

## Identifying Large-Scale Photovoltaic and Concentrated Solar Power Hot Spots: Multi-Criteria Decision-Making Framework

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**Abstract :** Solar Photovoltaic (PV) and Concentrated Solar Power (CSP) do not burn fossil fuels and, therefore, could meet the world's needs for low-carbon power generation as they do not release greenhouse gases into the atmosphere as they generate electricity. The power output of the solar PV module and CSP collector is proportional to the temperature and the amount of solar radiation received by their surface. Hence, the determination of the most convenient locations of PV and CSP systems is crucial to maximizing their output power. This study aims to provide a hands-on and plausible approach to the multi-criteria evaluation of site suitability of PV and CSP plants using a combination of Geographic Referenced Information (GRI) and Analytic Hierarchy Process (AHP). Applying the GRI-based AHP approach is meant to specify the criteria and sub-criteria, to identify the unsuitable areas, the low-, moderate-, high- and very high suitable areas for each layer of GRI, to perform the pairwise comparison matrix at each level of the hierarchy structure based on experts' knowledge, and calculate the weights using AHP to create the final map of solar PV and CSP plants suitability in Morocco with a particular focus on the Dakhla city. The results recognize that solar irradiation is the main decision factor for the integration of these technologies on energy policy goals of Morocco but explicitly account for other factors that cannot only limit the potential of certain locations but can even exclude the Dakhla city classified as unsuitable area. We discuss the sensitivity of the PV and CSP site suitability to different aspects, such as the methodology, the climate conditions, and the technology used in each source, and provide the final recommendations to the Moroccan energy strategy by analyzing if actual Morocco's PV and CSP installations are located within areas deemed suitable and by discussing several cases to provide mutual benefits across the Food-Energy-Water nexus. The adapted methodology and conducted suitability map could be used by researchers or engineers to provide helpful information for decision-makers in terms of sites selection, design, and planning of future solar plants, especially in areas suffering from energy shortages, such as the Dakhla city, which is now one of Africa's most promising investment hubs and it is especially attractive to investors looking to root their operations in Africa and import to European markets.

**Keywords :** analytic hierarchy process, concentrated solar power, dakhla, geographic referenced information, Morocco, multi-criteria decision-making, photovoltaic, site suitability

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