DEVELOPING A MATHEMATICAL MODEL TO PREDICT THE DAILY DEMAND FOR ELECTRICITY, BASED ON WEATHER PARAMETERS

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Degree of Master of Science

Department of Electrical Engineering

University of Moratuwa

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Thesis submitted in partial fulfillment of the requirements for the degree Master of Science in Electrical Engineering

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Declaration

I declare that this is my own work and this thesis 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

System Control Centre (SCC) of Ceylon Electricity Board (CEB) conducts short term (hour ahead, day ahead) and medium term (up to three years ahead) demand forecasting based on historic demand, seasonal patterns, time of day and regional sales forecast. However, there are no measures taken as yet to include the influence of weather conditions such as temperature, humidity, sky cover, wind speed, etc. in this forecasting exercise.

Ambient temperature and humidity has become dominant parameters for electricity demand with the introduction of space cooling methods in recent history. The study focuses not only the influence of temperature and humidity to electricity demand of Sri Lanka but also the influence of wind speed and wind direction.

Study focused to build up a linear model using hourly historical demand data and meteorological data of four consecutive years using IBM SPSS statistics V 21 software. Meteorological parameters were taken as the independent parameters and hourly demand data was taken as the dependent parameter. Correction factor was needed to include the effect of yearly demand growth, for a better correlation. Every demand data point was corrected based on the average demand growth (yearly) and time of day.

Weekdays were taken as one set and Saturday and Sunday were taken separately. Model consists of 72 independent equations (24 representing a weekday, 24 for Saturday and 24 for Sunday). Correction factors were calculated for calendar holidays which have major influence on electricity demand.

Model validation was done for historical weather data as well as forecasted weather data. Predicting average absolute error was under 9% decreasing more with the prediction date close to the real date. Model is recommended to be used for short term demand forecasting and power plant dispatching in Sri Lanka.

Key words: demand prediction, mathematical model, multiple-regression, daily demand

Dedication

I dedicate this thesis to my beloved parents, who have given me the world's biggest two gifts, LOVE and FREEDOM. And also to my little brother who has been the strength and joy for my whole life. And Gayathri, my loving wife who never lost faith in me even in very tense and difficult times and loved me unconditionally.

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It is a great pleasure to remember all my lecturers of University of Moratuwa and all friends in the post graduate program, for backing me from beginning to end of this course.

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LIST OF ABBREVIATIONS

Abbreviation	Description
CEB	Ceylon Electricity Board
HVAC	Heating ventilation and air conditioning
IPP	Independent power producer
IBM	International Business Machines
LECO	Lanka Electricity Company
MATLAB	Matrix Laboratory
MS	Microsoft
PASW	Predictive analytic software
POP	Probability of precipitation
SPSS	Statistical Package for Social Sciences
SCC	System Control Centre

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