

Assessment of decentralized hybrid mini-grids in Sub-Saharan Africa: Market analysis, Least-cost modelling, and Job creation analysis

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Abstract

With a growing impetus to meet energy demands through decentralized hybrid mini-grids in rural and semi-urban locations in Sub-Saharan Africa (SSA), the need to accurately assess the market drivers, policy requirements, and job creation impacts of this energy system typology within this region cannot be ignored. This work provides a techno-economic impact analysis of decentralized hybrid energy systems in selected locations in SSA.

To optimally satisfy an electricity demand time series for a year and minimize all cost components amortized over a period of 20 years, a least-cost modelling approach and tool; *urbs* is applied. Applying Employment Factors methodology to the system sizing results obtained from *urbs*, the direct jobs created across the value chain is determined for each region. The backward linkage economy-wide-jobs created is further estimated by Leontief Inverse Input – Output table model.

Preliminary results obtained show that “Solar + Wind + Diesel + Battery” hybrid system (SWDB) had the lowest Levelized Cost of Electricity (LCOE), thus it provided the cheapest means of meeting the electricity demand in the modelled regions. However, the highest locally created direct and net employment impact in the model locations is provided by “Wind + Storage” (WS) system. Additionally, two major sectors: Manufacturing and Agriculture had the largest backward linkage jobs in the local economy for all decentralized

hybrid systems analyzed. This occurs due to higher interlinkage between these sectors and productive energy use in the regions. Conversely, despite higher employment impacts obtained for WS, the cost and length of time needed for wind resource mapping and assessment served as a major bottleneck to WS systems market access in the regions. Sensitivity analysis results obtained further suggest that by de-risking macro-economic factors such as: Discount rates and Inflation, improved market access for decentralized renewable energy mini-grids can be realized in Sub-Saharan Africa.

Keywords: Decentralized hybrid energy systems; Electricity access; Job creation; Employment Impact; Least-cost energy system modelling

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