

## Solar Energy for Socio-Economic Wellbeing in Urban Areas, Malaysia

### Tenaga Solar untuk Kesejahteraan Sosioekonomi di Kawasan Bandar, Malaysia

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#### ABSTRACT

*The dependency of energy in terms of electricity becomes one of the promising needed sources for people in urban areas in Malaysia. Renewable energy could become one of the alternative sources for people in urban areas to gain environmental, economic and social wellbeing. Among the alternative sources, solar energy is one of the potential energy sources in tropical countries particularly in Malaysia for sustainable urban development. This study attempts to analyze the benefits and advantages related to solar energy for sustainable energy use and urban development. The study is using secondary sources of data such as policies, regulations and research reports from relevant ministries and agencies to attain the objectives. As began under Fifth Fuel Policy in 8<sup>th</sup> Malaysia Plan, Malaysia has taken initiatives for decreasing energy dependency on oil in a way to address the global concern on climate change by introduced solar as one of the alternative renewable energy in the energy supply mix for sustainable development. The study shows solar energy becomes one of the promising alternative energy sources for Malaysia in urban areas. Finally, solar energy has increased socio-economic wellbeing and develops green potential in energy sector of Malaysia by preserving environment as well as reducing carbon emission.*

*Keywords: Renewable energy; solar energy; socio-economic wellbeing; urban development; Malaysia*

#### ABSTRAK

*Kebergantungan tenaga dari segi elektrik menjadi salah satu sumber yang keperluan yang dijanjikan bagi orang-orang di kawasan bandar di Malaysia. Tenaga boleh diperbaharui boleh menjadi salah satu sumber alternatif bagi penduduk di kawasan bandar untuk mengimbangi alam sekitar, kesejahteraan ekonomi dan sosial. Antara sumber alternatif, tenaga solar merupakan salah satu sumber tenaga yang berpotensi di negara-negara tropika terutama di Malaysia untuk pembangunan bandar lestari. Kajian ini bertujuan untuk menganalisis manfaat dan kelebihan yang berkaitan dengan tenaga solar untuk kegunaan kelestarian tenaga dan pembangunan bandar. Kajian ini menggunakan sumber data sekunder seperti kertas dasar, peraturan dan laporan penyelidikan daripada kementerian dan agensi yang berkaitan untuk mencapai objektif kajian. Seperti yang bermula di bawah Dasar Bahan Api Kelima dalam Rancangan Malaysia Ke-8, Malaysia telah mengambil inisiatif untuk mengurangkan pergantungan tenaga kepada minyak sebagai cara untuk menangani kebimbangan global terhadap perubahan iklim dengan memperkenalkan solar sebagai tenaga alternatif boleh diperbaharui dalam bekalan tenaga untuk pembangunan lestari. Kajian menunjukkan tenaga solar menjadi salah satu sumber tenaga alternatif yang terbaik untuk Malaysia di kawasan bandar. Akhirnya, tenaga solar telah meningkatkan kesejahteraan sosioekonomi dan mengembangkan potensi hijau dalam sektor tenaga Malaysia dengan memelihara alam sekitar serta mengurangkan pelepasan karbon.*

*Kata kunci: Tenaga boleh diperbaharui; tenaga solar; kesejahteraan sosioekonomi; pembangunan bandar; Malaysia*

#### INTRODUCTION

The demand of energy had increased around the world years by years. People continue to rely on fossil fuel for energy contribution to the declination of the stock and need substitute for it. Facing the challenges to fulfill the increasing energy demand also make the situation worse (N.A. Ahmad and H. Byrd 2013). According to Siti Indati, M. et al. (2010) in Malaysia, energy had become the

main contributor for rapid growth and have been increased almost 20% from 13,000 MW in year 2000 to 15,500 MW in the year 2009. The increasing cost for electricity and declining fossil fuels resources causes various negative impacts to the people and environment especially in urban areas. Nevertheless, the consuming of high amount of fossil fuels causes Malaysia become as the second highest carbon dioxide emitter among top ten countries with annual rate is about 7.9 percent from year

1990 to 2006 (Figure 1) (Benjamin, K.S. 2012; National Khazanah 2010). Renewable energy (RE) is one of the best option to consider for replacing the fossil fuel energy. This energy is safe and has minimize effect toward environment. It is not just a sustainable energy but also become as alternative for major transformation technology (Jerry, H. 2010). The developing countries are taking initiatives to divert energy from fossil fuels to alternative and renewable sources for reduction of carbon emissions and sustainable energy uses (Rashidah et al. 2013).

