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Progress of Feed-in Tariff in Malaysia: A Year After

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Abstract: Malaysia enacted the Renewable Energy Act in April 2011. One of its important components is the feed-in tariff (FiT) scheme - launched in December 2011. The scheme is managed and administered by the Sustainable Energy Development Authority (SEDA) of Malaysia. This paper analyses the impact of the FiT mechanism in Malaysia a year after its implementation; particularly on the installation and economical aspects. First, the history of the scheme is presented before summarising the application process for the scheme. Next, a detailed evaluation on the implication of the scheme is discussed. Some of the key findings from the analysis include: (i) the uptake for renewable energy installations has been extremely high, particularly for solar photovoltaic installation;

(ii) the foreign and domestic direct investment related to renewable sectors have increased significantly; (iii) more 'green' jobs have been created, particularly in the manufacturing and installation sectors, and (iv) there are plans to include wind and thermal energy in the FiT scheme. It can be concluded that the FiT scheme in Malaysia has produced significant impact during the first year of its implementation. With a proper monitoring by SEDA and more awareness among the people, renewable energy will most likely flourish in Malaysia.

Keywords: Feed-in tariff, renewable energy, solar photovoltaic.

1. Introduction

Energy is essential in our daily life. It is needed not only to meet social and economic development, but also to improve human health and welfare (IPCC, 2011). According to a recent report by the Energy Information Administration (EIA), the world's energy consumption is projected to rise to 865 EJ in 2040, a significant growth of 56% when compared to the energy need in 2010 (EIA, 2011). The rising trend of energy consumption contributes directly to increasing greenhouse gas (GHG) emission which is mainly due to the fact that the largest proportion of energy supply comes from fossil fuels. The GHG emission prevents the reflection of heat back into outer space, and as a result, has increased the average earthly temperature by 0.7^{o}C since the pre-industrialization period (IPCC, 2011). This small increment of temperature has been considered to have resulted in climate change and causing a major change to the ecosystem of the world.

A study published in Nature in 2011, indicates that climate change is responsible for creating massive floods in England and Wales during autumn 2000 (Pall et al., 2011), which cost the UK

government approximately £3.5 billion (Carrington, 2011). The study also suggested such floods are two to three times more likely to happen due to climate change. Another study published by the same journal in 2011 points out that climate change has contributed to the rise in extreme rain, snow and hail specifically in the northern hemisphere (Min et al., 2011). Not only that, climate change also increases the rate of the melting of Artic ice, which is reported to be occurring at an 'amazing size and speed' (Shukman, 2012). This raises the sea level and in the long run could submerge substantial coastal areas around the globe (Lau et al., 2012).

To mitigate GHG emission while satisfying energy needs, one of the options suggested by the Intergovernmental Panel on Climate Change (IPCC) is the deployment of renewable energy (RE) technologies (IPCC, 2011). Currently, energy is supplied from three major classifications; fossil fuels (78.2%), renewable sources (19.0%) and nuclear power (2.8%) (REN21, 2013).

Malaysia is one of the countries in South East Asia that is experiencing a strong economic growth with a steady increase in energy demand. After five decades of independence, the country is still heavily relying on fossil fuels to support its energy requirement. During the United Nations Climate Change Conference 2009 in Copenhagen, the Prime Minister of Malaysia pledged to reduce the country's GHG emission by up to 40% by the year 2020 compared to the 2005 levels, subject to aid and support from developed countries (Gee, 2012). To curb the GHG emission, as well as to ensure the country's economy is resilient and sustainable in the long term, the Government of Malaysia (GoM) has started to elevate the usage of RE in meeting its energy needs.

Abbreviations & Nomenclatures

EIA	Energy Information Administration
EPIA	European Photovoltaic Industry Association
FiA	Feed-in Approval
FiT	Feed-in Tariff
GHG	Greenhouse Gas
GoM	Government of Malaysia
GPA	Green Prospects Asia
GTFS	Green Technology Financing Scheme
IPCC	Intergovernmental Panel on Climate Change
ISP	Institute for Sustainable Power
MEGTW	Ministry of Energy, Green Technology and Water
MIDA	Malaysia Investment Development Authority
MYR	Malaysian Ringgit
PHP	Perak Hi-Tech Park
PV	Photovoltaic
RE	Renewable Energy
REN21	Renewable Energy Policy Network for the 21st Century
RT	Refrigeration Ton
SAVE	Sustainability Achieved via Energy Efficiency
SEDA	Sustainable Energy Development Authority
SHRDC	Selangor Human Resource Development Centre
SREP	Small Renewable Energy Power
UiTM	Universiti Teknologi MARA

2. Materials and Methodology

In order to evaluate the development of the RE in Malaysia (specifically after one year of implementing the feed-in tariff (FiT) policy), extensive literature review has been carried out. The history of how the FiT is introduced and the overview of its structure are presented to help the readers understand the FiT concept in Malaysia. Afterwards, the analysis of the progress of RE is presented, particularly on the installation and economical aspects. The statistics for the analysis is obtained from various journals, technical reports (from government and private sectors) as well as the mass media.

3. Feed-in Tariff (FiT) in Malaysia

3.1 History of FiT

The journey towards RE usage in Malaysia has been discussed in detail in a number of literature (Economic Planning Unit, 2006; Chua and Oh, 2010; Ahmad et al., 2011; Jaffar, 2009; Oh et al., 2010; Chua and Oh, 2011; Muhammad-Sukki et al., 2011). For the past 30 years, the GoM has introduced a number of policies which help to accelerate RE penetration in Malaysia. Prior to 1980, oil was the primary source of electricity. In 1981, Malaysia introduced the Four Fuel Diversification Policy – highlighting hydro as one of the contributors to the nation's energy mix (Chua and Oh, 2010). This policy has been successful in greatly reducing the dependency on oil, from about 90% in 1980 to only 4.2% in 2000. However, despite the fact that large scale hydro managed to supply around 10% of the electricity requirement in Malaysia, another 90% of the supply was still dominated by other non-renewable sources, i.e. coal and natural gas (Chua and Oh, 2011). In 2001, the Fifth Fuel Policy was introduced which identified the potential in biomass, biogas, municipal waste, solar and mini hydro as sources of electricity generation. Unfortunately, this policy failed to increase the contribution of RE in

terms of electricity generation in Malaysia. At the end of 2005, it was reported that only 0.3% of electricity being generated by RE[1] (Economic Planning Unit, 2006).

