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Wind Power Mapping and NPV of Embedded Generation Systems in Nigeria

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Abstract : The study assessed the potential and economic viability of stand-alone wind systems for embedded generation, taking into account its benefits to small off-grid rural communities at 40 meteorological sites in Nigeria. A specific electric load profile was developed to accommodate communities consisting of 200 homes, a school and a community health centre. This load profile was incorporated within the distributed generation analysis producing energy in the MW range, while optimally meeting daily load demand for the rural communities. Twenty-four years (1987 to 2010) of wind speed data at a height of 10m utilized for the study were sourced from the Nigeria Meteorological Department, Oshodi. The HOMER® software optimizing tool was engaged for the feasibility study and design. Each site was suited to 3MW wind turbines in sets of five, thus 15MW was designed for each site. This design configuration was adopted in order to easily compare the distributed generation system amongst the sites to determine their relative economic viability in terms of life cycle cost, as well as levelised cost of producing energy. A net present value was estimated in terms of life cycle cost for 25 of the 40 meteorological sites. On the other hand, the remaining sites yielded a net present cost; meaning the installations at these locations were not economically viable when utilizing the present tariff regime for embedded generation in Nigeria.

Keywords : wind speed, wind power, distributed generation, cost per kilowatt-hour, clean energy, Nigeria
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