

# The Implication of Feed-in Tariff Funding Structure and the Sustainability of Renewable Energy in Malaysia

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**Abstract** — With the anticipated increase in energy use and its implication toward sustainable development, Malaysia has put renewable energy at the forefront of Malaysia's energy policy to address environmental issues such as climate change and fossil fuel depletion. Drawing from successful case-studies from around the globe, Malaysia implemented its own version of the Feed-in Tariff (FIT) mechanism in a bid to achieve energy security and environmental prosperity. After three years of success, the growth of the renewable energy market under FIT is under threat due to the small size of the Renewable Energy Fund. Since FIT is funded by electricity consumers, they would need to make a larger contribution to address the issue. The question remains on whether the Malaysian public is willing to pay more. Previous literatures from Europe suggested that large segments of the general population are willing to pay for green electricity. More importantly, existing literatures have mixed reviews on whether attitude towards environment affects WTP. Using theory of planned behavior (TPC), the NIMBY (not-in-my-backyard) attitude towards environment was highlighted in several studies, especially in Malaysian literatures. The application of contingent valuation method (CVM) was demonstrated in literatures from Europe and the United States. However, Malaysian literatures lacks the use of CVM in their WTP investigations. Finally, recommendation for future studies on WTP for green electricity in Malaysia was put forth with an emphasis on the use of TPC and CVM approach. The outcome of such study would give policy-makers the quantitative evidence to justify any changes to the FIT funding structure in a bid to further enhance the growth of renewable energy.

**Keywords:** Feed-in Tariff (FIT), Funding Structure, Renewable Energy, Sustainability, Environment.

## I. INTRODUCTION

As climate change becomes the predominant environmental issue, governments around the world have expressed the need to reduce the emission of greenhouse gases due to human activity. On the other hand, the need to meet the ever increasing energy demand further complicates

the situation as governments try to strike a balance between mitigating climate change while ensuring energy security. Also, depletion of fossil fuels further threatens energy security. In the power generation industry, the feed-in tariff (FIT) mechanism has been a popular policy to address both energy and environmental issues. Governments around the world have adopted the FIT mechanism to increase the generation of electricity from renewable sources. In simple terms, the FIT mechanism allows renewable energy (RE) producers to sell electricity to utility companies at a premium price for a fixed number of years. Such incentive encourages the private sector to invest in RE due to a guaranteed return of investment after a certain number of years [1]. Thus, such financial incentive has proven to be the driving force behind the rapid development of RE installation in developed countries [2]. However, the FIT mechanism is still at its infancy in many developing nations. The ability of the FIT mechanism to overcome barriers such as funding challenges, public acceptance, and hikes in electricity prices have not yet been fully explored in developing countries such as Malaysia.

This study looks at existing literatures on Malaysia's energy policies, public attitude towards environment, and willingness to pay for green electricity. By reviewing literatures in these major areas, the connection between FIT and the general public can be established. More importantly, a comprehensive review of these topics could reveal research gaps or areas of studies which need further investigation in order to address any challenges arising from FIT.

The study explored the broader view of feed-in tariff from the perspective of sustainable development policies in Malaysia. Review of literatures pertaining to the history of FIT, comparative studies of alternative RE policy mechanism, and the current challenges of FIT was carried out. Also, the role of FIT in the international arena and how it influenced FIT policies in Malaysia was explored. Subsequently a summary of previous literatures which deals with public acceptance of FIT and willingness to pay (WTP) was also carried out. The result illustrates how public

acceptance is very much connected to the existing challenges of the FIT funding structure. In addition, the methodology used in selected literatures was analyzed in detail for comparison where connection between the different topic areas was made, followed by recommendation for future studies.

## II. ORIGIN, DEVELOPMENT, AND CHALLENGES OF FEED-IN TARIFF IN MALAYSIA

### A. Energy Policy

In order to address the issue of climate change, countries around the world have been implementing a series of national policies which is consistent with the concept of sustainable development. Energy is an important issue in the realms of sustainable development because energy consumption has economic, social, and environmental implications. Moreover, energy is directly linked with key environmental pressures such as climate change, air pollution, and resource depletion whose impact range from local to global scale [3].

For the past 30 years, the Malaysian government had been implementing energy policies whose objectives include ensuring energy security while addressing environmental issues [2]. Energy security can only be achieved by meeting energy demands while ensuring access to natural resources for energy consumption [4].

