UNIVERSITI TEKNOLOGI MARA
Cawangan Perak
Kampus Seri Iskandar

e-Proceeding

v-GOGREEN2020

29 - 30 SEPT

VIRTUAL GO-GREEN: CONFERENCE & PUBLICATION

"SUSTAINABLE ENVIRONMENT, RESILIENCE AND SOCIAL WELL-BEING"

Organiser :
Research, Industrial Linkages, Community & Alumni Network (PJIM&A)

Co-organiser :
Faculty of Architecture, Planning and Surveying (FSPU) & Centre for Post Graduate Studies (CGS)

Publication Date : 22nd February 2021

Virtual Go-Green Conference and Publication 2020

UNIVERSITI TEKNOLOGI MARA, PERAK BRANCH
February 2021

Main Committee

Virtual Go-Green Conference and Publication 2020

Advisor 1	*: Prof Sr Dr Md Yusof Hamid, AMP*
Advisor 2	*: Assoc Prof Dr Nur Hisham Ibrahim*
Chairman	*: Sr Dr Asmalia Che Ahmad*
Co-Chairman	*: 1. Sr Dr Yuhainis Abdul Talib*
	2. Sr Dr Haryati Mohd Isa
Treasurer	*: Mohamad Haizam Mohamed Saraf*
Secretary	*: Noorliza Musa*
Head of v-Conference	*: Sr Dr Nor Suzila Lop*
Head of e-Proceeding	*: Dr Junainah Mohamad*
Head of Scopus Indexed Journal Planning Malaysia Journal (PMJ)	*: Assoc Prof Gs Dr Mohd Fadzil Abdul Rashid*
Head of Scopus Indexed Journal Malaysian Construction Research Journal (MCRJ)	*: Sr Dr Natasha Khalil*
Head of Paper Reviewer	: *Dr Asniza Hamimi Abdul Tharim*

Committee Members

Virtual Go-Green Conference and Publication 2020

E-Proceeding Paper Reviewer

Noraini Md Zain
Shafikah Saharuddin
Nur Fatiha Mohamed Yusof
Farrah Rina Mohd Roshdi

E-Proceeding Formatting

Nurulanis ahmad @ Mohamed
Jannatun Naemah Binti Ismam
Najma Binti Azman

E-Proceeding Language Reviewer

Dr Hjh Shazila Abdullah
Dr Daljeet Singh Sedhu A/L Janah Singh
Zarlina Mohd Zamari
Dr Mary Thomas
Iza Faradiba Mohd Patel
Farahidatul Akmar Awaludin
Wan Faridatul Akma Wan Mohd Rashdi
Jeyamahla Veeravagu
Wan Nurul Fatihah Wan Ismail
Nazirul Mubin Mohd Noor
Noor Aileen Ibrahim
Noraini Johari
Dr Hajah Norakmarwati Ishak

Virtual Conference

Norazlin Mat Salleh	*Registration*
Shahela Mamter	*Auditor*
Mohd Esham Mamat	*Auditor*
Noor Anisah Abdullah @ Dolah	*Auditor*
Mohamad Tajudin Saidin	*Certificate & Conference Kit*
Fairiz Miza Yob Zain	*Logistic*
Mohd Firdaus Zainuddin	*Logistic*
Farah Hanna Ahmad Fuad	*Promotion & Publicity*
Mohamad Shahin Shahdan	*Promotion & Publicity*
Mohd Asrul Hassin	*Liason Officer*

Organiser:
Research, Industrial Linkage Community and Alumni Network Office (PJIM&A)
Universiti Teknologi MARA, Perak Branch, Seri Iskandar.
Malaysia

Co-Organiser:
Faculty of Architecture, Planning and Surveying (FSPU)
and,
Centre for Post Graduate Studies (CGS)
Universiti Teknologi MARA, Perak Branch, Seri Iskandar.
Malaysia

e ISBN 978-967-2920-06-9

SOLAR ENERGY APPLICATION FOR MOSQUE IN PERAK: THE CASE STUDY OF AR-RAHMANIAH MOSQUE AT KAMPUNG PENGKALAN BAHARU, PERAK

Nur Sahida Rahman[1] , Nur Azfahani Ahmad[2] and Sabarinah Sheikh Ahmad[3]
[1]Master of Science (Built Environment), Faculty of Architecture, Planning and Surveying, Universiti Teknologi MARA, Selangor Branch, Shah Alam Campus, Shah Alam 42300, Selangor, Malaysia
2 Faculty of Architecture, Planning and Surveying, Universiti Teknologi MARA, Perak Branch, Seri Iskandar Campus, Seri Iskandar 32610, Perak, Malaysia
[3]Faculty of Architecture, Planning and Surveying, Universiti Teknologi MARA, Selangor Branch, Shah Alam Campus, Shah Alam 42300, Selangor, Malaysia

