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Techno economic assessment of wind/photo voltaic and conventional generator hybrid off-grid power systems for rural community in Meta Robi district

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Electrification to rural areas, those with no electric access or detached from national grid is one of the furthermost exciting issues in emerging countries similar Ethiopia. The intention of this research is to obtain an optimal suited configuration of hybrid electricity generation system using various renewable energy sources to meet the village load requirement reliably, economically, endlessly and sustainably. Hybrid system consists of sun energy, wind power and conventional electric generator. The analysis was done in the year 2017–18 at Deleta village in Meta Robi district, Oromia region, Ethiopia for hybrid electrification. The required solar potential values and wind speed statistics were taken from NASA. The data shows the study site has an average wind speed of 2.9 m/s at 10 m anemometer and solar radiation of 5.81 k Wh/m²/day. The cost of the associated hybrid components was collected from various springs and the electric load data was estimated for community and public service's needs. HOMER software was used to perform techno-economic analysis to meet the load requirement using renewable hybrid off-grid configuration. Based on the resources load, hybrid system and the component cost input data was considered. The simulation in HOMER gives optimization, sensitivity and grid comparison results. The optimization result of the simulation demonstrated the hybrid configuration that achieves total NPC of \$1,506,689 and COE of 0.360\$/kWh at a renewable fraction of 0.6 as the best optimal hybrid configuration considering economic and environmental point of view. From environmental stand point of view, the system is characterized with a minimum percentage of carbon dioxide and other GHG emission of about 195,974 kg/year.

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