

ANALYSIS ON THE RELIABILITY OF THE EXISTING RURAL SOLAR-DIESEL
HYBRID SYSTEM TO PROPOSE SIZING OF NEW PV MODULE TO REDUCE COST.

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DEDICATION

This project report is dedicated to my beloved mother, who taught me that the best kind of knowledge to have is that which is learned for its own sake. It is dedicated to my husband, who taught me that even the largest task can be also accomplished if it is done one step at a time.

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ABSTRACT

This project is to analyze the reliability of the existing rural solar-diesel hybrid system and propose the most suitable sizing for PV Module to meet the most cost-effective system. This is the pilot work which will contribute to millions of costs saving due to high fuel consumption. The most challenging aspect for this hybrid system is maintaining low generating cost by optimizing the PV Yield & solar irradiance. The existing design of PV module is unable to cater the present load demand. Hence, new simulation and proper sizing will be required. Various types of historical data and present data focus on Solar Hybrid Station Pulau Bangi, Kudat has been collected, analyze, validate the new sizing of PV in order to meet fuel cost reductions. From this analysis, it is proven that by resizing the PV module will absolutely reduce fuel and generation overall cost.

ABSTRAK

Projek ini adalah untuk menganalisis kebolehpercayaan sistem hibrid solar-diesel luar bandar yang sedia ada dan mencadangkan saiz yang paling sesuai untuk Modul PV untuk memenuhi sistem yang paling kos efektif. Ini adalah kerja perintis yang akan menyumbang kepada jutaan kos penjimatan terutama didalam penggunaan bahan api yang tinggi. Aspek yang paling mencabar untuk sistem hibrid ini ialah mengekalkan kos penjanaan rendah dengan mengoptimumkan Hasil PV & sinaran suria. Reka bentuk modul PV yang sedia ada tidak dapat memenuhi permintaan beban semasa. Oleh itu, simulasi baharu dan saiz yang betul akan diperlukan. Pelbagai jenis data sejarah dan fokus data semasa di Stesen Hibrid Solar Pulau Bangi, Kudat telah dikumpul, menganalisis, mengesahkan saiz baharu PV bagi memenuhi pengurangan kos bahan api. Daripada analisis ini, ia membuktikan bahawa dengan mengubah saiz modul PV secara mutlak akan mengurangkan bahan api dan kos keseluruhan penjanaan.

TABLE OF CONTENTS

	TITLE	PAGE
	DECLARATION	iii
	DEDICATION	iv
	ACKNOWLEDGEMENT	v
	ABSTRACT	vi
	ABSTRAK	vii
	TABLE OF CONTENTS	viii
	LIST OF TABLES	xi
	LIST OF FIGURES	xii
	LIST OF ABBREVIATIONS	xiii
	LIST OF SYMBOLS	xiv
	LIST OF APPENDICES	xv
CHAPTER 1	INTRODUCTION	1
1.1	Problem Background	1
1.2	Problem Statement	3
1.3	Research Objectives	3
1.4	Project Scopes	4
CHAPTER 2	LITERATURE REVIEW	5
2.1	Introduction	5
2.2	Limitation	6
2.3	Research Gap	6
CHAPTER 3	RESEARCH METHODOLOGY	7
3.1	Introduction	7
3.2	Main methods and process	8
3.3	Flow chart	8
3.4	Site Data Collections.	9
3.4.1	Existing configuration Data:	9

3.4.2	Performance Data	9
3.4.3	Load Profile	10
3.4.4	Solar Irradiations	11
3.5	Designing calculation - Mathematical Modelling and analysis	12
3.5.1	Source of losses	13
3.5.2	DC Coupling	13
3.5.3	AC Coupling	14
3.6	Mathematical simulation and analysis on the propose PV module sizes.	14
CHAPTER 4	RESULT AND DISCUSSION	15
4.1	Analytical Proofs	15
4.1.1	Source of losses	15
4.1.2	DC Coupling Sizing	16
4.1.3	AC Coupling Sizing	17
4.1.4	Total PV Sizing	18
4.2	Case 1 - PV _{AC} Module Size – 676kWp	19
4.2.1	Result for Case 1	19
4.2.2	Discussion for Case 2	21
4.3	Case 2 - PV _{AC} Module Size – 461kWp	22
4.3.1	Result for Case 2	22
4.3.2	Discussion on Case 2	24
4.4	Case 3 - PV _{DC} Module Size – 837.6kWp With Case 1 for day load	25
4.4.1	Result for Case 3	25
4.4.2	Discussion on Case 3	27
4.5	Case 4 - PV _{DC} Module Size – 837.6kWp With Case 2 for day load	28
4.5.1	Result for Case 4	28
4.5.2	Discussion on Case 4	30
4.6	Chapter Summary	31

