

SUSTAINABLE SOLAR COMMUNITY LIFESTYLES IN MALAYSIA: THE PRELIMINARY STUDY

Nur Sahida binti Abdul Rahman^{1*}, Nur Azfahani Ahmad² and Nur Huzeima Hussain³

^{1,2,3}Faculty of Architecture, Planning and Surveying, Universiti Teknologi MARA, Perak Branch, Seri Iskandar Campus, Seri Iskandar, 32610 Perak, Malaysia.

sahida_rahman94@yahoo.com *

Abstract - Malaysian people tend to use electricity generated from non-renewable fossil fuel every day and unaware of the situation that these resources are actually decreasing and depleting due to its rapid consumption. This is due to the rapid development of Malaysia that leads to heavy consumption of electricity in their lifestyle. In addition, the lack of knowledge of these people on the importance of renewable energy that can act as supplement power for electricity. People also are unaware of global warming issue and carbon footprints that produced due to electricity generation. Frequent blackouts can also occur in the future if the non-renewable resources deplete. Therefore, it is necessary to find a solution to overcome this situation. The aim of this research is to explore the establishment of using renewable energy sources as a supplement energy for electricity in order to establish a sustainable community lifestyles in Malaysia. The focus of this study is to enhance and encourage people in middle and low-income group in Malaysia to use energy generated from renewable energy. The most accessible renewable energy that can be gained in Malaysia is solar energy. Therefore, it is wise to propose a sustainable community lifestyle in Malaysia which is based on the application of solar energy. Through extensive literature, case studies, field observation, survey, simulation and modelling, the feasibility of establishing a sustainable solar community lifestyle can be explore. The focus of these studies is to help the middle and low-income group communities in Malaysia to obtain a sustainable lifestyle without the power interruption issue in the future. An analysis will be made and will be seen if the establishment of solar PV technology can be integrated as future technologies.

Keywords - Renewable Energy, Sustainable Community, Solar Energy, Solar Technology

1 INTRODUCTION

1.1 Background of study

Since after 2014, there is an issue about higher electricity bills in Malaysia due to the increasing tariff by Tenaga Nasional Berhad (Shagar, 2013). According to Rasid (2018), Malaysia maybe facing higher electricity bills because of the Electricity Industry Fund (EIF) that has been charged by TNB is used to absorb the increase in cost in the form of a surcharge. Higher surcharges apply to consumers if the use of electric energy is greater which is more than RM 0.30 per 1 kW (Mohd Noh, 2018). More electricity is used, more surcharge will be apply to consumers. Based on “Malaysia – oil and gas” (n.d.), the increase in bills was also due to the large demand and it exceeds the current supply of crude oil.

Mostly electricity production comes from burning fossil fuel such as coal, oil and natural gas. These productions of electricity can impact climate change on earth (“Air Quality Issues of Electricity Production: Climate Change,” n.d.). The carbon that came from burning fossil can contribute to the greenhouse effect meaning that the increased quantities of gases such as carbon dioxide in the air increased, and will also trapped the heat from these gases from the sun and cause a gradual rise in the temperature the earth’ atmosphere (Definition of 'greenhouse effect',”2010). This can affect global warming and it will create serious natural disasters. Fossil fuel is non-renewable energy because they were formed from the buried remains of animals and plants that lived millions of years ago (“Nuclear explained,”2018). The use of fossil fuel will be exhausted and the effects of burning can cause pollution (Mikael and Xu, 2013). Therefore, it is significant to establish a sustainable lifestyle, and this aim can be achieved through utilising renewable energies into the establishment of people’s lifestyles (Carlisle et al., 2008). However, it is hard to meet this goal since people keep on depending on energy from fossil fuel through their lifestyles.

Establishing a sustainable community lifestyle through the empowerment of renewable energies provide many benefits to the people, globally and locally (Terrapon et al., 2014). Among the

benefits are it create more self-sustaining energy production, especially during power interruption or blackouts from the fossil fuel electricity (Baranski, 2018) and gives control in the electricity bills price, so that option to use more affordable energy can be found (Hsu, 2019). It also promote greener lifestyles since green energy is being used (Letcher and Fthenakis, 2018). There are many option in adopting green energies into people's lifestyles, for instance solar, wind, biomass, wave and geothermal energy ("Renewable Energy," n.d.).

