AN OFF-GRID HYBRID POWER SYSTEM

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Abstract

In terms of worldwide installed capability, hydro, wind and solar photovoltaic power are the top renewable energy sources. However, no reports on off-grid hybrid systems consisting of all three sources have been released, making this application the first of its kind. This study can be used as a practical guide to implement comparable systems at different places. The paper introduces a new strategy to linking renewable energy sources to a mini-grid of utilities.

Key words: hydro, wind, solar, hybrid, grid.

Introduction

The fast-global depletion of fossil fuels also made it necessary to decrease reliance on these non-renewable energy resources. One way to do this is to leverage the enormous potential of renewable energy sources to satisfy ever-increasing energy requirements. Energy storage devices and standard generators are usually used as backup systems to enhance the reliability[1] and power quality of renewable energy (RE)-based systems. Distributed generation using two or more renewable power sources can also improve reliability considerably. Hybrid renewal energy systems (HRES)[2] that are commercially feasible include PV-battery, PV-diesel, wind-battery, wind-diesel, PV-wind-battery, and PV-wind-diesel-battery systems. Long-term solar irradiance and wind speed information are needed for PV and wind power schemes to enhance energy output projections. The energy discrepancy[3] between PV and wind systems requires the use of battery banks with sufficient ability to meet electricity demand.

Methodology

The current system contains two types of distributed generators: a synchronous generator produces power in the hydro system and an inverter-based system in the hybrid PV-wind system. Both generator types have distinct features that require particular consideration when connecting to the mini grid. In a synchronous generator, the output frequency is directly linked to the turbine's

rotational speed, while inverters are solid-state electronic equipment that convert DC energy to AC. Hydropower is the dominant system in the current scheme and therefore the hybrid PV – wind system should synchronize its production by hydropower production.

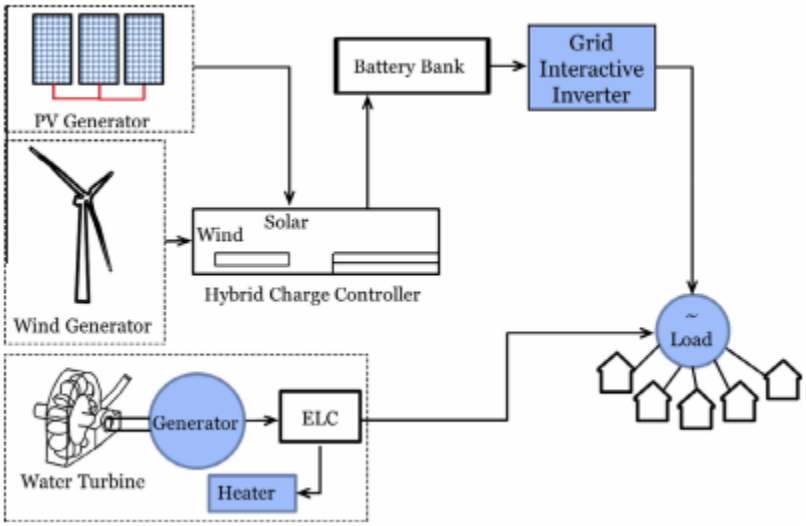

Fig. 1

The figure. 1 shows a hybridization method using grid tie inverter (GTI)[4]. Previously, PV and wind generators were hybridized using an HCC to charge the battery bank. However, unlike the use of the battery charger, this technique uses GTI to directly synchronize the hybrid PV – wind system with the mini-grid to ensure reliable power supply for the villages, the second technique was used to hybridize the three RE systems.

Conclusion

The use and hybridization of available energy resources will encourage environmental sustainability by decreasing demand for fossil fuels and wood and contributing to a productive, healthy lifestyle. Our results will therefore assist to accomplish the Millennium Development Goal which focuses towards ensuring environmental sustainability and developing a Global Partnership for Development.

References

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