MASTER OF SCIENCE THESIS

DESIGN AND SIMULATION OF A DEMAND SIDE MANAGEMENT ALGORITHM IN A PROPOSED SMART GRID ENVIRONMENT FOR PAKISTAN

BY

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Design and Simulation of a Demand-Side Management Algorithm in a Proposed Smart Grid Environment for Pakistan

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Declaration

I Majid Ali, Student ID No. 13005079015 student of Master of Science in Electric Power and Energy Engineering, hereby declare that the matter presented in this thesis titled "Design and Simulation of a Demand Side Management Algorithm in a proposed Smart Grid Environment for Pakistan" is my own work and has not been printed, published and submitted as thesis in any form in any other university, research institution etc. in Pakistan or Abroad.

Signature of Deponent Majid Ali

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List of Abbreviations

DSM	Demand Side Management
AMI	Advance metering interface
GDP	Gross Domestic Product
DR	Demand Response
DSEM	Demand Side Energy Management
EE	Energy Efficiency
EC	Energy Conversion
LD	Load Management
LS	Load Scheduling
RTP	Real Time Pricing
KW	Kilo Watt
KWH	Kilo Watt Hour
SG	Smart Grid
TOU	Time of Use
DLC	Direct Load Control
PLC	Power Line Communication
IEEE	Institute of Electrical and Electronics Engineers
WAPDA	Water and Power Development Authority
PEPCO	Pakistan Electric Power Company
GENCO	Northern Power Generation Company Limited
ESD	Energy Side Management
EDM	Energy Demand Management
EPRI	Electric Power Research Institute
ECS	Energy Consumption Scheduler
LAN	Local Area Network
SSM	Spot Pricing Management
PSM	Power Supply Management
IT	Information Technology
FA	Flexible Appliance
NFA	Non-Flexible Appliance
DADSM	Day Ahead demand side management
OF	Objective Function
LESCO	Lahore Electric Supply Company
NGO	Non-Governmental Organization

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Dedication

“Dedicated to my Beloved Parents and Teachers”

Abstract

Design and Simulation of a Demand-Side Management Algorithm in a Proposed Smart Grid Environment for Pakistan

By

Majid Ali

Advisor: Mr. Muhammad Fahad Zia

The electrical energy cannot be stored in large scale because we have no resource to store it in bulk.It has to be produced, transmitted, distributed and used instantly. However the nature of the load is variable with respect to time. The power generating plants are designed for maximum demand. It means the gap between peak load and the average load is high which results in greater per unit cost. The peak load increases suddenly in peak hours so we need to install large power generating plants to meet peak demand. It is not possible for developing countries to install such large power generating unitsdue to limited financial resources. The proposed solution of this problem is Demand Side Management (DSM) technique. In Demand Side Management (DSM) techniquethe load is shifted to off peak hourswhich results in financial benefit to residential customers.DSM is an important part of Smart Grid(SG)which is used to shift load to off peak timings as well as reshape load curve.As aresult, importance of SG increases and there isa decrease in per unitenergy cost. However this research thesisrevolves around DSM load shifting techniques for only flexible devices. The flexible devices should be shiftedto off peak period. “The Day Ahead Shifting” techniqueis proposed in this research thesis to minimize the above said problem significantly.Mathematical modelling and simulation in this research thesis are based on residential load during the spring season in Pakistan. This algorithm is developed in Matlab software. The findings of this thesissuggest thatDSMapproachattainssignificantenergy savings and objective curve.