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Current status and Challenges of Solar Energy in Malaysia; A Review

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Abstract

International interest in renewable energy, increased research activities around the world and dissemination of ideas faster than ever before has given rise to progress in Solar Energy. In line with this progress, there is a need to study the solar energy used in Malaysia. The solar radiation in Malaysia about 4.0 - 4.9 kWh/m2/day, compared to other locations around the world that have the most solar energy potential of about 6.0 - 6.9 kWh/m2/day, a According to the world standards, the solar radiation in Malaysia is among the lowest in the world, meaning that Malaysia may not be a place recommended to invest more in solar energy.

Keyword: Current Status, Challenges, Solar Energy, Malaysia

1. Introduction

Green energy is the energy that is produced in a manner that has less of a negative impact to the environment than other energy sources like fossil fuels, which are often produced with harmful side effects. Such types of energy that often come to mind are solar, wind, geothermal and hydro energy. There are several more, even including nuclear energy, that is sometimes considered a green energy source because of its lower waste output relative to energy sources such as coal or oil (Fayaza et al., 2011).

In general, the goal of green energy is to create power with as little pollution as possible and be produced as a by-product. Every form of energy collection will result in some pollution, but those that are green are known to cause less than those that are not. Similarly, many sources of green energy can come directly from the area in which the energy is needed rather than from an outside source. For example, a residence can be covered with solar panels for collecting energy to be used for electricity. When utilized properly, surplus energy is often produced in this manner, which can be sent back through the local power grid and used at other destinations (Razykov et al., 2011).

One of the goals of green energy technology is to take an existing fossil fuel energy technology and clean it up so that it can be produced more cleanly. One such case is that of clean coal technology, where scientists are trying to find ways to extract energy from coal and other fossil fuels without all of the harmful side effects. Their success depends upon the ability to extract harmful by products from fossil fuels while not only being energy efficient, but by being cost efficient as well (Hossain et al., 2011).

Renewable energy plays an important role in the supply of energy. The demand for fossil fuels will be reduced when more renewable energy sources are used, the. Therefore, this study has been conducted in order not only to enhance the development of renewable energy in Malaysia but to focus on solar energy and it is uses (Fayaz et al., 2011).

The Malaysian energy sector is still heavily dependent on non-renewable fuel such as fossil fuels and natural gas as a source of energy. With uncertainties in prices, depletion and environmental issues surrounding the non renewable energy resources, the renewable energy approach through solar energy plays a meaningful role as a country's fifth fuel. For this, the Malaysian government has taken various efforts to encourage individuals and companies to invest in solar PV projects (Johari et al; 2011).

The solar PV installation has grown considerably in Malaysia since the year 2000. Therefore, solar energy has a great potential in this country. As the main catalyst to accelerate the solar PV penetration in Malaysian residential houses, the MBIPV (Malaysia Building Integrated Photovoltaic) project was initiated with a growing number of funding for R&D activities, and supported by numerous government policies, the solar installation could become one of the major renewable sources for electricity generation in Malaysia (Mustafa, Peng and Hashim, 2010).

2. Literature Review

2.1 Solar Energy

Solar energy (SE) is considered as that energy received by the earth from the sun, which will be in the form of solar radiation, in order to make the production of solar electricity achievable. It therefore depends on some devices such as solar panels or solar cells in order to provide a source of clean and low cost renewable energy.

By conducting a survey on materials for solar energy conversion that have properties tailored to meet the requirements set by the spectral distribution, intensity, and incidence angle of electromagnetic radiation in our natural surroundings. Materials have risen during the past two decades as a result of the growing demand, cost, and environmental impact of energy production (Granqvist and Wittwer, 1997).

Solar energy reside in one of the most important places among a range of substitute energy sources. An accurate knowledge of solar radiation availability at a particular geographical location is very important for the development of solar energy systems and for the evaluation of their efficiencies and productivity. The familiarity of solar radiation data is a requirement for the modelling and design of all photovoltaic and solar thermal power schemes (Jakhrani, et al., 2010).

Hans and Queisser (2002) said that Nanostructuring have nevertheless to be investigated for obtaining substantial alterations in the energy losses of carriers via relaxation defect assisted recombination processes. Recombination represents one of the most difficult and elusive electronic processes in semiconductors, more than ever in the materials with indirect optical transitions. Furthermore, it also involves semiconductor solar cells that have been established to be useful and are carefully based on solid state physics. Semiconductor solar cells have already been proven to be useful and are thoroughly based on solid-state physics, but really only restricted to the micrometer regime (Queisser, 2002).

