

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



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RUPASINGHE APPUHAMILAGE UPALI RUPASINGHE

2003/2004

Supervised by

91254

Dr. A.G.T. Sugathapala
Department of Mechanical Engineering
University of Moratuwa, Sri Lanka

October 2007

University of Moratuwa



91254

91254

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.

R.A.U. Rupasinghe.

Name of Student

UOM Verified Signature

.....

Signature of the Student

Date: 29-11-2007

Supervised by:

Dr. A.G.T. Sugathapala.

UOM Verified Signature

Signature of the Supervisor

Date: 29-11-07



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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.

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R.A.U. Rupasinghe.

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.

CONTENT

	Page No
CHAPTER 1: INTRODUCTION.....	1
CHAPTER 2- PRESENTS STATES OF RENEWABLE ENERGY....	4
2.1 Introduction.....	4
2.2 Renewable Energy sources	
2.2.1 Wind Energy.....	4
2.2.2 Small Hydro.....	6
2.2.3 Solar Energy.....	8
2.2.4 Biomass.....	10
2.3 Economic comparison of off-grid renewable energy systems	13
2.4 Energy policy for off-grid renewable energy development	14
2.5 Dendro power.....	17
2.5.1 Biomass potential for fuel wood plantation.....	17
2.5.2 Fuel wood Production.....	17
2.5.3 Comparison of Gliricidia with other alternative fuel wood.....	18
2.5.4 Biomass technology.....	19
CHAPTER3: FUEL WOOD GASIFICATION TECHNOLOGY FOR RURAL ELECTRIFICATION.....	22
3.1 Introduction.....	22
3.2 Principle of gasification.....	22
3.2.1 The principle chemical reaction occurring in the gasifier.....	23
3.3 Gasifiers.....	25
3.3.1 Up draft Gasifier.....	25
3.3.2 Cross – draft Gasifiers.....	25
3.3.3 Fluidized – bed Gasifiers.....	26
3.3.4 Down – draft Gasifiers.....	27
3.4 Electricity generation systems.....	30
3.4.1 Gasification steam turbine.....	30
3.4.2 Gasification gas turbine.....	30

3.4.3 Gasification co-generation.....	31
3.4.4 Gasifier-internal Combustion (IC) Engine Driven Generator.....	31
3.4.5 Summary of the Power out put & performance calculations of the Engine, Gassifier and Generator.....	33

CHAPTER4: PRESENT STATUS ON VILLAGE DENDRO

POWER SCHEMES IN SRI LANKA.....	35
4.1 Introduction.....	35
4.2 Badalkumbura Community Based Pilot Dendro System (Wadakahakiula VDS).....	38
4.2.1 Background.....	38
4.2.2 Financing.....	39
4.2.3 Affordability of electricity.....	40
4.3 Endagalayaya Project.....	41
4.3.1 Background.....	41
4.4 Wattemada VDS.....	42
4.4.1 Background.....	42
4.5 Millagala VDS.....	43
4.5.1 Background.....	43
4.6 Kiula VDS.....	43
4.6.1 Background.....	43
4.7 Lessons learnt- How to initiate an off-grid village Dendro Scheme.....	44
4.7.1 System procedures involved in VDS.....	44
4.7.2 Project Developers.....	45
4.7.3 Electricity Consumers Societies (ECS).....	45
4.7.4 Power plant Installation, Handling and After Sales Services.....	46
4.7.5 Waste Control & Management of by-products.....	46
4.7.6 Safety Hazards and Prevention.....	46
4.8 Limitations of the Technologies.....	48

CHAPTER 5: METHODOLOGY.....

5.1 Introduction.....	49
5.2 Requirement identification.....	50

5.3	Requirement Analysis	50
5.4	Feasibility study.....	51
5.5	Project Design	51
5.5.1	Machine Parameter design.....	51
5.5.2	Design of Financial Model.....	52
5.5.3	The selection of a suitable Fuel wood.....	55
5.6	Implementation.....	56
5.6.1	Location.....	56
5.6.2	Government Contribution.....	56
5.6.3	Funding.....	57
5.7	Operation and maintenance.....	58
CHAPTER 6: TECHNICAL AND FINANCIAL VIABILITY OF DENDRO		
POWER IN OFF-GRID ELECTRIFICATION.....		
6.1	Introduction.....	59
6.2	Technical Viability of machinery.....	59
6.3	Agro-technical viability of Fuel wood.....	62
6.4	Financial Viability.....	62
6.4.1	Sensitivity Analysis for Financial viability of VDS.....	66
6.5	Case Study.....	72
6.5.1	Requirement identification.....	72
6.5.2	Requirement analysis.....	73
6.5.3	Feasibility study.....	75
6.5.4	Basic design parameters of Batugammana VDS.....	78
6.5.5	Implementation.....	80
6.5.6	Operations and maintenance.....	81
6.5.7	Side benefits from village dendro systems.....	83
6.5.8	Social Services	84
CHAPTER 7: DISCUSSION		85
 CHAPTER8: CONCLUSION AND RECOMMENDATIONS.....		87

