



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

**FEASIBILITY CASE STUDY OF PV SOLAR SYSTEM WITH
NET METERING: A CASE STUDY OF RESIDENTIAL AREA
(BUKIT KATIL, MELAKA)**

This report submitted in accordance with requirement of the Universiti Teknikal
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by

MUHAMMAD ASIF RAZAN BIN MD DON

B071510578

940921-14-5061

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APPROVAL

This report is submitted to the Faculty of Mechanical and Manufacturing Engineering Technology of Universiti Teknikal Malaysia Melaka (UTeM) as a partial fulfilment of the requirements for the degree of Bachelor of Mechanical Engineering Technology (Automotive) with Honours. The member of the supervisory is as follow:

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ABSTRAK

Net metering adalah satu mekanisme yang biasa yang membolehkan pengguna mengurangkan bil elektrik mereka dengan menggunakan elektrik sendiri yang dihasilkan dari sumber tenaga boleh diperbaharui, juga membolehkan menjual lebih tenaga yang dikeluarkan kepada utiliti atau grid (TNB). Sistem fotovoltaiik digunakan secara meluas dalam pengukuran bersih untuk pelaksanaan perumahan. Kajian ini adalah pemeriksaan kebolehlaksanaan untuk melaksanakan metering bersih di Malaysia dan juga menganalisis simpanan tahunan pengguna elektrik kediaman untuk isi rumah biasa. Kemungkinan ekonomi dianalisis dalam sistem PV kediaman berdasarkan perubahan pola penggunaan sebagai rendah, sederhana dan tinggi. Dari kajian kemungkinan, pengukuran bersih itu menguntungkan bagi lokasi yang mempunyai penggunaan yang tinggi dapat dibuktikan.

ABSTRACT

Net metering is a common mechanism which allows consumers to reduce their electricity bills by utilizing self-produced electricity from renewable energy resources, it also allows to sell the excess energy produced to utilities or grid (TNB). Photovoltaic system is used extensively in net-metering for residential implementation. This study is a feasibility check for implementing net metering in Malaysia and also to analyses the yearly savings of residential electricity consumers for typical household. The economic feasibility is analysed in residential PV systems based on changing consumption pattern as low, medium and high. From the feasibility study, that net metering is profitable for locations with high consumption can be proven.

DEDICATION

To my beloved parents

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LIST OF SYMBOLS

V_{mp}	-	Maximum Power voltage
I_{mp}	-	Maximum power current
V	-	Voltage
I	-	Amps
P	-	Power
DC	-	Direct Current
AC	-	Alternating Current
m	-	Meter
R	-	Resistor
h	-	Hour
P_p	-	Peak Power
E_r	-	Daily energy requirement
T_{min}	-	Peak Sun hour
E	-	Daily average energy Consumption
IDC	-	Total current needed
VDC	-	System DC Voltage
N_s	-	Series Module
N_p	-	Parallel Module
N_m	-	Total number of module
KW	-	Kilowatt
W	-	Watts

Wp	-	Watt peak
Voc	-	Open circuit voltage
Pmax	-	Maximum power rating
Isc	-	Short circuit current
KG	-	Kilogram

LIST OF ABBREVIATIONS

PV	Photovoltaic
NEM	Net Energy Metering
MH	Micro Hydro
SET	Solar energy technology
ST	Suruhanjaya Tenaga
SEDA	Sustainable energy development authority Malaysia
GCPV	Grid connected photovoltaic
SAPV	Stand Alone Photovoltaic
PCU	Power Conditioning unit
CT	Current Transformer
TNB	Tenaga Nasional Berhad
ROI	Return On Investment
PV	Photovoltaic
NEM	Net Energy Metering

CHAPTER 1

INTRODUCTION

1. Introduction

Solar energy is the energy that are been extract from the sun. This process includes changing the sun energy to the electricity for our everyday use. In order to convert this energy, we use a device call solar panel. Solar panel work by using multiple devices called a solar cell. When the photon hit a solar cell, the electrons will unattached from their atoms. If the conductors are attached to the negative and positive sides of a cell, it will form an electrical circuit. The electron that had been break off the atom will flow through the circuit and will generate electricity.