David et al. (2005) said that there are certain types of solar cells that can operate at relatively high temperatures of between 100 and 170 C without any loss of their efficiency. Furthermore, the lifetime of these cells under conditions mentioned above was not studied, but it could be said that the high-temperature cells had yet to be designed, constructed and investigated. However, given that the data already obtained with the existing cells are promising enough to act on.

There are so many unlike types of solar energy materials as some of them have been used commercially for photo thermal and photoelectric energy production and for achieving energy efficiency in buildings or some constructions as for others are on the road towards certain applications (Claes and Volker, 1997)

Nelson and Thomas (2011) have spoken about H/DTS (Multi format digital production switcher) ratio, as H/DTS ratio approximately obeyed the well known cosine response law. On sunny days, H/DTS approached 0.5, i.e., by tracking the sun; it would yield twice as much solar energy as a fixed horizontal tilt. On cloudy days or during cloudy periods, our analysis shows that 2-axis tracking will reduce the solar energy capture versus a horizontally tilted sensor (or array). We observed that the H/DTS ratio reached values of 1.37 for the cloudiest days. Over a whole cloudy day, we estimate an H orientation of a solar array can collect as much as 50% more energy than that of a system that moves the array to track the obscured solar disk.

David et al. (2008) believed in the solar power industry, both PV and thermal technologies, are on track to become more and more significant component of future global energy supplies. Although the industry is currently based on Si, ultimately, Si might not be able to meet long-term cost goals, opening the door to thin films and solar thermal conversion. Significant materials challenges do exist for these technologies as well, but they are nearing the point of manufacturability on a large scale.

Mahadi et al. (2011) have spoken about ways of connecting and distributing, as for connection to network, t two types are available and as follows:

a. A grid connected system connects to a huge independent grid and feeds power into the grid.

b. Stand alone system is unconnected to grid.

2.2 History of Solar Energy

In 1767 a Swiss scientist named Horace Benedict de Saussure managed to create the first solar collector, an insulated box covered with three layers of glass to absorb heat energy.

Saussure's box became widely known as the first solar oven, which could reach temperatures of 230F (exploringgreentechnology.com).

Solar radiation in Malaysia is only about 4.0 - 4.9 kWh/m2/day when measured up to the other locations around the world that have the most potential for solar energy of about 6.0 - 6.9 kWh/m2/day. (Azman et al., 2011).

One can observe that a majority of the researchers already have highly developed solar technologies and able to learn how to construct solar convertors. One renewable energy technology uses photovoltaic (PV) solar cells, which convert incoming solar radiation directly into electricity. With regards to the history of solar cell, it began in 1954 at Bell Labs, when three American researchers, Gerald Pearson, Calvin Fuller and Daryl Chapin designed a silicon solar cell capable of energy conversion efficiency with direct sunlight but produced less than a watt of power (Faucet 2002).

Today's PV solar panels are widely used to supply the power for satellites and buildings. Typically, solar cells use a solid state p-n junction created by a multi-step process that is used by the semiconductor industry to manufacture integrated circuits (Khalid et el, 2011).

2.3 Use and users of energy

Uses of solar energy can be found in several systems such as electrical vehicles and so on. However, in the 21st century this solar energy has been improved in order to match the needs of it by cutting down uses of known energy in order to have a better environment. By improving the circuit of solar power conversion, it led the way to maximize power and eliminate or reduce power losses. Also in future implementation, one may face some problems as solar cell and microprocessor may need some further studies in order to be embedded in 1 chip as a new technology (Tetsumi and Takahiro, 2001).

Hafshar et al., (2011) mentioned in their paper that increase in fossil fuel prices today and the country's commitment to reduce the carbon emission has supported the interests in expanding the use of renewable energy (RE) for energy generation. As for Malaysian government agreed that RE will be considered as a 5th energy resource for the country.

Green energy likely to be one of the more promising sources of clean energy in the upcoming decades wide-reaching, the mean reason why is that the solar irradiation is highly available thus solar power technology or energy considered one of the more economic and able to provide about 10% of the world's electricity by 2050 and expected to supply most of electricity demands in the world as well (Solangi et el, 2011).

Razykov (2011) specifies that the world energy consumption is 10 TW per year and by the year of 2050, it is planned to be about 30 TW, at this point the world will be in need of around 20 TW of non-CO2 (Carbon dioxide) energy to stabilize CO2 in the atmosphere by mid century. The simplest scenario to stabilize CO2 by mid century is one in which photovoltaic (PV) and other renewable are used for electricity (10 TW), hydrogen for transportation (10 TW) and fossil fuels for residential and industrial.