In the case of Malaysia, the most potential renewable energy to be utilised comes from solar energy. This is because Malaysia is exposed to solar radiation for average 4500kWh/m²/12hours every day with higher radiation stated at 1900 kWh/m² in Kota Kinabalu and followed by Bayan Lepas also Georgetown with annual solar radiation of 1890 and 1785 kWh/m² (Aziz, 2016). The capital price of installing solar panel has also decreased for the past 10 years, from RM 45, 000 for 4kWp per house in 2009 (Tan , 2014) to RM 19, 000 for 4kWp per house in 2019. This shows a huge potential in using this energy to establish sustainable community lifestyles in Malaysia.

Unfortunately, average Malaysians still lack exposure on solar energy technology and had caused less interest in solar energy application (Anonymous, 2014). They prefer electricity that came from fossil fuels because it is much easier and has long been used in the world (Anonymous, 2014).

However, issues on power interruptions due to 'energy gap' ("Common Power Problems & Power Protection Solutions," n.d.) can occur in Malaysia since fossil fuel resources are not sustainable (Chen, 2019). At the moment, fossil fuels used in Malaysia to generated electricity comes from coal resources that is imported from Indonesia (Leong , 2018) and oil and gas that comes from South China Sea ("Energy Exploration and Development," n.d.). These resources can be depleted in the near future and the stock of resources may decreased year after year ("When will fossil fuels run out," n.d.). It is hard to imagine if the electricity production from fossil fuels depleted due to the issues of fossil fuel depletion. It may be difficult for people to do daily work ("When will fossil fuels run out," n.d.). The road may also be chaotic due to non-functioning traffic lights. Those who work in high-rise buildings are forced to climb stairs due to the non-functional lift due to the lack of electricity (Bakar, 2017). Food will be easily spoiled since there is no electricity for fridge and freezer. Without energy, it cannot be imagined how life is in the world today (Bakar, 2017). Hence, it is important to establish a sustainable lifestyle, and this can be achieved through solar energy application for community's lifestyles in Malaysia.

2 PROBLEM STATEMENT

Disruption of electricity supply is the loss of long or short supply of electricity in an area. There are many causes of power outages ("The Many Causes of Power Failures", n.d.). These include failure of the central power generator, damage to the transmission line, substation or other parts of the electrical distribution system, short circuit, or overload on the mains supply ("The Many Causes of Power Failures", n.d.). Disruption of electricity supply can be critical in areas where public safety and the environment are at risk ("How a Power Outage Puts Your Home Security at Risk,'2018). Institutions such as hospitals cannot operate because they depend on electricity to operate ("Surgeons can't work in the dark,"2017). In addition, when there is a power outage in Malaysia, the homeowner will usually wait for the power supply to recover without doing anything and these may take up to more than 24 hours. This shows that the Malaysia population is very dependent on electricity (Hafshar, 2015). Consequently, it is vital to establish a sustainable lifestyle that can depended on energy applications, and this can be accomplished through renewable energy application for community's lifestyles (Carlisle et al., 2008).

In addition, the implementation of solar panels is also an issue, as many people lack information about solar panels technologies (Pedraza, 2014). People always thought the use of solar panels was expensive and only used by high-income communities. Nor do they know how much electricity they can save by using solar panels (Karakaya and Sriwannawit, 2015). If effort can be made to introduce solar energy application to communities in Malaysia, it will create sustainable solar community's lifestyles in Malaysia and promote greener way of living (Tu, 2016).

2 LITERATURE

A sustainable community is a community that takes into account human needs over the long term such as taking into account various backgrounds, security, managing human capital, nature, finances, current needs, ensuring resources are available to future generations and having the right to make decisions to achieve mutual prosperity (“What is a sustainable community,”2019).

