

GIS-BASED MULTI-CRITERIA ASSESSMENT OF PV-DRIVEN GREEN HYDROGEN SITES IN THE MENA REGION

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Extended Abstract

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Abstract Summary

Identifying viable sites for large-scale PV-based PtX production across the Middle East and North Africa (MENA) requires the simultaneous assessment of technical suitability, production cost competitiveness, and country-level investability; dimensions that existing studies address separately and rarely at regional scale. This study presents a GIS-driven Multi-Criteria Decision Analysis (MCDA) framework combining the Analytic Hierarchy Process (AHP) with geospatial exclusion and inclusion criteria to assess PtX site suitability across 18 MENA countries at a 50 × 50 km grid resolution. Following the application of exclusion criteria, inclusion criteria, grouped into spatial proximity indicators, the Levelized Cost of Hydrogen (LCOH), and country-level macro- and micro-level investment risk indices, are scored, weighted, and aggregated into a composite suitability map. Six sensitivity scenarios complement the baseline weighting scheme to test the robustness of results under varying stakeholder priorities. Results are validated operational and prospective utility-scale PV projects from the Global Solar Power Tracker. Under the baseline scenario, only 1.4% of available MENA grids achieve Very High suitability, with the UAE (28.2%), Morocco (21.9%), and Qatar (14.3%) leading. The GCC achieves a mean suitability score of 5.9 versus 4.5 for North Africa. The sensitivity analysis confirms that water stress is the single most binding constraint - collapsing Very High suitability to 0.1% MENA-wide under the water-weighted scenario - while Morocco reaches 64.1% Very High under risk weighting, the highest value observed across all countries and scenarios. Country rankings show high stability, with Qatar, Morocco, and the UAE occupying the top three positions in six of seven scenarios. The case study demonstrates that 89% of operating and 72% of prospective PV project capacities align with High or Very High suitability areas, broadly validating the modelled hierarchy. The results provide actionable guidance for investors and policymakers seeking to prioritize PV-based green hydrogen investments in MENA.