TETHYS ENGINEERING BLAST

28 February 2020

Tethys Engineering is an online knowledge base that facilitates the exchange and dissemination of information on the technical and engineering aspects of marine renewable 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.

Announcements

Waves to Water Prize

The Water Power Technologies Office at the U.S. Department of Energy has launched the second stage of the Waves to Water Prize, which seeks to accelerate technology innovation in wave energy powered desalination systems. Submissions are due 13 March 2020.

Call for Abstracts

Abstracts are currently being accepted for the 5th Asian Wave and Tidal Energy Conference (AWTEC 2020), which will be held in Hobart, Australia from 8-12 November 2020. Abstracts must be submitted through the presentation portal before 1 March 2020. Authors of accepted abstracts will then be required to submit a full paper through the conference portal before 20 June 2020.

Tender Call

The Selkie Project is inviting wave energy developer companies to tender their services to validate the five tools developed during the project. Further information and details for application are available here. The application deadline is 30 March 2020.

Employment Opportunities

The Centre for Ocean Energy Research at Maynooth University currently has a vacancy for a PhD student in the area of real-time control of wave energy devices. The project focusses on a commercial device currently under development at CorPower Ocean. To apply for this job, email your details to CarrieAnne.Barry@mu.ie.

Orbital Marine Power is currently seeking a full time Loads & Control Engineer to develop design improvements to the turbine dynamic controller. For a full job description and details of how to apply please contact: office@orbitalmarine.com.

Carnegie Clean Energy is currently seeking a Hydrodynamic Engineer, an Electrical Machine Expert, and a Machine Learning Expert to join their technical team. Applications should be sent to careers@carnegiece.com.

Upcoming Events

Upcoming Workshop

In collaboration with MaRINET2, WavEC Offshore Renewables will be hosting a short course entitled, Installation and O&M of Offshore Renewable Energy Systems. The short course will take place in Viana do Castelo, Portugal from 13-14 May 2020. There is no registration fee, and travel & subsistence support is available to early-stage researchers and postgraduate students. Registration closes 7 April 2020.

Upcoming Conferences

Oceanology International (OI 2020) will be held in London, U.K. from 17-19 March 2020.

France Energies Marines' third Scientific & Technical Tribune dedicated to offshore renewable energy will be held in Champs-sur-Marne, France on 20 March 2020. Register here.

OCEANS 2020 will be held in Singapore from 6-9 April 2020. Early bird registration is available until 6 March 2020.

New Documents on *Tethys Engineering*

Enabling Power at Sea: Opportunities for Expanded Ocean Observations through Marine Renewable Energy Integration – Green et al. 2020

> The blue economy is a dynamic and rapidly growing movement that captures the interplay between economic, social, and ecological sustainability of the ocean and encompasses numerous maritime sectors and activities (e.g., commerce and trade; living resources; renewable energy; minerals, materials, and freshwater; and ocean health and

data). The U.S. Department of Energy Water Power Technologies Office is exploring the potential for marine renewable energy (MRE) devices (largely wave and tidal energy converters) to provide power to support multiple blue economy opportunities.

Investigation of array layout of tidal stream turbines on energy extraction efficiency – Zhang et al. 2020

A two-dimensional model based on OpenTidalFarm is applied to simulate tidal stream flow around turbines. The model is governed by shallow water equations and is able to optimize the layout of the deployed turbine array in terms of maximizing the energy outputs. Three turbine array layouts including two structured layouts (regular and staggered) and one unstructured layout (optimized) are simulated to investigate the effect of turbine layouts on energy extraction. Taking the tidal array around Zhoushan Islands as a case study, results show that the optimized layout can extract 106.8% energy of that extracted by the regular and staggered layout for a full tide in the same marine area.

A New Integrated Ocean Thermal Energy Conversion-Based Trigeneration System for Sustainable Communities – Hasan and Dincer 2020

A novel ocean thermal energy conversion (OTEC) system is proposed for the production of methanol; cooling and power is developed and energetically analyzed. In this proposed trigeneration system, a two-stage Rankine cycle that operates on the inherent temperature difference along the depth of the ocean is used for power production, along with an electrolytic cation exchange membrane (ECEM) reactor for carbon dioxide and hydrogen production to feed the methanol production system. The carbon dioxide is sourced from the deep cold seawater, where the concentrations are found to be the highest.

