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UNVEILING FUTURE OFFSHORE WIND POTENTIAL: A MULTICRITERIA FRAMEWORK FOR SUSTAINABLE DEVELOPMENT

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Abstract – Climate change poses a critical threat to the environment and human societies, prompting a shift towards clean energy sources. Among these sources, offshore wind energy emerged as a promising alternative due to its consistent and strong wind resource availability, coupled with matured technology. However, offshore wind energy being susceptible to the climate change, the efficiency, reliability, and financial viability of the offshore wind farms is location specific. Therefore, the present study introduces a novel framework for identifying suitable regions for offshore wind farm development by considering future projections under the various Shared Socioeconomic Pathway (SSP) scenarios. A weighted multi-model ensemble (MME_{wt}) created using nine Coupled Model Intercomparison Project Phase 6 (CMIP6) climate models was considered for the analysis. The suitability of a location is evaluated considering richness, stability of the resource, risk, and economic factors. CRiteria Importance Through Intercriteria Correlation (CRITIC) multi-criteria technique is used to evaluate the prominence of each factor. Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) is used to determine the suitability of each grid within the study area and their hierarchy. Findings of this study showed that the northwestern and southern regions within the study area are relatively plausible compared to other regions. The proposed methodology built on the theoretical framework of multi-criteria techniques can be extended to other regions and determine the suitability map of plausible wind regions over the specified area for future time periods.

Keywords – Climate change; CMIP6 climate models; multi-model ensemble; multi-criteria techniques; offshore wind energy