Abstract

Malaysians use electricity generated from non-renewable fossil fuel every day and are 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 are also unaware of global warming issues and carbon footprints produced due to electricity generation. Frequent blackouts can also occur in the future if the non-renewable resources deplete. It also can happen to many Mosques in Malaysia which use main power supply for conventional electricity. Therefore, it is necessary to find a solution to overcome this situation by using renewable energy. The most accessible renewable energy that can be harnessed in Malaysia is solar energy. Therefore, it is wise to propose a sustainable energy consumption for Mosques in Malaysia which is based on the application of solar energy. The aim of this research is to explore the establishment of solar energy application as a supplement energy for electricity for Mosques in Perak, Malaysia. The focus of this study is to encourage people in Malaysia to use energy generated from solar energy. Mosques are among the important buildings which symbolises the local community in Perak. Therefore, it is significant to implement solar energy application for this Mosque. This research intends to assist communities in Perak Malaysia to obtain a sustainable lifestyle from the Mosque significant building that we have in Malaysia.

Keywords: mosque, solar energy application; sustainable community; Perak communities

1.0 INTRODUCTION

Issue of higher electricity bills in Malaysia has existed since 2014 due to the increasing power tariff by TNB (Shagar, 2013). This happened because the Electricity Industry Funds (EIF) that has been charged by TNB is used to absorb the increase in cost in form of a surcharge (Rashid,2018). According to Mohd Noh (2018), the high surcharges will be applied to consumers if the use of electricity is greater which is more than RM 0.30 per 1 kW, meaning that the more electricity consumers used, more surcharge will be applied to the consumers. Due to high demand, Malaysia has imported coal from abroad such as Indonesia and imports oil and gas that comes from the South China Sea (Chong et al., 2015) Without realizing it, this resource has been in depleting stages and may lead to insufficient energy resources (Ahmad et al., 2016). There will be a chaotic scenario to people in Malaysia if power supply is interrupted that can cause difficulties to people to do daily chores, to store food since there is no electricity for refrigerators and at night, with no electricity, it may cause safety issues, for

instance robbery. In the case of Malaysian mosques, power interruption may cause uncomfortable situations for the people to perform daily prayers, especially during night time. Usually in mosques, people tend to use air-conditioning systems, fans, lighting and public automation systems (microphone and speaker). In future, if electricity keeps on being interrupted due to insufficient energy resources, the operation of mosques is hindered by technical issues that may decrease the performance of the mosque.

To overcome this issue, people should adopt renewable energy as a source to supply electricity during emergencies. In Malaysian context, solar energy is the most highly potential energy that can be harvested in Malaysia (Abdullah et al., 2019). Many studies have been conducted to foresee the potential of renewable energy in a sustainable community in Malaysia (Mekhilef et al., 2014). But unfortunately, people in Malaysia are still unaware and lack information about renewable energy technologies (Pedraza, 2014) especially solar energy. People always think that the use of solar panels is expensive and only can be used by high-income communities. They are unaware that community buildings like mosques can also be installed with solar technologies; nor do they know how much electricity can they save by using solar panels (Karakaya and Sriwannawit, 2015). In fact, mosques use low demand of energy which is significant to be associated with solar energy. Mostly, mosques in Malaysia are strategically located in larger areas with direct sunlight and have wide roof surfaces. Sometimes, there are large flat roof areas in the mosques that are suitable to be installed with solar technology. Therefore, this paper tries to identify the potential of solar technology establishment at a mosque that can be a bench-marking in creating sustainable rural communities in Malaysia. But some rural communities in Perak have proved that the use of solar technology can be established and applied in their areas (Ahmad et al.,2014).

2.0 THE SOLAR TECHNOLOGY: WHY IT IS IMPORTANT?

Solar technology has been viewed as an alternative technology for the past couple of decades in providing clean and green energy. Based on Senthilarasu S. et al. (2016), solar energy is the most abundant and everlasting energy resource available on earth. Malaysia is capable of establishing this technology since this country is located in a tropical region. There are many advantages of using solar technology, for instance, eco-friendly and has a long life span (Groenendaal, 2014). Other than that, it hinders pollution related problems and greenhouse effects (Groenendaal, 2014). According to Hussin (2019), Malaysia ranks third in the world as a hub for solar power and green technology and it has a good support for the national economic resources. This is because, Malaysia is exposed to solar radiation, for average 4500kWh/m ² /12hours every day with higher radiation stated at 1900 kWh/m2 in Kota Kinabalu and followed by Bayan Lepas and Georgetown with annual solar radiation of 1890 and 1785 kWh/m² (Aziz, 2016).