CHAPTER 5	CONCLUSION AND RECOMMENDATIONS	33
5.1	Research Outcomes	33
5.2	Contributions to Knowledge	33
5.3	Future Works	34
REFERENCES		35
Appendices A - D		37 - 43

LIST OF TABLES

TABLE NO.	TITLE	PAGE
Table 3.1	Existing configuration data	9
Table 3.2	Performance data on SHS Pulau Banggi for 2019 to 2021	10
Table 4.1	AC-Coupling losses	15
Table 4.2	DC coupling losses	15
Table 4.3	Assumptions on components' parameter	18
Table 4.4	Parameters for Case 1	19
Table 4.5	Fuel cost for case 1 - Day load	19
Table 4.6	Fuel cost for case 1 - Night load	20
Table 4.7	Comparison on Monthly Fuel Cost Reduction Case-1	20
Table 4.8	Parameters for Case 2	22
Table 4.9	Fuel cost for case 2 - Day load	22
Table 4.10	Fuel cost for case 2 - Night load	23
Table 4.11	Comparison on Monthly Fuel Cost Reduction Case-2	23
Table 4.12	Parameters for Case 3	25
Table 4.13	Fuel cost for case 3 - Night load	26
Table 4.14	Fuel cost comparison for case 3	26
Table 4.15	Fuel cost for case 4 - Night load	28
Table 4.16	Fuel cost comparison for case 4	29
Table 4.17	Fuel cost for case 4 - Night load	32

LIST OF FIGURES

FIGURE NO.	TITLE	PAGE
Figure 1.1	Location of all isolated Solar Hybrid Stations in Sabah State.	2
Figure 1.2	View of SHS Pulau Banggi	2
Figure 3.1	Existing Configuration of SHS Pulau Banggi.	7
Figure 3.2	Project Flowchart	8
Figure 3.3	Load profile pattern on SHS Pulau Banggi in 2021	11
Figure 3.4	Power trending pattern on SHS Pulau Banggi in 2021	11
Figure 3.5	Daily and monthly average solar Irradiation for 2021	12
Figure 4.1	MATLAB-Simulink mathematical modelled with maximum night-load	16
Figure 4.2	MATLAB-simulink mathematical modelled with minimum night-load	16
Figure 4.3	MATLAB-Simulink mathematical modelled with maximum day-load	17
Figure 4.4	MATLAB-Simulink mathematical modelled with minimum day-load	17
Figure 4.5	Charts of Fuel Cost comparison for Case 1	21
Figure 4.6	Charts of Fuel Cost comparison for Case 2	24
Figure 4.7	Charts of Fuel Cost comparison for Case 3	27
Figure 4.8	Chart on Summary of Fuel Cost Reduction for all Cases	31

LIST OF ABBREVIATIONS

PV	-	Photovoltaic Module
GA	-	Genetic Algorithm
DG	-	Diesel Generator set
UTM	-	Universiti Teknologi Malaysia
UG	-	Unit Generated
SHS	-	Solar Hybrid Station
AC	-	Alternating Current
DC	-	Direct Current

LIST OF SYMBOLS

kWh - Unit generated in kilo-watt-hour

LIST OF APPENDICES

APPENDIX	TITLE	PAGE
Appendix A	Detail Calculation On Case 1	37
Appendix B	Detail Calculation On Case 2	39
Appendix C	Detail Calculation On Case 3	41
Appendix D	Detail Calculation On Case 4	43

CHAPTER 1

INTRODUCTION

1.1 Problem Background

Solar hybrid system is proven as a cost-efficient system among other types of Renewable Energy Sources (RES). The system fulfills the load demand and maintaining the power quality of the system. There are many types of hybrid system in the world. One of the common types is Solar-Diesel system. Diesel generator is as the backup supplies to the consumer during low solar irradiation from the sun

In Sabah state, there are approximately 33 solar hybrid stations supplying to isolated 33 rural areas which some of the stations were design 10 years back where the design and studies irrelevant with the current demand. Figure 1.1 below shows the location of SHS Pulau Banggi and all existing power stations in Sabah whereas Figure 2 show the view of SSH Pulau Banggi.

