

DEVELOPMENT OF AN INTEGRATED GRID- CONNECTED HYBRID ENERGY SYSTEM COMPRISING SOLAR AND BIOMASS FOR RURAL ELECTRIFICATION: The case of Kibindu Village in Chalinze District, Tanzania.

By MRISHO SANGIWA.(2021)

ABSTRACT

This dissertation is for the development of an integrated grid- connected hybrid energy system for rural electrification. This study is mainly concentrated on the analysis, modelling of bio fuel generator, solar PV cell, control of voltage source converter(VSC) and integration with a grid to eliminate the problem of power exchange and manual engagement of the grid. The voltage source converter (VSC) is used to integrate distributed energy sources and provide system functions: such as real and reactive power regulation, voltage and frequency support during is-landing conditions, and abnormal system condition mitigation. In this study, Matlab/Simulink and HOMER software was used for performing modelling, simulation and optimization of the energy system. Homer optimization system is employed to find the most effective combination of power generation and designed to minimize the cost of the system and fully validated for efficient energy utilization and enhanced interface power quality under different operating conditions and load excursions.

On testing the performance of energy system, it is observed that the voltage and frequency at the point of common coupling (PCC) are maintained constant at $1 pu$ and $50 HZ$, respectively. In addition, if we are opting for only a grid system the Net Present Cost (NPC) is \$ 5.69M but if we are employing a hybrid energy system the NPC reduces to \$ 2.31 equivalent to a 59.40% decrease hence reducing the cost of electricity from \$0.600 to \$ 0.111. such a system would have benefits in terms of energy autonomy and environment quality improvement, as well as in terms of job opportunity creation. Based on the findings from this study, the development of a grid -connected solar PV and biomass system at Kibindu village could be economically viable. The effects of the cost of the PV systems and global solar radiation were also investigated.

M. Eng.(Sustainable Energy Engineering) Dissertation