In other countries such as India which has a large population, there is an issue of stable electricity supply, especially in rural communities (Tiewsoh et al., 2019). In order to overcome this problem, the government of India has helped rural communities by funding solar technology projects with the aid of Non-Government Organizations (NGOs) (Rajesh and Majid, 2020). Feedback obtained from the people was very positive (Karelia, 2019). These communities do not have to spend a long time collecting wood as fire resources anymore and chores can be done easily (Karelia, 2019). Other country's citizens like South Africa have been using solar technology in their daily lifestyle since the country is huge and has difficult topography, which makes it harder for the government to set up power infrastructures in remote regions (Kariuki, 2018). Therefore, many inventions were created by using solar technologies in this country. The inventions are solar-powered mobile car wash, mobile solar kiosk, solar- powered haircuts, solar-powered clock that also functions as a lamp, cell-phone charger when the grid fails, solar-powered street lights, and water purification plant that runs on the sun rays (Isiaka, 2018). These prove that rural communities are also capable of understanding and applying solar technologies in their lifestyle.

Figure 1(a) : Solar panel for rural communities in India (Karelia, 2019)

Figure 1(b): Villager in India use electricity from solar panel (Karelia, 2019)

Figure 1(c): Water purification plant run on the sun's rays is the one of the invention that created in Africa (Isiaka, 2018)

Figure 1 : Solar technologies invention overseas

If people in Malaysia can have the same awareness like people in India and South Africa, the potential to apply solar technologies in their lifestyle is higher because there are many policies that have been introduced by the Malaysian government to support the establishment of solar technologies (Senthilarasu S. et al., 2016). The government of Malaysia has established the Sustainable Energy Development Authority (SEDA) under the Sustainable Energy Development Act 2011 (Act 726) where the organization has the responsibility to administer and manage the implementation of the feed-in tarff mechanism under the Renewable Energy Act 2011 (Act 726 & 725) (Renewable Energy Act, 2011). Among the successful policies in Malaysia are the Feed in Taarif (FiT) and Net Energy Metering (NEM) policies (SEDA, 2020). SEDA has introduced new policy such as the Net Energy Metering (NEM) program in order to help users to record electricity by installing a solar PV system on the user rooftop via the NEM program (Hussin, 2019). Any excess of energy generated by the user of a solar PV system can be offset on a 1 on 1 basis which helps to give income to solar-users. NEM program can reduce electricity, generate own clean energy, reduce carbon footprint and hedge against uncertainty in electricity tariff (Saharudin, 2018). It is the government's commitment to develop the solar industry and help the low and middle income groups to use this technology in their communities. With the strong acts and policies from the governmental body, Malaysia has the potential to establish a sustainable solar community (Mekhilef et al., 2014). There are also other supporting financial mechanisms like an insurance company known as Allianze Malaysia, that has launched solar insurance where it can cover against damage or loss to solar panels as a result of parts of aircraft falling, explosions, lightning, fires, earthquakes, other natural disasters, thieves and more that can contribute to damage or loss of solar panels (Gopalan, 2018).

However, at the moment, there are limited policies that cover the establishment of solar technologies at community buildings, like mosques. This needs a strategic mechanism, standard procedures and guidelines, and financial aid for the government to promote this application for mosques in communities. Therefore, if strategic policy for the establishment of solar technologies for mosques can be developed, many mosques in Malaysia may be attracted to install this technology.

3.0 THE CASE STUDY - AR-RAHMANIAH MOSQUE, PERAK

Mosque is the most iconic building in Malaysia, where almost 70% of states in Malaysia have their own mosques (Rahim et al., 2015). Mosques in Malaysia have the potential to install solar technology because mosques have larger areas, wider roofs and they accommodate many people to gather in this building. The energy demand in mosques is significantly low since mosuques are only used during prayer times. Therefore, the energy can actually be sourced from simple solar technology and the energy can be used by mosque goers and

shared by the community. It also can help mosques to generate income through the application of Net Energy Metering (NEM) (Raihanah, 2019). However, there is limited awareness among the management of many mosques in Malaysia to install and utilise this technology for the benefits of mosques.