Without proper design and sizing of the PV module, it will cause higher fuel consumptions that leads to significant amount of generation cost (billions of MYR). Hence, the proper analysis and simulation need to be done to exponentially reduce the generation cost.

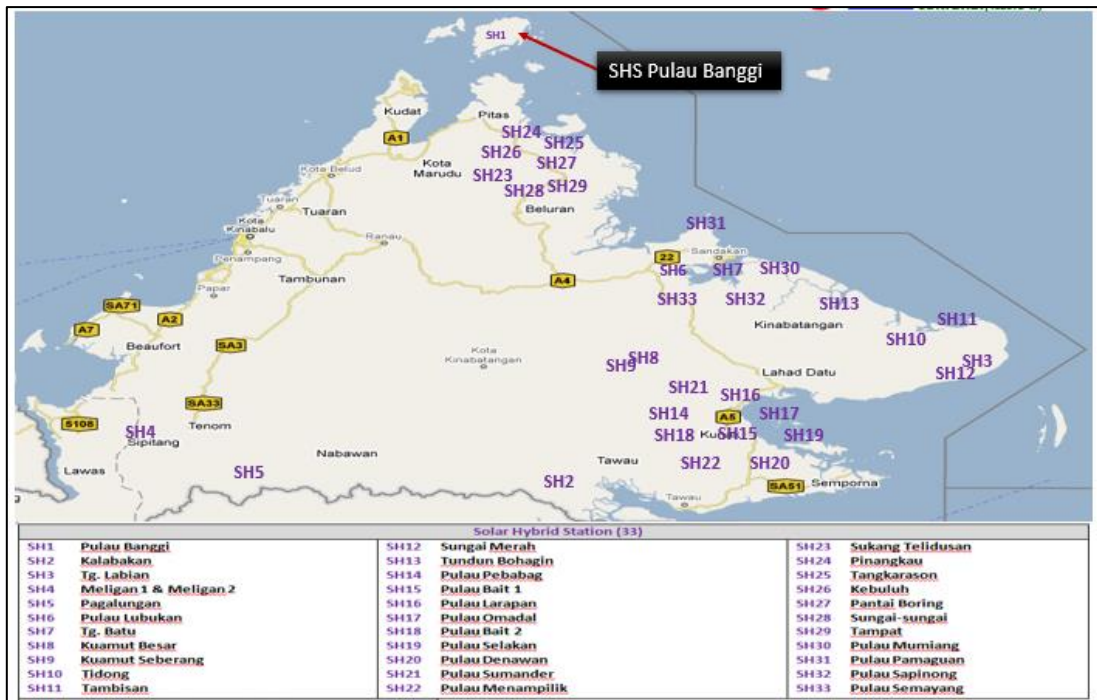


Figure 1.1 Location of all isolated Solar Hybrid Stations in Sabah State.



Figure 1.2 View of SHS Pulau Banggi

1.2 Problem Statement

Expanding the power grid's availability to meet all of the region's distributed loads is quite expensive especially for remote and rural areas. As an alternative, off-grid systems made up of photovoltaic (PV module) plus diesel generators plus batteries have been configured together ^[2]. Renewable energy technology systems are considered as the reliable power system and PV system is one of the most popular options.

Nowadays, with the increasing of energy demand and consumption, the major challenges facing by the power provider is to provide reliable and uninterrupted power supply at lowest cost possible ^[8].

Research questions to be answered in this paper is “What is the effect of solar PV sizing to prevent high generation cost due to high fuel consumption?”.

By this research question, the main problem faced by most of the solar-diesel Hybrid system is due to high cost of fuel consumption which basically due to in efficient of PV module.

1.3 Research Objectives

The objectives of this project are:

- (a) to assess the current needs and demands for a standalone solar-diesel hybrid system; and
- (b) to calculate, propose and validate the new sizing of PV in order to meet fuel cost reductions.
- (c) To conclude the cost reduction by validation using existing load profile through conventional calculation.

1.4 Project Scopes

This research work will be focusing to the most problematic solar-diesel hybrid system owned by Sabah Electricity Sdn. Bhd which is Pulau Bangi Solar Hybrid which is located in an isolated island in Kudat District, Sabah, Malaysia.

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