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**TECHNO-ECONOMIC FEASIBILITY ASSESSMENT OF
INTEGRATING FLOATING SOLAR WITH HYDRO:
A CASE STUDY FOR VICTORIA POWER STATION
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Degree of Master of Science

Department of Electrical Engineering

University of Moratuwa

Sri Lanka

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of the University of Moratuwa in partial fulfillment of the requirements for the
Degree of Master of Science in Electrical Installation



June 2025

Supervisors : Prof. L N W Arachchige
: Dr. Upuli Jayatunga

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.

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Prof. L. N. Widanagama Arachchige

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Dr. Upuli Jayatunga

ABSTRACT

The addition of floating solar photovoltaic (FSPV) to existing hydropower facilities is a potential game-changer in the incorporation of renewable power sources while maximizing resource allocation. This study explores the potential deployment of an FSPV system configuration at the Victoria hydropower station in Sri Lanka from a technical, as well as a financial perspective. It explores the possibility of approximately 93 MWp of solar capacity being placed on the surface of the reservoir, which would result in the generation of 133.5 GWh of energy per year. By utilizing the existing grid structure at Victoria, this method serves as a cheaper solution than ground-mounted and independent floating solar plants. The analyzed comparative levelized cost of electricity (LCOE) data is suggestive of a hybrid model in comparison to the standard solar PV design in the country.

Dynamic simulations were carried out on the proposed system with the aid of Power System Simulator for Engineering (PSS/E) and a dynamic model received from the Ceylon Electricity Board (CEB) Transmission Division. The outcome suggests that the complementary operation of FSPV and hydropower does not put system stability at risks, since the frequency response and bus voltage profiles of the system are within allowed limits under all system disturbances. Furthermore, the existing arrangement for power sharing between solar and hydro resources offers additional energy security in that it permits dominance of solar over daylight hours while allowing hydro resources to be stored for generation during the night.

The results of this study elaborate that the complimentary use of floating solar PV (FSPV) and hydropower has the potential in making the country's energy transition economically sustainable. Even though there may be some boundaries, the analysis does set up a strong case for the future large-scale implementation of hybrid FSPV-hydro systems.

Keywords: *Complementary Operation, Financial feasibility, Floating Solar Photovoltaic (FSPV), Frequency stability, Hybrid Energy Systems (HESs), Power system stability, Solar energy penetration.*

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TABLE OF CONTENTS

DECLARATION.....	i
ABSTRACT.....	ii
ACKNOWLEDGEMENT	iii
TABLE OF CONTENTS	iv
LIST OF FIGURES.....	vii
LIST OF TABLES.....	ix
LIST OF ABBREVIATIONS.....	x
LIST OF APPENDICES	xi
CHAPTER 1	1
INTRODUCTION	1
1.1 Present Sri Lankan Power System.....	1
1.1.1 Sri Lanka's Energy Supply	3
1.1.2 Sri Lanka's Electricity Demand.....	3
1.2 Problem Statement.....	4
1.3 Research Objectives	6
1.4 Thesis Outline.....	6
CHAPTER 2	7
LITERATURE REVIEW	7
2.1 Solar Energy and Hydropower Potential in Sri Lanka	7
2.1.1 Solar Energy Potential.....	7
2.1.2 Hydropower potential in Sri Lanka.....	7
2.2 Floating Solar PV Systems (FSPV).....	9
2.2.1 Concept of Floating Solar PV Systems	9
2.2.2 Benefits of Floating Solar PV Systems	10
2.3 Hydro – PV Systems	13

2.4	Global Implementations of Floating Solar Photovoltaic (FSPV) Systems Integrated with Hydropower Plants	19
2.5	Effects of Renewable Energy Penetration on Power System Stability	20
2.6	Research Gap.....	21
CHAPTER 3		22
SYSTEM MODELING.....		22
3.1	Present Sri Lankan Transmission System	22
3.2	System Modeling.....	23
3.2.1	Overview of PSS/E Software	24
3.2.2	Steady State and Dynamic Analysis.....	24
3.3	Modeling of 2023 Reduced Sri Lankan Power System.....	25
3.3.1	PSS/E Model Used for Simulations	26
3.4	Model Validation	27
3.5	Power Flow Data Entry in PSS/E.....	33
3.6	Power System Dynamic Modeling in PSS/E.....	33
3.6.1	Hydropower Plant Modeling.....	34
3.6.2	Thermal Power Plant Modeling	35
3.6.3	Solar Power Plant Modeling	36
CHAPTER 4		40
FLOATING SOLAR PV DESIGN FOR VICTORIA RESERVOIR.....		40
4.1	Data Acquisition	41
4.2	FSPV System Design for Victoria Reservoir	45
4.2.1	FSPV Sizing Methodology	47
4.2.2	Energy Calculation for the Proposed FSPV at Victoria Reservoir.....	51
4.3	System Integration.....	53
CHAPTER 5		56
ANALYSIS OF SYSTEM STABILIT UNDER COMPLEMENTARY OPERATION		56