This case study has been selected because this mosque is among the first rural mosques that has installed solar Pholovaltaic (PV) technology in Perak. The management of this mosque has collaborated with the Perak state government in supporting a green energy campaign that involves solar PV installation for rural development (Omar, 2018). Ar-Rahmaniah Mosque is located at Kampung Pengkalan Baharu, 31610 Kampung Kepayang, Perak, Malaysia. The mosque's roof surface area is very wide and suitable to be installed with solar PV technology. It is also located near to the main road and residential areas that can consider it as a solar community project (see Figure 2).

Figure 2. Key plan and site plan

Ar-Rahmaniah Mosque has hip roof design that comprises large surfaces in an exposed area that allows this mosque to be naturally exposed to the sunlight. Ar-Rahmaniah mosque has been installed with a 12KWp solar panel system by Fabulous Sunview Sdn.Bhd. From the interview that has been conducted with the mosque management, it has been informed that the energy which has been generated by the solar panels do not contribute to the mosque. Since this mosque has applied the application of FiT (Feed-in Tariff), the energy generated by the solar panel on this mosque is sold to TNB. The installation of this solar technology has provided green income to the mosque through the FiT scheme which provides monthly income of specific energy tariff (SEDA, 2015). It also promotes awareness to the community that lives near to the mosque (Refer Figure 3).

Figure 3. Ar-Rahmaniah Mosque with solar PV installation (Front and rear elevation)

3.1 Solar Panel Layout

This mosque has a total of 35 solar panels installed on the mosque roofs (Refer Figure 3). There are 20 solar panels placed on the front roof of the mosque and there are 15 solar panels placed on the rear roof of the mosque (Refer Figure 4). All of these solar panels can produce

12KWp of energy. Material that has been applied for this solar panel is Polycrystalline solar module.

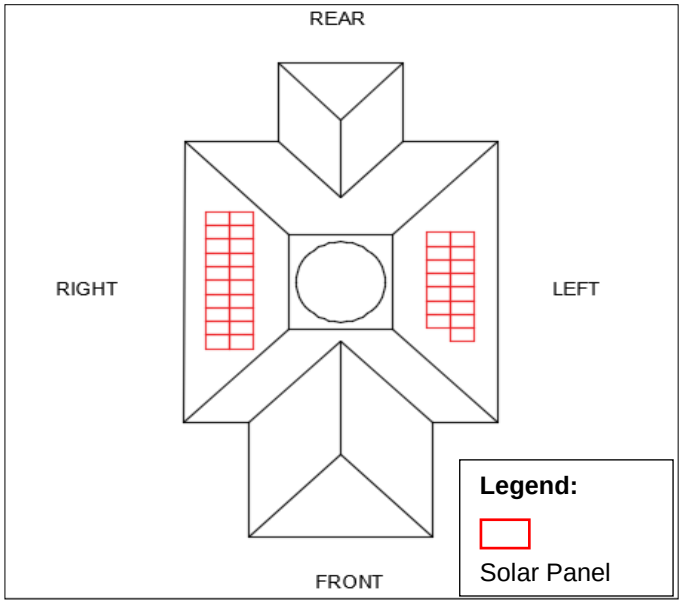


Figure 4. Ar-Rahmaniah Mosque roof plan

Figure 5 shows the solar PV schematic plan of the mosque which connects the solar panel with solar charger controller and inverter. It will direct link to the distribution board and meter that will supply back to the TNB electricity grid. This is how the FiT scheme works for the mosque

