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Nearshore wave energy resource assessment for off grid islands: a case study in cuyo island, palawan, philippines

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Electrifying off-grid and isolated islands in an archipelagic countries like the Philippines remains one of the challenges that hinders community development. So far, most off-grid island communities relies heavily on imported oils for its power generation needs, which has its drawback in terms of transportation and the continuous increase of oil prices. One of the solutions seen to ensure energy security, expand energy access and promote a low carbon future in this isolated islands is the use of renewable energy sources.. This study determines the nearshore wave energy resource during monsoon seasons in Cuyo Island using a 40-year wave hindcast and 8 - year on-site wind speed data as inputs to develop a high-resolution wave energy model using SWAN and assesses its annual energy production through matching with wave energy devices. The results show that the average significant wave height (Hs), peak period (Tp) and wave power density (Pd) during a northeast monsoon are Hs = 1.35 m, Tp = 4.79 s and Pd = 4.05 kW/m, respectively, while a southwest monsoon, which is sheltered by the mainland, results in Hs = 0.52 m, Tp = 3.37 s and Pd = 0.34 kW/m. While the simulated model was observed to overestimate the significant wave height (bias = 0.398, RMSE = 0.54 and SI = 1.34), it has a strong relationship with the "observed values" (average r = 0.9). The annual energy production for Wave Dragon, Archimedes Wave Swing and Seawave Slot-Cone Generator are highest at 1970.6 MWh, 2462.04 MWh, 62.424 MWh and 4099.23 MWh, respectively. The highest AEP is at station F, SSG with 4099.23 MWh, followed by WD7 with 2462.04 MWh, but in terms of capacity factor, WD7 is the highest at 3.4%; low capacity factors happen because the majority of the data falls on lower values of Hs and Tp where the wave energy device is not capable of producing energy or the energy produced is low. Although the highest is only at a 3.4% capacity factor, it can supply 28.53% of the islands' average power demand or 20.0% of their peak demand. If these scenarios can be realized, they will be able to lessen the country's dependency on fossil fuels for electrifying off-grid and isolated islands. Results show that downscaling of WEC to increase the capacity factor of the device in milder resources can answer the challenges in bringing sustainable renewable energy resources to unviable islands in the Philippines or in any areas ofthesameclimatecharacteristics.

Biography

Engr. Jonathan Pacaldo is a faculty of Electrical Engineering Department, Palawan State University, Philippines and handles core and higher mathematics subjects. Currently, he is enrolled in the Doctor of Engineering – Energy Systems Program of the University of San Carlos, Cebu City, Philippines as Department of Science and Technology (DOST) Graduate Scholar. His interest are on the fields or renewable energy, power systems, energy audit and infrastructure. Philippines being archipelagic country aroused his interest in the field of marine renewable energy specifically on the resource assessment part since none has been conducted in the province of Palawan and few are conducted in the whole country. Engr. Pacaldo, teamed up with Dr. Teh Hee Min of the Universiti Teknologi Petronas, Malaysia and worked on the wave energy resource assessment of Dumaran Island, Palawan, for future deployment of a wave energy converter in the island.

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