Due to that, the Ministry of Energy, Green Technology and Water (MEGTW) decided to establish a more comprehensive RE Policy and Action Plan, aiming to push the uptake of RE technologies in the country. The policy was established in 2009 and incorporated the proposal to introduce a Feed-in Tariff (FiT) scheme (SEDA, 2012). In 2010, the proposed FiT scheme was included in the Tenth Malaysia Plan and subsequently received a national budget for its implementation in 2011 (SEDA, 2012). At the end of 2010, the Renewable Energy Bill and Sustainable Energy Development Authority (SEDA) Bill were tabled in the Parliament to introduce and regulate the FiT in Malaysia (SEDA, 2012).

Both Bills were passed in the Parliament in April 2011 and subsequently received the royal assent in June 2011 (SEDA, 2012). The FiT scheme is aimed at achieving 5.5% of the country's electricity generated from the RE sources by the end of 2015 (Economic Planning Unit, 2010).

3.2. Overview of FiT in Malaysia

The FiT scheme means the RE producers will be paid a set rate (tariff) for each unit of electricity fed into the grid, and generally obliges the power companies to purchase all the electricity from the eligible producers in their service area over a long period of time - usually 15 to 20 years (Muhammad-Sukki et al., 2012). From a study conducted by the MEGTW, it has been concluded that "*FiT is the most effective RE policy mechanism in promoting and sustaining renewable energy growth"* (MEGTW, 2011). To date, there are more than 80 countries which have adopted an FiT scheme

[1] This figure takes into account the contribution of mini hydro. The contribution of large scale hydro is omitted from the estimation.

(REN21, 2013), mainly because (SEDA, 2012): (i) it is proven to reduce the capital cost significantly at the fastest rate when compared to other incentives; (ii) it encourages a diversified portfolio of RE technologies and industries, as well as providing substantial growth for both sectors, and (iii) it promotes market competition among all players, especially in terms of price, which leads to better market conditions in the country.

The FiT scheme in Malaysia started on the 1st December 2011 and is administered and implemented by a new entity called the Sustainable Energy Development Authority (SEDA) of Malaysia. There are four RE sources listed under the FiT scheme (SEDA, 2013): (i) biogas; (ii) biomass (including municipal solid waste); (iii) small hydropower, and (iv) solar photovoltaic (PV). These four are chosen based on proven technologies and technical potential under the local environment in Malaysia (GPA, 2012e). The FiT rate for each unit of generated electricity varies according to the source of energy, as illustrated in Table 1. To finance this FiT scheme, an RE fund is created and the money comes from the consumers themselves. This is achieved by increasing the current electricity tariff by 1% (only applicable to consumers with monthly electricity consumptions of more than 300 kWh per month), and that amount is pooled into the fund (Yee, 2010).

[Insert Table 1 here]

SEDA imposes a quota for the renewable applications mainly to ensure the availability of the fund. The quota varies depending on the technology and is set for every 6-months window for the next three years. At the beginning of the FiT scheme, SEDA has announced an RE quota of 630 MW (Sher Mohamad, 2012), but this figure was revised to 505 MW (SEDA, 2012). From this value, 190 MW was allocated to installations in 2011/2012 and 2013 and the remainder is for 2014 (SEDA, 2012). Table 2 shows the detailed breakdown of the quota allocations for each technology until 2014.

[Insert Table 2 here]

In order to benefit from the FiT scheme, i.e. to sell the electricity generated from RE to the distribution licensee, an application to become a Feed-in Approval (FiA) must be submitted and granted by SEDA Malaysia. The step by step process in applying to become an FiA is presented in Figure 1. The process indicates that any solar PV application (for installation capacity of less than and equal to 72 kW only) has a much simpler requirements when compared with other RE installations, which shorten its installation period.

[Insert Figure 1 here]

Each application can be done manually or online via SEDA's official website. The online application system, known as the e-FiT Online system is used widely as compared to the manual application. The online system was developed by a company called Novartis and cost approximately MYR 4.6 million for software and the hosting fee (GPA, 2012a). Due to the quota system, SEDA instigated the e-FiT online system in order to minimize human intervention in the application process. By doing this, it ensures a fair and transparent practice which is a crucial ingredient in maintaining SEDA's integrity (SEDA, 2012).

Catalysed by the FiT scheme, RE sources are expected to play a significant role in Malaysia, with a projected cumulative capacity of 11.5 GW by 2050. From this, close to 9 GW is expected to come from solar PV, as illustrated in Figure 2 (Abdul Malek, 2010). This could potentially avoid an emission of 17,649,620 tonnes of CO_2 a year by 2050 (Abdul Malek, 2010). Currently, the FiT scheme is only applicable to installations carried out in West Malaysia. As for East Malaysia, the applicants from Sabah could reap the benefit of FiT only if they have previously participated in the Small Renewable Energy Power (SREP) Programme (GPA, 2012e).

[Insert Figure 2 here]

4. Results and Discussion

According to Aqel (2012), Malaysia has experienced the fastest development in RE in the Southeast Region, even though it only has the shortest history of incentivising the RE. This section evaluates the progress of RE installations, the impact on economy and the awareness activities conducted in Malaysia in relation to RE throughout the entire one year of the FiT implementation existence.

4.1 Progress of Renewable Energy Installation

The e-FiT online application system which was launched on 2nd December 2011 received immense response from the public (SEDA, 2013). Two hours after it was launched, the three-year quota for small scale non-residential solar PV was taken up. Within 24 hours, there were a total of 229 applications submitted, of which 201 were for solar PV corresponding to 143.78 MW. For the installation of solar PV in residential houses, the quota until 2012 was already full by mid February 2012, leaving only 5.12 MW for installation in 2013 and 2014. Even after six months, solar PV still championed FiT applications, where out of 377 applications received under the FIT scheme, 92% of them were for solar PV (SEDA, 2013).