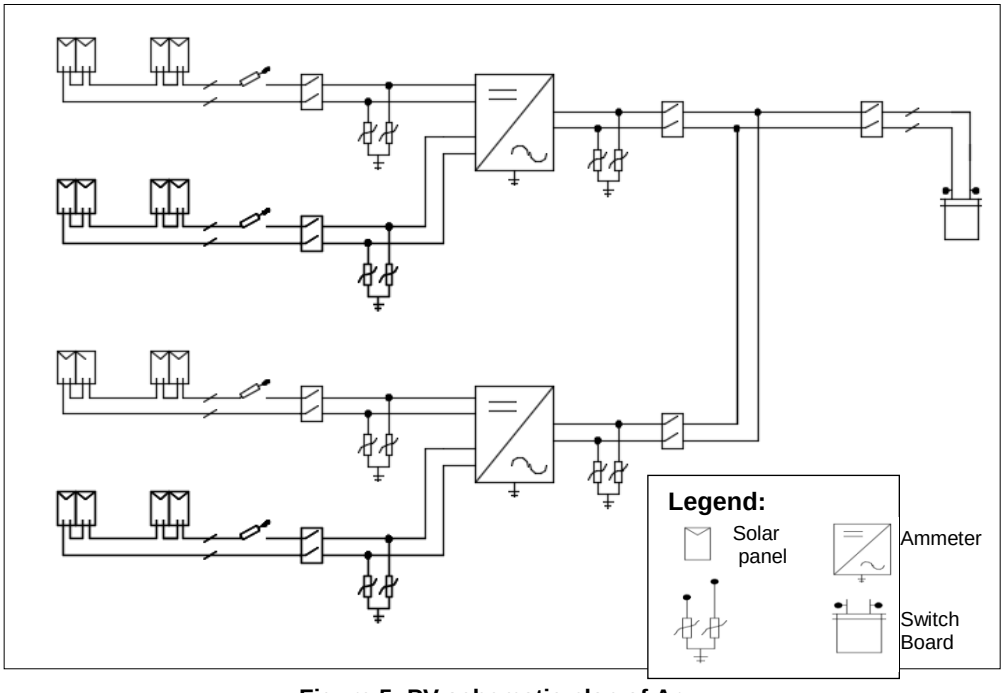


Figure 5: PV schematic plan of Ar-Rahmaniah Mosque

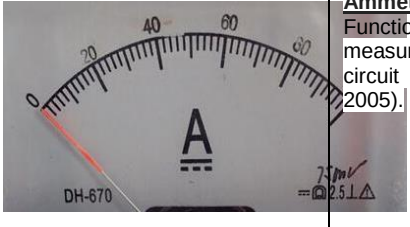
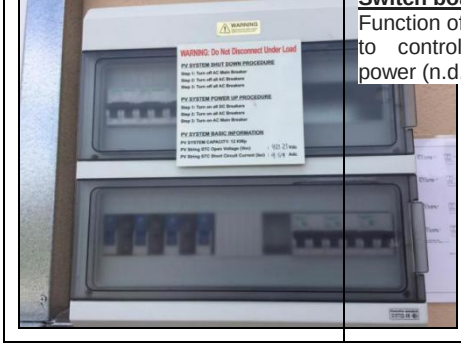
3.2 The components of Solar PV panel

Table 1 and Figure 6 show the components of the solar PV panels system for the mosque. Each component will absorb solar energy, transfer and convert it into electrical energy.

Figure 6: PV system indicator on Ar-Rahmaniah Mosque

Table 1: The component of PV system

Pictures	Description	Specification
	**Solar Module** Function solar cells is to absorb and convert sunlight into electricity (Askari & el, 2015).	i. 35 panels can produce 12KWp of energy ii. Can produce 80% efficiency iii. Orientation of the roof is 220º from north

	**Inverter** Function of inverter is to convert Direct Current(DC) into Alternating Current(AC) (Regello R., 2012)	i. Efficiency can reach until 98.50%. ii. Input PV power 24,000Wp iii. Rated input voltage is 600V
	**RE Meter** Function of Renewable Energy(RE) meter is to manage the electricity supply by monitoring the level of demand produce from solar PV panel (TNB, 2020).	i. Brand by Metronix ii. Digitals screen numbering iii. Accuracy class in 0.5% iv. Voltage rate input is 220/380V v. Frequency is 50/60Hz
	**Ammeter** Function of ammeter is to measure current flow in a circuit (Hollembeak B., 2005).	Moving iron type with continuous overload capacity of 120% of rated value and full scale value accuracy of ±2%. They shall be provided with maximum demand indicator, if specified (JKR, 2016).
	**Switch board** Function of switch board is to control the flow of power (n.d., 2012)	● The switchboards shall be capable of withstanding fault condition of not less than 50 kA at 415 V for 1 s as defined in IEC 60439-1. ● The degree of protection shall be IP42 for indoor installation and IP54 for outdoor installation in accordance to IEC 60529 (JKR, 2016).

4.0 THE FIT ANALYSIS

As mentioned in section 3, the case study has applied a FiT scheme which has generated income for the mosque by selling the electricity produced from the PV panels. Since the power system of this PV panel is 12KWp, the estimated electricity generated from the system is 1260kWh (Shawn, 2019). Based on the FiT scheme, below are the calculations of income that can be gained by the mosque.

