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# Study on Electricity Pricing For a typical Distribution System With a Case Study

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This thesis was submitted to the Department of Mechanical Engineering of the University of Moratuwa in partial fulfillment of the requirements of the Degree of Master of Engineering in Energy Technology.



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## DECLARATION

*I hereby declare that this submission is my own work and that, to the best of my knowledge and behalf, it contains no materials previously published or written by another person nor material, which to substantial extent, has been accepted for the award of my other academic qualification of a university or other institute of higher learning except where acknowledgement is made in the text.*



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## NOMENCLATURE

CEB	Ceylon Electricity Board
LECO	Lanka Electricity Company Ltd.
WPS	Western Province South
TOD	Time of the day
AIC	Average Incremental Cost
LRMC	Long run Marginal Cost
SRMC	Short Run Marginal cost
LDC	Load Duration Curve
PPP's	Private Power producers
GDP	Gross Domestic Product
BOO	Built Own Operate
Ktoe	Kilo tone oil equivalent
UG	Under ground
GSS	Grid Substations
DSM	Demand Side Management
LV	Low Voltage
HT	High Tension
Small I & C	Small Industrial and Commercial
IPP's	Independent power producers

## ABSTRACT

The scope of the study was to develop a cost reflective, economically efficient tariff structure for a typical distribution system with a case study on Western Province South (WPS) of the Ceylon Electricity Board (CEB). The WPS is one of the CEB's provinces in administrating the electricity distribution system. Different tariff structures were developed under two approaches. They are; one based on average incremental cost and the other based on average historical cost.

In order to develop above tariff structures future load forecasts were made using the past trends and the planning period for the tariff study was taken as from 2002 to 2009. The energy, peak power and losses for the above period were established. Future costs including investments, system augmentation and rehabilitation costs, operation and maintenance costs were established for the planning period. Using above data, tariff structures were developed using AIC principals under four scenarios to see the effect of different parameters. Average historical cost based tariff was developed using 2001 data and it establishes a slightly lower tariff than the AIC based tariffs. Also, prices are differentiated only on voltage levels in the historical cost based tariff due to the non-availability of adequate data. Sensitivities of these tariffs were checked for the purchase price and for the discount rate. All these tariff structures were compared and most appropriate tariff was selected which differentiate prices on voltage levels, time of usage, and contribution to the peak.

As the average generation costs of CEB has been continuously increased since 2000 due to the emergency and hired thermal power, a more realistic price at the grid sub level was established based on the thermal and hydro costs, and the generation mix. It was found that this price is Rs. 5.73 per kWh at grid substation level. With this purchase price; the proposed tariff was revalued to establish the final tariff structure. This final tariff generates an average selling price of Rs. 7.35. This final tariff is then compared with the present tariff and found it charges higher price for Domestic, LECO and Street light consumers and charge a lower price for Industrial and Commercial consumers. It was further studied the possibility of maintaining the same tariff as present for the Domestic consumers. In this case it was found, a subsidy of Rs 1.13 billion has to be paid annually to the utility.

## CONTENTS

ITEM	Page No.
DECLARATION	I
NOMENCLATURE	II
ABSTRACT	III
CONTENTS	IV
LIST OF TABLES	VII
LIST OF FIGURES	VIII
ACKNOWLEDGEMENT	X
 Chapter 1 – Introduction to the Research problem	 1
1.1 The Electricity Industry in Sri Lanka & the Western Province South	3
1.2 The Research Problem	4
1.3 Objectives of the Study	4
1.4 Rationale to the Research Problem	5
 Chapter 2 – Utility Framework in the Power & Energy Sector	 6
2.1 The Sri Lankan Power Sector	6
2.11 The Ceylon Electricity Board	7
2.12 Electricity Demand & Consumption	7
2.13 Electricity Consumption by Different Sectors	9
2.2 Economy of the Country	10
2.21 Economic projections	11
2.3 The Energy balance of the Country – Energy Supply & Demand	12
2.4 Functional areas of the CEB	13
2.41 The Generating system	13
2.42 The Transmission System	14
2.43 The Distribution System	14

## Chapter 3 – The Western province South &amp; its Power &amp; Energy demand

3.1 Introduction to the Western Province South(WPS) of CEB	17
3.2 Distribution Network of WPS	19
3.3 WPS Energy Requirement & Load patterns	20
3.31 Load Patterns established by the Load Research Project, DSM Branch, CEB	22
3.32 Customer load profiles	23
3.4 Anticipated Major Loads in WPS	24
3.5 Primary substations in WPS & their Capacities	25
3.6 WPS Future Load Forecasts	26