One of the key aspect to provide a sustainable community is through securing energy resources in a country (“What is a sustainable community,”2019). However, people tend to use electricity generated from non-renewable fossil fuel every day and unaware of the situation that these resources are actually decreasing and depleting due to its rapid consumption which leads to unsustainable lifestyle (“When will fossil fuels run out,” n.d.).

Many studies have been conducted to see the potential of renewable energy in a sustainable community in Malaysia. The government supports and encourages people to green energy (Mekhilef et al., 2014).

There are many sources of renewable energy that came from wind, water, sunlight and also energy from plant and animals in the form of food (Johanson, 2015). Others than that, people also used non-renewable resources from oil, coal and natural gas in order to get energy for their living in the world (Johanson, 2015).Renewable energy is sustainable energy because these sources are non-exhausted and it is reliable for the long term (“Renewable energy and alternate energy sources,”n.d.). Renewable energy is safe energy and eco-friendly.

In the case of Malaysia, the most accessible energy comes from solar. Based on Senthilarasu S. (2016), solar energy is the most abundant and everlasting energy resource available on earth. Solar panel is a module that can convert light from the sun into direct current (DC) electricity (Energy Matters, 2018). Solar PV has been viewed as an alternative technology for the past couple of decades. According to government policies, they supported that solar panel is a low cost, low carbon emission, and long-term stability (Senthilarasu S., 2016).

There are several types of solar panel that has different advantages and disadvantages which is monocrystalline, polycrystalline and thin-film (“PV Solar Thin Film vs. Polycrystalline,”n.d.). For monocrystalline, the advantages of this solar panel is its high efficiency also aesthetics but unfortunately, this solar panel cost is higher than the other solar panel. The advantages for polycrystalline and thin-film is their cost is economical but the advantages are both solar panel has the lowest efficiency (“Types of solar panel,” 2019).

The overall advantages of using solar panels are the extra sunlight that has been absorbed can be stored for later use. Others than that it’s a cost-saving, the electricity from the solar panel is free and have a long life span also it’s eco-friendly (“The benefits of solar power,”n.d.). By using the solar panel as the source of electricity, the problem such as pollution can be avoided because solar is a naturally sources that can’t create a greenhouse effect like electricity from burning fossil fuel (“Easing Concerns About Pollution From Manufacture Of Solar Cells,”2008).

According to Hussin (2019), Malaysia ranks third in the world as a hub for solar power and green technology and is a national economic resource. Sustainable Energy Development Authority (SEDA) has introduced new policies such as the Net Energy Metering (NEM) program. NEM is generating and consume user electricity by installing a solar PV system on user rooftop via the NEM program (Hussin, 2019). Any excess of energy generated by user solar PV system can be offset on a 1 on 1 basis. NEM program can reduce electricity, generate own clean energy, reduce carbon footprint and hedge against uncertainty in electricity tariff (“Retrieved from Net Energy Metering (NEM),”n.d.). It is the government’s commitment to developing the solar industry. Most energy companies are already developing their plans or pursuing existing strategies to generate more renewable energy to reduce electricity bills and carbon dioxide emissions (Hussin, 2019).

With the strong policies from the government, Malaysia has the potential to establish a sustainable solar community (Mekhilef et al., 2014). However, it needs strategic mechanism, standard procedures and guideline, and financial aid for the government to promote this application for communities.

4 SCOPE OF CASE STUDY

Purpose of this research is to focus on the establishment of solar technology application between communities that has middle income and low income group with locations of higher solar exposures. The investigation on electricity bill and monthly income are essential in order to get a piece of information whether the establishment of solar communities can be implemented. This research case study is focused on communities in Selangor and Perak. Since both states comprises higher population of low and middle communities, that is significant purpose for this study.

Selangor is exposed to solar radiation for average 1653 kWh/m² peryear, while Perak is 1862 kWh/m² peryear. The selected communities for this case study is based on their income which is a low and middle-income group also on their locations characteristics. The study will be conducted in three chosen locations, basically (i) near to the seashore, (ii) rural areas (typical village), and (iii) sub-urban (housing residential area) which are based on the communities income. Basically, the communities near to the (i) seashore is lower income, (ii) rural village is low to average medium income and (iii) sub-urban communities is medium income.