Table 2: FiT analysis for mosque

Solar PV system	Years	MYR /kWh *	Average load per year (kWh)	Overall income per year (MYR)
12KWp	21	1.20	1260	1512.00
Bonus for rooftop system	21	0.26	1260	327.60
Bonus for local module	21	0.03	1260	37.80
Overall income (MYR)				1877.40

* Based on SEDA FiT scheme (2015).

From Table 2, it shows that the overall income that can be gained by the mosque is MYR 1877.40 per year. This amount is collected from the tariff shown in Table 3 with the consideration of additional bonus gained from the roof top installation and the local manufactures aspect provided by SEDA. This amount will decrease to 8% per annum based on the price stated by SEDA (Refer Table 3).

Renewable Tariffs in Malaysia						
14-Apr-11						
			4.191	1.370	1.369	
	Years	MYR/kWh	€/kWh	CAD/kWh	USD/kWh	Degression
Solar PV						
<4 kW	21	1.23	0.293	0.402	0.402	-8.0%
>4 kW<24 kW	21	1.20	0.286	0.392	0.392	-8.0%
>24 kW<72 kW	21	1.18	0.282	0.386	0.386	-8.0%
>72 kW<1,000 kW	21	1.14	0.272	0.373	0.372	-8.0%
>1 MW<10 MW	21	0.95	0.227	0.311	0.310	-8.0%
>10 MW<30 MW	21	0.85	0.203	0.278	0.278	-8.0%
Bonus for rooftop	21	0.26	0.062	0.085	0.085	-8.0%
Bonus for BIPV	21	0.25	0.060	0.082	0.082	-8.0%
Bonus for local modules	21	0.03	0.007	0.010	0.010	-8.0%
Bonus for local inverters	21	0.01	0.002	0.003	0.003	-8.0%

Table 3: Solar PV tariff in FiT scheme (SEDA, 2015)

Based on this tariff, the mosque will receive the income for 21 years, with the first revenue is MYR 1877.40 and the final revenue, during the 21st years of operation is MYR 1846.11 (Refer Table 4). The overall revenue for this mosque after the contractual agreement of FiT scheme is MYR 39111.59.

Table 4: Income for 21 years

Year	Income received per month (MYR)	Degression	Minus (-)	MYR
1	1877.40	8%	1.50	1875.90
2	1875.90	8%	1.50	1874.40
3	1874.40	8%	1.50	1872.90
4	1872.90	8%	1.50	1871.40
5	1871.40	8%	1.50	1869.90
6	1869.90	8%	1.50	1868.41
7	1868.41	8%	1.49	1866.91
8	1866.91	8%	1.49	1865.42
9	1865.42	8%	1.49	1863.93
10	1863.93	8%	1.49	1862.43
11	1862.43	8%	1.49	1860.94
12	1860.94	8%	1.49	1859.46
13	1859.46	8%	1.49	1857.97
14	1857.97	8%	1.49	1856.48
15	1856.48	8%	1.49	1855.00
16	1855.00	8%	1.48	1853.51
17	1853.51	8%	1.48	1852.03
18	1852.03	8%	1.48	1850.55
19	1850.55	8%	1.48	1849.07
20	1849.07	8%	1.48	1847.59
21	1847.59	8%	1.48	1846.11
Overall total:	**39111.59**			

