MINIMIZING GENERATOR TRIPPING AT LAKVIJAYA POWER STATION WITH ADAPTIVE ISLANDING OPERATION

A.S.W Epa

208738K

Degree of Master of Science

Department of Electrical Engineering
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Thesis/Dissertation submitted in partial fulfilment of the requirements for the degree
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DECLARATION

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

Signature: Date: 25.09.2025

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.

Signature of the Supervisor: Date: 25.09.2025

(Mr. Mahesh Rathnayake)

Signature of the Supervisor: Date: 25.09.2025

(Dr. R.M.T. Damayanthi)

DEDICATION

This thesis is dedicated to my beloved parents, family and friends whose endless love, unwavering support, and constant encouragement.

I dedicate this thesis to my supervisors, whose mentorship and guidance have profoundly shaped this work.

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Firstly, I extend my sincere gratitude to my supervisors, Dr. Thushara Rathnayaka and Mr. Mahesh Rathnayake, for their invaluable guidance, unwavering support, and constructive feedback. Their profound expertise and mentorship have been instrumental in shaping both the direction and the quality of this research.

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ABSTRACT

Sri Lankan power system consists of broad diversity of energy sources including hydropower, coal, petroleum fuels and renewable sources such as wind, solar and biomass. Lakvijaya power station, the largest coal power complex, consisting of 3 units of 300MW generation. Based on recent statistics, Lakvijaya power plant produced 4645 GWh in 2023, which is 29.8% of the total generation [22].

In Lakvijaya Power Station, after isolating a generator unit from the grid due to a protection scheme which occurs outside the plant premises, generating units are configured to switch to fast cut back procedure, in which the generating units are operating on in house loads. However, if the grid is not ready to reconnect within 30 minutes, generating units are switched to uncontrolled complete shutdown. After an uncontrolled shutdown it requires approximately 3- 4 days and with the absence of 900MW of power from the national grid, causes a huge financial and economic losses [15].

In this study, an algorithm is proposed for implementing adaptive islanding operation to ensure continuous operation of Lakvijaya power station during a system collapse. The methodology encompasses of 3 steps. Initially, transmission line configuration is arranged in a matrix form using graph theory and using the Dijkstra algorithm shortest path between frequency controlling generator and Lakvijaya PowerStation is identified while minimizing the Load – Generation gap and the final network path is obtained. After obtaining the network path which represents the island then fed in to the PSSE software to observe the steady state and dynamic stability.

Keywords: Adaptive islanding, PSSE, Dijkstra algorithm, Graph theory

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LIST OF ABBREVIATIONS

Abbreviation	**Description**
IEEE	*Institute of Electrical and Electronics Engineers*
PSSE	*Power System Simulator for Engineers*
CEB	*Ceylon Electricity Board*
RMS	*Root Mean Square*
AC	*Alternating Current*
DC	*Direct Current*
PES	*Power Engineering Society (IEEE)*
ICEE	*International Conference on Engineering Education*
UFLS	*Under Frequency Load Shedding*
SCADA	*Supervisory Control And Data Acquisition*
NCRE	*Non-Conventional Renewable Energy*