SEDA recognised the great demand for solar PV, especially in the household sector. After a long wait, SEDA announced a new project called the 2,000 Solar Home Rooftop on the 24th September 2012 (GPA, 2012c). This initiative aims at capturing the household sector, with a new quota of 8 MW, whereby 2 MW will be for installations in 2012 and another 6 MW to be completed in 2013. This quota targeted approximately 500 homes in 2012 and 1,500 homes in 2013 to be equipped with solar PV. To further promote this programme, the applicants do not need to show any proof of financial

ability to fund the installation. Within a week after the launch, 13.5% of the quota was taken up, totaling to approximately 1.08 MW (GPA, 2012d). There were a total of 167 applications, where 130 were for the installations in 2012 (about 0.89 MW) and the balance to be carried out in the following year (approximately 0.19 MW). According to SEDA, this programme is part of a massive project for 100,000 homes, pending some infrastructure issues including funding (GPA, 2012c).

Table 3 shows the statistics on the RE capacity in Malaysia by 31 December 2012. SEDA received a total application of 1480, of which 960 applications were approved for installations that will be carried out until 2015 (SEDA, 2012). From the total application, 96% of them are for solar PV installations (SEDA, 2012). At the end of the year, there total operational RE plant capacity stood at 98.52 MW (SEDA, 2012). Based on this data, the total cumulative capacity from all RE by 2015 is approximately 450.85 MW (SEDA, 2012). The share of RE in terms of total capacity is led by solar PV (37.48%), followed by biomass (32.45%), small hydro (25.52%) and biogas (4.55%).

[Insert Table 3 here]

It is evident that the uptake for the FiT applications is dominated by solar PV. A study conducted by Green Prospects Asia, lists out the possible reasons of fewer applications from other types of REs, and these include the following (GPA, 2012e): (i) significantly low tariffs of between MYR 0.23 and MYR 0.45 per kWh resulting in very low return on investment; (ii) high capital cost for biomass and biogas plants, e.g. a 10 MW biomass plant costs about MYR 120 million; (iii) lack of interest and expertise in power generation among existing players; (iv) limited cost savings potential from rationalization of maturing (biogas and biomass) and mature (hydro) technologies; (v) higher demand for feedstock for other non-renewable usage creating less supply for biomass segment; (vi) limitations in transmission infrastructure in rural areas where existing feedstock operators are located, and (vii) monopoly in ownership of oil plantations in Peninsular Malaysia creating an uneven bargaining position for potential power generators.

SEDA has announced new plans to address the uneven RE mix. Among the proposed plans are:

(i) To reduce the tariff for solar PV installation; this is in line with the downward trend of solar PV cost. The current cost per kWp of solar PV is between MYR 10,000 and MYR 12,000 (Green Prospects Asia (GPA), 2012c) and is projected to reduce by MYR 2,200 per year (Muhammad-Sukki et al., 2012).

(ii) To re-allocate the quota of each renewable energy category, reducing the imbalance in RE mixture.

(iii) To introduce the FiT payment for thermal and wind energy. Recently, SEDA has already advertised a plan for a wind study to investigate the wind energy potential and justify the inclusion of wind energy in the FiT scheme (SEDA, 2013). A study on a geothermal site in Tawau, Sabah indicates that it could potentially produce up to 67 MW, enough to satisfy the electricity requirement of Tawau's residents (Bernama, 2012c).

4.2 Impact on the Economy

It has been proven that the introduction of FiT has contributed to the positive economic development in many countries, for example Germany, Italy, Spain and the United Kingdom (Muhammad-Sukki et al., 2012). This is also the case for Malaysia. The MEGTW states that the FiT in Malaysia could (MEGTW, 2011): (i) create a minimum of about 52,000 jobs related to RE technologies and power plants; (ii) generate more than MYR 70 billion of business revenue from RE power plants operation, and (iii) create a minimum of MYR 19 billion worth of loans to fund RE projects – which will be provided by the banks and financial institutions. This section evaluates the impact of FiT on three sectors: investment, business and job creations and banking and financial institutions.

4.2.1 Investment

It is not possible to acquire the exact figure pertaining to the domestic and foreign direct investments. However, based on the report of the Malaysia Investment Development Authority (MIDA) published in 2013 (MIDA, 2013), Malaysia attracted a lot of investment in new and emerging technology – including solar. In 2011, for example, Malaysia gained a total of MYR 9.6 billion worth of investment in the electrical sector, where the solar industry contributes to approximately MYR 7 billion[2] (MIDA, 2012). Table 4 shows some of the significant projects approved in Malaysia that relate to renewable technologies.

[Insert Table 4 here]

4.2.2 Business and Job Creations

The FiT has also created a number of business opportunities for the local RE industry. This includes the areas of consultancy, manufacturing, provision of services, financing and supply of equipment. This information is made available on SEDA's website to assist consumers on the RE projects. To date, SEDA has recorded 78 companies (SEDA, 2013).

The FiT has also had a positive impact on the training industry. According to the CEO of SEDA, the organisation is working with various institutions to enhance the skills development related to RE in Malaysia (GPA, 2012f). Specifically for the PV industry, SEDA has appointed Universiti Teknologi MARA (UiTM) and Selangor Human Resource Development Centre (SHRDC) to enhance the competency of the service providers. These training centres are using the accredited training

[2] This figure includes the investment from First Solar, one of the biggest investors in solar technology in Malaysia. However, in April 2012, First Solar ceased operation in Malaysia. It is reported that the company is cutting down its workforce by 30% worldwide mainly due to global recession, competition from the China market and also reduction of solar subsidies in Europe (CBC News, 2012).

programme developed by the Institute for Sustainable Power (ISP). For small hydro, SEDA has collaborated with Perak Hi-Tech Park (PHP) to provide competency trainings, where a number of sessions have been conducted recently in the states of Perak and Pahang. In the long term, SEDA and the Ministry of Human Resources are working closely to identify institutions to develop an appropriate syllabus in order to train semi-professionals in Malaysia. As the start, SEDA has also appointed the Renewables Academy (Renac) AG, a German-based company to provide a series of train-the-trainer programmes under the Capacity and Competency Development in Renewable Energy scheme. So far, 10 trainers have been trained who will be responsible for training semi-professionals in Malaysia. SEDA has set an interim target of 300 semi-professionals by the end of 2012.

SEDA also presented a statistic to illustrate the impact of FiT in Malaysia, indicating the total number of jobs created, the installed capacity generation of RE technology as well as the carbon dioxide reduction (see Table 5) (SEDA, 2012). The report shows that about 10,852 jobs have been created after 13 months of the e-FiT system launched. The two highest contributions are from the biomass and the solar PV sectors - about 4,389 and 4,224 jobs respectively (SEDA, 2012).