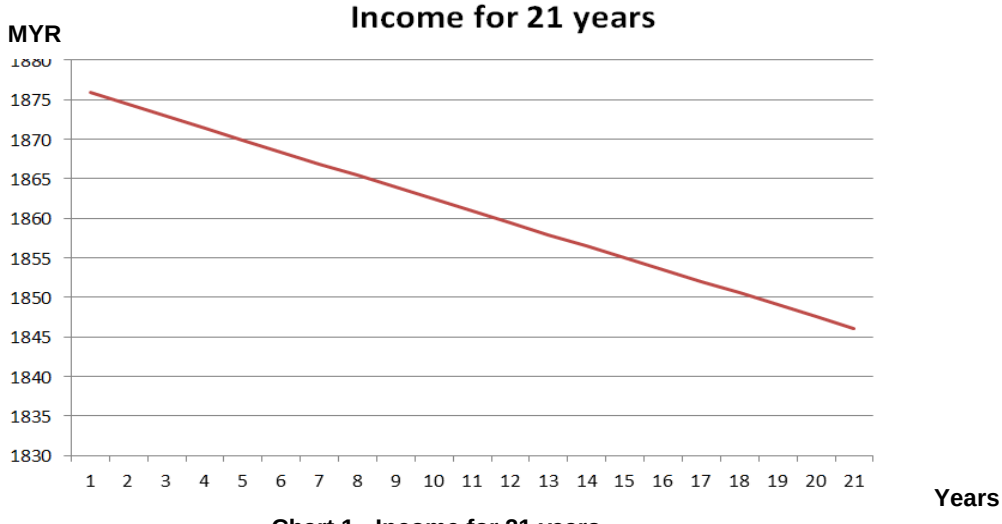


Chart 1: Income for 21 years

5.0 CONCLUSION

To conclude, in order to establish the solar energy application for mosques in Perak, issues such as lack of awareness and knowledge need to be addressed by highlighting the issue of fossil fuel depletion in order to raise awareness of the people. These people can be approached by introducing the advantages of solar technology application and how it can generate income for the mosque through the Feed in Tariff scheme provided by the government. It is hoped that in the future, many mosques will install solar PV systems in order to create a greener mosque and sustainable rural communities.

6.0 ACKNOWLEDGEMENT

Highest gratitude to my supervisor Sr.Dr. Nur Azfahani Ahmad, with her FRGS Grant (session 2019 to 2021) under the Ministry of Higher Education and Universiti Teknologi Mara (UiTM) that has funded this research.

REFERENCES

Abdullah, W.S.W., Osman, M., Kadir, M.Z.A.A., & Verayiah, R.(2019).The Potential and Status of Renewable Energy Development in Malaysia.*Energies* 2019, *12*(12), 2437; https://doi.org/10.3390/en12122437

Ahmad, N.A. (2014). Solar 'Kampong': Community Power Supply For Low-Income Households In Rural Malaysia. Retrieved from https://researchspace.auckland.ac.nz/handle/2292/25564

Ahmad, N.A., Zahari, N.F., & Wahab, S.N.A.(2016). Solar Village in Malaysia - A Route Map for Financing Mechanism. *MATEC Web of Conferences* 66:00057 DOI: 10.1051/matecconf/20166600057

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

Chong, C., Ni, W., Ma, L., Liu, P., & Li, Z.(2015). The Use of Energy in Malaysia: Tracing Energy Flows from Primary Source to End Use. *Energies* 2015, 8, 2828-2866; doi:10.3390/en8042828

Gopalan, S. (2018). Allianz Malaysia launches Solar PV Insurance at IGEM 2018.Retrieved October 17, 2018, from

Groenendaal, H. (2014). Understanding the benefits of solar power. Retrieved August, 2014, from https://www.researchgate.net/publication/297330059_Understanding_the_benefits_of_solar_power

https://www.allianz.com.my/documents/144671/482249/PR_Allianz+Malaysia+launches+Solar+PV+Insurance+%28ENG%29_2.pdf/bd4cdb04-2297-418e-a173-46a2339ba6c5

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

Isiaka, T.(2018). Top five solar energy inventions from Africa. *Sustyvibes.* Retrieved 2018, from https://sustyvibes.com/top-five-solar-energy-inventions-africa/

Jalal, T., & Bodger. P. (2010). National Energy Policies and the Electricity Sector in Malaysia. *Energy and Environment,* 441-448. doi: 10.1109/ICEENVIRON.2009.5398618

JKR (2016).SPECIFICATION FOR LOW VOLTAGE INTERNAL ELECTRICAL INSTALLATION (L-S1). Retrieved 2016.

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

Karelia, G.(2019).Innovation first all solar kitchen village eco-friendly India. Retrieved June 10,2019, from https://www.thebetterindia.com/185580/iit-innovation-first-all-solar- kitchen-village-eco-friendly-india/

KariukI, D.(2018). Barriers to renewable energy technologies development. *EnergyToday.*Retrieved January 1,2018, from https://www.energytoday.net/economics-policy/barriers-renewable-energy-technologies-development/

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.

Mekhilef, S., Barimani, M., Safari, A., & Salam, Z. (2014). alaysia'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_p olicies_and_programs_with_green_aspects

Mohd Noh, C. K. (2006). Tariff Book. Retrieved from https://www.tnb.com.my/assets/files/Tariff_booklet.pdf

Omar, S.S., Illias, N.H., Teh, M.Z.,& Borhan, R.(2018).Green Mosque: A Living Nexus. Environment-Behaviour Proceedings Journal 3(7)DOI: 10.21834/e-bpj.v3i7.1281

