

**ANALYSIS OF BIOMASS POWER GENERATION POTENTIAL FOR  
FEED IN TARIFF (FIT)**

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**A report submitted in partial fulfilment of the requirements for the degree of  
Bachelor of Electrical Engineering (Industrial Power)**

**Faculty of Electrical Engineering  
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I declare that this report entitle “Analysis Of Biomass Power Generation PotentialFor Feed In Tariff (FIT)” is the result of my own research except as cited in the references. The report has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature : .....  
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To my beloved mother and father



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Lastly, I don’t claim all information in this term of research is included perfectly. There me be shortcoming, factual error, mistaken opinion which are all mine and I alone am responsible for those but I will try to give a better volume in future.

## ABSTARCT

The enforcement of the Renewable Energy Act 2011 (Act 725) on 1st December 2011 has allowed the Feed-in-Tariff (FiT) processes to be implemented in Malaysia providing for a sustainable for renewable energy (RE) growth base for the RE Industry in Malaysia including biomass and biogas. Both RE resources have shown promising development and it could be seen from the number of projects which has benefited from the FiT mechanism. Biomass coming from plantation sector especially from the palm oil industry waste such as empty fruit bunches (EFB) and palm oil mill effluent (POME) has a huge potential to be explored for power generation. SEDA Malaysia, being the agency responsible for facilitation of RE growth is playing its role to ensure installations especially those under the Feed-in Tariff (FiT) mechanism meet and complying to the international standards in terms of quality, reliability and safety which will indirectly impact the performance of the biomass power plants. This project uses Kilang Sawit Felda Chini as a place to do research on the Feed-in-Tariff (FiT) process based on the existing biomass generation in the plant. If FiT implemented in this plant, it can provide a great advantage due to the sale of electricity generated each day. However, the investment cost for the implementation of FiT on biomass generation is very high.



## ABSTRAK

Penguatkuasaan Akta tenaga boleh diperbaharui 2011 (Akta 725) pada 1 Disember 2011 telah membenarkan proses “Feed-in-Tariff” (FiT) yang akan dilaksanakan di Malaysia bagi menggalakkan pembangunan tenaga boleh diperbaharui (RE) yang asas dalam industri di Malaysia termasuk biomass dan biogas. Kedua-dua sumber tenaga boleh baharu ini telah menunjukkan perkembangan yang memberangsangkan dan ia dapat dilihat daripada jumlah projek yang telah mendapat manfaat daripada sistem FiT. Di Malaysia, biomass yang datang dari sektor perladangan terutamanya daripada bahan buangan industri minyak sawit seperti tandan buah kosong (EFB) dan kolam sisa buangan kilang kelapa sawit (POME) mempunyai potensi besar untuk diterokai bagi penjanaan kuasa. SEDA Malaysia, yang merupakan agensi bertanggungjawab ke atas fasilitasi kepada pertumbuhan tenaga boleh baharu memainkan peranannya bagi memastikan pemasangan berkenaan Feed-in Tariff (FiT) mekanisme memenuhi dan mematuhi piawaian antarabangsa dari segi kualiti, kebolehpercayaan dan Keselamatan yang akan memberi kesan yang langsung kepada prestasi penjanakuasa biomas. Projek ini menggunakan Kilang Sawit Felda Chini sebagai tempat untuk menjalankan penyelidikan tentang proses suapan dalam tariff (FiT) berdasarkan kepada janakuasa biomass yang sedia ada di kilang. Jika sesuai dilaksanakan di kilang ini, ia boleh memberikan kelebihan yang besar disebabkan oleh jualan tenaga elektrik yang dijana setiap hari. Walau bagaimanapun, kos pelaburan bagi pelaksanaan wajar mengenai penjanaan biomass adalah sangat tinggi

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## CHAPTER 1

### INTRODUCTION

#### 1.1 Research Background

In early 2004, the Feed-in Tariff mechanism start presented in Malaysia. In 9th Malaysia plan (2006-2010), China has been making dream to build renewable energy by linking to the power utility grid. Renewable energy development plan is to build a 300MW in Peninsular Malaysia and Sabah 50MW [1]. Later in the year 2011, Malaysia finally achieving a dream to apply this mechanism based on two FiT the laws that need to be observed towards sustainable energy's existing or new. Feed-in Tariff is a medium of the energy services to purchase renewable energy from the manufacturer at a bill scale on set depending on future profitable investment to a company, industry, and individuals.