The common type of solar panel is photovoltaic solar panel are mostly known as PV solar panels. These solar panels are made up by a lot of solar cells. The main composition of solar cell is silicon. By constructed positive layer and negative layer together, it creates an electrical field. PV solar panel will generate direct current (DC) type of electricity. Dc means that the electron will flows only in one direction only different from alternating current (AC) type of electricity.

NEM concept which the energy produced by PV solar system installed will be consumed first by consumer, and an extra power will be sold to the distribution licensee (such as TNB/SESB) at the current Displayed Cost impose by the Energy Commission. This organization is relevant to all domestic, merchant and industrial section as long as they are customer of TNB (Peninsular Malaysia) or SESB (Sabah

and FT Labuan). PV system are allowed to be locate at accessible car porch or rooftops and only within their own premise.

The purpose of this project is to study and promote initiatives for cost-efficient PV adoption and use without need for FIT. Besides that, this project will show how to handle PV energy generation through smart management of supply and demand but focusing to the net metering.

1.1. Project Background

The Industrial uprising was a time full of changes and many natural resources had to be used especially in the industrial. Therefore engineers were trying to increase the use of renewable energy (sunlight, biomass, geothermal, wind;etc) for industry. The use of renewable energy as a sources to the environment with renewable energy technology is to achieve the desired effect such as providing heat, power or work done. This project focus on PV solar system with net metering in household building. Solar cells, also can be called photovoltaic (PV) cells by way of scientists, convert sunlight directly into electricity. PV gets its name from the method of converting light (photons) to the electricity (voltage), which can also called as the PV effect. Research had to be made at several places to observe the accuracy and problem when using PV solar system and there are advantages and disadvantages of the PV solar system. This research is to study the feasibility of PV solar power system especially in household and maybe can make some encouragement to the public energy consumer to use this type of renewable energy in the future to their houses.

1.2. Problems Statement

Energy consumption in Malaysia rapidly increase through this modern years. Energy demand for residential are one of the reason energy demand in Malaysia increase and forced any resources such as natural resources to sustain the energy demand for economic growth. The government has reducing subsidies in the face of mounting Government fiscal deficit shrinking current account surplus and worsening debt. The huge subsidies bill has been a bone of contention over the last few years and will give negative impact to consumer.

Vitality utilization will rise annually, the cost and bills likewise will be corresponding to the vitality use. This will prompted the additional consumptions on it while with appropriate vitality administration; there will be a ton of additional saving money on bills in long haul runs. The cash that recoveries from this strategy can be utilized to pay different duties.

1.3. Objectives

The objectives of this project are:

- i. To design PV system for a typical household
- ii. To analyse the feasibility of solar PV installed using net metering scheme

1.4. Scopes

This research is focusing on the selected NEM scheme for housing area which facing high consumption of energy during daylight. The scope is listed as following:

- i. Collect data and analyse for energy consumption for household.
- ii. Method for installation Net Metering for typical household.
- iii. Analyse net metering scheme by using Return On Investment (ROI) method.
Even though the starting cost for setup this system higher, in long term it will give the benefit to the user because of the cost saving.

1.5. Outline of project

This research consists of five main chapters which are:

1. Chapter 1: Introduction
2. Chapter 2: Literature Review
3. Chapter 3: Methodology
4. Chapter 4: Result and Discussion
5. Chapter 5: Conclusion

Chapter 1 will discuss regarding the introduction, objective, problem statement, scope of the project and the outline of project. On the following chapter, the theoretical information such as literature review and previous researches will be discussed. Chapter 3 will explain about the methodology of the project and progress track of the research. The flowchart of the project also is illustrated. In chapter 4, the discussion is discussed. From the result gathered, an analysis is done based from the research. It will show project improvement and failure result that we get during this period. The fifth