

## Solar Energy: Dilemma and the Way Forward

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### Abstract

Renewable energy plays important roles in supplying energy to the world since it able to reduce the demand of fossil fuels. Natural processes and minerals such as sunlight, wind, tide and geothermal heat describes renewable energy. Nowadays, the world is shifting to renewable energy sources due to several factors such as rising prices of oil and gas and scarcity. Theoretically, solar energy is the energy from the sun. Too expensive for mainstream market was the main factors that make solar technologies occupied on uncomfortable position. As time change, global warming and climate change began to emerge. Essentially, solar power can offer a greener, cheaper path to development. Furthermore, meeting rising energy demand with cost-effective new generation capacity is a critical challenge facing most developing countries. Review of literatures shows that it is a clear signal that something needs to be done about renewable energy to put the world on a better path to avoiding the impacts of climate change. Thus, Just in Time (JIT), one procurement mechanism and support schemes for clean energy such as solar energy seems to lead the charge. This research involved a literature search on the challenges of the solar energy and the way forward based on the frequency of the factors identified by past researchers. As a result, more effort is necessary to boost and further stimulate action towards a better understanding on the positive and negative effects of solar energy, which will result in greener, cheaper and better path of the current and future development.

*Keywords:* Solar energy, Dilemma, Benefits, Barriers, Solutions

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### 1.0 Introduction

Meeting rising energy demand with cost-effective new generation capacity is a critical challenge facing most developing countries (Marshall, 2015). It is an urgent issue, dilemma and has been for many years. Thus, as an initial strategy, renewable energy is the parallel consideration of healthy environments, life, and human well-being that includes issues of population, climate, economic prosperity, energy, natural resource use, technology, green building, etc. Later, renewable generation, particularly wind and solar photovoltaic generators, are added to reduce our reliance on fossil fuels (Ghalib, 2007). Natural processes and minerals such as sunlight, wind, tide and geothermal heat describes renewable energy. Nowadays, the world is shifting to renewable energy sources due to several factors such as rising prices of oil and gas and scarcity (Komor, 2009).

### 2.0 Problem Statement

Solar energy is the energy from the sun (Ogunleye, I.O & Awogbemi, O., 2010). The sun is a big ball of heat and light resulting from nuclear fusion at its core. The nuclear reaction releases energy that travels outward to the surface of the sun. A collection of solar cells is call solar panel. Solar panel is devices that convert light into electricity. According to Otasowie(2008), it is also known as photovoltaic (PV) which means light electricity. The more light that hits the cell more electricity would be produced. For example, solar panel on the spacecraft is design to point the sun even as the rest of the body is moving around.

Referring to the Solar Trading Post (2008) article, solar energy started when Russia and United States competes each other to send the first satellites into the atmosphere. At that time, solar panel was use to power the satellites and lots of money was invested in order to ensure solar panels durable and reliable. Once the space race ended, investment of solar technologies slowed down. Too expensive for mainstream market was the main factors that make solar technologies occupied on uncomfortable position. As time change, global warming and climate change began to emerge. Suddenly, there was a need for a clean, reliable energy producing technology. Firstly, Solar Panels have become more efficient over time. Secondly, as solar panels have become more efficient the energy produced costs less (Solar Trading Post, 2008).

According to Butti and Perlin (1981), the early development of solar technologies had started in the 1860s. It was driven by an expectation that coal would soon become scarce. However, development of solar technologies stagnated in the early 20th century in the face of the increasing availability, economy, and utility of coal and petroleum.

Subsequently, in the mid-1990s, development of both, residential and commercial rooftop solar as well as utility-scale photovoltaic (PV) power stations, began to accelerate again due to supply issues with oil and natural gas, global warming concerns, and the improving economic position of PV relative to other energy technologies (Bradford, 2006; Oji et. al., 2012).

According to Berger (1997), essentially when compared the price alone (short-term price), Renewable energy are more expensive than conventional established fossil fuel technologies due to lack consideration of the following:

- 1) Full environmental costs of the conventional technologies
- 2) Fossil fuel market domination and, long operating industries and price advantages
- 3) Maintenance costs of the older fossil fuel technologies
- 4) Environmental benefits produced by renewables (not properly valued by the marketplace as it is free access)
- 5) Freedom from future fuel price shocks
- 6) Small capital investment than a large proportions of the total costs of natural gas and fossil fuel (lavish federal subsidies)
- 7) New technologies

In this research, researchers try to review the positive and negative effects of renewable energy and come out with recommendations that will be useful for effective and efficient utilization of solar electricity.

