Short Review on recent solar PV policies in Malaysia

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Abstract. Energy in developing countries essential for economic growth and development. In result of the rapid growth of development, society demands more electricity. In addition to that, unsustainable energy production can have a harmful effect on our environment. Solar energy is the most inexhaustible method of energy. With that has been stated, it is evident that PV technology is starting to be one of the primary roots of energy generator to supply power for development. The economic ambition is to create solar energy more cost effective and efficient, nevertheless, it is still not compatible with fossil fuel. Typically, in order for solar energy to replace the fossil fuel or at least support the development demands of energy, the implementation of solar energy system must increase in homes and plantation projects. This problem drove governments to come up with policies that encourage implementing solar system in homes of citizens. The most used policies are fed in tariff and net energy metering, which is applied in 80 nations round the globe. This paper studied the policies applied in solar energy in Malaysia in the past 8 years. The paper went over each policy and considered their financial and environmental welfare. It did show the effect of the policy applied at the time on the capacity installed in Malaysia.

1 Introduction

Energy is the first important factor for development, growth all around the world. The expansion of renewable electricity is progressing rapidly, with worldwide annual growth rates for wind and solar PV of 21% and 55%, respectively, from end-2008 to 2013.The demand of energy and pollution caused by it, is increasing every year. [1] In order to fulfill the demand and support the rapid growth and reduce the pollution, the governments must support renewable energy sources. In the future, it will be hard depend on only the fossil fuel as the main source of energy. Therefore, solar energy is one of the main sustainable energy that is available in abundant amount that can be used to produce electricity and support the demand of energy. [2] Solar systems absorb photons of sunlight and convert it into electricity that can be used if at least we can produce 100% of the sun light energy into useful electricity, then it is possible to create electricity that can cover the demands for 1 year. [3] This makes solar energy an important source of sustainable energy. [4][5] The price of solar panels dropped to 50% since 2010. This encourages the growth of the solar market and the application of solar energy. [6]

Malaysia depend mainly on fossil fuel as a main source of energy, however, lately the government aims to produce more sustainable energy. In order to influence the people to install and produce solar energy in their homes the government and to come up with a policy that encourages them. There are different schemes for supporting renewable energy RE. The applied schemes has been analyzed by researchers to confirm the positive effect of the government's policies on the growth of renewable energy.[7] Many internal and external factors may influence the choice of a strategy such as the available resources, the originating system, status of the market, etc.[8] The demand of creating home markets to reinforce local industries that would lead to exportation global markets is a major factor. The first policy was implemented is Feed in tariff in 2011. The scheme is managed and administered by the Sustainable Energy Development Authority (SEDA) of Malaysia with a 505 MW quota. [9] Later on in 2016 Malaysia implemented Net Energy Metering with a quota of 500 MW. [10] This paper study the progress of NEM in Malaysia in the past 2 years and compare it to FiT and with NEM in other countries.

1.1 Feed in Tariff

In March 2007, the European Union targeted 20% renew- able energy for 2020, with special emphasis on small scale units. [11] Feed in tariff is a payment system that will pay for those who produce energy at their homes. This policy is implemented to speed up the utilization of solar energy. [12][13] Malaysia's Feed-in Tariff (FiT) system provide Distribution Licensees (DLs) to buy from Feed-in users the electricity produced from renewable resources (renewable energy) and sets the FiT rate. The DLs will pay for renewable energy supplied to the electricity grid for a specific duration. [14] Through ensuring the customers an access to the

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grid and setting a suitable price per kW of energy produced form solar system, the FiT policy would guarantee that renewable energy becomes a viable and sound long-term investment for companies industries and also for individuals. [15] This scheme was introduced in 2011 in Malaysia and it was taken seriously due to its high profit return.