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

Rahim, A.A., Sarkawi, A.A., Amirah, N., & Samad, N.A.A.(2015). Masjid for all: access audit on sultan idris shah, ipoh, masjid negeri, seremban and masjid tunku mizan, putrajaya. *ResearchGate.* Retrieved November, 2015, from https://www.researchgate.net/publication/286861624_MASJID_FOR_ALL_ACCESS_AUDIT_ON_MASJID_SULTAN_IDRIS_SHAH_IPOH_MASJID_NEGERI_SEREMBAN_AND_MASJID_TUNKU_MIZAN_PUTRAJAYA

Raihanah, S.(2019). Being sustainable from home and work. *StarProperty.* Retrieved May 31, 2019, from https://www.starproperty.my/news/home-living-and-lifestyle/being-sustainable- from-home-and-work/112298

Rajesh, C. & Majid, M.A.(2020).Renewable energy for sustainable development in India: current status, future prospects, challenges, employment, and investment opportunities. *Energy, Sustainability and Society* 10(2):1-36DOI: 10.1186/s13705-019-0232-1

Rashid, 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 Act, Revised Law of Malaysia Act 725 (2011). Retrieved from the SEDA website: http://www.seda.gov.my/policies/renewable-energy-act-2011/

Retrieved December 2, 2013, from https://www.thestar.com.my/News/Nation/2013/12/02/Electricity-tariff-increase-Jan-1-201 4,

Saharudin, E. (2018). "Tenaga bersih akan diperkenalkan pada 1 Januari bagi mengalakkan penggunaan panel solar". Retrieved November 27, 2018, from https://amanz.my/2018186345/

SEDA (2015). Feed-in Tariff(FiT). *SEDA.* Retrieved September 23, 2020, from http://www.seda.gov.my/reportal/fit/

SEDA (2020). Net Energy Metering(NEM). *SEDA.* Retrieved September 23, 2020, from http://www.seda.gov.my/reportal/nem/

Senthilarasu, S., Shanks, K., & Mallick, T.K. (2016). Optics for concentrating photovoltaics: Trends, limits and opportunities for materials and design. Retrieved July, 2016, from https://www.sciencedirect.com/science/article/pii/S1364032116001192

Shagar, L. K. (2013). Electricity tariff up by average 15% from Jan 1. *The Star Online*.

Shawn, N.(2019). Go solar and save on your electricity bill. *EdgeProp.* Retrieved May 25, 2019, from https://www.edgeprop.my/content/1541671/go-solar-and-save-your-electricity-bill

TNB (2020). Smart meter. Retrieved September 21, 2020, from https://www.tnb.com.my/residential/smartmeters

Pejabat Perpustakaan
Librarian Office

Universiti Teknologi MARA
Cawangan Perak
Kampus Seri Iskandar
32610 Bandar Baru Seri Iskandar,
Perak Darul Ridzuan, MALAYSIA
Tel: (+605) 374 2093/2453 Faks: (+605) 374 2299

UNIVERSITI TEKNOLOGI MARA

Surat kami : 700-KPK (PRP.UP.1/20/1)
Tarikh : 20 Januari 2023

UNIVERSITI TEKNOLOGI MARA PERAK
TERIMA
25 JAN 2023
Tindakan
Universiti Teknologi MARA Perak
PEJABAT REKTOR

Prof. Madya Dr. Nur Hisham Ibrahim
Rektor
Universiti Teknologi MARA
Cawangan Perak

Tuan,

PERMOHONAN KELULUSAN MEMUAT NAIK PENERBITAN UiTM CAWANGAN PERAK MELALUI REPOSITORI INSTITUSI UiTM (IR)

Perkara di atas adalah dirujuk.

2. Adalah dimaklumkan bahawa pihak kami ingin memohon kelulusan tuan untuk mengimbas (*digitize*) dan memuat naik semua jenis penerbitan di bawah UiTM Cawangan Perak melalui Repositori Institusi UiTM, PTAR.

3. Tujuan permohonan ini adalah bagi membolehkan akses yang lebih meluas oleh pengguna perpustakaan terhadap semua maklumat yang terkandung di dalam penerbitan melalui laman Web PTAR UiTM Cawangan Perak.

Kelulusan daripada pihak tuan dalam perkara ini amat dihargai.

Sekian, terima kasih.

"BERKHIDMAT UNTUK NEGARA"

Saya yang menjalankan amanah,

SITI BASRIYAH SHAIK BAHARUDIN
Timbalan Ketua Pustakawan

nar

Setuju.

27.1.2023

PROF. MADYA DR. NUR HISHAM IBRAHIM
REKTOR
UNIVERSITI TEKNOLOGI MARA
CAWANGAN PERAK
KAMPUS SERI ISKANDAR