In Malaysia, energy security became a national priority beginning in the early 1970s after the global energy crisis. The "Four-Fuel Diversification Policy" was implemented in 1981 to reduce the nation's dependency on oil [2, 5]. According to Rahman et al. [6], Malaysia's dependency on oil dropped from 90% in 1980 to 10% in 2003. At the same time, natural gas, coal, and hydro contributed 71%, 11%, and 10% respectively by the end of 2003. However, the "Four-Fuel Diversification Policy" predominantly relied on fossil fuel for electricity generation which is both finite and emits greenhouse gas after combustion. Moreover, Malaysia's energy security becomes increasingly under threat from the prospect of having to rely more on imported of fossil fuel to meet future energy demand [5, 7].

In 2001, the government initiated "Fifth-Fuel Diversification Policy" under the Eight Malaysia Plan which aims at utilizing energy derived from renewable sources [6, 8-11]. The Small Renewable Energy Power (SREP) Program was set up to drive the growth of renewable energy as the fifth fuel [12]. However, Sovacool and Drupady [8] pointed that SREP was executed poorly which led to lengthy approval process, lack of coordination, lack of stakeholder involvement, and poor return of investment from renewable energy projects due to distortions in electricity price created by the fossil fuel subsidies. Several literatures [13-15] deduced that the SREP program was a failure due to the fact that the program did not attain its target of increasing share of renewables in the energy mix up to 5%. In fact, electricity generation from renewable sources constitutes a meager 1% in the mix at the end of the program [16]. The SREP program was put to a halt after 10 years of operation to pave way for the Feed-in Tariff mechanism which is a more

aggressive policy mechanism to drive the growth of renewable energy.

### B. Developing Renewable Energy Through Feed-in Tariff

Renewable energy developments have been a longstanding challenge for many countries worldwide. High financial cost, inaccurate electricity price due to fossil fuel subsidies, inconsistent political support are among the numerous barriers which have traditionally impeded the utilization of renewable sources [7]. Since 2000, Feed-in Tariff and Renewable Portfolio Standard (RPS) are the two most common policy mechanism that are being utilized in various countries to drive their renewable energy development [1, 17, 18]. The FIT mechanism is based around a standard offer contract whereby electricity produced from renewable sources are sold to utility companies at a premium price for a fix period of time. Such contract offers fiscal securities to developers of renewable energy installation [1]. On the other hand, RPS is mechanism whereby power utilities are obligated to increase the share of electricity produced from renewable sources over time [1]. Nonetheless, Hashim and Ho [2] pointed out that the FIT mechanism is the most effective RE policy which has proven to be successful in fostering rapid RE growth in over 40 countries. Other policy mechanism such as portfolios, voluntary payment scheme, and direct incentives were not able to match the success of FIT in terms of catalyzing RE growth in each respective country. Burer [19] conducted a quantitative study on the perceived effectiveness various renewable energy policy mechanism. With a maximum effectiveness score of 5, her study showed that FIT topped the chart with a score of 4.16 whereas as RPS was at 3.27.

Much of the FIT mechanism used around the world today is based on the German model. Through the FIT instrument, Germany had managed to increase renewable energy share of electricity production up from 7% to 20% between 2000 and 2011 [20]. Germany's success story served as an impetus for other countries to adopt a similar mechanism and tailor it towards local conditions. Therefore, Malaysia followed suit and implemented its own version of FIT under the Renewable Energy Act 2011 [13]. The Sustainable Energy Development Authority was established during the same period as a semi-government agency whose responsibility is to govern FIT operations [12]. The impact was almost immediate. After only three years of operation, grid-connected RE generating capacity increased from 65 MW to 239 MW [21]. The growth is remarkable given that the SREP program only produced 53MW of grid-connected RE generating capacity after 9 years of operation [1]. Moreover, Muhammad-Sukki [14] claimed that FIT had catalyzed the growth of RE in other sectors as well which includes the manufacturing industry, education, employment, and foreign investment. Overall, several literatures [13-15] have concluded that FIT is showing early signs of success with more room to grow in the future.

