RATIONALIZING THE TIME OF USE ELECTRICITY PRICING SYSTEM IN SRI LANKA

Sachethana Dhananjani Ranasinghe

229001X

Master of Science in Electrical Installation

Department of Electrical Engineering
Faculty of Engineering

University of Moratuwa
Sri Lanka

July 2025

RATIONALIZING THE TIME OF USE ELECTRICITY PRICING SYSTEM IN SRI LANKA

Sachethana Dhananjani Ranasinghe

229001X

Dissertation submitted in partial fulfillment of the requirements for the degree

Master of Science in Electrical Installation

Department of Electrical Engineering

Faculty of Engineering

University of Moratuwa

Sri Lanka

July 2025

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. I retain the right to use this content in whole or part in future works (such as articles or books).

Signature: Date: 05.07.2025

The above candidate has carried out research for the Master's thesis under my supervision. I confirm that the declaration made above by the student is true and correct.

Names of Supervisors:

1. Dr Tilak Siyambalapitiya

2. Dr Thushara Rathnayake

Signatures of the Supervisors: Date:

1. 06-07-2025

2. 07-07-2025

ACKNOWLEDGEMENT

I would like to take this opportunity to thank first of all my research supervisors, Dr. Tilak Siyambalapitiya and Dr. Thushara Rathnayaka, for their great assistance in practicality, encouragement and expertise during the entire course of this research work. On this study on Rationalizing the Time of Use pricing System in Sri Lanka, a number of their insights, and constructive criticism were key to the advancement of the research process.

Furthermore, I thank the University of Moratuwa for the opportunity and resources for this Master's program as well as the Department of Electrical Engineering for constant assistance during the course work and research. Special thanks go to all the lecturers and members of staff who in one way or the other made me learn.

I am also grateful to my workmates and friends for their support and motivation in times when it was most needed. Their motivation enabled me during the hard times of this research. In the same breath, I send my appreciation to my students from KDU that have always uplifted my standards because of their interest in research.

Last but not least, I owe a great debt of gratitude to my parents for their unconditional love, understanding and encouragement over the years. It has been a great blessing to receive their support.

In conclusion, I would like to express my gratitude for the lessons and skills acquired during this research.

ABSTRACT

Time-of-Use (ToU) electricity pricing is a widely used demand-side management strategy intended to shift electricity consumption from peak periods to off-peak hours. This enables easing pressure on the grid and improving cost efficiency in power generation. In Sri Lanka, with the rapid integration of distributed energy resources, particularly rooftop solar photovoltaic (PV) systems, the traditional daily demand profile has changed significantly. When adjusted for rooftop solar PV generation, which is not visible to the System Control Center, the timing of peak demand shifts from the evening to afternoon. This shift suggests that the prevailing ToU tariffs may no longer reflect the true cost of electricity generation at different times of the day. This study aims to rationalize the ToU pricing system in Sri Lanka which at present does not encourage consumers to go towards the tariff due to insignificant differences, by developing a data-driven framework. This incorporates high-resolution generation dispatch data, actual fuel costs, and adjusted demand profiles that account for both telemetered and non-telemetered solar PV generation. Hydropower, although assigned to zero cost in cost calculations in regulatory accounts, is given notional value under selected scenarios to better signal the use of thermal generation during certain intervals. A revenue-neutral seasonal correction factor was introduced to avoid unintended financial gains when using these adjusted cost values to determine ToU tariffs. The study evaluates the effectiveness of multiple ToU tariff structures based on cost reflectivity, consumer demand alignment, and practicality for adoption. A simplified two-interval tariff structure is proposed, for peak time from 05:30 -22:30 and off-peak from 22:30-05:30. This has combined the day and peak time intervals from the current thre-interval ToU tariffs, to better reflect the current generation mix and consumer usage patterns. Feedback from industrial consumers and analysis of shiftable household loads based on national survey support the feasibility of the new model. The proposed approach provides a foundation for policymakers and utilities to reform the existing tariff structure. By showing a 20% difference between the peak and off-peak costs and thus aligning tariffs with actual system costs and behavioral incentives, the rationalized ToU pricing framework enhances transparency, supports renewable energy integration, and promotes more efficient electricity usage across the country.

Keywords: ToU, demand shifting, tariff

TABLE OF CONTENTS

LIST OF FIGURES

Figure **Description** **Page**

LIST OF TABLES

Table Description **Page**

LIST OF ABBREVIATIONS

Abbreviation	Description
CEB	Ceylon Electricity Board
DER	Distributed Energy Resources
PV	Photovoltaic
PUCSL	Public Utilities Commission of Sri Lanka
SLSEA	Sri Lanka Sustainable Energy Authority
ToU	Time of Use