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Determining Key Criteria for Solar Farm Location Selection in Riau, Indonesia: An Expert Approach and Sensitivity Assessment

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ABSTRACT

Indonesia faces an urgent need to accelerate its transition to renewable energy due to rising greenhouse gas emissions. This study aims to identify optimal locations for solar farm development in Riau Province, which holds the second-largest solar potential nationally (290 GW) and receives 4–5 kWh/m² of daily solar radiation. Analytical Hierarchy Process (AHP) was used to evaluate six criteria: solar radiation, air temperature, slope, aspect, distance to built-up areas, and distance to main roads. Findings show that solar radiation is the most influential criterion (45%), followed by slope (23%) and aspect (16%). Sensitivity analysis indicates that removing solar radiation shifts weight to topographic factors and improves consistency, while excluding slope, aspect, or infrastructure-related criteria can reduce the model's structural stability. The most suitable areas for solar farms are those with high solar intensity, low slopes, and favourable orientation. This study offers a structured, expert-based decision-making framework for solar farm site selection. The approach is adaptable and supports Indonesia's broader efforts in renewable energy development and sustainable planning.

Keywords: *Solar Farm; Site Selection; Riau Province; Evaluation Criteria; Expert Judgment; AHP; Sensitivity Analysis; Multi-Criteria Decision Making (MCDM)*