[Insert Table 5 here]

4.2.3 Banks and Financial Institutions

The banks and financial institutions play a vital role in the development of RE in Malaysia. Companies and the commercial sector in Malaysia have the opportunity to implement RE projects under the Green Technology Financing Scheme (GTFS) (GTFS, 2012). The GTFS started in 2010 with a total funding of MYR 1.5 billion. The Government funds 60% of the cost of the project while the remaining 40% is provided by a financial institution. This fund is expected to assist companies that supply or utilise green technology, with a maximum value of MYR10 million per consumer company

and MYR 50 million per producer company with the financing tenure being 10 years and 15 years respectively. During the 2013 Budget presentation, it was announced that an additional MYR 2 billion has been allocated to the GTFS, and the duration for applying for it has been extended until 2015 (Ministry of Finance, 2012). To date, 218 projects have been approved with a total funding of slightly more than MYR 1 billion (GTFS, 2012).

As for domestic consumers, to date, there is no loan financing available. Most of the installations for the domestic side are self-funded by the home owners (GPA, 2012c). SEDA is still negotiating with the Central Bank of Malaysia to come up with a specific guideline related to RE financing. SEDA is proposing a loan interest of between 4% and 5% (Ab Aziz, 2012). Some of the institutions have shown interest in funding RE projects for the domestic sector. They include CIMB, Maybank, HSBC, Bank of China, Kuwait Bank, Bank Pembangunan Malaysia and Ambank (GPA, 2012c; 2012f).

4.3 Awareness Activity

The MEGTW has been actively promoting awareness on RE in the country. One of the campaigns is the Green Community Carnival, which was first introduced in March 2011 and has been an on-going activity conducted in various cities in Malaysia. With the theme "1 Hijau 1 Komuniti", the carnival is aimed "*to encourage the community to adopt a greener way of life, protect and preserve the environment, introduce green products and to highlight green initiatives advocated by the government to promote green living*" (MEGTW, 2012). The local mass media also play a vital role in the awareness campaign, by actively airing and publishing the latest progress of renewable energy to the general public (Achu, 2012; Bernama, 2012a; Bernama, 2012b; Bernama, 2012d; Choong, 2012).

The Ministry has also organised a number of green technology conferences that bring together academia and industry (MEGTW, 2012). The most recent one was the International Sustainable Energy

Summit (ISES) 2012 conducted in Putrajaya, the country's new administrative centre on 7-8 November 2012 (GPA, 2012b). The ISES 2012 was attended by key players in academia and industry around the globe discussing and highlighting ideas, best practices and projects related to RE. Among the distinguished speakers who presented during the summit were the Dr. Winfried Hoffmann (President of European Photovoltaic Industry Association (EPIA)), Dr. Shawn Qu (founder and CEO of Canadian Solar Inc.), Professor Hu Runqing (Energy Research Institute, China's National Development and Reform Commission), Dr. AK Tripathi (India's Ministry of New and Renewable Energy) and Miss Karen Forsten (Director for Renewable Integration of the Electric Power Research Institute, USA).

A number of fiscal incentives have been introduced to help promote the usage of renewable technology, such as the GTFS, pioneer status, investment tax allowance and exemption from payment of import duty and/or sales tax (e.g. on machinery, equipment, materials, spare parts and consumables) (Chua and Oh, 2011; Chua and Oh, 2012). There is also a plan to introduce a soft loan scheme for residential consumers (Muhammad-Sukki et al., 2012).

Apart from the FiT scheme, the Ministry continues with a programme known as the Sustainability Achieved via Energy Efficiency (SAVE), to improve energy efficiency in Malaysia (MEGTW, 2012). This initiative is implemented in order to stimulate sales of energy-efficient appliances - by providing rebates for refrigerators, air-conditioners and chillers to qualified consumers. Specifically for a five-star rated refrigerator, a household could obtain a rebate voucher worth MYR 200 while for a five-star rated air conditioner, the voucher is worth MYR 100. The Ministry has approved an allocation of 100,000 rebate vouchers for five-star rated refrigerators and 65,000 vouchers for five-star rated air conditioners to all the states across Malaysia, totalling to a budget of MYR 26.5 million. Table 6 shows the summary of the SAVE programme, where 99.79% of the total allocation has been redeemed (164,648 vouchers) as of 31 December 2012, totaling to MYR 26,499 700 (SEDA, 2012).

[Insert Table 6 here]

As for the private entities, they are qualified to redeem a rebate to replace old chiller with a new efficient one, with a voucher of MYR 200 per refrigeration ton (RT). An allocation of 72,000 RT has been approved with a funding pot of MYR 14.4 million. Table 7 shows the distribution of the vouchers for chillers by the end of 2012, where around 86% of the vouchers has been allocated for – amounting to approximately MYR 12.4 million (SEDA, 2012).

[Insert Table 7 here]

4.4. Issue on the E-FiT System

Despite the positive developments in Malaysia, a negative report (Vinod, 2012) has been exposed recently regarding the e-FiT system. It was reported that 32.4% of the solar energy quota was awarded to 12 companies linked to a person named Suzi Suliana, the daughter of the Chairman of Malaysia's oil and gas company, PETRONAS. The report states that all 12 companies were set up weeks before the launching of the e-FiT system. These companies could potentially get more than MYR 70 million annually from the FiT scheme. In response to the allegation, SEDA asserts that the e-FiT system is transparent, which does not permit any human interference. SEDA also states that the applications are based on a 'first-come first-served' basis, and the online system will only accept applications that have fulfilled all required criteria (SEDA, 2013).

To improve the e-FiT system, SEDA has recently announced a number of measures including (GPA, 2012f): (i) creating a more user friendly interface, as many had complained that the system is difficult to use; (ii) limiting the number of applications to only one per company within a 24-hour period, and (iii) each shareholder will be capped to a maximum of 30 MW, which may be held through

a range of companies.

5. Conclusions and Policy Implications

Malaysia is seriously pushing RE by providing great stimulus. The FiT scheme has proven accelerating RE penetration in the country. After only one year of its implementation, significant installations of renewable technology are recorded. The FiT scheme has attracted a significant amount of investment from local and foreign investors, hence creating new job opportunities for Malaysians. The Government of Malaysia has been actively involved in creating awareness among the general public to ensure that RE will prosper in the country.

