TECHNICAL AND FINANCIAL VIABILITY OF WOOD GASIFICATION BASED OFF GRID ELECTRICITY GENERATION IN SRI LANKA

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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DECLARATION

The work submitted in this research Project is the result of my own investigation, except where otherwise stated.

It has not already been accepted for any degree and is also not being submitted for any other degree.

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Signature of the Student

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Date: 29-11-07

ACKNOWLEDGEMENT

Through the MEng/PG Dip in Energy Technology course, I am benefited to do a Research Project on " Technical & Financial viability of wood based Off-grid Electricity Generation in Sri Lanka."In this survey I found a lot of research areas in Energy Sector on off-grid village Dendro power schemes in Sri Lanka.

I wish to thank those who stimulated the writing of this Research Project . I feel indebted to Dr. Thusitha Sugathapala, the head of the Department of Mechanical Engineering of the University of Moratuwa, for his interest in this Research Project for the Technical & Financial viability of wood based off-grid rural electrification in Sri Lanka.

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ABSTRACT

In this research project the technical and financial viability of wood gasification based off-grid electricity generation in Sri Lanka were analyzed. A six phase model was introduced to develop and implement a village dendro system. A financial analysis was carried out to search the financial viability of the system. A literature survey for the existing wood gasification based off-grid village dendro systems in Sri Lanka was carried out. Overall activities from feasibility study up to commissioning stage of Batugammana village dendro system were studied as a case study. The six phase model outlines salient features of the development and implementation stages of such systems, emphasizing the requirement identification and method of requirement analysis, feasibility study, project design including electro mechanical equipment specification and financial model as well as operation & maintenance systematically.

The financial model was developed with real assumptions and actual data reflecting the case study to search the financial viability of a wood gasification based off grid village dendro system. The Net Present Value and Internal Rate of Return were calculated for both Project and Equity aspects. A Sensitivity analysis was conducted to search the financial viability as well as the most appropriate financially viable operating state of the Power plant ensuring the optimum financial viability of the village dendro system on both domains. According to the findings, the village dendro system developed for the case study was analyzed and found it was not financially viable. Therefore the options and steps to be taken to make such systems financially viable were also discussed and key parameters were calculated through the financial model.

It was revealed through the financial model, a village dendro system is not financially viable, if the Power plant does not deliver power at it's maximum continuous rating mode all the time. That occurs, the number of households are not enough to consume power at the predetermine wattage per household or unavailability of other income generating activities which consume power when running the machine on the said mode.

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ABBREVIATIONS

AU	Administrative Unit
CBSL	Central Bank of Sri Lanka
CDM	Continuous Development Mechanism
CEB	Ceylon Electricity Board
DFI	Development Finance Institution
DS	Divisional Secretary
ECF	Energy Conservation Fund
ECS	Electricity Consumers' Society
EF	Energy Forum
ESDP	Energy Service Delivery Project
GAP	Global energy Action Programme
GEF	Global Environmental Facility
GN	Grama Niladhari
GOSL	Government of Sri Lanka
GVEP	Global Village Energy Partnership
IC	Internal Combustion
IDA	International Donor Agencies
IEE	Institution of Electrical Engineers
IRR	Internal Rate of Return
ITDG	Intermediate Technology Development Group
LCD	Liquid Crystal Display
LGA	Local Government Authorities
MCR	Maximum Continuous Rating
MFI	Micro Finance Institution
MOF	Ministry of Finance
NGO	Non Governmental Organization
NPV	Net Present Value
PCB	Programmable Circuit Breakers
PCI	Participating Credit Institution
SPV	Solar photovoltaic
RERED	Renewable Energy for Rural Economic Development
SEEDS	Sarvodaya Economic Enterprises Development Services

TA	Technical Assistance
UPS	Uninterrupted Power Supply
VDS	Village Dendro Schemes