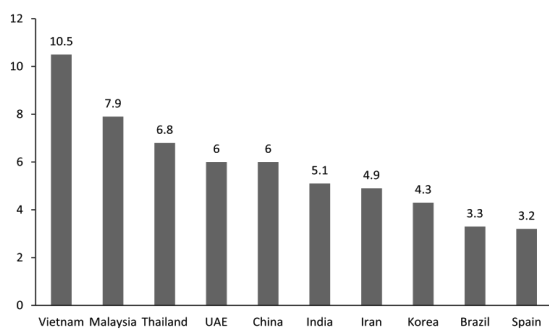


FIGURE 1. Growth rate of carbon dioxide emissions from 1990-2006 (%)

Source: Benjamin, K.S. and Bulan, L.C. (2012); National Khazanah (2010)

Besides biomass, biogas, mini hydro and municipal waste, solar is one of the potential RE that could be taken into account for the development purposes. It is also show significant potential in satisfy the increasing of the demand of energy in the world (Firdaus et al. 2012). Malaysia's condition which in the tropical region which located at the equator (Ahmad et al. 2011) and being in the strategic geographical location, which has abundant sunlight with average irradiance per year of 1643kWh/m<sup>2</sup> become promising condition for the development of solar energy (Haris 2008).

Solar energy provides benefits to community and increase socio-economic wellbeing especially in urban areas. The high cost of living in urban areas especially in terms of energy uses, making solar energy as the best option to put into consideration. Socio-economic wellbeing could be measure based on jobs opportunities, incomes and lifestyle (Edwin and Grace 2007). The relationship between socio-economic wellbeing and solar energy in terms of its benefits, make the life easier and the dependency to grid electricity will be decreased.

Urban development in Malaysia is a broad idea to build and develop at urban area in efficient way

towards achieving sustainable urban development. Increasing of population and economic growth from expansion of urban area will be contributing to global and local climates due to increased energy uses and emissions (Yang et al. 2005). By using the solar energy, it will becoming one of the solution for this problem. A lot of studies explained about relationship between urban structure and energy used (Dresner, S. 2002). Urban area is a strategic location for solar energy to be implemented. Urban area has become an attraction or the center for people to live in. The human population in urban city is in ascending value over the time. It happened mostly due to increasing of jobs opportunity and economic activities taking place compared to rural areas. With a lot of building in the urban area, it has provided suitable surfaces for installation of solar panels (Jaroslav, H. et al. 2009). Public transportation, such as bus, that regenerating by solar energy could being use in urban areas. While reducing the traffic, these public transports also save and protect the environment to achieve urban sustainability. Urban sustainability is defined by characterized the functions of proper use of resources to guarantee a generational equity, minimal the use of non-renewable resources to generational equity and protection of the environment, individual wellbeing, community self-reliance and satisfaction of basic human needs (Choguill 1996; Hardoy et al. 1992). This proved that by using solar energy which is one of renewable energy sources, living towards urban sustainability will be achieved. The present study explores the potential of solar energy as alternative energy sources for Malaysia in urban areas. The studies also analyze the advantages related to solar energy for sustainable energy use and urban development.

## METHODS

The study used secondary sources such as policies, acts and regulations from relevant ministries and agencies of Malaysian Government. Relevant published materials such as research reports, articles, books, annual reports as well as websites were also reviewed in order to accumulate secondary data.

## RESULTS AND DISCUSSION

Around the world, solar energy development had becomes a trending market and has huge potential

for sustainable energy development. Two types of solar energy that always being referring to which are Solar Photovoltaic (PV) and Solar Thermal System. In Europe, especially Germany had becomes a leading country in terms of PV installation with a total cumulative installation of more than 9 GW and it also been followed by Japan and US which accounted 2.1 GW and 1.2 GW respectively (Figure 2) (German Federal Network Agency 2011; Global Market Outlook for Photovoltaics until 2013).

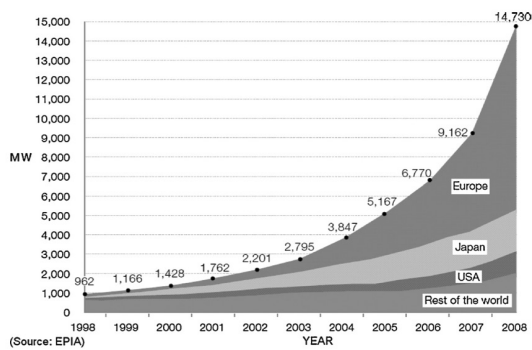


FIGURE 2. Global Cumulative PV power installed per Region  
Source: EPIA

In Malaysia, solar PV is the highest potential energy among other RE. Based on the (Table 1), solar contribute to the highest potential which is 6500 MW compare to other source of renewable energy such as biomass, biogas mini hydro and municipal waste. Based on theoretically calculated by (Haris 2008), solar panels installed in an area of 431 km<sup>2</sup> in Malaysia could generate enough electricity to fulfill the electricity demand of the country in 2005 (Figure 3).