Based on the title of the project "Analysis on Feed-in Tariff (FiT) rates in Malaysia for Biomass System at Palm oil factory", the term "Feed-in Tariff (FiT)" mean a tariff containing the tax return or the issuance of a payment from the Government subsidies to renewable energy sources (RES) producers per Kilowatt-hour (KWh) of electricity that has been produced in an area in a specified period of time [2]. And the word of "Biomass" means all biological materials such as firewood, firewood waste, agronomic residues and compost farming [3, 4], which is a fuel used for electricity generation through the concept of renewable energy worldwide.

Starting year 2000, the increase in demand of electricity biomass power generation factor is introduced based on the ability of the preparation bio residues in four Southeast

Asian Countries including Malaysia [5]. With a growing need for green technology research and development (RD) activities have low sulfur content and being carbon dioxide neutral over many fossil fuels. In addition, the limitation of fossil fuel is one aspect that led the Government to change the policy of energy conservation to other sources of energy [6]. After Indonesia, Malaysia is the second palm oil manufacturer in the world after and the resulting large quantity of palm oil waste are used as a boiler fuel to generate steam [7]. This can reflect the palm oil producer is one of the largest contributors in the development of biomass power generation. However, Biomass power is to be weaker in Malaysia than in the other countries.

## **1.2 Project Motivation**

Today, Malaysia is looking forward to visualize the 2020 VISION and has undertake the challenges to support the worldwide policies on environmental issues and remedy it with renewable energy resources. Nowadays, green technologies are needed to not only give benefits on environmental but also towards fighting the recycle waste product. Considering Malaysian, the waste fruit bunch as a fuel supply is the most significant sources of generating the electricity. Now, Malaysia is looking for FIT schemes that can promote for effective policies in order to make move on renewable energy and overcome the high investment risk. The goal of FIT is to such resources for the duration of the program and potentially pave the way for future growth [3]

## **1.3 Problem Statement**

Malaysia's financial development is equally related with fossil energy resources, which is kept on belongings by the developing energy demand. The two power segment,



industrial and transportation continued intensely dependent on oil and natural gas. High demand in electricity consumption also increased from year to year.

Based on these two major issues, the feed in tariff mechanism were be introduced to settle up this problem. By warranting access to the grid and set an encouraging price per unit of renewable energy such as biomass power generation, the FiT mechanism would guarantee that renewable energy turns into a suitable and as a long term investment for companies industries and similarly for individuals.

The most common issues is about biomass power generation commonly popular used in independent industrial user. So, the electricity that were be generate will use for electrical equipment in their factory. Commonly the power that be generated is higher than the energy consumption. The waste of energy that is not used can bring in real money by access to the Power Grid is assured since the utilities are legally obliged to accept all electricity generate by renewable energy private creator.

#### **1.4 Objectives**

The objectives below should be effectively accomplished so as to meet all condition of analysis due to Feed-in Tariff biomass power generation

1. To overview a biomass system power generation system with capacity of 1.6MW, by refer to the palm oil factory.
2. To analyze the net export capacity of renewable energy installation related to FiT rates.
3. To analyze the upcoming financial return as indicated by Malaysia FiT rates (Ringgit/KWh)

## 1.5 Scope

Approach of this project is to analyze the power system related to Malaysia FiT. There is a biomass power generation at Felda Selancar 2B Palm Oil Industries Sdn. Bhd as a place to evaluate the potential of power that were generated to sell it by follow the FiT concept. The data of electrical parameter that have been recorded is used to implement the proposed of Feed in Tariff.