### **3.0 Objectives**

The focus of this paper is to identify the positive and negative effects of solar energy. This paper also reviews and outlines current status, challenges and some solutions to stem solar technologies trend.

### **4.0 Methodology**

Literature was selected based on different issues of sustainable development and renewable energy including the benefits, weakness, usage, challenges, constraint, new concept, trend and techniques against solar energydemand and technologies that meets the needs of the present.

### **5.0 Literature Review**

Literature was chosen to illustrate the findings on solar issues. A greater emphasis was placed on literature that addressed the positive effects, constraints and solutions of renewable energy issues in order to commercialize the usage of solar system and to determine the effectiveness of a commercial solar panel system i.e. a moveable reflector that able to track sun and new technique in generating solar energy.

#### **5.1 Benefits and Major Barriers of Solar Usage**

For many years, electricity utilities are highly dependent and focusing on fossil fuel and highly exposed to volatility in domestic and global fuel markets. As noted above, solar energy is one of several renewable energy sources that produce energy without producing carbon dioxide, reduces the greenhouse gases which cause global warming, and have clear environmental advantages such as healthy environments, life, and human well-being.

It is pretty straightforward to see the differences between a fossil fuel and a solar energy. For example in Table 1, a brief comparison between fossil fuel and solar energy can be made as follows (Wise Power System, 2015):

Table 1: Comparison between Fossil Fuel and Solar Energy

<b>Fossil Fuel</b>	<b>Solar Energy</b>
Environmentally Destructive	Clean / Environmental benefits / Zero-Carbon Technologies
Unsustainable	sustainable / renewable resources
Dangerous / Diminishing Global Supply Of Fossil Fuels	domestically supplied and secure / reliable

However, it still constrained by the variability challenge and the technical potential of the renewable resources themselves. According to Komor (2009), many electricity system operators see the solar energy as a threat to system stability and reliability due to several factors such as:

- 1) Availability and variability; cannot be scheduled to deliver specified amounts of power at specified times as the system generate electricity when the energy resources (the sun) are available. The demand of electricity and the weather pattern, however, does not in parallel mode thus energy source fluctuates due to weather patterns, clouds, and cycles of day and night
- 2) Not necessarily cost-effective; higher perceived technical risk, high ratio of capital to operating costs
- 3) Policy uncertainty; renewable energy technologies less competitive on cost basis due to current government policies in the power sector are oftentimes in favour of the conventional energy technology at the expense of the renewable energy technologies (Komor, 2009; Owolabi, 2008).

This section summarizes the benefits of solar usage (Table 2) and major barriers to greater use of solar (Table 3) based on the frequency of the factors identified by past researchers.

Table 2: Benefits of Solar Usage

Ref.	Author	Benefits of Solar Usage		
		Zero-Carbon Technologies	Environmental Benefits	Fuel Diversification / Energy Security
1	Komor, P. (2009)	/	/	/
2	Mitavachan, H. (2012)	/	/	
3	Ogunleye, I.O &Awogbemi, O. (2010)		/	
4	Owolabi I.E. (2008)		/	
5	Ghalib, M. (2007)		/	/
6	Butti&Perlin (1981)			/
7	Bradford, T. (2006)	/	/	/
8	Berger, John J. (1997)		/	/
9	Oji, J. O. et. al. (2012)	/	/	/

Table 3: Major Barriers of Solar Usage

Ref.	Author	Major Barriers to Greater Use of Solar		
		Availability / Variability	High Costs (Short-Term Price)	Current policy / Government Incentives
1	Komor, P. (2009)	/	/	/
2	Mitavachan, H. (2012)		/	
3	Ogunleye, I.O &Awogbemi, O. (2010)		/	
4	Owolabi I.E (2008)		/	/
5	Solar Trading Post (2008)		/	
6	Bradford, T. (2006)	/	/	/
7	Oji, J. O. et. al. (2012)		/	/

## 5.2 Solar Technologies: Solutions and Paradigm Shift

As noted above, more effort is necessary to boost and further stimulate action towards a better understanding on the positive effects of renewable energy, which will result in greener, cheaper and better path of the current and future development. According to Oji et. al (2012), the future of solar electricity is brighter than before, however in order to have maximization of the sun's energy supply, the following recommendations will be useful:

- 1) More research involving the initial and subsequent costs of solar plants and their power efficiencies.
- 2) More Government subsidization for Renewable Energy Technologies (RET) most especially solar PV to bring down the high cost.
- 3) More encouragement by authorities to the private individuals and to invest in solar technologies.
- 4) More initiative by the Government to create more awareness on the advantages derivable from Renewable Energy Technologies (RET) such as solar technologies.
- 5) More Government policy implementation such as placing restrictions on the importation of diesel and petrol engine generators due to its adverse effects on the environment (greener and clean energy support)
- 6) More funding for the solar technology researches and development initiatives to develop the most efficient solar technologies with environmental benefits.