Malaysia has high yearly average solar energy which range mostly started from 1600 kWh/m<sup>2</sup> to 1900 kWh/m<sup>2</sup>. Solar radiation is estimated could provide four times of the world fossil fuel resources and also relatively high based on the world standards (Azhari et al. 2008; Borhanazad et al. 2013). It opens big opportunity to Malaysia for generating solar energy. Malaysia should take this opportunity and explore this resource for countries benefits (Firdaus et al. 2011). Solar also become popular and act as perfect choice because it only need minimal maintenances, quick times to install (MBIPV 2011) also the source is infinite and available.

TABLE 1. Renewable Energy Resource Potential in Malaysia

Renewable Energy	Potential (MW)
Biomass	1,340
Biogas	410
Mini Hydro	500
(Total Hydro potential is 22,000 MW)	
Solar	6,500
Municipal Waste	400
<b>Total</b>	<b>9,150</b>

Source: Siti Indati, M. et al. 2010

RE has been promoted in Malaysia by the government through initiatives during 8<sup>th</sup> Malaysia Plan which in between 2001 to 2005. It is a way and strategy to introduce RE as the fifth fuel also as an option for energy supply to replaced traditional energy sources (Siti Indati, M. et al. 2010). Malaysia also put initiative by introducing Renewable Energy Act 2011 in 27 April 2011 by established and implemented tariff system mechanism to generate renewable energy (SEDA 2011).

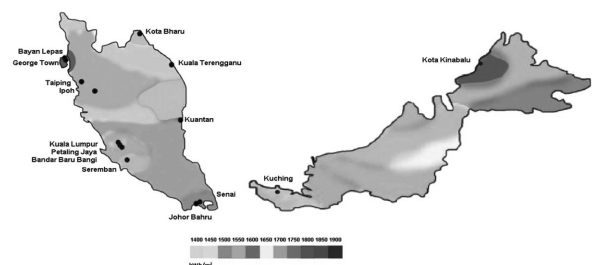


FIGURE 3. The Yearly Average Solar Energy in Malaysia  
Source: Haris 2008

Solar has been used to provide energy to the community. Based on research that has been conducted by Sovacoo and Drupady (2011), it is estimated that one square meter solar panel could reduced 40 kg of CO<sub>2</sub> annually. In worldwide scenario, solar energy resource not only help people by providing energy for electricity, but also plays an important role in increasing socio-economic wellbeing especially in urban areas. The creation of green jobs specifically for solar panels and solar thermal system purposes in industry sectors (Mekhilef et al. 2011), increasing of public transportation that generated by solar energy, green infrastructures and facilities that provide wireless and electricity powered by solar energy and solar energy power also has big responsibility to protect the environment with reducing the emission of carbon dioxide.

#### SOLAR ENERGY DEVELOPMENT IN MALAYSIA

Government of Malaysia (GoM) has taken a few initiatives and incentives to support RE development including solar energy. Projects such as Small Renewable Energy Programme (SREP) that has been formulated as a key project in 8<sup>th</sup> Malaysia Plan and Malaysian Building Integrated Photovoltaic Technology Application Project (MBIPV) (Siti Indati et al. 2010). SREP is introduced to utilize renewable energy resources including biomass, biogas, municipal waste, solar, mini hydro and wind energy (Benjamin and Ira 2011; Firdaus et al. 2011). The objectives of SREP are to identify the waste energy potential from the palm oil industry which is one of the largest agricultural sectors in the country. Then, functioned as a technological learning also promoting innovation for Malaysia like small scale hydro, solar photovoltaic panels and waste incineration.

One of the popular initiatives in RE development is FiT scheme or FiT mechanism which had been implemented under SREP. This mechanism allows electricity for RE been paid in kilowatt-hour (kWh). The FiT could be defined as electricity export

promoter and as a good investment especially for community in urban area (Shing, C.C. et al. 2012). According to SEDA (2011), advantages of using FiT mechanism are including getting the benefits which related to economic issues faces by many countries like Germany and UK also provide employment opportunity and increase gross national income in renewable energy industry growth.

In Malaysia, projects that have been succeed are 1. SP Setia at location Setia Eco. Park in Shah Alam, Selangor which developed 5kWp PV systems cost over RM170k (USD 52.5k) each in 20 of the 39 bungalows, 2. Putrajaya Perdana at location Precinct 16 of Putrajaya which offers average 5.4kWp PV modules in 15 bungalows, and 3. Amarin Wickham at U-Thant area of Kuala Lumpur which incorporated PV cells into the sunshade on the roof of its condominium (The Star 2008). By the end of 2005, 470kWp of grid-connected PV systems installed in Peninsular Malaysia and most notably the 362kWp system at Technology Park Malaysia (TPM) and proven that Malaysia is capable of utilizing the solar energy sources in urban areas (Ahmad, H.H. et al. 2007). FiT scheme also provided economic, political, social and environment's benefits (refers to Table 2). It is not only creating green jobs and drive economic development under economic category, but it is also increasing energy security and autonomy in political category. For social wellbeing, it will encourage citizen and community engagement in activities protecting climate and environment and make RE as a common part of the landscape and cityscape. For environmental category, it will reduce carbon emission and pollution and also reduce dependency on fossil fuels (Mendonca et al. 2010). Based on these four categories, it shows that there is significant relationship between economic, political, social and environmental categories to achieve sustainable urbanization. This relationship is also supported by Drakakis-Smith, D. (2000) in his definition: sustainable urbanization refers to the well-balanced relationship between the social, economic and environmental agents in society, so as to accomplish sustainable urban development.