Mohamad Azlan et al., (2011) talked about Electric vehicles (EV) as it has prominent advantages as high efficiency, lower energy, low noise, zero emissions Part of the project study a novel method to improve EV driving range using solar energy as they have

highlighted the power consumption modelling using torque equivalent. The study has suggests that 79.85 pounds feet or 108.14 Nm of torque required to drive MBOV at 50mph.

There are so many attempts have been made to extract solar energy by means of solar collectors, sun trackers and giant mirrors in order to utilize it for industrial purposes. It is also observed that the solar powered systems are reliable and cost-effective as they are largely applied in industrial processes in line with energy sustainability issues globally. Solar electricity is used in many remote and isolated industrial applications worldwide (Hossaina et el, 2011).

2.4 Policies of Solar Energy

To ensure the sustainability of energy supply and subsequently of the country's sustainable economic development, the Malaysian government will have to intensify further the implementation of renewable energy (RE) and energy efficiency programs. As can be seen happening in a number of successful countries such as Germany, Denmark, and Japan, promoting RE require strong and long-term commitment from the Government which is crucial in implementing any kind of policies which will lead to RE development (Siti, Leong and Amir 2010).

Solar power technology or energy is considered one of the most economical and therefore able to provide about 10% of the world's electricity by 2050 and expected to provide most of world's electricity demands as well. The RE Cumulative Installed Capacity in MW has shown that in the coming future, solar energy will have a very high demand when compared to other energy resources. Some of the government's policy has been implemented in order to make a better use of RE resources to be sold to power utilities at a fixed price (Solangi et al., 2011).

In developed countries solar energy policies are designed very well so as to improve electricity generation from solar power. By looking at some comparison on the energy polices – way or strategy from the government in taking decisions – in different countries such as USA, France and Australia with those policies in Malaysia, countries may be able to have different policies to use for solar energy or any other type of energy, that policy it is based on, use, need, geography, weather etc (Fayaza et el, 2011).

2.5 Challenges of Solar energy

Some studies showed that in Malaysia the potential from solar PV = 9,150 MW. Also mentioned that the Government exposed the huge potential of renewable energy options in Malaysia such as biomass, biogas, municipal wastes and solar, but yet not enough support or promotion to renewable energy (Solangi et el, 2011).

The most important challenges that may face solar energy in Malaysia could be:

a. Financial barriers: many green energy projects are implemented with the assistance of grants
b. Technical barriers: There are uncertainties in some technologies that may not be suitable because of unreliable power supply of some developing countries.

3. Methodology

a. *By industrial*: Malaysia has prioritized industry and economic development. Now it is set to expand its solar industry, from producing solar panels to producing solar power. Malaysia is already home to large scale production facilities of three leading photovoltaic (PV) module manufacturers (SunPower, Q-Cells and First Solar).
b. *By domestic*: in Malaysia is at domestic level only and large scale commercial use is not significant yet.
c. *Challenges*: The fundamental challenge facing the power sector in Malaysia is the issue of sustainability that is to ensure the security and reliability of energy supply and the use of the various energy resources.
d. *Converting to solar*: To be put to work solar energy must be converted into more useful forms of energy. Solar technology is expanding rapidly into areas other than for traditional applications.

4. Conclusion

As it mentioned earlier in the abstract and also after reviewing a number of articles, we are of the view that Malaysia may not be a recommendable country to make use of solar energy. The reason of being that the cost of installing PV systems in Malaysia is expensive, even though the cost is falling at a rate of more than 10% per annum.

Consequently, solar energy, as well as other renewable energy, cannot be a major contributor for electricity generation in Malaysia. This would only be true until such time as solar technologies become more affordable and much more efficient in electricity generation..

A few factors that must be taken as the reasons leading to limited solar energy in Malaysia and as a major challenge for solar power in Malaysia include the following:

- ✓ Malaysia has an average about 4 hours per day of solar insulation.
- ✓ Malaysia has an average of 2 months of either cloudy or raining day per year, which is may not be a favourable for solar power.
- ✓ When solar cell (panel or module) heat up (day time), the solar cell's efficiency (output power) will start to go down.
- ✓ Installed solar panels need to be dirt-free in order to have maximum efficiency, this is considered as an extra cost for the owner as it may increased longer payback period as well.

With the implementation of the motivation packages and aggressive promotional strategy to attract both foreign and local investors, the government has identified solar energy as one of the growth areas to promote.

As a result of such strategy, Bosch Malaysia plans to set up a new solar energy manufacturing site in Penang, Malaysia. With a planned investment of RM2.2 billion (EUR 520 million), the construction project is one of the biggest in the company's history.

This latest investment of a solar energy plant in Penang, Malaysia marks a significant milestone for the Southeast Asian regional

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