However, there are some issues that need to be addressed by SEDA. These are:

(i) To increase the RE quota especially solar PV. The trend of installation indicates that solar PV is the most popular technology in the country. The bottle neck in increasing the quota is the RE fund. Currently, the fund is financed by a 1% hike in consumer bills (only applicable to consumers that consume more than 300 kWh per month). Although another increase in the electricity bill is possible (but not desirable), one alternative would be to engage the power producers in Malaysia to contribute to the RE fund, as practiced in Europe. This can be achieved by imposing a mandatory tax payment (for their CO_2 contribution) or a reduction in tax revenue if they contribute a certain amount of money to the fund.

(ii) To include the states of Sabah and Sarawak (the states in East Malaysia) in the FiT scheme. Some of the benefits gained from this would include tapping the huge biomass market due to the large oil palm industry, land resources for installation of large PV plants, numerous rivers for small hydro, as well as wind and geothermal. SEDA has

been discussing this issue with Sabah's state government. Recently, it was reported that Sabah's state government is showing interest in participating in the scheme, as well as in contributing 1% to the RE fund (Ab Aziz, 2012).

(iii) To finalise the RE financing with the Central Bank of Malaysia as well as the financial institutions to fund domestic PV installations.

(iv) To properly address any degression rate of the FiT scheme, specifically for solar PV, to ensure the PV uptake and its market remains strong and achieves 78% contribution to RE mix by 2050. Any sudden reduction could destabilise the PV industry, as has happened in Europe[3] (Muhammad-Sukki et al., 2013).

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7. References

Ab Aziz A, 2012. Personal Communication with PEMANDU, Malaysia.

[3] Muhammad-Sukki et al. (2013) discusses the situation in the United Kingdom where the FiT rate for solar PV installation was reduced by as much as 56%, e.g. £0.433/kWh to £0.21/kWh starting from 12 December 2011. This was in contrast to the earlier proposal of degression rate of only by about 8.5%. The sudden announcement received negative responses from the solar PV industry in the UK. A lot of solar PV projects were put on hold. In response to this announcement, Solarcentery and two other groups took this matter to court in which they won the case against the UK government to delay the commencement of the reduced rate to 1 April 2012 onwards.

Abdul Malek B, 2010. Renewable energy development in Malaysia. 34th Expert Group on New and Renewable Energy Technologies (EGNRET), Kuala Lumpur, Malaysia, pp. 1-46.

Achu CY, 2012. Feed-in Tariff scheme fits in well with Gading Kencana. Business Times, Kuala Lumpur, Malaysia.

Ahmad S, Kadir MZAA & Shafie S, 2011. Current perspective of the renewable energy development in Malaysia. Renewable and Sustainable Energy Reviews; 15(2):897-904.

Aqel A, 2012. Malaysia's renewable energy outlook. Green Prospects Asia (GPA). Last accessed on [26/11/2012]. Available from http://www.greenprospectsasia.com/content/malaysia%E2%80%99s-renewable-energy-outlook

Bernama, 2012a. Malaysia penetap trend teknologi hijau. Utusan Malaysia, Kuala Lumpur, Malaysia.

Bernama, 2012b. Pelaburan Korea Selatan akan bertambah RM5 bilion: Najib. Berita Harian, Kuala Lumpur, Malaysia.

Bernama, 2012c. Study on geothermal resources in Tawau completed – Kurup. Bernama, Malaysia.

Bernama, 2012d. Teknologi hijau tingkat dagangan Malaysia-Taiwan. Utusan Malaysia, Kuala Lumpur, Malaysia.

Carrington D, 2011. Climate change doubled likelihood of devastating UK floods of 2000. The Guardian, UK. Last accessed on [28/11/2012]. Available from http://www.guardian.co.uk/environment/2011/feb/16/climate-change-risk-uk-floods

CBC News, 2012. First Solar cuts jobs by 30%.CBC News. Last accessed on [26/11/2012]. Available from http://www.cbc.ca/news/business/story/2012/04/17/first-solar-layoffs.html

Choong MY, 2012. All lit-up by fossil fuels. The Star, Kuala Lumpur, Malaysia.

Chua SC & Oh TH, 2010. Review on Malaysia's national energy developments: Key policies, agencies, programmes and international involvements. Renewable and Sustainable Energy Reviews; 14(9):2916-2925.

Chua SC & Oh TH, 2011. Green progress and prospect in Malaysia. Renewable and Sustainable Energy Reviews; 15(6): 2850-2861.

Chua SC & Oh TH, 2012. Solar energy outlook in Malaysia. Renewable and Sustainable Energy Reviews; 16(1):564–574.

Economic Planning Unit, 2006. Ninth Malaysia Plan 2006-2010. Putrajaya, Malaysia.

Economic Planning Unit, 2010. Tenth Malaysia Plan. Putrajaya, Malaysia.

Gee LT, 2012. International Sustainable Energy Summit (ISES 2012). Putrajaya, Malaysia.

GPA, 2012a. Badriyah Abdul Malek: Keeper of Malaysia's feed-in tariffs. GPA. Last accessed on [26/11/2012]. Available from http://www.greenprospectsasia.com/content/badriyah-abdul-malek-keeper-malaysias-feed-tariffs

GPA, 2012b. Malaysia holds first Sustainable Energy Summit: ISES 2012. GPA. Last accessed on [26/11/2012]. Available from http://www.greenprospectsasia.com/content/malaysia-holds-first-sustainable-energy-summit-ises-2012

GPA, 2012c. Malaysia: 8 MW of solar PV FiT quota up for grabs from September 24th. GPA. Last accessed on [26/11/2012]. Available from http://www.greenprospectsasia.com/content/malaysia-8-mw-solar-pv-fit-quota-grabs-september-24th

GPA, 2012d. Malaysian houseowners take up 13.5% solar PV quota under 2,000 Homes Programme. GPA. Last accessed on [26/11/2012]. Available from http://www.greenprospectsasia.com/content/malaysian-houseowners-take-135-solar-pv-quota-under-2000-homes-programme

GPA, 2012e. Promoting Renewable Energy via Malaysia's Feed-in Tariff (FiT). GPA Report, Report no: GPA-SG-1-020512, Singapore.