This study will mainly focus on biomass system generation. For the first part, the study are focusing on observing and collect the data of a biomass power system circuit for low power consumption including specification of biomass fuel, boiler system, alternator ,genset , turbine and various load such as switch socket outlet, lighting, motors, and mechanical machine. For the second part, the study are focusing on analyzing the data in power generating and power consumption per hour. Next, the future financial return will be evaluate from the expected power that want to sell.

## **CHAPTER 2**

### **LITERATURE REVIEW**

#### **2.1 Economic of Distribution Resources**

The procedure expected to assess the financial matters of both side of electrical by introduce on supply side and demand side need to investigate. Some of this useful engineering economic, the energy system that we have to assess including renewable energy in biomass methods and at time required uncommon points of view to effectively describe their economic circumstances. This section additionally incorporates the technologies, system, business sector to drive the FIT plan and energy intention to be survey.

#### **2.2 Feed-in Tarif**

The FiT is Malaysia's new system under the renewable strategy and activity plan to funding the generation of renewable energy up to 30MW in size [1]. The renewable energy assets to be retailed to the power values at fixed quality cost for a particular term. The simple idea of FiT is that the distribution license pays the renewable energy power generator a best for clean energy that is produced. This permits holders to shift their clean

energy to the distribution license for fixed number of years. The length of time is directed by the sort of the renewable energy utilized for power generation.

The encouragement to give a permanent fee from the power supplier for each kilowatt hour (KWh) of power created and an ensuredless fee for each kilowatt hour (KWh) traded to the grid. The Sustainable Energy Development Authority has been built up under the Act of Parliament to accomplish and supervise the operation of the FiT. The Act has been acknowledged by parliament in March 2011 and has been built up by April 2011.

The renewable energy properties that has been qualified for FiT were solar PV, biomass, small hydro, and biomass. The FiT rates in Malaysia were appeared as Table 2.1. It shows that, the maximum capacity of installation the renewable energy for FiT is 30MWp for compelling duration for 16 years [8].

Table 2.1 Feed in Tariff aimed at Biomass Power Generation

Description of qualifying renewable energy installation	FiT rates (RM per KWh)
<b>a) Basic FiT rates having installed capacity of:</b>	
<b>Up to and including 10MW</b>	0.3085
<b>Above 10MW and up to and including 20MW</b>	0.2886
<b>Above 20MW and up to and including 30MW</b>	0.2687
<b>b) Bonus FiT rates having the following criteria (one or more)</b>	
<b>Use of gasification technology</b>	+0.0199
<b>Use of steam-based electricity generating system with overall efficiency of above 20%</b>	+0.0100
<b>Use of locally manufactured or assembled boiler or gasifier</b>	+0.0500
<b>Use of solid waste as fuel source</b>	+0.0982

It has payback period for a long time and the deviation rate of 8% every year. The client that attracted on this FIT plan can back without anyone else or even have title capital, there is punitive bank that may help to placed advances. This asset will reach is

combined estimation of MY18.9 billion in 2030 with the expanding on current electrical tax by 1% and the sum assembled into the FiT asset [9]. A few issues must be delivered by laws to guarantee the FiT plan work effectively in Malaysia. To begin with, the energy that created by biomass framework must be joined with grid. Second, any nearby endorsement must be clear and reorganized. Third, the FiT plan must have the capacity to create return on benefit. Fourth, the FiT rate must be reformed for long stretch of business. Fifth, the FiT must have an adequate asset and a skill organization how can actualize the FiT.

