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Hydrogen based electrification vs direct electrification using solar PV and wind in Egypt: A HOMER PRO study

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This study conducts a comparative techno-economic analysis of two renewable energy strategies for Egypt's energy transition: hydrogen-based electrification through the production of green hydrogen via electrolysis and direct electrification using solar photovoltaic and wind energy. The study focuses on Egypt's Suez Canal Economic Zone, a key area for renewable energy development, and utilizes HOMER PRO software to model both systems under the same load and resource conditions. The goal is to assess each system's feasibility in terms of cost, operational efficiency, scalability, and environmental impact.

Simulation results show that direct electrification is the more viable option for domestic energy supply. It delivers electricity at an LCOE of 0.23 per kilowatt-hour, meets 99.98% of domestic needs, while investments in hydrogen infrastructure should be developed for long-term industrial use and export. The study contributes to the growing body of research supporting clean energy transition in emerging economies and provides a

Author: JAIN, Srishti (Technical University Berlin)

Co-authors: AGADI, Nadjji; SAKHRAOUI, Khadidja (Technische Universität Berlin)

Presenter: JAIN, Srishti (Technical University Berlin)

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