GPA, 2012f. Sabah: Malaysia's potential renewable energy hub. GPA. Last accessed on [26/11/2012]. Available from http://www.greenprospectsasia.com/content/sabah-malaysia%E2%80%99s-potential-renewable-energy-hub

GTFS, 2012. Last accessed on [26/11/2012]. Available from http://www.gtfs.my/

IPCC, 2011. Summary for policymakers - IPCC Special Report on Renewable Energy Sources and Climate Change Mitigation. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

Jaffar AJ, 2009. Outlook of coal demand/supply & policy in Malaysia. Cleaner Coal: Moving Towards Zero Emissions, APEC, Incheon, South Korea.

Lau LC, Lee KT & Mohamed AR, 2012. Global warming mitigation and renewable energy policy development from the Kyoto Protocol to the Copenhagen Accord—A comment. Renewable and Sustainable Energy Reviews; 16(7): 5280-5284.

MIDA, 2012. Malaysia investment performance 2011. Government of Malaysia, Malaysia.

MIDA, 2013. Malaysia investment performance 2012. Government of Malaysia, Malaysia.

Min S, Zhang X, Zwiers FW & Hegerl GC, 2011. Human contribution to more-intense precipitation extremes. Nature; 470: 378-381.

MEGTW, 2011. Handbook on the Malaysian Feed-in Tariff for the Promotion of Renewable Energy. Government of Malaysia, Malaysia.

MEGTW, 2012. Last accessed on [26/06/2012]. Available from http://www.kettha.gov.my.

Ministry of Finance, 2012. Budget 2013. Ministry of Finance, Malaysia.

Muhammad-Sukki F, Munir AB, Ramirez-Iniguez R, Abu-Bakar SH, Mohd Yasin SH, McMeekin SG & Stewart BG, 2012. Solar photovoltaic in Malaysia: The way forward. Renewable and Sustainable Energy Reviews; 16(7):5232-5244.

Muhammad-Sukki F, Ramirez-Iniguez R, Abu-Bakar SH, McMeekin SG & Stewart BG, 2011. An evaluation of the installation of solar photovoltaic in residential houses in Malaysia: Past, present and future. Energy Policy; 39(12):7975–7987.

Muhammad-Sukki F, Ramirez-Iniguez R, Munir AB, Mohd Yasin SH, Abu-Bakar SH, McMeekin SG & Stewart BG, 2013. Revised Feed in Tariff for solar photovoltaic in the United Kingdom: A cloudy future ahead?. Energy Policy; 52(1):832-838.

Oh TH, Pang SY & Chua SC, 2010. Energy policy and alternative energy in Malaysia: Issues and challenges for sustainable growth. Renewable and Sustainable Energy Reviews; 14(4):1241-1252.

Pall P, Aina T, Stone DA, Stott PA, Nozawa T, Hilberts AGJ, Lohmann D & Allen MR, 2011. Anthropogenic greenhouse gas contribution to flood risk in England and Wales in autumn 2000. Nature; 470: 382-385.

REN21, 2013. Renewables 2013 Global Status Report. REN21, Paris.

Sher Mohamad AA, 2012. Features and Processes of the Feed-in Tariff. Renewable Energy Financing Workshop, Bank Negara Malaysia, Malaysia.

Shukman D, 2012. Arctic ice melting at 'amazing' speed, scientists find. BBC News, UK. Last accessed on [28/11/2012]. Available from http://www.bbc.co.uk/news/world-europe-19508906

SEDA, 2012. Annual Report 2012. SEDA, Malaysia.

SEDA, 2013. Last accessed on [10/12/2013]. Available from www.seda.gov.my.

EIA, 2013. International Energy Outlook 2013. U.S. EIA, Washington DC, USA.

Vinod G, 2012. Petronas boss' daughter to rake in RM70m. Free Malaysia Today, Malaysia.

Yee LH, 2010. You Can Make Electricity at Home and Sell It to TNB. MyStarJob, Kuala Lumpur, Malaysia.

Figures and Tables description.

Figure	Description	Proposed size (width)
1	Process to become an FiA. Adapted from (SEDA, 2012).	190 mm
2	Cumulative value of the REs in Malaysia (2011-2050). Adapted from (Abdul Malek, 2010).	90 mm

Table	Description	Proposed size (width)
1	The FiT rate for applicable RE source. Adapted from (SEDA, 2013).	190 mm
2	Detailed breakdown of the quota allocation (in MW) for each technology until 2014 (SEDA, 2012).	190 mm
3	RE capacities granted with Feed-in Approval under the FiT scheme. Adapted from (SEDA, 2012).	190 mm
4	Significant projects approved in Malaysia that relate to renewable technologies. Adapted from (MIDA, 2012; 2013).	190 mm
5	Statistic of green job creation in Malaysia, as of 31 December 2012. Adapted from (SEDA, 2012).	190 mm
6	Distribution of vouchers for refrigerators and air conditioners under the SAVE programme. Adapted from (SEDA, 2012).	190 mm
7	Distribution of vouchers for chillers under the SAVE programme (SEDA, 2012).	190 mm

Table 1

Table 1: The FiT rate for applicable RE source. Adapted from (SEDA, 2012).

Type	FiT rate (MYR/kWh)	Effective period (year)	Degression rate (%)
Biogas	0.28 - 0.43	16	0.5 – 1.8
Biomass	0.27 - 0.45	16	0.5 – 1.8
Small Hydropower	0.23 - 0.24	21	0.0
Solar Photovoltaic	0.85 - 1.78	21	8.0

Table 2

Table 2: Detailed breakdown of the quota allocation (in MW) for each technology until 2014 (SEDA, 2012).

Year	Biogas Sewage	Biogas	Biomass	Solid waste	Small hydro	Solar PV (<1 MW)	Solar PV (> 1MW)	Total
	MW	MW	MW	MW	MW	MW	MW	MW
2011/2012	20	10	60	20	30	10	40	190
2013	20	10	50	30	30	10	40	190
2014	5	10	25	15	45	5	20	125

Table 3

Table 3: RE capacities granted with Feed-in Approval under the FiT scheme. Adapted from (SEDA, 2012).

RE Type	In Operation (MW)	In Progress (MW)				Total (MW)
	2012	2012	2013	2014	2015	
Biogas	7.41	6.32	6.80	0.00	0.00	20.53
Biomass	50.40	26.5	48.50	20.89	0.00	146.29
Small Hydro	15.70	0.00	28.30	49.05	22.00	115.05
Solar PV (Individual)	2.21	6.26	3.86	0.00	0.00	12.33
Solar PV (Non-Individual)	22.81	45.80	56.72	31.32	0.00	156.65
Total	98.53	84.88	144.02	95.27	22.00	450.85

Table 4

Table 4: Significant projects approved in Malaysia that relate to renewable technologies. Adapted from (MIDA, 2012; 2013).