TABLE 2. Advantages of FiT

Economic	Green jobs creation Drive economic development Create stable conditions for market growth
Political	Demonstrate commitment to RE deployment Create mechanism for achieving RE and emissions reduction targets Increase the stakeholder base supporting RE policies Increase energy security and autonomy
Social	Fairer wealth distribution and empower citizens and communities Increased public support for renewables through direct stake and increased exposure to renewables Encourage citizen and community engagement in activities protecting climate and environment
Environment	Make RE a common part of the landscape and cityscape Encourage energy efficiency measures Reduce dependency on fossil fuels Reduce carbon emission and pollutions

Source: Mendonca et al. 2010

According to a report by (Ministry of Energy, Green Technology and Water 2011), solar energy is proven to accelerate positive socio economic impacts for urban development in Malaysia. The introduction of FiT to urban community will give a huge benefits such as 1. to create minimum of 52,000 'green' jobs to build, operate and maintain RE power plants; 2. RE power plants operation will projected more than MYR70 billion of RE business revenues; 3. huge reduction on emission of CO<sub>2</sub> and 4. Malaysia will contribute towards sustainable energy security and committed to mitigate climate change as it's social responsibility. Edwin, H.W.C. and Grace, K. L. Lee (2007) also agreed that solar could improve the development of urban area to achieve sustainable development.

Besides, research that has been conducted online by Firdaus, et al. (2011) shows that 51.4% respondents choose solar energy as one of the renewable energy. This shows that solar energy could increase public awareness on benefits and advantages of renewable energy including solar energy and also their willingness to pay for electricity that generated by renewable sources even though it will cost higher than fossil fuels resources (Figure 4).

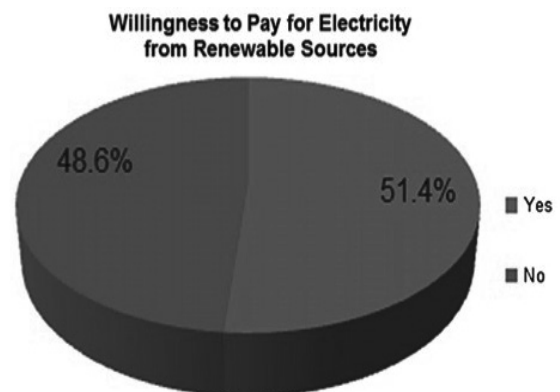


FIGURE 4. Willingness to Pay for Electricity from Renewable Sources

Source: Firdaus et al. (2011)

Nevertheless, there are challenges in facing the SREP in Malaysia. First dimension is technical aspects such as lack of sufficient education, training and sharing of experiences among all stakeholders (eg: planners, developers, research institutes, financial institutions, expensive feasibility studies and high grid interconnection costs). Second is, economic dimension such as low electricity tariffs for renewable power producers. Third, authorities institutional such as lack of adequate and strongly implemented national policy frameworks (Benjamin, K.S. and Ira, M.D. 2011). These challenges should be defeated in order to make sure solar energy development in Malaysia could be one of a sustainable resources for people in urban areas.

## CONCLUSION

Solar is one of the most potential energy source in Malaysia to fulfill the increasing energy demands especially for urban areas. Moreover, solar also preserving environmental wellbeings and reducing carbon emissions. Solar energy is able to increase socio-economic wellbeing, develop green potential for urban community and also energy sector in Malaysia. In the future, Malaysia will be able to exert significant green potential using solar energy. Participation, involvement and integration from government, private sectors, NGOs and local community is needed for proper utilization of solar energy resource prospects. Public awareness and education for citizens on solar energy sources should be addressed clearly in order to promote solar energy for every urban area in Malaysia. More research and development (R&D) also needed to prepare cheaper technology for solar energy development that could be use more in efficient way. Incentives, such as financial supports and effective strategies could generate more growth in solar energy development also could attract more participation from private sectors. Sustainable urban planning is a formula to facilitate solar energy development and also become the main ideas in optimizing solar for achieving sustainable development as a common practice. Solar energy has proven in increasing socio-economic wellbeing and develops great potential in urban areas of Malaysia by preserving environment as well as reducing carbon emission.

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