5.1	Generation Scenarios.....	56
5.2	Demand Scenarios	58
5.3	Simulation Results.....	59
5.3.1	Traditional Mode (FSPV is not Integrated at Victoria Reservoir)	59
5.3.2	Complementary Mode (FSPV + Hydro)	61
5.3.3	Other Different Contingencies Considered.....	63
CHAPTER 6		65
FINANCIAL ANALYSIS OF INTEGRATING FSPV VICTORIA HYDROPOWER STATION		65
6.1	Overview	65
6.2	HOMER Pro Software.....	65
6.3	Financial Analysis Methodology	66
6.4	Levelized Cost of Electricity Calculation.....	68
CHAPTER 7		70
CONCLUSION		70
CHAPTER 8		72
FUTURE IMPLEMENTATIONS AND LIMITATIONS		72
8.1	Future Possible Implementations	72
8.2	Research Limitations	73
REFERENCE LIST		74
LIST OF APPENDICES		76
Appendix A		76
Appendix B		77
Appendix C		78
Appendix D		79
Appendix E		80
Appendix F		81
Appendix G		82

LIST OF FIGURES

Figure 1: Renewable Energy (RE) capacity (MW) as at 31.03.2024 [2]	2
Figure 2: Renewable generation mix (GWh)- 1 st Quarter 2024 [2]	2
Figure 3: Total installed capacity and peak demand variation [3]	4
Figure 4: Comparison of RE generation between Q4 2023 and Q1 2024 [2]	8
Figure 5: Typical layout of a FSPV plant [6]	9
Figure 6: First stage compensation of PV through hydropower[11]	14
Figure 7: Stage Two Process – eliminate random output of PV [11]	14
Figure 8: Stage Two Process- eliminate intermittent output of PV [11]	15
Figure 9: ADL scenario output pattern [13]	16
Figure 10: Daytime lifting scenario [13]	17
Figure 11: PPL scenario [13]	18
Figure 12: Single Line Diagram (SLD) of the reduced network model used in PSS/E	26
Figure 13: Overview of the tripped circuits during the failure [17]	29
Figure 14: Frequency variation at Biyagama GSS during the failure [17]	30
Figure 15: The Frequency of the fault recreated in PSS/E	31
Figure 16: PV connectivity diagram for solar dynamic modeling [18]	36
Figure 17: Generator block diagram of PV converter [18]	37
Figure 18: Electrical control model block diagram [18]	38
Figure 19: Map of selected water body locations [5]	41
Figure 20: FSPV sizing methodology [5]	49
Figure 21: Frequency response– non-hybrid mode	59
Figure 22: Generator power – non-hybrid mode	59
Figure 23- Bus Voltages – non-hybrid mode	60
Figure 24: Dynamic modeling of FSPV at Victoria reservoir in PSS/E	61
Figure 25: Frequency response – complementary mode	61

Figure 26: Generator power- complementary mode	62
Figure 27: Bus Voltages – complementary mode.....	62
Figure 28: Frequency response – non-hybrid mode.....	64
Figure 29: Frequency response – complementary mode.....	64

LIST OF TABLES

Table 1: Potential reservoirs to develop large scale floating solar [7]	11
Table 2: Proposed floating solar capacities presented in [5].....	12
Table 3: Present FSPV and hydro complementary power plants built globally.....	19
Table 4: Summary of grid substations (GSS) present in the network [1]	23
Table 5: Transmission network line lengths [1]	23
Table 6: Generation and loading scenarios [1].....	27
Table 7: Load flow data.....	32
Table 8: Panel output curve parameters [18].....	39
Table 9: Irradiance parameters [18]	39
Table 10 : Reservoirs with FSPV development potential [5].....	40
Table 11: Proposed FSPV capacities and key electrical parameters [5]	43
Table 12: Key reservoir characteristics [5]	44
Table 13: Minimum Operating Level (MOL) data [5].....	46
Table 14: Reservoir range data [5]	46
Table 15: Percentage allocations [5]	47
Table 16 : Trina Solar PV module electrical characteristics	48
Table 17: Trina Solar PV module mechanical characteristics.....	48
Table 18: PV modules that can be accommodated at each location [5].....	50
Table 19: Hydropower plants with strong links to 220kV network [5]	54
Table 20: Key transmission line parameters of the selected hybrid plants [5].....	55
Table 21: Allowable voltage variations [1]	60
Table 22: Levelized Cost of Electricity (LCOE) calculation for the proposed FSPV plant at Victoria	68
Table 23 : Levelized Cost of Electricity Analysis (For Each Case).....	69

LIST OF ABBREVIATIONS

Abbreviation	Description
CEB	Ceylon Electricity Board
LTGEP	Long Term Generation Expansion Plan
RE	Renewable Energy
NCRE	Non-Conventional Renewable Energy
ORE	Other Renewable Energy
FSPV	Floating Solar Photovoltaic
HES	Hybrid Energy Sources
LCOE	Levelized Cost of Electricity
PUCSL	Public Utilities Commission of Sri Lanka

LIST OF APPENDICES

Appendix A - Mahaweli Scheme Hydro Reservoir Network.....	76
Appendix B- The Map of Sri Lankan Transmission Network 2023	77
Appendix C- Trina Solar Vertex N Series Datasheet	78
Appendix D-Trina Solar 620Wp Electrical and Mechanical Data.....	79
Appendix E- PVSyst Energy Simulation Summa	80
Appendix F- PVSyst System Losses.....	81
Appendix G – Simulation Parameters Considered in PSS/E	82