

**OPTIMAL SIZING OF THE ENERGY STORAGE
SYSTEM THROUGH COST MINIMIZATION IN A
MICROGRID USING DEMAND RESPONSE
TECHNIQUES**

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Degree of Master of Science

Department of Electrical Engineering

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DECLARATION

I declare that this is my own work, and this thesis/dissertation does not incorporate without acknowledgement any material previously submitted for a Degree or Diploma in any other University or institute of higher learning and to the best of my knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text.

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ABSTRACT

Employment of Energy Storage Systems (ESS) in microgrids has become important as it enhances the overall performance of microgrids. With the improvement in the technologies associated with power system optimization, developing an exact model to identify the optimal size of ESS, which brings the maximum benefits to the microgrid with the least cost has become a major research area.

In this research, the optimization of ESS in a selected microgrid is carried out under the implementation of a Demand Response (DR) program. The main aim of this research is to determine the optimal size of ESS that minimizes the investment cost and maintenance cost of ESS, together with the operating cost within microgrid. Due to the uncertain nature of the load and PV generation, a stochastic model was employed to predict those parameters accurately. Dynamic Programming (DP) is used to model the optimization problem in GAMS optimization software. Two cases were studied to evaluate the effectiveness of the proposed methodology, and the results highlight that the implementation of Demand Response Program leads to a curtailment in the size of Energy Storage System and a reasonable reduction in the total cost in the microgrid.

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LIST OF ABBREVIATION

BESS	Battery Energy Storage System
DER	Distributed Energy Resources
DG	Distributed Generators
DP	Dynamic Programming
DR	Demand Response
DS	Distributed Storages
DSM	Demand Side Management
EMP	Extended Mathematical Programming
ESS	Energy Storage System
GAMS	General Algebraic Modelling Software
IBR	Inclining Block Rate
LOLE	Loss of Load Expectation
MIP	Mixed Integer Programming
PDF	Probability Density Function
PV	Photo Voltaic
RTP	Real Time Price
SoC	State of Charge
TOU	Time of Use