REFERENCES	89
APPENDIX-A: World wind turbine Installations (MW)	91
APPENDIX-B: Power output and performance calculations of the Engine, Gasifier and Generator	92
APPENDIX-C: Results of the survey carried out in Batugamma village	95
APPENDIX-D: Financial Model for Project IRR	100
APPENDIX-E: Financial Model for Equity IRR	102
APPENDIX-F: Sensitivity Analysis for Project IRR	104
APPENDIX-G: Sensitivity Analysis for Equity IRR	106



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LIST OF FIGURES

	Page No
Figure 2.1: Global cumulative wind energy capacity [6].....	5
Figure 2.2: Geographic Distribution of solar and hydro Off-Grid Projects Approved under RERED by June 2007.....	9
Figure 2.3: Bioelectricity installed capacity in OECD Europe in 2002.....	11
Figure 3.1: Schematic diagram of a Down draft gasifier.....	27
Figure 3.2: Dendro home system Down draft gasifier.....	29
Figure 4.1: The process schematic diagram of a Gasifier powered IC engine generating set.....	37
Figure 4.2: The 10kW Millagala Gasifier powered IC engine generating set....	38
Figure 5.1: Six phase VDS implementation model.....	50
Figure 5.2: Electricity peak demand forecast by CEB for next 20 years.....	55
Figure 5.3: Financing Model for Off-grid Village Schemes.....	57
Figure 6.1: 25 kW generating set powered by wood gasifiers.....	60
Figure 6.2: Gasifiers for 7.5kW to 15kW Engines, Gemcor Company, Philippines	61
Figure 6.3: Gasifier manufacturing factory, Gemcor Company, Philippines.....	61
Figure 6.4: Visit to Testing lab of gasifier powered IC engine driven Generating sets at Pokunutenna.....	74
Figure 6.5: Power house in the 15 perch land, Battugammana.....	74
Figure 6.6: Millagala 10kW Dendro Power station.....	75

LIST OF TABLES

	Page No
Table 2.1: Off grid Wind Turbine installations for electricity generation in Sri Lanka.....	6
Table 2.2: Grid connected wind turbine energy system in Sri Lanka	6
Table 2.3: Present states of off-grid hydro projects under RERED by June 2007....	7
Table 2.4: off grid solar energy systems in Sri Lanka	10
Table 2.5: Arable land per capita in EU 2007	12
Table 2.6: Energy consumption in Sri Lanka	13
Table 2.7: Renewable power specific cost comparison (US cents per kWh).....	14
Table 2.8: Medium- term targets for off-grid electrification.....	16
Table 2.9: Available land for energy plantation.....	17
Table 2.10: Yield of woody biomass of different species in Sri Lanka.....	18
Table 2.11: Alternative species that can be used for an energy plantation.....	18
Table 3.1: Summery of specifications of engine and generator set model	32
Table 4.1: The summery details of Dendro power schemes.....	36
Table 4.2: Possible issues and control techniques of by products.....	46
Table 4.3: The safety aspects and precautions.....	47
Table 5.1: Load forecast for the next 20 years.....	54
Table 6.1: Sensitivity Analysis of the VDS under Project IRR for System 1.....	67
Table 6.2: Sensitivity Analysis of the VDS under Equity IRR for System 1.....	68
Table 6.3: Sensitivity Analysis for Project IRR for 78 households.....	69
Table 6.4 : Sensitivity Analysis for Equity IRR for 78 households.....	69
Table 6.5: Case 1-Search the optimum Power plant operating state for financial viability.....	70
Table 6.6: Case 2-Search the optimum Power plant operating state for financial viability.....	71
Table 6.7: VDS site information and Plant data.....	75
Table 6.8: Income level of villagers.....	76
Table 6.9: Energy Demanded at Battugammana.....	76
Table 6.10: Average Monthly Expenditure on Energy (Before commencing the Project).....	77
Table 6.11: Pre estimated cost of the project.....	78

Table 6.12: Pre- Estimated Committed Funds.....	78
Table 6.13: Basic Plant specification.....	79
Table 6.14: Mini grid Design.....	79
Table 6.15: Actual cost breakdown of the project.....	80
Table 6.16: Fuel wood Supply.....	81
Table 6.17: Monthly Operational cost.....	82
Table 6.18: Beneficiary charges.....	82



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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



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TA	Technical Assistance
UPS	Uninterrupted Power Supply
VDS	Village Dendro Schemes



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