1.2 Net energy metering

NEM is an electricity policy which permits the utility customers to offset some or all of the energy created by their solar system along the utility charge per unit. Using a bidirectional meter that spins in both ways. When the customer export energy to the utility the meter spin in a clockwise direction if the user is consuming energy from the utility, the meter spin in the opposite direction. [16] A photovoltaic system have a panel or an array of solar modules, a solar inverter, and sometimes a battery and interconnection wiring. In addition to that customer must install the bidirectional meter. [17] The element of net metering in solar system are explained in Figure 1:

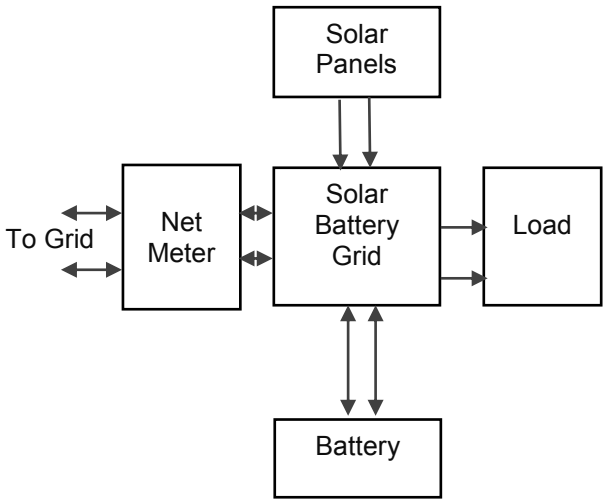

Fig. 1. Block diagram of Net Metering Using Solar [13]

2 RE Installed solar capacity in Malaysia

NEM have been applied in Malaysia since 2016 before that FiT was the applied scheme. As The Table 1 show the installation of solar PV started in 2012 with 31.53 under FiT policy and ended in 2015 with a total of 260.74 MW in four years. Awhile after that the installation of PV in 2016 started with 77.88 MW and reached 121.01 MW which means the installation of solar PV decreased in the past 4 years since NEM is applied. This is due to many factors, one of them is the incentives of the Fit is liquidized money while in NEM is substituted with Electricity bill reduction only. However, in 2019 a new NEM scheme is introduced to replace the old NEM. The Electricity bill of a residential customer is equal to the price of the consumed energy minuses the price of the generated energy by the PV which is decided by the electricity company. While in 2019 the electricity bill is computed after substituting the electricity generated from the electricity consumed. The total energy is multiplied by the standard domestic tariff. [18]

Table 1 Installed Capacity (MW) of Commissioned RE Installations [19]

Year	PV installed in MW
2012	31.53
2013	106.98
2014	61.87
2015	60.36
2016	77.88
2017	38.90
2018	3.62
2019	0.61

3 Environment and Return of profit comparison between FiT and NEM 2016 and NEM 2019

There are steps to follow to compute and confirm the validity and benefit of the solar PV system before installing it and falling into a mistake where the price of the KWh from PV is higher than the grid KWh his happens when the size and location of the PV is wrong.[20] In terms of the return on investment in PV it takes some amount of years to return the upfront money paid, then the electricity will be for free until the PV age end. For a comparison between the three policies we will assume a resident in Malaysia installing 4 KWp PV system that would have an upfront cost of RM 24000 and the electricity while the customer electricity demand is 2000 kWh annually Table 2. The 4 KW PV system generates around 5200 kWh annually.

Table 2 Resident electricity profile and PV specification

Annual consumption	Annual PV generation	PV size	Cost of PV	Annual Electricity bill from the grid	Rate of kWh for 200K Wh
2000 kWh	5200 kWh	4 KWp	RM 24000	RM 523.2	0.218

