

# **CO-FIRING BIOMASS WITH COAL IN PULVERIZED COAL FIRED BOILERS**

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University of Moratuwa, Sri Lanka.  
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Degree of Master of Science

Department of Electrical Engineering

University of Moratuwa  
Sri Lanka

April 2016

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

Department of Electrical Engineering

University of Moratuwa

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April 2016

## 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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## DEDICATION

I would like to dedicate this thesis to my mother, father, all teachers who educated me and to my wife.



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## ABSTRACT

Power generation using pulverized coal power technology is a very mature and extremely popular technical trend in the global scenario. The first coal fired power plant complex in Sri Lanka, Lakvijaya Power Station employs the same technology. For a country like Sri Lanka, import of coal will cost a lot of foreign exchange since it has no coal reserves within the country. Also, as a nation, it is strategically advantageous to rely on multiple fuels which reduces energy imports in to the country. Biomass co-firing is successfully being demonstrated around the world. There are several co-firing technologies and the pulverized coal fired plants can retrofit the technology very easily. By doing so, there are many benefits that a nation can achieve. The amount of fuel can be conserved while substituting it with a suitable type of available biomass. Hence, a direct nationwide economic benefit can be achieved. Also, with the global climatic changes, the world is currently looking for way to reduce and compensate to green house gas emissions. Biomass co-firing is also beneficial in that manner since a significant amount of fossil fuels will be substituted with carbon neutral biomass. When introducing co-firing technology, there are many other aspects to be considered. They are of technical, economical and social of nature, and hence can impact national economy in various ways. As a nation whose future generation plan is coal dominant, it is vital that Sri Lanka consider this particular concept seriously.

In this thesis, glerecedia is considered as the candidate biomass option which will be mixed with coal to be fired within the same boiler. An extensive analysis is carried out and elaborated in this thesis in regard to technical, economical and other concerns arising when co-firing is introduced to an existing pulverized coal fired installation. As a case study Lakvijaya Power Station Complex is considered. It is concluded that the introduction of direct co-firing techniques and subsequently addressing minor concerns related to it, can be demonstrated in a commercial scale successfully. It is recommended to carry out initial trials up to a co-firing ratio of 5%. This report will focus on the design of co-firing arrangement up to a maximum of 5% as it is the globally established benchmark for direct co-firing strategy.

## TABLE OF CONTENTS

Declaration of the candidate & Supervisor	i
Dedication	ii
Acknowledgements	iii
Abstract	iv
Table of content	v
List of Figures	vii
List of Tables	ix
List of Abbreviations	x
List of Appendices	xi
1. Introduction	1
1.1 Global Status of Co-firing	2
1.2 Properties:Coal vs Biomass	3
1.3 Technology Options for Co-firing	4
1.3.1 Direct Co-firing	4
1.3.2 In-direct Co-firing	6
1.3.3 Parallel Co-firing	6
1.5 Pulverized Coal Power Technology and Co-firing	8
1.6 Co-firing Ratio	9
2. Methodology	
2.1 Selection of Type of Biomass for Co-firing	11
2.2 Pretreatment Plant Design	17
2.3 A Technical Comparison: Selection of Co-firing Technology	23
2.3.1 Direct Co-firing	23
2.3.1.1 Direct Co-firing : Option 1	23
2.3.1.2 Direct Co-firing : Option 2	26
2.3.1.3 Direct Co-firing : Option 3	27
2.3.2 Indirect Co-firing	29
2.3.3 Parallel Co-firing	30
2.3.4 Comparison and Conclusion	30
2.4 Final Design	36

2.4.1	Introduction	36
2.4.2	Design Aspects	36
	2.4.2.1 Injection Mechanism for Biomass	37
	2.4.2.2 Biomass Feeding and Conveying System Design	44
	2.4.2.3 Control Logic for the System	45
2.4.3	Design Finalization	48
2.5	Economical Evaluation	49
2.5.1	Introduction	49
2.5.2	Capital Cost Components	49
2.5.3	Operational and Maintenance Costs	51
2.5.4	Fuel Saving Revenue	53
2.5.5	Social and Environmental Benefits	55
2.5.6	Overall Economic Evaluation	56
2.5.7	Conclusion	56
3.	Conclusions and Recommendations	57
Reference List	 University of Moratuwa, Sri Lanka. Electronic Theses & Dissertations <a href="http://www.lib.mrt.ac.lk">www.lib.mrt.ac.lk</a>	59
Appendix A:	Important Parameters Required for Co-firing Fuel Calculations	61