### **2.2.1 The Advantages of Feed-in Tariff**

There are many advantages of utilizing feed-in tariff as the financial support scheme. Firstly, the FIT scheme will encourage the development and implementation of RE in order to reduce the carbon emissions being emitted to the atmosphere. Besides that, FIT scheme does not only help the community to secure their own electricity supply but also help on improving global and domestic security of electricity supply. Finally, the rate of payment on the electricity is guaranteed including the electricity produced by RET and supply to the electricity grid. Moving to renewable and environmentally responsive energy resources will likewise support to produce a new 'green' industry, which in turn it will form extra of jobs

Furthermore, there will be added technologies driven inventions which are useful to community [9]. Countries like Germany, Canada, United States, Australia, Denmark and Spain have successfully implemented the FIT systems and the FIT system has verified to be one of the „green energy“ programs towards global energy conservation.

The RET producers have to submit the application to get the agreement with the utilities to apply this FIT scheme. After that, the RET producers are entitled for the FIT of which then they will get benefits on it. Some of the benefits are:

- i. Generation tariff
- ii. Export tariff
- iii. Energy bill savings

### **2.2.1.1 Generation Tariff**

The generation tariff remains the set of rates payment by the utilities for each kWh of electrical energy that generated by the RET producers [10]. The rate for RET producers is same for 20 to 25 years depends on the types of solar modules being used but the rate will change each year for new installment of RET to the FIT scheme.

### **2.2.1.2 Export Tariff**

The export tariff is the RET producers will receive amount of price by the utilities for further 3p/kWh for every kWh that supply to an electricity grid. The rate is same for all RET.

### **2.2.1.3 Energy Bill Saving**

Energy bill saving is the post result of the FIT scheme implementation. The RET producers do not have to import the electricity from the utilities because of they have their own electricity supplier. So that, they do not have to pay any price of electricity usage to the utilities which means, they have making the saving on electricity bills.

## 2.3 Energy Economic

There are numerous techniques to figure the economic viability of distribution generation and energy efficiency projects. The cost of operation, the equipment, maintenance costs and other payments must be combined in some method so that an evaluation may be made with the cost of not doing the project. It is proposed to give a sensible begin to the budgetary assessment and enough at any rate to know whether the undertaking merits further, more watchful, examination [11 ].

### 2.3.1 Cash flow

The income is state to the development of money into or out of a record, a business or a speculation. At the point when a money inflow surpass money outlaw, this is for the most part consider to be a sign as great monetary good, both of individual and organization [12].

There are commonly have three types of cash flow.

- i. Operating cash flows is discuss to the money got or spent as an outcome of organization's business activities.
- ii. Investment cash flow is state to money got or spend through investment activities. Basically acquiring and offering resource that will expand his total assets
- iii. Financing cash flows is mention to the money got through debt obligation or paid out as obligation repayment [12]. For company, issuing stock, paying death debt and repurchasing offer would as component of financing income.

### 2.3.2 Return on assets

It is a measure of how gainful an organization is in respect to its benefits or the assets its own particular or controls. This measure permits the financial specialist to legitimize how proficiency administration is and utilizing organization resources for produce gaining [12]. For instance, Total assets of Company X on July 1, 2014 and June 30, 2015 were RM2,132,000 and RM2,434,000 respectively. During the year ended June 30, 2015 it earned net income of RM213,00. So the average total assets is RM2,283,00 and the return on assets ratio is 0.09 or 9 %. Typical industry will have diverse ROA, assembling required bunches of assets and will have huge measure of advantages. Conversely, administrations organization like record firm will have not very many hard resources, consequently is ideal to contrast ROA and same industry.

### 2.3.3 Return of investment

Return of investment (ROI) assists financiers with evaluating the execution of a speculation and relate it with the execution of their other venture. The ROI calculation is flexible and can be manipulated for different uses. A company may use the calculation to compare the ROI on different potential investments, while an investor could use it to calculate a return on a stock. For example, an investor buys \$1,000 worth of stocks and sells the shares two years later for \$1,200. The net profit from the investment would be RM200 and The ROI in the example above would be 20%. The calculation can be altered by deducting taxes and fees to get a more accurate picture of the total ROI.