## Chapter 4 – Literature Review – Principals &amp; Policies of Electricity pricing

4.1 Modern Principals of electricity Pricing	29
4.11 Electricity Pricing Objectives	30
4.2 Basic Marginal cost Theory	31
4.3 LRMC based Tariffs	33
4.31 Lumpiness of Investments & Peak load Pricing	34
4.32 A Basic static peak Load pricing Model	35
4.33 Extension to Simple Model	36
4.34 Strict Long run Marginal Costing	36
4.35 Cost categories & rating periods	37
4.36 Marginal capacity Costs	37
4.37 The LRMC of Transmission & Distribution	39
4.38 Adjusting the strict LRMC	39
4.4 Different Types of Tariff Structures	40
4.5 Present pricing policy of the CEB	41
4.51 Tariff Revisions & Revenue Changes	43

## Chapter 5 – Evaluation of Tariff structures

5.1 Incremental cost Based tariffs	45
------------------------------------	----

5.11 Scenario 1 – Tariff based on average incremental cost at the LV end	46
5.12 Scenario 2 – Tariff based on average incremental costs at different voltage levels.	48
5.13 Scenario 3 – Incremental cost based TOD Tariff based on Contribution to peak	50
5.14 – Scenario 4 – Incremental cost based TOD Tariff for consumer categories at different voltage levels	52
5.2 Historical cost Based Tariff	55
5.21 Average Costs	55
5.22 Capacity related & Energy related costs of Electricity supply	56
5.23 Electricity supply Costs for different consumer categories	56
5.3 Compression of tariff structures	58
5.31 Analysis of Tariff structures	60
5.4 Electricity price at 33kv grid sub level	62
5.41 Generation & Transmission Costs	62
5.5 Final tariff adjusted to the Purchase price	64
5.6 Comparison of adjusted New Tariff with the Present tariff	65
5.7 Subsidy to low income Domestic consumers	66
 Chapter 6 – Analysis	
6.1 Comparison of different tariff structures	67
6.2 A realistic Purchase Price	69
6.3 Adjusting the proposed tariff to the realistic Purchase price	69
6.4 Comparison of Present & proposed tariff structures	70
6.5 Subsidy to maintain the present Domestic tariff under proposed Tariff	71
6.6 System losses	71
Chapter 7 – Conclusion	72
REFERENCES	73
APPENDICES	

## LIST OF TABLES

### Chapter 2

- 2.1 Provincial demographic variables 2001
- 2.2 Economic indicators and demographic variables over the past few years.
- 2.3 Forecast of GDP growth in real terms

### Chapter 3

- 3.1 Power demand and energy sales of WPS in year 2001
- 3.2 Network data – WPS in year 2001
- 3.3 Sales by tariff WPS 2000-2001
- 3.4 Anticipated major loads in the coming years in WPS
- 3.5 Primary substations and their capacities
- 3.6 Peak, off peak energy and losses for 2002 – 2009
- 3.7 Peak demand and peak loss 2002 – 2009

### Chapter 5

- 5.1 Tariff at different voltage levels for different discount rates for the purchase price of Rs. 4.49/kWh.
- 5.2 Tariff at different voltage levels for different discount rates for the purchase price of Rs.5.49/kWh
- 5.3 TOD tariff for different consumer categories.
- 5.4 Sensitivity of tariff for discount rate
- 5.5 Allocation of costs
- 5.6 Summary of tariff structures
- 5.7 Comparison of the proposed tariff and the present tariff
- 5.8 Revenue generation from the present tariff and the proposed tariff
- 5.9 Cost at 33kV level for different thermal prices and for different generation mix
- 5.10 Electricity consumption pattern – Domestic sector WPS

### Chapter 6

- 6.1 Different tariff structures under AIC and accounting cost principals



## LIST OF FIGURES

### Chapter 1

1.1 Price discrimination between consumer categories – Total CEB

1.2 Price discrimination between consumer categories – WPS

1.3

### Chapter 2

2.1 Percentage electrification at provincial level- 2001

2.2 Contribution to the electricity demand by provinces.

2.3 Electricity consumption by different sectors – 2002

2.4 GDP growth and the Electricity demand variation

2.5 Primary Energy supply in year 2000

2.6 Sectoral electricity consumption – 2000

2.7 Provincial set up of the CEB's Distribution system

### Chapter 3

3.1 WPS 33 kV network and GSS locations

3.2 Activities of the load research project

3.3 Customer load profiles by Sector

3.4 Peak, Off peak energy demand and losses 2002 – 2009

3.5 Peak, Off peak power demand and peak losses 2002 – 2009

### Chapter 4

4.1 Marginal Costs

4.2 Short Run Marginal Costs

4.3 Basic Static peak pricing model

4.4 a Load duration curve

4.4b Capacity development plan

### Chapter 5

5.1 Structure of the LV distribution system WPS

5.2 Tariff for different purchase prices

- 5.3 Sensitivities of the tariff for discount rate & the purchase price.
- 5.4 TOD tariff for different consumer categories
- 5.5 Tariff differentiated by voltage level, time of use and the contribution to the peak.
- 5.6 Sensitivity of the tariff for the discount rate
- 5.7 Accounting cost based tariff
- 5.8 Comparison of tariff structures
- 5.9 Comparison of the proposed tariff and the present tariff
- 5.10 Electricity cost at 33 kV level
- 5.11 Comparison of tariff structures.



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