FEASIBILITY AND PERFORMANCE ANALYSIS OF AN INVERTER BASED HYBRID POWER GENERATION SYSTEM

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DECLARATION PAGE OF THE CANDIDATE & SUPERVISOR

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ABSTRACT

For rural electrification, the use of off-grid hybrid energy systems based on renewable energy has become an intelligent solution for regions where electricity from the main electricity grid is not profitable or impractical. A hybrid distribution system uses either one or more renewable power generation technologies as the main source of energy and as a backup source, the conventional diesel generator is used.

Therefore, this kind of system reduces the necessity on an energy source, causing affordable and reliable electricity for rural users. Since hybrid distribution systems use some energy technologies, selecting the appropriate technologies and optimally determining the size of the designated components is essential to lessen the total cost and increase the availability and reliability of the supply.

The aim of the study was to find the feasibility of constructing a hybrid distribution system that can provide electricity to the rural community living Eluvaithivu which is a remote island in the Jaffna District. Also, once the hybrid system is established this study will continue to analyze the output of the system to check if the quality is up to the general standards. This remote island contains about 110 houses and the daily power demand of 255 kWh and a night-time peak of 30 kW. Similar inverter based hybrid power generation system has being modeled using the load profile and renewable resource data at the site.

Simulation results shows that the grouping of PV systems, wind turbines, diesel generator and Li-ion battery bank gives a hybrid system with following rated capacities will match the load requirement of the island, Simulation results shows the optimal combination of 44.9 kW solar modules, 18kW wind turbines, 126 kWh battery bank and 32 kW diesel generator.

This study analyzes the system by measuring the voltage, current, utility frequency and power factor of the generated output of the system. And from this analysis, it was found that those parameters mentioned above were varying within acceptable tolerance levels define in engineering standards. Also, from the wind power generation analysis it was found that during April wind energy harvesting becomes comparatively low and in June it becomes comparatively high.

Due to the high rate of electrification; in future the demand may increase significantly. To face this situation provisions have been kept increasing the battery bank capacity when necessary. Otherwise the system will not capable of handling the night time load and may cause to run the generator more often during night time peak.

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