COMPARATIVE ANALYSIS BETWEEN NET AND GROSS METERING BASED FEED-IN TARIFF

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“Specially dedicated to

My Beloved Parents Kassim and Sahira and my Sisters Sara and Huda”

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ABSTRACT

Depleting gas and oil have encouraged scientist and governments to seek other alternatives. Renewable Energy (RE) resources have been the best option as a solution for the time being issue. In order to achieve rapid development of RE resources usage, Feed in-Tariff has been introduced and applied. FIT considers as an energy supply policy that offers a guarantee of payment to RE developers for the electricity the customers produce. It incentive to encourage uptake of RE technology including photovoltaic (PV) and wind turbines and other technologies. There are two different types of metering systems, Gross and Net metering. Gross metering policy is to pay customers for both RE installation and for the generated electricity weather it has been consumed or injected directly to the grid. However, Net metering policy only considers the difference of the injected and the consumed electricity. The customers are paid only if their electricity consumption is less than their generation. This project compares the results for Net and Gross metering system for various load cases. The works presented here include i) review different FIT scheme metering system for various countries, ii) to make different case studies for different loads scenarios for UTM load and a typical Malaysian house, in JB, comparing it to a European (Portugal) house and the analyses is performed by using Homer software. All cases will be considering grid connecting PV system. The effect of financial factor like payback period, NPC (Vet Present Cost) and COE (Cost of Electricity) are used in the comparison. Results showed that Gross metering was preferable for Malaysian domestic or commercial load because it has less COE, NPC and less payback period comparing to Net metering system.

ABSTRAK

Semakin berkurangan gas dan minyak telah menggalakkan saintis dan kerajaan untuk mencari alternatif lain. Tenaga boleh diperbaharui (RE) telah pilihan terbaik sebagai penyelesaian buat kali menjadi isu. Dalam usaha untuk mencapai pembangunan pesat dalam penggunaan sumber RE, Feed in-Tariff telah diperkenalkan dan digunakan. FIT menganggap sebagai dasar bekalan tenaga yang menawarkan jaminan pembayaran kepada pemaju RE untuk peghasilan elektrik oleh pelanggan. insentif untuk menggalakkan penggunaan teknologi RE termasuk photovoltaic (PV) dan turbin angin dan teknologi lain. Terdapat dua jenis sistem pemeteran, iaitu pemeteran kasar dan pemeteran bersih. Dasar pemeteran kasar adalah untuk membayar pelanggan untuk kedua-dua pemasangan RE dan penjanaan elektrik sama ada tenaga elektrik telah digunakan atau disuap secara terus ke grid. Walaubagaimanapun, dasar pemeteran bersih hanya mempertimbangkan perbezaan tenaga elektrik yang disuap dan digunakan. Para pelanggan hanya akan membayar jumlah pengunnan tenaga elektrik jika penggunaan mereka kurang dari penjaan mereka. Projek ini membandingkan keputusan untuk sistem pemeteran bersih dan kasar bagi pelbagai kes beban. Kerja-kerja yang dibentangkan di sini termasuk i) kajian skim meter FIT yang berbeza-beza untuk untuk pelbagai negara, ii) untuk membuat kajian kes yang berbeza bagi beban yang berbeza senario untuk beban UTM dan sebuah rumah kediaman Malaysia, di JB, membandingkannya kepada (Portugal) rumah Eropah dan analisis yang dilakukan dengan menggunakan perisian Homer. Semua kes akan mempertimbangkan penyambungan grid ke sistem PV. Kesan faktor kewangan seperti tempoh bayaran balik, NPC (Vet Kos Sekarang) dan COE (Kos Elektrik) digunakan dalam perbandingan. Hasil kajian menunjukkan bahawa pemeteran Kasar adalah lebih sesuai untuk beban domestik atau komersial di Malaysia kerana ia mempunyai kurang COE, NPC dan kurang tempoh bayaran balik berbanding dengan sistem pemeteran bersih.

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LIST OF ABBREVIATIONS

NPC	–	Net Present Value
PV	–	Present Value
COE	–	Cost Of Energy
RE	–	Renewable Energy
FIT	–	Feed-In Tariff
NREPAP	–	National Renewable Energy Policy and Action Plan
UTM	–	Universisi Teknologi Malaysia
GWh	–	Giga Watt hour
MJ	–	Mega Joule
m2	–	Meter square
PV	–	Photovoltaic
MBIPV	–	Malaysia Building Integrated Photovoltaic
kW	–	Kilo Watt
GHG	–	Green House Gases
TNB	–	Tenaga Nasional Berhad
RM	–	Ringgit Malaysia
Pc-Si	–	poly-crystalline silicon
Mc-Si	–	mono-crystalline silicon
CIS	–	Copper-indium-dieseline
A-Si	–	Amorphous silicon
UKM	–	Universiti Kebangsaan Malaysia
RECs	–	Renewable Energy Certificates
PPA	–	Purchased Power Agreements
DG	–	Distributed Generation

USA	–	United State of America
EBIT	–	Earnings before Interest and Taxes
NY	–	New York
AZ	–	Arizona
WV	–	West Virginia
LCOE	–	Levelised Cost of Energy
K$	–	1000$
NREL	–	National Renewable Energy Laboratory
HOMER	–	Hybrid Optimization of Multiple Energy Resources
JB	–	Johor Bahru

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CHAPTER 1

INTRODUCTION

1.1 Project Overview

The primary solution for the world wide serious issue ''depleting gas and oil'' is to provide a continuous energy supply to cover all needed demand. For any developed county, energy demand increases rapidly due to huge consumption of the different loads like commercial and domestic. To overcome this problem, many scientist and researchers found out that using renewable energy (RE) to provide electricity can be achieved and the technology has proved that by making wind turbines, PV panels and other RE technologies. Best alternative resources are RE like solar, wind, tidal, wave, geothermal and biomass. The location and the potential of these RE are important before installing the system and decide which RE technology to use.