The performance of the three-float M4 wave energy converter off Albany, on the south coast of western Australia, compared to Orkney (EMEC) in the U.K. – Santo et al. 2020

This paper presents a numerical study on the hydrodynamic performance of a vertical pile-restrained wave energy converter type floating breakwater. The aims are to further understand the characteristics of such integrated system in terms of both wave energy extraction and wave attenuation, and to provide guidance for optimising the shape of the floating breakwater for more energy absorption and less wave transmission at the same time. The numerical model solves the incompressible Navier-Stokes equations for free-surface flows using the particle-in-cell method and incorporates a Cartesian cut cell based strong coupling algorithm for fluid-structure interaction.

Uncertainty quantification in tidal energy resource assessment – Kreimair 2019

In river and tidal stream power assessment, uncertainties arise from model assumptions and the inexact specification of physical and numerical model parameters. Combined, such uncertainties can greatly affect power estimates for a given site. The thesis examines the effects of bed roughness and turbine drag uncertainties on turbine power estimates. An analytic model is developed for transfer of bed friction uncertainty to power extracted

from turbines in a strait, representative of a river. A validated finite volume solver of the shallow water equations is developed and applied to simulate flow driven by a constant head difference through a one-dimensional strait.

Variability of the thermohaline structure of a coastal hypersaline lagoon and the implications for salinity gradient energy harvesting – Reyes-Mendoza et al. 2020

Natural and artificial systems containing water resources that have different salinities can be used to generate salinity-gradient energy (SGE). In this paper, the feasibility of implementing SGE in hypersaline coastal lagoons is addressed, taking the coastal lagoon La Carbonera in Yucatan, Mexico, as an exemplary case. A realistic approach to the exploitation conditions and potential that could occur in a SGE plant in these ecosystems is presented. We first analyzed the variability of salinity and temperature in the three characteristic zones of the coastal lagoon and the correlation of these variables with atmospheric forcing.

News & Press Releases

Magallanes at EMEC Through Horizon 2020 Projects – European Marine Energy Centre

Tidal energy developer Magallanes Renovables have been successfully testing their second generation, 2MW tidal platform 'ATIR' at the EMEC, since 2018, as part of the Ocean_2G project. The aim of the project was to test, validate and pre-certify Magallanes' device and this was successfully achieved through a structured programme of testing, which resulted in the ATIR generating electricity into the UK national grid for the first time in 2019. This has allowed Magallanes to demonstrate the operational performance of the device and brings them closer to readying the technology for market.

Malin Wins $1.3m Wave Energy Contract – Marine Technology News

Malin has been appointed by AWS Ocean Energy Ltd to build the half scale Archimedes Waveswing power generation device, designed for offshore wave energy production. The development of the Archimedes Waveswing is funded by Wave Energy Scotland through its Novel Wave Energy Converter program. The Waveswing will be fabricated and assembled at Malin's Westway Park site in Renfrew. Activity will commence immediately to create the first partial-scale converter, which will work to verify the concept to drive forward grid scale and micro grid scale variants.

Norway Scouts Marine Energy Options in India – Marine Energy

GCE Ocean Technology, Innovation Norway and National Institute of Ocean Technology recently held a meeting in Chennai, India to discuss opportunities for Norwegian ocean players. Offshore wind, marine renewable energy and ocean research are topics of essence for both Norway and India and these markets are said to represent huge growth

potential. India has a vast ocean area that is not yet fully explored and utilised and is a country prognosed to multiply its energy consumption by 3.5 times by 2040.

Minesto signs PPA with electric utility SEV for utility-scale tidal energy installations – Minesto

Leading marine energy developer Minesto has signed a power purchase agreement (PPA) with the Faroese electric utility company SEV, advancing the parties' collaboration to integrate tidal energy in the Faroe Island's electricity mix. The PPA comprises both the planned installations of two 100kW systems of Minesto's subsea kite technology and an additional 2MW capacity allocated for installations of utility-scale tidal energy systems in the Faroe Islands.

NOVACAVI Cables for ISWEC Prototype – Marine Energy

NOVACAVI has contributed to the development of technologies that convert sea wave power into electrical energy, with a special custom cable engineered to connect the pilot unit moored offshore to the network of the ISWEC prototype (Inertial Sea Wave Energy Converter) within the Eni MaREnergy research programme. Installed offshore Ravenna by ENI, ISWEC is the world's first example of the "smart grid" system for the production of wave energy combined with photovoltaic and energy storage.