### C. Current Challenges of Feed-in Tariff

FIT offers financial security to potential investors, thus making RE projects attractive [19, 22]. Nevertheless, the attractiveness of FIT among investors is dependent on the remuneration package which is defined by the cost of the premium tariff at which power utility companies purchase electricity from RE producers [13]. Therefore, securing funding source to operate the FIT mechanism has been one of the key challenges that FIT operating countries are experiencing [17, 23]. In most countries, the preferred method of funding FIT operations is through collective payment vehicle in which a significant portion of electricity consumers must contribute [24]. Most European countries impose 'green levies' which appear in the electricity bill of consumers in which the money collected from these levies are being distributed in various sustainability programs which include FIT [20, 24]. Nevertheless, the connection between consumer electricity bills and FIT funding source essentially means that bigger FIT schemes can potentially result in hikes in electricity price to cover the FIT operating cost. Dangers in the unpredictable hikes in electricity prices due to FIT schemes have been demonstrated in Italy and Germany [17]. Antonelli and Desideri [17] claimed that the uncapped FIT scheme in Italy had caused a boom in the PV market, but scheme had caused a financial burden which exceed 7 billion euros over the next 20 years. Hence, mismanagement of FIT funding can cause a hike in electricity prices and put countries in a fiscal crisis.

With the benefit of hindsight, Malaysia introduced a quota system which is a cap in the FIT scheme based on the availability of the Renewable Energy Fund. The RE Fund is the money collected from electricity consumers to fund the FIT operation in Malaysia. To guarantee funding for new RE projects, the RE Fund is converted into a quota system whereby only a limited number of RE projects are approved each year. Such quota mechanism prevents the RE market from booming out of control which may result in a fiscal crisis that is ultimately paid by electricity consumers in form of electricity price hikes [1].

A quota system prevents a fiscal crisis under the FIT mechanism, however, the quota system can also act as a barrier to the achievable RE capacities. In other words, there can be a high demand for RE projects but the limited RE Fund can only finance a limited amount of projects, thus RE growth would stagnate once the RE Fund reaches its saturation point [1, 23]. Weibel [23] did a case study on Switzerland's RE growth from 2010 onwards and he claims that Switzerland's capping system had placed more than half of potential RE projects on the waiting list which accumulates to more than 3000 MW of RE capacities. Recently, Malaysia has encountered the same problem as the RE Fund is too small to meet demand for PV projects. In 2011, the quota for small scale PV projects was filled up within two hours of the opening [14]. Moreover, SEDA announced on 12<sup>th</sup> September 2014 that there will be no PV quota allocated for households for 2015 due to the overwhelming response for household PV projects in 2014 [25]. Overall, the small size of the RE Fund has already

caused the PV market to stagnate which must be address soon before collapsing even further.

### III. PUBLIC ACCEPTANCE OF FEED-IN TARIFF AND WILLINGNESS TO PAY

#### A. Relationship between Feed-in Tariff and the Malaysian Public

Despite the promising signs of RE growth after three years of operation, the small size of the RE fund has threatened to stagnate the RE market. At present, electricity consumers using more than 300kw per month are being charged 1.6% levy to their electricity bill [21].

In 2014, the RE Fund collected by SEDA accumulated to more than Rm 600 million from the levy, however, the RE Fund is still unable to meet the demand of RE projects. In order to increase the RE Fund, the 1.6% RE levy must increase as well [21]. However, any changes in the RE levy requires parliamentary approval according to the Renewable Energy Act 2011 [26].

As previously discussed, failure to increase the RE fund would stagnate the growth of the RE industry as cited by Weibel [23]. Unlike the carbon tax, direct public opposition against FIT has yet to take precedence.

The challenge for policy-makers is to increase the fund for FIT operations via an increase in levy or by alternative means, while ensuring that such new policy would not face severe public pressure. Whether the public could accept any further increase in RE levy is a question worth investigating. Answering this question requires references to literatures in the realms of public attitude towards environment and willingness to pay for green electricity which will be discussed in detail in the following section.

#### B. International Comparison on Public Attitude Towards Environment

There has been studies conducted in the past which attempts to draw the connection on whether an individual's values and awareness concerning the environment would influence his or her attitude towards it. Such studies uses the theory of planned behavior (TPC) which was proposed by Ajzen [27]. Kolmuss and Agyeman [28] incorporated TPC in their study and proposed that there is a linear relationship between a person's environmental awareness and environmental behaviors. Hansla et al. [29] further supports Kolmuss and Agyeman's [28] findings by proposing that values and awareness would influence an individual's willingness to pay for green electricity. Both literatures suggested that higher environmental awareness would translate to more pro-environmental behavior. On the other hand, there are existing literatures suggesting that circumstantial factors can give rise to the NIMBY (not-in-my-backyard) attitude whereby individuals are supportive of pro-environmental action as long as their interests are not under threat. Devine-Wright [30] and Jobert et al. [31] found that NIMBY attitude towards wind energy in Europe is more

prevalent in populations residing near wind farms. Yet, a study conducted by Ek [32] on wind farms in Sweden does not support the NIMBY hypothesis. Accordingly, these literatures suggest that the correlation between environmental awareness and attitude are not always clear cut, and that circumstantial factors must be considered.