Towards make the solar technologies successfully, the following solutions and paradigm shift such as Commercial solar panel system, new concept and procurement mechanism will be useful:

- 1) The Implementation of Just In Time Basis  
According to Hertzog (2014), the electric utility sector has been quite successful at managing power on a JIT basis as it is cost effective ways to store energy. Thus, introducing JIT as one of the practice that could be applied in the electric utility sector as an approach to obtain a smooth management of power (remained in a stand-by capacity until needed for power, voltage, or frequency regulation). An effective form of energy storage would eliminate the solar availability and variability issues (Peltier, 2011).
- 2) Application Of A Simple and High-Precision Modeling Method  
PV system with storage battery (Just-In-Time Modeling to the forecast of residential load) shows that the introduction of load forecast into PV system operation contributes to environmental conservation and reduction of operating cost (Goto, Suzuki, Shimoo, Hayashi, &Wakao, 2011). It is designed to drive down the cost of solar technology (environmental conservation and operating cost) and overcome obstacles to solar adoption such as availability and variability issues.
- 3) Development of the most efficient solar technologies  
Towards make the most efficient solar technologies, solar tracker concept to the reflector will be more effective to solve the availability issues. It is a commercial solar panel system with a moveable reflector that able to track sun and new technique in generating solar energy (Figure 1).Solar tracking is a technology that been used to increase solar production by directing the solar panel to follow the sun along its path from dawn until dusk in order to capture the maximum solar radiation for the longest time possible, while reflector will be used to help solar panel to generate more energy because the reflector reflect the diffuse radiation (sunlight that scatter by molecules and particles in the atmosphere but still made down to the surface of earth. It is different compared to the existing technique as it will add more sources to the input in order to generate more energy when diffuse radiation hit the surface.

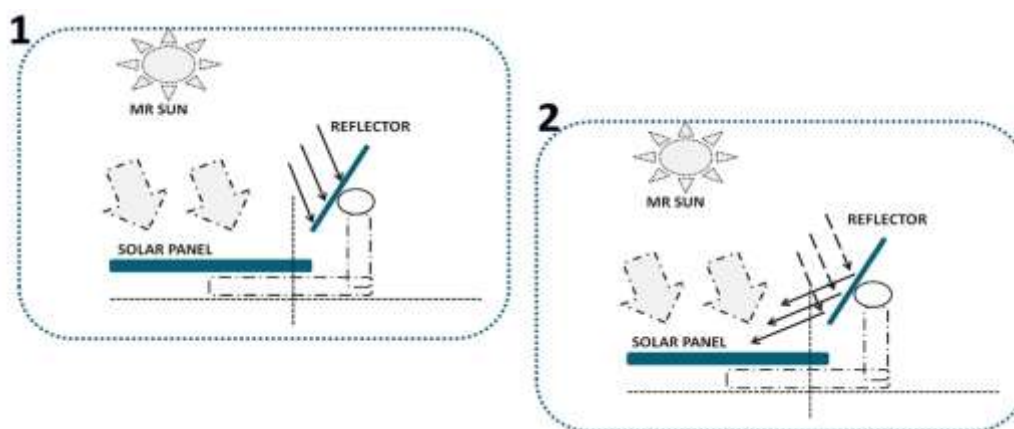


Figure 1: Generating More Energy with Diffuse Radiation

## 6.0 Conclusion

Thus, for the long term effects, with the government and investors support, new procurement mechanism and support schemes, impressive technological advances and renewable energy (solar system) as well as its bright financial prospects will result in greener, cheaper and better path of the current and future development of renewable energy (Berger, 1997). Solar energy is indeed better for the environment than burning fossil fuels. The good news is that the electricity industry could readily eliminate many of the damaging side effects that do exist such as environmentally destructive, unsustainable, dangerous and diminishing global supply of fossil fuels issues. Essentially, this problem could completely go away in the future. The new Government policy implementation, efforts, choices investors and consumers make could, in principle, have a big influence on the future direction and practices of the solar energy in supplying energy to the world.

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