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Entitled

Split-Horizon Dual-Stage Dispatch Scheme for a Standalone Microgrid

by

Aslam Amir

Faculty Advisor

Prof. Hussain Shareef, Department of Electrical Engineering

College of Engineering

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Abstract

The advent of microgrids has prompted plenty of studies into its design, control, protection, and implementation, with several operational as well as pilot systems being commissioned worldwide. This necessitates the development of hardware and software for the Energy Management System, the supervisory controller in a microgrid. Hence, this thesis provides a novel dual-stage dispatch scheme for the Energy Management System of a Standalone microgrid by "splitting" the dispatch time horizon into four equal quarters to facilitate better usage of power forecast accuracies. The two stages include Unit Commitment/Scheduling and Economic Dispatch for the dispatchable Distributed Energy Resources based on renewable energy availability and the State of Charge of the Battery Energy Storage System. The objective function for the above is a cost minimization problem, optimized using a Customized Particle Swarm Optimization method, a novel variant of the Particle Swarm Optimization. The performance of the proposed optimizer is validated in comparison with the latter method using case studies meant to present load factor improvement in the microgrid network using Battery Energy Storage System, a second objective. Thus, based on the outcome of the case studies, this thesis provides a two-fold contribution towards resource management: fully utilizing the renewable energy availability by setting a known level of power reserve, and improving the load profile of the considered network using the Battery Energy Storage System.

Keywords: Microgrid, dual-stage economic dispatch, split-horizon, forecasting accuracy, power reserve, battery energy storage system, resource management