While the prevailing public attitude towards the environment in European countries are not straight forward, the situation is less complex in Malaysia. Several literatures suggested that the NIMBY approach toward the environment has been the predominant attitude among the Malaysian public [5, 33-35]. Ahmad et al. [35] found that the Malaysian public do have a moderate to high level of awareness on environmental issues. Yet, the public scored low on environmental attitude and behavior. Similarly, Wahid and Abustan [34] claim that Malaysians are aware about environmental issues but are quite reluctant to be personally involved when given the opportunity. Thus, the authors suggest that high awareness does not necessarily translate to active participation. A survey by Lim and Lam [33] indicated that 82.8% of respondents supported marine renewable energy but 56% of them are reluctant to pay for green electricity. More importantly, what is widely discussed in European literatures but lacks in these particular Malaysian studies is an investigation on the circumstantial factors and root causes of that led to the poor uptake of pro-environmental attitudes in Malaysia.

### *C. International Comparison on Willingness to Pay for Green Electricity*

Willingness to pay for green electricity is a subject that has been thoroughly studied in developed countries [3]. Batley et al. [36] conducted a comprehensive study with respect to public's willingness to pay (WTP) for green electricity in the United Kingdom (UK). The authors of this study found that the probability of paying extra for green electricity is greater for individuals with higher income which amounts to 16.6% extra. Hansla et al. [29] found that WTP increases with positive attitude towards green electricity with 66% of households willing to pay an extra 0.2 Swedish Krona per kWh. On the other hand, WTP decreases with higher electricity price. Results for studies in other developed countries has been extensively compiled in a review by Stigka et al [3].

Wiser [24] conducted a study which explores how different money collection mechanism would influence the public's willingness to pay. In the United States, public opinions hold that collective payment method whereby all members of the public must contribute is not perceived to be necessary. Voluntary payment is preferred but actual uptake of voluntary green payment option is estimated at only 1-3%.

Past literatures have shown that stated willingness to pay does not translate to actual contribution [36]. According to Batley [36], out of all the individuals who said that they would pay more for green electricity in a survey, only 12 to 15% actually contributed in real practice. Diaz-Rainey and Ashton [37] found that there is a high stated willingness to pay a premium for green electricity among in the United

Kingdom. However, from 42% who stated that they were willing to pay premium from green electricity, the authors estimated that only 0.3% would actually uptake the premium if given the opportunity. The important point to note is that previous literature have confirmed that individual's stated interest to pay more for green electricity should be treated with caution since WTP response are often inflated and does not materialize in real practice .

On the other hand, literatures on WTP for green electricity in Malaysia has been limited. A preliminary study by Lim and Lam [33] found that 56.8% of Malaysians are reluctant to pay for green electricity. They support pro-environmental policies but are not willing to be actively involved in it. The NIMBY attitude is still widespread in Malaysian society. However, the simplicity of the survey used in this research does not allow the authors to conduct an economic valuation on the price for green electricity.

In a different topic, Muhammad-Sukki et al. [5] initially deduced that Malaysians are not willing to invest in green electricity via FIT scheme by investing in solar panels due to high upfront installation cost. However, three years later, Muhammad-Sukki et al. [14] conducted a follow-up study on the FIT scheme and found that investment in PV installation for household has become increasingly popular. Again, such study is related to green electricity, but it was not intended to put a price on using electricity from renewable sources.

Overall, WTP literatures have been extensively studied in developed countries, however, such area of research is still at its infancy in Malaysia. Hence, the further research must be conducted in order to quantitatively justify an economic valuation of green electricity in Malaysia.

### *D. Contingent Valuation Method*

The previous section established the notion that WTP studies on green electricity in Malaysia are not up to par compared to the standard set by European and U.S studies. A part of the issue is due to the methodology used to answer the research question. Diaz-Rainey and Ashton [37], Hansla et al. [29], Wiser [24] Wiser [24], and other numerous prominent researchers in this field of study used the contingent valuation method in order to analyze the willingness to pay for green electricity [3, 24]. Contingent valuation method (CVM) is used in many studies that intends to put a price on a particular environmental service. CVM is a tool used to estimate the economic value of goods and services that are usually not tradable in the market place, and therefore they do not have a market price [38]. CVM is typically conducted through surveys whereby the respondents are placed in a hypothetical situation and their willingness to pay for a certain good or service are recorded [3, 38]. Accordingly, CVM is often featured in literatures which studies the public's willingness to pay for green electricity.