5 THE INTEGRATION OF RESEARCH QUESTIONS AND RESEARCH OBJECTIVES FOR THE RESEARCH

Research Questions	Research Objectives	Research Methodologies and Approaches
What are the characteristics needed in establishing a solar community lifestyles?	To identify the characteristics needed in establishing a solar community lifestyles	<ul style="list-style-type: none"> • Literature review development: <ul style="list-style-type: none"> - Review appropriate theory and identify research questions, problem statement and content.
What is the potential of solar energy application in establishing a solar community lifestyle in Malaysia?	To investigate the potential of solar energy application in establishing a solar community lifestyle in Malaysia	<ul style="list-style-type: none"> • Case studies: <ul style="list-style-type: none"> (i) near to the seashore (low income) (ii) rural areas (typical village) (low to average medium income) (iii) sub-urban (housing residential area) (medium income) • Interview: <ul style="list-style-type: none"> - The government • Simulation and modelling • Questionnaires
What is the feasibility prospects of establishing a solar community lifestyle in Malaysia?	To determine the feasibility prospects of establishing a solar community lifestyle in Malaysia	<ul style="list-style-type: none"> • Numerical analysis

6 METHODOLOGY

For details of the case study, the location for case study number 1 has been determined in a residential area on urban areas. And for case study number 2 is communities that living next to the beach/river. Below is the framework for the implementation of solar panel and conceptual model for both communities:

