INTEGRATION OF BIOGAS TECHNOLOGY INTO POWER GENERATION IN SRI LANKA

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Degree of Master of Science

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Thesis/ Dissertation submitted in partial fulfillment of the requirements for the Degree Master of Science

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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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ABSTRACT

The integration of biogas technology into power generation system in Sri Lanka, is studied and analysed, as a possible solution to raising problematic situation in Colombo city from generating MSW. To fulfill this requirement, present energy scenario in Sri Lanka, literature review and global development of biogas to power, case studies related to biogas technology, data collection of MSW to estimate the potential of biogas from OFMSW in Colombo city, analysis of data, developing a plan for a biogas power plant and evaluation of the proposed plant, are discussed. It is investigated and identified the biogas potential from OFMSW generating in Colombo city and electricity potential from produced biogas. It is synthesized to select the suitable digester technology and conversion technology to generate electricity from OFMSW, to continue the study. Further it is calculated and compared the key financial indexes such as NPV, IRR and payback period for the selected scenario, for several cases, to find out the financial viability of the proposed power project as well as evaluated the project under several aspects, to conclude the objective of this study. Further, it is revealed that the integration of biogas technology into power generation system is financially viable for all cases.

DEDICATION

I dedicate my thesis work to my family and many friends. A special feeling of gratitude to my loving parents, H.A.A. Wijenayake and M. Kusumawathi whose words of encouragement and push for tenacity ring in my ears. My wife G. Kumari Wijenayake has never left my side and is very special. I dedicate this work and give special thank to my wife, G. Kumari Wijenayake for being helping there for me throughout the entire master programme.

I also dedicate this thesis to my many friends who have supported me throughout the process. I will always appreciate all they have carried out on behalf of me.

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LIST OF ABBREVIATIONS

AAS	Advanced Animal Science Co. Ltd
AD	Anaerobic Digestion
BOD	Biological Oxygen Demand
BWEP	Boland Waste Energy Project
CCY	Combined Cycle Power Plant
CCHP	Combined Cooling Heat & Power
CEB	Ceylon Electricity Board
CG	Centralised Generation
CHP	Combined Heat and Power
CISIR	Ceylon Institute of Scientific and Industrial Research
COD	Chemical Oxygen Demand
CO_x	Carbon Monoxide/Dioxide
DE	Distributed Energy
DER	Distributed Energy Resource
DHW	Domestic Hot Water
DOC	Degradable Organic Carbon
DSM	Demand Side Management
EPA	Environmental Protection Agency
ESDP	Energy Service Delivery Project
ESMAP	Energy Sector Management Assistant Programme
FIT	Feed In Tariff
GDP	Gross Domestic Product
GEMIS	Global Emission Model for Integrated Systems
GIS	Geographic Information Software
GOSL	Government of Sri Lanka
GTZ	German Agency for Technical Corporation
GWh	Giga watt hours
IAEA	International Atomic Energy Agency
IC	Internal Combustion
IGEN	Indo German Energy Program

LNG	Liquid Nitrogen Gas
LOLP	Loss of Load Probability
MCFC	Molten Carbonate Fuel Cell
MSW	Municipal Solid Waste
OFMSW	Organic Fraction of Municipal Solid Waste
MT	Metric Tone
MW	Mega watt
NNFC	National Non Food Crop Centre (UK)
NCRE	Non Conventional Renewable Energy
NO_x	Nitrogen Oxide/Dioxide
NORAD	Royal Norwegian Embassy
NRE	Non-conventional Renewable Energy
NREL	National Renewable Energy Laboratory
ORC	Organic Rankine Cycle
OTEC	Ocean Thermal Energy Conversion
O&M	Operation & Maintenance
PDP	Project Development Programme
PEMFC	Proton Exchange Membrane Fuel Cell
PPP	Public Private Partnership
PSDA	Private Sector Development in Agriculture
PUCSL	Public Utility Commission of Sri Lanka
RERED	Renewable Energy Rural Economic Development
SOFC	Solid Oxide Fuel Cell
SO_x	Sulphur Oxides
SPM	Suspended Particulate Matter
SS	Suspended Solids
T&D	Transmission & Distribution
UNEP	United Nations Environment Programe
UNIDO	United Nations Industrial Development Organization
VS	Volatile Solids

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