Description	Company type	Investment Value (MYR)	Number of job created.
Design, develop and manufacture photovoltaic wafer, cells and modules.	Wholly foreign-owned company	4.5 billion	3,400
Develop the first bio-methionine facility in Kertih Biopolymer Park with completion date is expected by 2014.	Wholly foreign-owned company (Joint venture between CJ Cheil Jedang (Korea) and Arkema (France)	2 billion	2,500
Manufacture solar-grade silicon wafer and ingots.	Wholly foreign-owned company	1,200 million	1,261
Construction of a geothermal power plant in Tawau.	n/a	500 million	n/a
Construction of RE power plant in Perak to generate electricity from biogas from palm oil mil effluent (POME).	n/a	134 million	n/a
Construction of RE power plant in Pahang to generate electricity from oil palm empty fruit bunches (EFBs).	n/a	125 million	n/a
Construction of solar farm in Perlis.	n/a	123.2 million	n/a
Produce super capacitors for solar energy applications.	Wholly Malaysian-owned company	101.5 million	95
Manufacture silicon ingots and wafers for solar panel.	Wholly Malaysian-owned company	87 million	116
An integrated project to produce solar inverters involving R&D and manufacturing activities, and will be the first company producing off-grid inverters in Malaysia.	Joint ownership company	33 million	46
Manufacture components for smart energy solutions.	Wholly foreign-owned company	4.4 million	n/a
Producing polycrystalline silicon in Samalaju Industrial Park, Sarawak.	Foreign company (Tokuyama Malaysia)	n/a	1000 (Expected from 2013-2014)

Table 5

Table 5: Statistic of green job creation in Malaysia, as of 31 December 2012. Adapted from (SEDA, 2012).

Renewable Energy Technology	Number of Job Creation	RE Generation (MWh)	Installed Capacity (MW)	CO2 reduction (tones)
Biogas (palm oil waste, agro based, farming)	513	150,902	20.5	278,662
Biomass (palm oil waste, agro based)	4,389	900,475	146,3	1,447,095
Small Hydro	1,726	711,660	115.1	644,689
Solar PV	4,224	225,797	189.0	356,792
Total	10,852	1,988,833	450.9	2,471,591

Table 6

Table 6: Distribution of vouchers for refrigerators and air conditioners under the SAVE programme. Adapted from (SEDA, 2012).

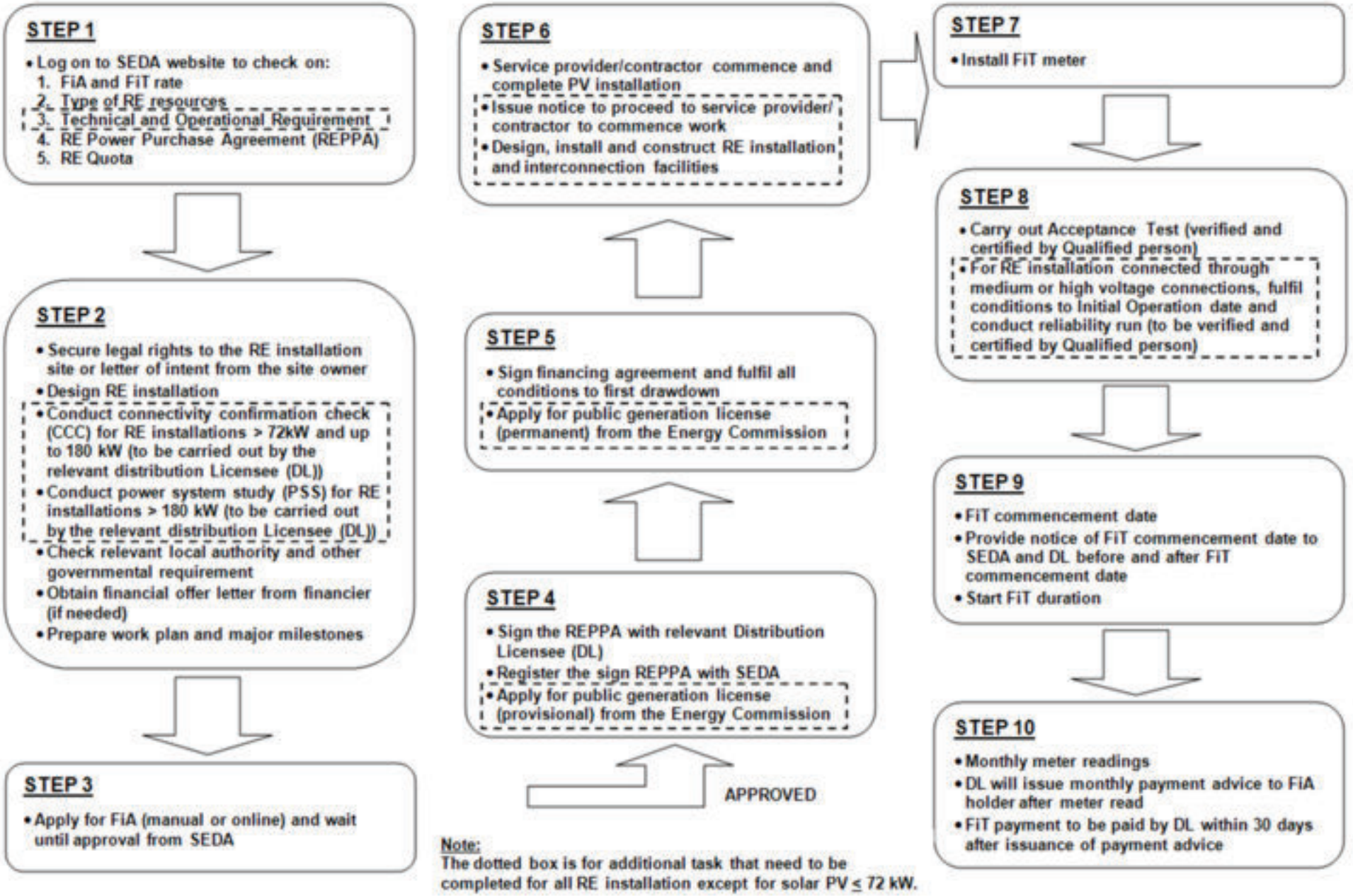
State	Total Allocation			Total Redeemed Quantity			
	Refrigerators	Air-conditioners	Total	Refrigerators	Air-conditioners	Total	Total Redeem/ Total Allocation (%)
Johor	14,969	10,343	25,312	14,968	10,343	25,311	100.00
Kedah	10,814	6,693	17,507	10,813	6,692	17,505	99.99
Kelantan	3,101	1,257	4,358	3,093	1,256	4,349	99.79
Kuala Lumpur	7,467	4,786	12,253	7,465	4,782	12,247	99.95
Melaka	4,896	2,997	7,893	4,892	2,975	7,867	99.67
Negeri Sembilan	3,025	1,922	4,947	3,015	1,904	4,919	99.43
Pahang	4,058	2,503	6,561	4,057	2,501	6,558	99.95
Perak	12,445	8,086	20,531	12,444	8,086	20,530	100.00
Perlis	1,568	1,047	2,615	1,563	1,045	2,608	99.73
Pulau Pinang	12,937	8,079	21,016	12,934	8,079	21,013	99.99
Putrajaya/ Cyberjaya	249	138	387	249	134	383	98.97
Sabah & Labuan	3,564	3,822	7,386	3,556	3,731	7,287	98.66
Sarawak	3,111	2,213	5,324	3,024	2,161	5,185	97.39
Selangor	15,476	10,168	25,644	15,457	10,164	25,621	99.91
Terengganu	2,320	946	3,266	2,319	946	3,265	99.97
Total (Unit)	100,000	65,000	165,000	99,849	64,799	164,648	99.79
Amount (MYR Million)	20,000,000	6,500,000	26,500,000	19,969,800	6,479,900	26,449,700	99.81