At FiT rate in Malaysia the generated electricity will be sold to the grid at the rate of 1.23 RM for 21 years which gives back to the customer 6396 RM yearly. However the customer still need to purchase electricity at the rate of 0.218 per kWh, which is around 523.2 RM yearly bills of electricity. Which gives a profit of 5872.8 RM. With FiT the ROI would take around 4 years and after that the customer will earn a RM 5873 yearly profit. Assuming that the FiT agreement will end in 21 years the customer can earn around RM 99.8K from this project in total. However, this policy ended in 2016 and only customers who got accepted previously are enjoying these incentives. On the other hand, for NEM in 2016 for the same resident electricity profile and 4 KWp PV installed Table 2. The price of electricity consumed is RM 523.2 and the price of energy generated is obtained by multiplying the energy generated by the PV with RM 0.31 domestic rate which gives RM 1612. This means the customer can save RM 1088.8 profit yearly. This will give the customer around 22 years to get back the investment money and 3 years of profit which is RM 3266.4 Figure 2. This kind of profit is not promising and it decreased the installation of solar PV as it is pointed in Table 1. It must be pointed that in NEM there is no money sustained, but a reduction in electricity bill of the next month. Which makes 4 KW in this case for this household a loss since the extra energy is sent to the grid and not a saving. This pushed for new policy of NEM that allow the customer to use the electricity produced by the PV and the extra KW generated can be sold to the grid, however, this cannot be substituted as money but as an electricity reduction from the next monthly bill. The electricity generated yearly is 5200 kWh, while the consumed energy is 2000 kWh, which sent back to the grid and substituted in the next electricity bill with a rate of RM 0.218 per kWh this save 697.6 of the electricity bill. The Time it takes to return the investment is 34.4 years, which more than the age of the solar project. This will put the customer in the negative instead of saving money. This size has been chosen to show the profit could be earned from installing only 4 KWp PV under FiT compared to the new schemes.

SEDA has introduced a peer-to-peer (P2P) energy trading program. Which allows the customers to sell the extra KWh generated by the PV to other customers at a cost of 39.05 sen for each KWh while, the cost of the KWh produced from the PV is 35.5 sen this will earn the customer 10% profit. However since the electricity generated will be sent to the grid first then sold to the customer the grid charges 6.3 sen per KWh which, makes the cost of the KWh generated 45.35 sen on the consumer. Yet this is still less than the electricity provide by the grid which has a tariff of 50.9 sen and that is 11% more than the PV generated electricity. This program needs more time to insure its effectivity. [21] It must be highlighted that solar PV growth in Malaysia is limited also by the energy mixed decided by the government. [22]

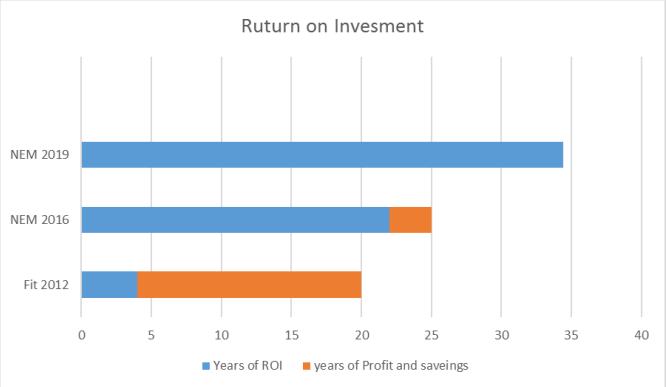

Fig. 2. Return on Investments years and Profit years for PV installation

From environmental aspect 4 KW PV would produce around 5200 kWh annul and with this household needs only 10% of this energy is used by the house and the rest is sent to the grid which is sold to other customers to be used as clean energy instead of fuel. This amount of energy is equal to 83 tons of Carbon Dioxide CO2 emission in the air. This reduction of pollution in the air is significant, especially if this is applied for more residents.

4 Conclusion

In this paper polices of solar PV in Malaysia has been explained from Fit to NEM in 2012, 2016 and 2019. It is clear from the installed capacity from 2012 until 2019 Fit is the most encouraging schemes that encouraged customers to install PV in their homes. That is due to its high profit earned from just 4KWp PV. While in NEM in both years 2016 and 2019 the profit is not sustained as money but only as electricity. Which makes it a loss for a house with only 200 KWh demand monthly. However the SEDA has introduced a peer-to-peer (P2P) energy trading program. This allows customers to sell the extra electricity generated for other customers for 39.05 per kWh, which is a new incentive for customers. However, this is just recently applied and it need time to get feedback on the new program.

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