Mixed Method Research Design

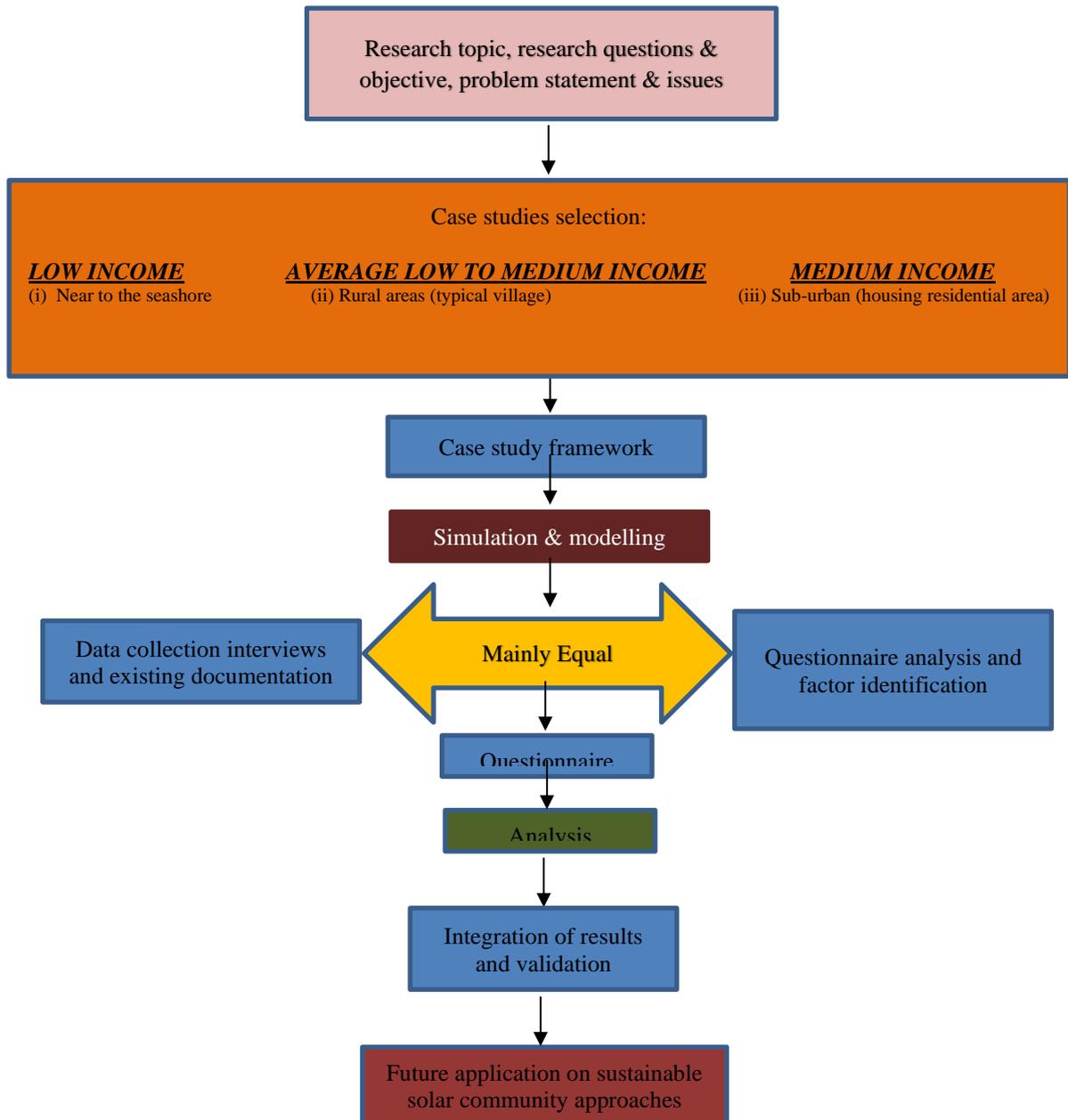


Figure 1 Framework for implementation of solar panel

7 CONCLUSIONS

To sum up, in order to create a sustainable community lifestyle, issues such as lack of awareness and lack of knowledge must be addressed by highlighting the issue of global warming to raise awareness for the people. They also need to know the advantages of solar technology and how cheap it can be and save on their electricity bills. So assessments will be made on low- and middle-income groups in Perak dan Selangor to see if they can create a sustainable community lifestyle. After the research is carried out, the results will be evaluated and seen if the aims of this research purpose of this research can be established and solar PV technology can be integrated as future technology.

REFERENCES

- Abdullah, M. (2017). Non-renewable Resources that can't be Recycled, 2. Retrieved from https://www.researchgate.net/publication/312218812_Non-Renewable_Resources_that_cannot_be_recycled
- Air Quality Issues of Electricity Production: Climate Change. (n.d.). Retrieved from http://www.powerscorecard.org/issue_detail.cfm?issue_id=1
- Alam, S. S., Fariza, N., Ahmad, M., & Hashim, H. (2016). A Survey on Renewable Energy Development in Malaysia: Current Status, Problems and Prospects. *Environmental and Climate Technologies*, 10. Retrieved from https://www.researchgate.net/publication/304003930_A_Survey_on_Renewable_Energy_Development_in_Malaysia_Current_Status_Problems_and_Prospects
- Alhayali, Z. A. M., Chew, B. C., Salleh, N. F., & Hamid, M. S. R. (2017). Implementation of renewable energy concept in the automotive industry in malaysia: an exploratory study. *Technology Management and Business*, 4, 98. Retrieved from file:///C:/Users/user/Downloads/975-Article Text-5743-1-10-20170528.pdf
- Anonymous. (2014). Malaysia's solar potential remains untapped, says Amcham-Mari. *The Sun Daily*. Retrieved December 16, 2014, from <https://www.thesundaily.my/archive/1269242-GRARCH286152>,
- Anonymous. (2014). Tak manfaat tenaga solar. *My Metro*. Retrieved December 17, 2014, from <https://www.hmetro.com.my/node/16821>
- Aziz, A., W., Arief, Y. Z., & Aziz, A. (2016). Evaluation of Solar Energy Potential in Malaysia. *Trends in Bioinformatics*, 9(2). Retrieved from <https://scialert.net/abstract/?doi=tb.2016.35.43>
- Bakar, A. (2017). Did you ever imagine, "THE WORLD WITHOUT ELECTRICITY '." Retrieved April 29, 2017, from <https://medium.com/@aboubakar/did-you-ever-imagine-the-world-without-electricity-789721561f68>
- Baranski, A. (2018). Solar PV: Advantages and Disadvantages of Solar Panels. Retrieved September 1, 2018, from <https://www.profolus.com/topics/solar-pv-advantages-and-disadvantages-of-solar-panels/>
- Carlisle, N., Elling, J., & Penney, T. (2008). A Renewable Energy Community: Key Elements A reinvented community to meet untapped customer needs for shelter and transportation with minimal environmental impacts, stable energy costs, and a sense of belonging . *Innovation for Our Energy Future* , 1–27. Retrieved from <https://www.nrel.gov/docs/fy08osti/42774.pdf>
- Chen, J. (2019). Nonrenewable Resource. Retrieved Jun 25, 2019, from <https://www.investopedia.com/terms/n/nonrenewableresource.asp>,
- Common Power Problems & Power Protection Solutions. (n.d.). TRIPP.LITE. Retrieved from <https://assets.tripplite.com/white-paper/common-power-problems-and-power-protection-solutions-white-paper-230v-en.pdf>
- Definition of 'greenhouse effect'. (2010). Retrieved from <https://www.collinsdictionary.com/dictionary/english/greenhouse-effect>
- Easing Concerns About Pollution From Manufacture Of Solar Cells. (2008). Retrieved February 26, 2008, from <https://www.sciencedaily.com/releases/2008/02/080225090826.htm>
- Energy Exploration and Development. (n.d.). Retrieved from <https://amti.csis.org/south-china-sea-energy-exploration-and-development/>
<https://www.ecsintl.com/what-can-a-power-outage-do-to-a-hospital/>
- Eshchanov, B. R., Stultjes, M. G. P., Eshchanov, R. A., & Salaev, S. K. (2011). People's Perceptions

