ELECTRICITY DEMAND SIDE MANAGEMENT: ANALYSIS OF OPTIONS AND PRIORITIE S FOR KENYAN RESIDENTIAL SECTOR

STEPHEN KIAMA GICHUHI

E221-003-0004/2012

A Thesis Submitted in Partial Fulfilment for the award of the degree of Master of Science in Industrial Engineering and Management in the School of Engineering, Dedan Kimathi University of Technology

April, 2016

Declaration

I declare that this research work is my original work and has never been presented to this institution or to any other institution for examination or for any other purpose.

Sign: ..... Date: 27/04/2016

Stephen Kiama Gichuhi

Certification

I certify that the above-mentioned student carried out the work detailed in this report under my supervision.

Sign: ..... Date: 27/04/2016

Dr. Joseph N. Muguthu

School of Engineering, Kenyatta University

Sign: ..... Date: 27/04/2016

Prof. Peter N. Muchiri

School of Engineering, Dedan Kimathi University of Technology

ABSTRACT

The demand for electricity in Kenya has increased significantly in the last 5 years. While the peak demand was 1194 MW in 2011, it currently stands at 1585 MW.The demand has only been met by inclusion of the expensive thermal generators and imports which negates the current government's commitment to lower the cost of electricity. The system peak is experienced between 1830hrs and 2130hrs everyday, which is largely attributed to consumption from the residential consumers.To invest in more capacity to meet growing demand would be an expensive solution both for the utility and consumers, requiring heavy expenditure on power generation capabilities which will most likely be used only a few hours per year. To invest in Demand side management to curb peak load demand and overall load consumption, would on the other hand present a more proactive and constructive solution. Therefore, the purpose of this research is to develop load reduction strategies which could be implemented in the residential sector and lead to a substantial reduction in peak demand in the country.

The research design included asurveyon randomly selected households in Nairobi region to determine the electrical appliances in use, end use patterns of the electrical appliances and identify the potential energy efficiency measures (DSM Options).Effectiveness of the identified DSM optionswas evaluated and ranked in priority order using the Analytic Hierarchy Process (AHP).Estimation ofthe potential peak demand reductions by the implementation of identified DSM options and its reflection on the country Load Duration Curve (LDC) was also determined.

The research showed that a DSM portfolio consisting of the six identified measurescould have substantial reductions in energy consumption and peak demand.The total peak demand reductionachieved was 5.3% of the overall peak load.This research provides an understanding of the demand variations in the residential sector and also developsload reduction strategies that can be implemented in the households to reduce peak demand in the country.