## LIST OF FIGURES

<b>Figure</b>	<b>Page</b>
1.1 Coal Power Plants Experienced Biomass Co-firing	2
1.2 Options Available for Direct co-firing	5
1.3 Schematic Diagram for In-direct co-firing	6
1.4 Schematic Diagram for Parallel co-firing	6
1.5 Typical Arrangement of a Pulverized Coal Fired Power Station	7
1.6 Corner and Multilayer Firing	8
1.7 Tangential Firing	8
2.1 Co-firing Design Process	11
2.2 Ultimate Analysis of Glerecedia Sample (dry basis)	12
2.3 Analysis of Glerecedia Sample (As received)	12
2.4 Chemical Analysis of Glerecedia Sample	13
2.5 Sticks of Glerecedia	14
2.6 Chopped Sticks of Glerecedia	14
2.7 Moisture vs time for Glerecedia Raw Sticks & Husked Sticks	14
2.8 Process Flow Diagram for Pretreatment Plant	17
2.9 Operation of a disc chipper for wood	18
2.10 Operation of a rotary dryer	19
2.11 Dryer Heating Device	19
2.12 Crusher Mill with Airlock and Cyclone Separator	22
2.13 Silo Storage System	22
2.14 Mixing Biomass & coal under 1 <sup>st</sup> Method of Direct Co-firing	24
2.15 1 <sup>st</sup> Method of Direct Co-firing Process Schematic	24
2.16 2 <sup>nd</sup> Method of Direct Co-firing Process Schematic (single layer)	26
2.17 3 <sup>rd</sup> Method of Direct Co-firing Process Schematic	28
2.18 Comparison of all three options (section view of boiler)	31
2.19 Air flow rates in to furnace during all Direct Options	33
2.20 Overall Process Design Schematic	36
2.21 Glerecedia Injection Point	38
2.22 Representation of Velocity Components	39
2.23 Solid Works 3D Flow Analysis Model for Velocity Simulation	40

2.24	Pipe front plane section Results for Velocity Analysis	40
2.25	Velocity Cut Plots along the pipe cross section	41
2.26	Velocity Plots Along the Length of the Pipe	41
2.27	Modified Flow Analysis Injection Model with Expander	42
2.28	Pipe front plane section Results for Velocity Analysis with Expander (above & Comparison with the case without expander)	42
2.29	Velocity Plots along the Length of the Pipe after adding Expander	43
2.30	Velocity Cut Plots along the pipe cross section with Expander	43
2.31	Silo and Feeding System	44
2.32	Biomass Feeding Tree for Pipelines	45
2.33	Silo and Feeding System	44
2.34	Total Cost of Biomass vs Distance Traversed	54
2.35	Summary : Project Capital, Income and Expenditure over the time	56



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## LIST OF TABLES

<b>Table</b>		<b>Page</b>
1.1	Thermal Properties of Coal and Biomass	3
1.2	Chemical Properties of Coal and Biomass	3
1.3	Co-firing Ratios of Various Pulverized Coal Fired Power Stations	9
2.1	Comparison between Direct Co-firing Options 1 & 2	33
2.2	Costs and Income Components	49
2.3	Cost Breakdown for Pretreatment Plant	50
2.4	Cost Breakdown for Feeding & Injection System	51
2.5	Cost Breakdown for Plant Maintenance	52



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## LIST OF ABBREVIATIONS

<b>Abbreviation</b>	<b>Description</b>
CFR	Co-firing Ratio
BM	Biomass
GCV	Gross Calorific Value
NCV	Net Calorific Value



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## LIST OF APPENDICES

Appendix	Description
Appendix A	Power Plant and Other Data used for Calculations



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