Table 7

Table 7: Distribution of vouchers for chillers under the SAVE programme (SEDA, 2012).

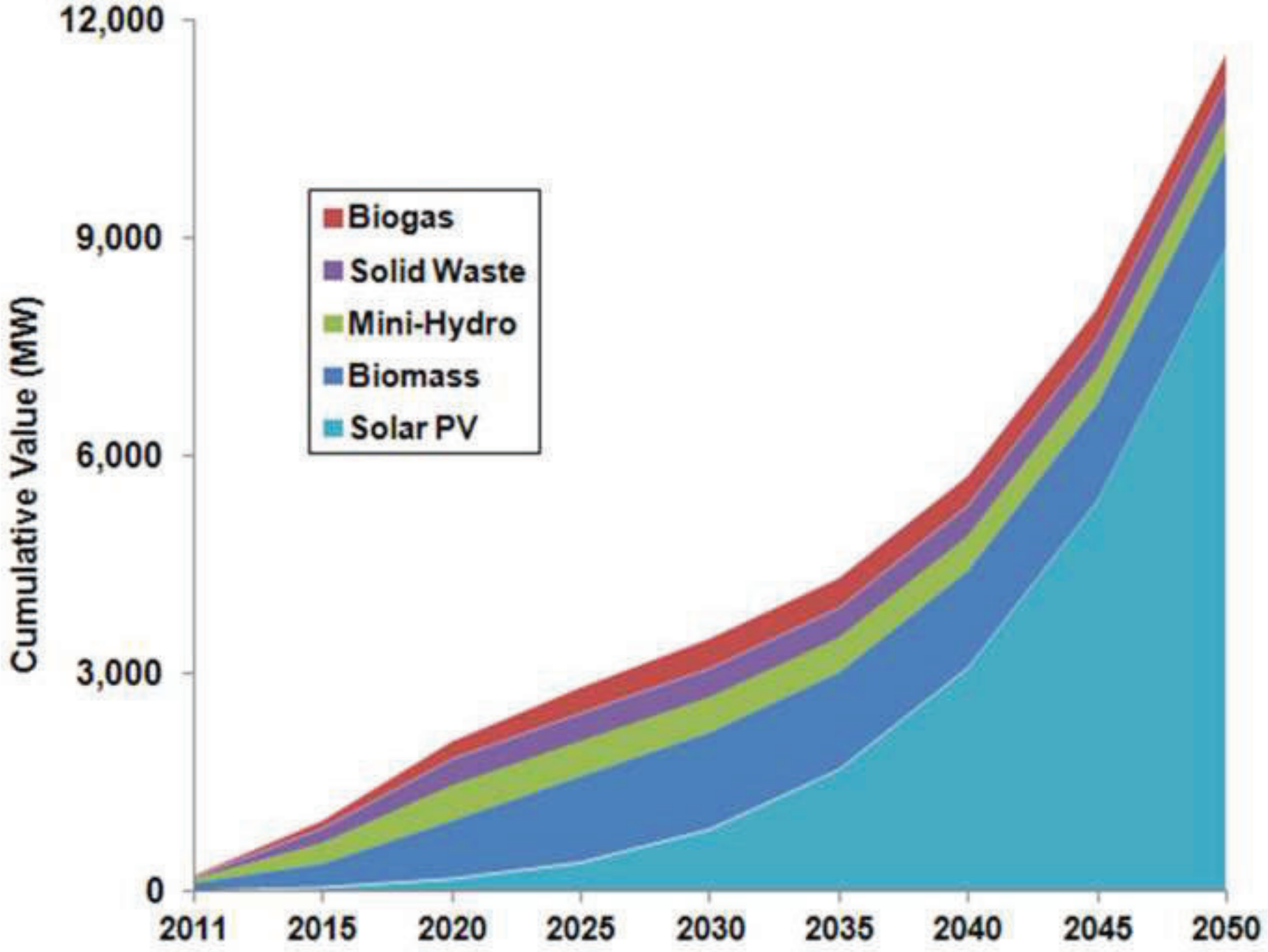
	Allocation	New Applications	Work in Progress	Completed	Total Applications	Balance
Capacity (RT)	72,000	4,819	44,018	13,143	61,980	10,020
Amount (MYR)	14,400,000	963,800	8,803,600	2,628,600	12,396,000	2,004,000

Figure 1



Note:
The dotted box is for additional task that need to be completed for all RE installation except for solar PV ≤ 72 kW.

Figure 2


12,000
9,000
6,000
3,000
0
Cumulative Value (MW)
Biogas
Solid Waste
Mini-Hydro
Biomass
Solar PV
2011
2015
2020
2025
2030
2035
2040
2045
2050