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Tidal energy assessment with hydrodynamic modelling

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ABSTRACT

The increasing demand for sustainable energy generation brings a need for tidal current energy resource exploration around the globe. Hydrodynamic modelling is an essential aspect to explore macro tidal sites. In the current research paper, a 2D hydrodynamic model is set up by utilizing the numerical application of Delft3D. The model is validated against the database results and the two macro tidal sites are identified along the coastline of Sarawak, Malaysia. The maximum available kinetic energy flux at the identified location is 0.6 kW/m2, during peak neap tide hours. This stands as a sound justification to have a detailed tidal energy assessment study in this area in future research.

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1. INTRODUCTION

Increasing concerns about sustainable energy generation have triggered considerable advancement in the tidal stream industry. The tidal stream industry is in the initial stage of converting the full-scale tested prototypes to a commercial level, therefore the planning of tidal stream sites needs to follow a strategy to maximize their potential [1]. Among the marine renewable energies, tidal stream, as well as tidal range technology, are the most promising renewable sources due to their highly predictable potential [2], [3]. Because of the increased prediction and accuracy rate of the tides, the output power of a particular tidal power plant is also highly predictable, which is an essential parameter in the cost-benefit evaluation phase. Compared to wind energy generation, the tidal stream flow highly depends upon the phases of the moon, and sun, and therefore tidal power prediction is comparatively more accurate [4]. Furthermore, the density of seawater is almost 800 times higher than the density of air, in this way the power generation by a Tidal energy converter (TEC) will be higher than the wind machine at an appropriate rated speed. Moreover, the extreme velocity of the wind can damage the wind machines, however, the TECs do not incorporate such damage because of the absence of extreme tidal flow velocities. Apart from the advantages of tidal stream technologies, they can lay minor negative impacts on the marine environment. The major drawbacks include the impact on the biota at the plant site, morphodynamics, and sediment transport. It is therefore important to have a detailed impact assessment before selecting the tidal stream energy site.