- on Renewable Energy Sources' Penetration Prospects in the Khorezm Province, Uzbekistan. *Knowledge Management, Economics and Information Technology*, (7), 5. Retrieved from <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.675.6166&rep=rep1&type=pdf>
- Hafshar, S. (2015). Potential of Solar Energy System in Electricity Generation from Islamic Perspective. *Global Journal Al-Thaqafah*. Retrieved from https://www.researchgate.net/publication/288904868_Potential_of_Solar_Energy_System_in_Electricity_Generation_from_Islamic_Perspective
- How a Power Outage Puts Your Home Security at Risk. (2018). Retrieved from <https://www.rd.com/home/improvement/power-outage-home-security/>
- Hsu, J. (2019). Solar Power's Benefits Don't Shine Equally on Everyone. Retrieved April 4, 2019, from <https://www.scientificamerican.com/article/solar-powers-benefits-dont-shine-equally-on-everyone/>
- Hussin, K. A. (2019). Malaysia ketiga dunia hab tenaga solar. *Berita Harian*. Retrieved July 23, 2019, from <https://www.bharian.com.my/berita/nasional/2019/07/588390/malaysia-ketiga-dunia-hab-tenaga-solar>
- Johanson, P. (2015). *What is Energy?* Britannica Educational Publishing.
- Karakaya, E., & Sriwannawit, P. (2015). Barriers to the adoption of photovoltaic systems: The state of the art. *Renewable and Sustainable Energy Reviews*. Retrieved from https://www.researchgate.net/publication/276365231_Barriers_to_the_adoption_of_photovoltaic_systems_The_state_of_the_art
- Leong, Y. H. (2018). High coal prices putting pressure on Malaysia power sector . *The Star Online*. Retrieved July 23, 2018, from <https://www.thestar.com.my/business/business-news/2018/07/23/high-coal-prices-putting-pressure-on-power-sector>
- Letcher, T. M., & Fthenakis, V. M. (2018). *A Comprehensive Guide to Solar Energy Systems: With Special Focus on Photovoltaic system*. London, United Kingdom: Joe Hayton.
- Malaysia - Oil and Gas. (n.d.). Retrieved from <https://www.export.gov/article?id=Malaysia-Oil-and-Gas-Equipment>
- Matthewman, S., & Byrd, H. (n.d.). *Blackouts: a sociology of electrical power failure*. Retrieved from <https://core.ac.uk/download/pdf/19531796.pdf>
- Mekhilef, S., Barimani, M., Safari, A., & Salam, Z. (2014). Malaysia's renewable energy policies and programs with green aspects. *Renewable and Sustainable Energy Reviews*. Retrieved from https://www.researchgate.net/publication/264981906_Malaysia's_renewable_energy_policies_and_programs_with_green_aspects
- Mikael, H., & Xu, T. (2013). Depletion of fossil fuels and anthropogenic climate change – a review. *Energy Policy*, 1–20. Retrieved from https://www.researchgate.net/publication/233952036_Depletion_of_fossil_fuels_and_anthropogenic_climate_change_-_A_review
- Mohd Noh, C. K. (2006). *Tariff Book*. Retrieved from https://www.tnb.com.my/assets/files/Tariff_booklet.pdf
- Nuclear explained. (2008). Retrieved August 28, 2008, from <https://www.eia.gov/energyexplained/nuclear/>
- Pedraza, J. M. (2014). What are the main barriers for the extensive utilization of solar energy? Retrieved February 2, 2014, from https://www.researchgate.net/post/What_are_the_main_barriers_for_the_extensive_utilization_of_solar_energy
- Perez, I. C., Mediavilla, M., Castro, C. D., Carpintero, O., & Miguel, L. J. (2014). Fossil fuel depletion