CVM based literatures in Malaysia has been extensively conducted in the field of eco-product valuation [39-41]. Rezai et al. [40] used a combination of CVM and theory of planned behavior (TPB) in order to evaluate the willingness to pay for green food among Malaysian consumers which

consisted of 1,355 participants. Similarly, Mohamed et al. [39] used the same methodology but focused on WTP for eco-labelled food products in Malaysia with 1,115 participants. An important point to mention is that both literatures mentioned above contained a sample size of above 1000 respondents which suggests the maturity of the research topic.

On the other hand, Lim and Lam [33] attempted to evaluate the WTP for green electricity among Malaysians. However, the authors does not use the CVM approach. Rather, the surveys put forth by the authors simply requires the respondents to answer the WTP question on a 'yes' or 'no' basis. Such qualitative response option does not allow the authors to conduct a meaningful quantitative valuation on the price of green electricity. In addition, well-structured WTP question requires a spectrum of response since previous research has shown that individuals are often willing to contribute up to a certain range [3, 29, 37, 42]. Accordingly, it is recommended that future studies on WTP in Malaysia follows the CVM approach which has already been widely applied elsewhere.

#### IV. CONCLUSION

In this study, the evolution of Malaysia's energy policy and the connection between the FIT and the public has been explored. This study provided an overview of the extensive history of Malaysia's energy policy. The energy policy was constantly revised over time in order to address new issues that pose a threat towards the nation's energy security. Today, Malaysia acknowledges the threat arising from climate change and resource depletion. Such recognition has prompted the government to implement an energy policy which is consistent with sustainable development. However, many researchers agree that the pro-environmental energy policies under the Eighth and Ninth Malaysia Plan failed to meet its objectives. Accordingly, a radical new policy mechanism was needed and many literatures supported the notion that the FIT scheme is proven to be successful globally. Although still in its infancy, preliminary results suggest that FIT is making an impact in Malaysia. Nevertheless, barriers are beginning to emerge due to the small allocation of fund dedicated to the project. At present, the RE Fund is insufficient to meet the demands for RE project under the FIT scheme. Parliament needs to amend the law which allows an increase to the 1.6% contribution from electricity consumers. However, such move is likely to result in public resistance if it is not handled properly. Yet, studies conducted on analyzing the financial sustainability of the FIT scheme is still lacking. This research gap needs to be filled in order to help policy-makers amend the RE law based on factual evidence, and thereby providing the public with the necessary justification to change the 1.6% contribution.

Given that the sustainability of the Malaysian FIT funding structure requires further study, past literatures conducted in developed countries provides some insight on how such question could be addressed. The FIT source of funding is generated from electricity consumers. Essentially,

the FIT scheme would have a larger funding source if electricity consumers are willing to contribute more. Using the CVM approach, WTP literatures in Europe and the United States provides convincing results which suggests that a significant percentage of the population are willing to pay more in their electricity bills for environmental services such as clean energy. Equally important, previous studies used the theory of planned behavior to demonstrate how an individual's value, knowledge, and attitude towards environment can have an impact on the extent to which they are willing to pay for green electricity. However, WTP studies on green electricity in Malaysia has been inadequately answered since the CVM approach was not utilized. An economic valuation for green electricity in Malaysia is yet to be established. Therefore, such topic is subjected to further investigation while using methodologies conducted in European studies as reference.

Overall, by reviewing the latest development of Malaysia energy policies and the existing literatures on green electricity, a research gap was identified. The question which needs to be asked is: to what is the Malaysian public willing to accept an increase to the 1.6% Renewable Energy Fund contribution in order to support renewable energy development and increase the generation of green electricity? The sustainability of the FIT scheme in the near future can be better understood by addressing such question. In a more practical sense, using CVM to answer this WTP research question would bring about quantitative information which would help policy-makers make an informed decisions on the future of the 1.6% RE contribution. Ultimately, it is recognized that there is a need for future studies on FIT to be multidisciplinary since FIT is a policy mechanism that has economic, environmental, energy, and public dimensions. Future studies must encompass these dimensions in order to allow policy-makers to further refine the FIT scheme into a comprehensive policy mechanism that addresses multiple national issues simultaneously whilst supporting the national sustainable development agenda for the country.

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