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TECHNICAL AND FINANCIAL VIABILITY OF BIOMASS POWER PLANTS FOR GRID ELECTRICITY GENERATION IN SRI LANKA

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A Research Project submitted to the
Department of Mechanical Engineering, University of Moratuwa
in partial fulfillment of the requirement for the
Degree of Master of Engineering in Energy Technology

By

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DEDICATION

*This Research Report is dedicated to my beloved wife Carina
and to my children Jonathan, Mystica and Elisha*



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DECLARATION

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

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Abbreviations and Notations

BOP	Balance of Plant
BFP	Boiler Feed Pump
C	Centigrade
CCGT	Combine Cycle Gas Turbine
CEB	Ceylon Electricity Board
CEP	Condensate Extraction Pump
CI	Compression Ignition
CRI	Coconut Research Institute
CV	Calorific Value
DM	Demineralization
DC	Direct Current
DCF	Discounted Cash Flow
EJC	Ejector Condenser
EPC	Equipment Procurement and Construction
FD	Forced Draft
GHVD	Gross Heating Value Dry Basis
GSC	Gland Steam Condenser
GSS	Grid Sub Station
ha	Hectare
I	Currant
ID	Induced Draft
IPP	Independent Power Producer
IRR	Internal Rate of Return
ITI	Industrial Technology Institute
LKR	Sri Lankan Rupee
LOI	Letter of Intent
NHV	Net Heating Value
NO	Number of
NPV	Net Present Value
O&M	Operations and Maintenance
PF	Plant Factor



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PPM	Parts Per Million
PV	Photo Voltaic
R	Resistance
ROI	Return on Investment
SI	Spark Ignition
SPPA	Standard Power Purchase Agreement
SRC	Short Rotation Coppice
TDS	Total Dissolve Solid
TPH	Tons per Hour
USD	United State Dollar
UPS	Uninterrupted Power supply
UHC	Utilizable Heat Content
VSD	Variable Speed Drives



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ABSTRACT

The technical and financial viability of biomass power plants for grid electricity generation in Sri Lanka is analyzed. To fulfill this requirement, present energy scenario, renewable energy sources in Sri Lanka for grid electricity generation, policy imitative for biomass grid electricity generation, present status of biomass electricity generation and biomass conversation technologies are discussed. A methodology is developed for setting up of commercially accepted biomass power plant and energy plantation for grid electricity generation. This methodology is applied for 5MW power plant. The technical and financial viability of this 5MW power plant and the methodology are analyzed to conclude the objective of this study. Higher end 5MW power plant is selected because the issues associated with large scale plant could be identified and analyzed. A biomass power plant with company own energy plantation and direct combustion turbine based technology is technically viable for grid electricity generation. The costing and cash flow statement derived from the sizing of energy plantation and power plant revealed that 5MW power plant is financially viable.



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