which is aiming to secure 12GW of electricity capacity – more renewable capacity than the previous 3 rounds combined. The additional offshore wind capacity resulting from the funding alone could generate enough electricity to power around 8 million homes. Compared to the previous round, this is open to an expanded number of renewable energy technologies, with offshore wind, onshore wind, solar, tidal and floating offshore wind projects, amongst others, all eligible to bid for funding.

Scottish energy innovators win €2.5M to turn up the tempo of tidal power – Nova Innovation

Tidal titans Nova Innovation have won €2.5 million to build an upscaled tidal energy turbine that will further slash the cost of tidal power and meet the needs of utility clients and coastal populations around the world. The European Innovation Council Accelerator Fund will finance Nova's UpTEMPO (Upscaling Tidal Energy Manufacturing and Production Output) project – a two-year campaign to design, build, and demonstrate an enhanced version of Nova's 100kW tidal turbine. The advanced 200kW device will

feature blade pitch control, increasing the amount of power and energy generated, and a more compact turbine body that will reduce the weight and cost of the device. Together, these innovations will cut the cost of tidal energy by 30%, smashing the EU Strategic Energy Technology Plan tidal energy cost target of €150/MWh by 2025.

Spain approves offshore wind and marine energy roadmap – Offshore Energy

Spain's Council of Ministers, at the proposal of the Ministry for the Ecological Transition and the Demographic Challenge, has approved the Roadmap for the Development of Offshore Wind and Marine Energy. The Roadmap contains 20 lines of action with the aim of reaching between 1 GW and 3 GW of floating offshore wind power capacity by 2030–up to 40 per cent of the EU target–and up to 60 MW of other pre-commercial marine energies such as waves or tidal energy. Spain will also spend at least €200 million by 2023 on the advancement and development of offshore renewable energy technologies as the country tries to position itself as the leader in the field of research & development. The port infrastructure will also be evaluated under the Roadmap, and between €500 million and €1 billion is expected to be invested to cover the new logistics needs.

Further progress for Morlais as marine licence granted – Morlais Energy

Natural Resources Wales recently confirmed that it will grant the necessary marine licence to develop tidal energy scheme, Morlais, off the west coast of Anglesey. This is another major step forward for the project and it means that developers of tidal stream technology can deploy their devices in the sea to generate electricity. Morlais is run by locally-based social enterprise, Menter Môn. The development will be located off the north west coast of Holy Island, generating clean electricity from one of the strongest tidal resource in Europe. Now that all the necessary consents are in place, construction and operation will happen in phases to enable monitoring of impact on wildlife and habitat. Work on land is expected to begin next year, with work offshore to start in 2023.