- and socio-economic scenarios: an integrated approach, 2. Retrieved from http://www.eis.uva.es/energiasostenible/wp-content/uploads/2014/10/AAManuscript_Capellán-Pérez_2014.pdf
- PV Solar Thin Film vs. Polycrystalline. (n.d.). Retrieved from <https://www.newssouthernenergy.com/pv-solar-thin-film-vs-polycrystalline/>
- Rasid, A. H. (2018). Higher electricity bills next year? *New Straits Times*. Retrieved December 21, 2018, from <https://www.nst.com.my/business/2018/12/442675/higher-electricity-bills-next-year>
- Renewable Energy. (n.d.). Retrieved from <http://www.altenergy.org/renewables/renewables.html>
- Renewable energy and alternate energy sources. (n.d.). Retrieved from <https://www.energymatters.com.au/components/renewable-energy/#>
- Retrieved from Net Energy Metering (NEM). (n.d.). Retrieved from <http://www.seda.gov.my/reportal/nem/>
- Terrapon, J., Dienst, C., Konig, J., & Ortiz, W. (2014). A cross-sectional review: Impacts and sustainability of small-scale renewable energy projects in developing countries. *Elsevier Renewable and Sustainable Energy Reviews*, 1–8. Retrieved from <https://www.sciencedirect.com/science/article/pii/S1364032114006133>
- The benefits of solar power. (n.d.). Sealite. Retrieved from <https://pdf.nauticexpo.com/pdf/sealite/benefit-solar-power/23608-79433.html>
- The Many Causes of Power Failures. (n.d.). Retrieved from https://www.dieselserviceandsupply.com/Causes_of_Power_Failures.aspx
- Tu, F. (2016). Promoting urban sustainability through green technology in malaysia. *Promoting Urban Sustainability through Green Technology in Malaysia*. Retrieved from <https://malaysiacities.mit.edu/home>
- Types of solar panels.(2019). Retrieved May 10, 2019, from <https://www.energysage.com/solar/101/types-solar-panels/>
- Shagar, L. K. (2013). Electricity tariff up by average 15% from Jan 1. *The Star Online*. Retrieved December 2, 2013, from <https://www.thestar.com.my/News/Nation/2013/12/02/Electricity-tariff-increase-Jan-1-2014>,
- What is a Sustainable Community? (2019). Retrieved from <https://sustain.org/about/what-is-a-sustainable-community/>
- When will fossil fuels run out?. (n.d.). Retrieved from <https://www.ecotricity.co.uk/our-green-energy/energy-independence/the-end-of-fossil-fuels>