

Design and Control of Microgrid Fed by Renewable Energy Generating Source

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Abstract: This study describes the control of a micro-grid in an isolated area that is powered by wind and solar hybrid energy sources. The wind energy conversion machine is a doubly fed induction generator (DFIG), and a battery bank is linked to a common DC bus of them. A solar photovoltaic (PV) array is utilised to convert solar power that is evacuated at the DFIG's common DC bus utilising a DC-DC boost converter in an efficient manner. The voltage and frequency are regulated via the line side converter's indirect vector control, which incorporates droop characteristics. It modifies the frequency set point based on the battery's energy level, which slows down overcharging or discharging. The system may also function when wind power is unavailable. Maximum power point tracking (MPPT) is a control technique used by both wind and solar energy blocks. The system is intended for fully autonomous functioning while taking into account all realistic situations. The system also has a facility for external power supply for battery charging, which is not required. In the Matlab environment, a simulation model of the system is created, and simulation results are shown under various scenarios such as unavailability of wind or solar energy, unbalanced and nonlinear loads, and low battery state of charge. Finally, a system prototype is built utilising a 5 kW solar PV array simulator and a 3.7 kW wrapped rotor induction machine.

Keywords: micro-grid

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