MURDOCH UNIVERSITY SCHOOL OF ENGINEERING AND ENERGY

ENG460 FINAL YEAR THESIS PROJECT REPORT

HOW TO DECENTRALISE OUR ENERGY SUPPLY USING BIOGAS

A Demonstration of How to Design Sustainable Biogas Energy Systems

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A report submitted to the School of Engineering and Energy, Murdoch University, in partial fulfilment of the requirements for the Bachelor of Engineering Degree

Under the Academic Supervision of
Professor Parisa Bahri & Dr Karne de Boer

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Abstract

The purpose of the project discussed in this report was to demonstrate that biogas energy systems are an integral and relevant part of ensuring a sustainable future. In order to do this, the first objective of the project was to develop a methodology for designing sustainable energy systems using biogas technology. The methodology was developed after reviewing existing literature on sustainable design methodologies. The proposed methodology consists of five main stages; identifying the fundamental desired outcome, investigating the energy requirements, biogas resource assessment, biogas technology review and designing the biogas energy supply system.

The second objective of this project was to conduct a preliminary assessment of the potential biogas resources in Western Australia. The research into the biogas potential from waste resources in WA was limited to the wheat, dairy, pork and meat processing industries. The estimated annual energy production potential from these resources in WA is 2,030GWh. Biogas is currently an underutilised technology in Western Australia and further investigation is highly recommended to more accurately assess the potential of biogas in the state.

The developed design methodology was applied to design a sustainable biogas system for a meat processing facility in the southwest of Western Australia. The application of the design process highlighted the ability of biogas technologies to provide decentralised energy supply and increase reliability, in addition to meeting the desired outcome of reducing the costs and greenhouse gas emissions related to the facility's current energy consumption. The recommended biogas technology for the meat processing facility, based on the outcomes of the design process, is a two-stage continuous stirred tank reactor, which is one of many proven biogas technologies that has been used successfully internationally over many years.

Academic Supervisor Endorsement Pro Forma

I am satisfied with the progress of this thesis project and that the attached report is an accurate reflection of the work undertaken.

Signed:

Date:

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Acronyms

ABP	-	Animal By-Products
AD	-	Anaerobic Digestion
BOD	-	Biological oxygen demand
CAL	-	Covered anaerobic lagoon
CHP	-	Combined heat and power plant
CO_2	-	Carbon dioxide
CO_2e	-	Carbon dioxide equivalent
COD	-	Chemical oxygen demand
CODR	-	Chemical oxygen demand removed
CSTR	-	Continuous stirred tank reactor
DM	-	Dry matter
EROI	-	Energy return on energy investment
FM	-	Fresh matter
GHG	-	Greenhouse gas
H_2S	-	Hydrogen sulfide
HSCW	-	Hot standard carcase weight
IECP	-	Integrated Environmental and Cost Potential
LCA	-	Life Cycle Assessment
LTR	-	Low temperature rendering
oDM	-	Organic dry matter
UASB	-	Upflow anaerobic sludge blanket
VFA	-	Volatile fatty acid
WA	-	Western Australia

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