

**FEASIBILITY OF OFF-GRID HYBRID SOLAR-WIND
ENERGY FOR POWERING UMS PEAK
COMMUNICATION REPEATER**



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UMS
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**FACULTY OF ENGINEERING
UNIVERSITI MALAYSIA SABAH
2020**

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ENERGY FOR POWERING UMS PEAK
COMMUNICATION REPEATER**

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UNIVERSITI MALAYSIA SABAH

UIMS

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DEGREE OF MASTER OF ENGINEERING**

**FACULTY OF ENGINEERING
UNIVERSITI MALAYSIA SABAH
2020**

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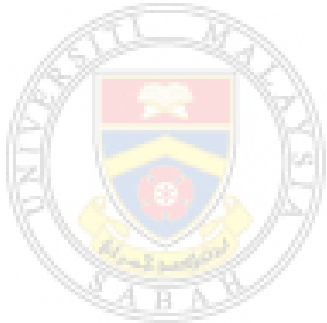
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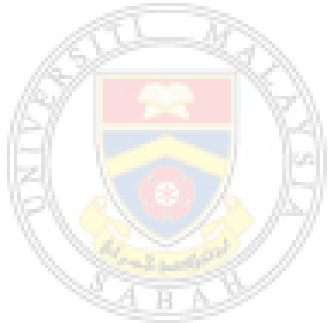
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ZECKREY JIKURUN
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ABSTRACT

Communication signal (Data and Sound) at UMS Peak and surrounding area including Kolej A and Kolej B was found very weak to no signal because of the location that located behind the hill. Therefore, communication repeater is suggested to be installed at this location. Since the UMS Peak is located at remote area at UMS location with no access to electricity thus, selected renewable energy resource specifically solar and wind renewable energy is chosen to be studied since the resource is exists perpetually at targeted site for communication repeater off-grid electrification. After comprehensive study is done, off-grid solar wind renewable energy will be install using proposed single line diagram at UMS peak strategic location to power up communication repeater. The generated energy and telecommunication signal strength will be analyse and study.



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ABSTRAK

KAJIAN KEBOLEHLAKSANAAN SUMBER TENAGA HIBRID SOLAR-ANGIN LUAR-GRID UNTUK MEMBEKALKAN KUASA ELEKTRIK KEPADA ALAT PENGULANG TALIAN KOMUNIKASI PUNCAK UMS

Kekuatan isyarat telekomunikasi di lokasi UMS Peak didapati lemah dan tidak stabil. Oleh itu, "Communication Repeater" dicadangkan untuk dipasang di lokasi ini. Lokasi Puncak UMS terletak di kawasan terpencil tanpa akses kepada elektrik, jadi sumber tenaga yang boleh diperbaharui dipilih untuk dikaji dan dituai untuk menghasilkan elektrik bagi menghidupkan alat "Communication Repeater". Memandangkan lokasi tapak berada berdekatan dengan garisan khatulistiwa maka, tenaga solar yang menukar sinar matahari kepada elektrik dengan menggunakan alat elektronik kuasa didapati sesuai dengan projek ini untuk dikaji. Satu lagi pilihan tenaga yang boleh diperbaharui adalah angin yang menukar tenaga kinetik angin ke elektrik menggunakan turbin. Walaupun tenaga angin tidak banyak di kawasan ini, kajian penyelidikan persamaan Weibull untuk meramalkan tenaga angin dan pengalaman teknikal yang diperolehi akan menjadi berharga kerana terdapat lokasi tertentu di Sabah yang mempunyai potensi tenaga angin yang hebat. Untuk membolehkan kedua-dua jenis tenaga dikaji dalam satu sistem, generasi "Off-grid" hybrid tenaga suria dan angin dicadangkan menjadi sumber penjanaan tenaga elektrik di UMS Peak.

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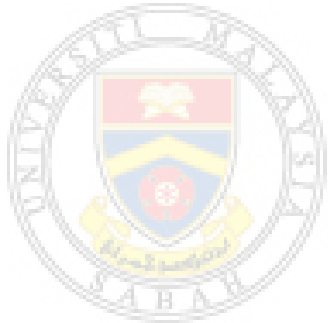
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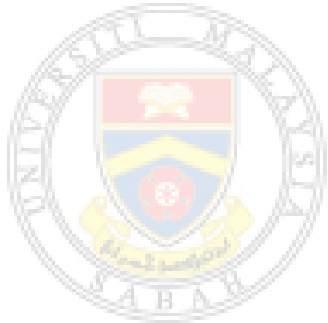
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LIST OF SYMBOLS AND ABBREVIATIONS

AC	Alternating Current
AGM	Absorbed Glass Mate
BTS	Base Transceiver Station
CDMA	Code Division Multiple Access
DC	Direct Current
DOD	Deep-of-Discharge
IEA	International Energy Agency
INC	Incremental Conductance
LCD	Liquid Crystal Display
MCB	Miniature Circuit Breaker
MPP	Maximum Power Point
MPPT	Maximum Power Point Tracking
OCVC	Open Circuit Voltage Control
P&O	Perturbation and Observation
PV	Photovoltaic System
PWM	Pulse Width Modulation
SCCC	Short Circuit Current Control
SPD	Surge Protection Device
STC	Standard Temperature Conditions
UMS	Universiti Malaysia Sabah
UMTS	Universal Mobile Telecommunication System
UN	United Nation
VRLA	Valve Regulated Lead Acid
WCDMA	Wideband Code Division Multiple Access

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CHAPTER 1

INTRODUCTION

1.1 Research Background

1.2 Problem Statement

Communication signal (Data and Sound) at UMS Peak and surrounding areas, including Kolej A and Kolej B, was found very weak to no signal because of the location that was located behind the hilly area. Therefore, Telecommunication Repeaters were proposed to be installed to strengthen the communication signal in the surrounding area, and site location was chosen at UMS peak due to its high location, and the installed communication repeater will have broader coverage. However, at this location, there was no electric supply to power the communication repeater. Hence Off-grid system renewable energy solar and wind specifically were proposed to be studied and installed at the site.

1.3 Project Objectives

The study was conducted to fulfill the following objectives:

1. To investigate the suitable renewable energy and strategic location.
2. To do equipment installation for harvesting solar and wind renewable energy at UMS peak.
3. To do data analysis and energy study on installed solar and wind renewable energy.
4. To analyze communication signal improvement electrified by solar and wind renewable energy.

1.4 Project Scope of Work

The scope of work for this project shall include the following matters:

1. Study on multiple renewable energy and suitable locations to harvest solar and wind renewable energy.

2. Proposed a single line diagram and install a proper solar and wind harvesting equipment at UMS peak, including the safety feature.
3. Recording and analyzing data captured at UMS peak for the duration of 1-year study.
4. Solar and renewable wind energy can sustain Communication repeaters. Communication signal improvement will be analyzed using cell info software.

1.5 Project Report Organization

This report is divided into five main parts. Chapter 1 is the introduction, which discusses the background of the project, problem statement, objectives, scope of work, and the project report organization briefly. Chapter 2 is about the literature review being summarized or gathered related to renewable energy, off-grid power system design, challenges of such systems. The literature reviews also provided some insight into the method of doing the renewable energy profile assessment as well as in understanding how hybrid power systems work and the critical parts in the system that could affect the reliability of the overall system.

Chapter 3 is about the methodology of doing the project. This chapter contained the project structure, project flowchart, systems hardware datasheet, method of analyzing the data collected. In Chapter 4, all the collected data from the solar PV and wind turbine would be presented in several forms for more straightforward observation on the data collected. In the last chapter, the overall project was wrapped-up based on the founding during the process of completing the project.