Different techniques have been used as well not only to encourage investors but also to encourage people for using RE technology partially to generate electricity for their own usage. These protocols vary from one country to another by different rules contracts and various tariffs. Feed-In Tariff (FIT) scheme considered as a good technique to use RE technology and encourages people to use and install it. There are two schemes for FIT to apply, Gross and Net metering system.

The recent studies signify the importance of the applying FIT system to supply green electricity using one scheme depending on the country and the utility contracts. However, each state or country uses either gross or net metering system.

Guaranteed price is set for the RE electricity generation is being performed using FIT scheme. It will be for long period of time, depend on the country and the utility contract for it, in order to encourage investment for the use of RE system. China, Germany, Denmark, Portugal, Spain and many other European countries or the other American continents have applied FIT scheme with success in prevailing huge amount of solar, biomass and wind energy. The main advantage of FIT is long-term assurance of financial support which leads to reduce the investment risks noticeably.

Net metering is a policy that allows customers to use RE system to generate electricity and sell the extra generation to the grid. It works by using one meter that spin and records the flow of the energy in both directions. When it spins forward, means the customer is drawing electricity from the utility grid and when it spins backward then the customer is sending power to the grid. By the end of the month the customer will be charged for the difference of the electricity if it consumes more than what it generates. But if it injects power more than needed then depending on the arrangements in that place it get paid back somehow.

On 2nd April 2010, the FIT was introduced under the National Renewable Energy Policy and Action Plan (NREPAP) which has been approved by Malaysian cabinet. This NREPAP is established to enhancing the utilisation of local RE resources to contribute towards national electricity supply security and sustainable socio-economic development. The FIT scheme is an enterprise to allow consumer to generate electricity from RE resources and sold it to the power provider at fixed rates in specific duration. For example, renewable energy for biogas and biomass, the lifetime agreements is 16 years while for small hydro and solar PV the agreements is for 21 years. In Malaysia, gross metering is applied. The objectives of FIT scheme are as follows [1]:

i. To ensure reasonable RE generation is used,
ii. To ease the growth of the RE industry,
iii. To conserve the environment for future generation and
iv. To increase RE contribution in the national power generation.

Gross or Net metering systems are two techniques used for calculating the difference in electricity used, generate from RE installed system and the benefits for the investors. Net metering considers to pay the customers regarding the difference of the electricity energy injected to the grid and consumed from utility, whereas Gross metering pay them once for their installation of RE system and for the injected electricity to the grid.

This project aims to evaluate Fit (gross and net) scheme, pricing (COE and NPC), payback period and the optimum scheme to use in Malaysia will be considered for different load scenarios.

1.2 Problem Statement

FIT has been known as an actual solution to make a monthly income. Customers can generate electricity from RE sources that they installed. Either Net or Gross metering system is being used, the utility will pay the customer regarding the type of mechanism they are using. Due to the difference between these two mechanisms, this study will compare between them by assessing various scenarios of different load profiles. Malaysian and European domestic load will be studied. Also different scenarios of UTM load profile will be done. All scenarios based on grid connected PV system. The COE, NPC and payback period will be studied for all cases using Homer software.

1.3 Objectives

In order to achieve the aim, this study has the following objectives:

1. To review different FIT scheme metering system for various countries
2. To apply Gross and Net metering scheme on different types of customers using HOMER software
3. To analyze and compare for both metering scheme in terms of NPC, COE and payback period

1.4 Significance of Study

The main superiority of the proposed project is to study the difference of gross and net metering system and make a comparison of them to decide which pricing mechanism better to apply in Malaysia.

1.5 Scope of Study

This project provides a comparison between Net and Gross metering system while considering similar cases applied in several countries. It depends on many factors such as load profile, tariff structure, solar irradiance, discount rate and other factors. It is important to do comparative analysis to investigate the preferred metering that would benefit both customers and utility. In this study, it will be limited to grid connected PV system for domestic and

commercial loads. A case of a residential load profile for a typical Malaysian and European (Portugal) house will be investigated. Installing 4kW of grid connected PV system will be introduced. COE, NPC and payback period will be considered. Another case is UTM commercial load, many scenarios will be done considering different PV capacity varies from 27kW to 30MW. Different tariff rates will be considered regarding the each various PV capacity.

1.6 Project Report Outline

This report is produced in order to fulfil the requirement of master project. The report is organized in the following ways:

Chapter 1 describes the project introduction, problem statement and objective of the studies.

Chapter 2 reviewed and summarized the previous studies and works that has been discussed of other countries regarding feed-in tariff (FiT) scheme, comparison of different metering systems, Home software and other important parameters.

Chapter 3 covers the project methodology which involves studies in historical data of using FiTs, solar irradiation, FiT rates and data collection of selected residential house for Malaysia and Europe, some calculations regarding some parameters to find out and Homer software for estimate approaches.

Chapter 4 is the project result and discussion. In this chapter, the data projection for the suggested different loads (Malaysian house, European house and UTM load) scenarios to evaluate it using Homer software and find out the COE, NPC and payback period. Deciding which scheme is better by comparing the results that has been performed.

Chapter 5 Concludes the overall project and suggesting for future work.

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