

IMPLEMENTATION OF LARGE SCALE SOLAR (LSS) POLICY IN MALAYSIA



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ABSTRACT

Large Scale Solar (LSS) is one of the initiatives announced by the Government of Malaysia in order to increase the share of renewable energy in electricity generation. It is widely known that the energy sector is the major contributor to the Greenhouse Gas (GHG) emissions (or carbon emissions) for many countries including Malaysia. It was recorded that the energy has contributed as much as 218.9 MtCO₂eq in 2011, an increase of 31% since 2000. Therefore, this article will discuss the current situation of electricity generation by renewable energy in Malaysia, the expected outcomes of LSS implementation, and showcase the LSS project by Tadau Energy Sdn, Bhd. in Kudat.

INTRODUCTION

Malaysia has pledged to reduce its GHG emissions intensity of GDP by 45% by 2030 relative to the emissions intensity of GDP in 2005. This consists of 35% on an unconditional basis and

a further 10% is conditional upon receipt of climate finance, technology transfer and capacity building from developed countries. In accordance to that, one of the selected outcomes stipulated in the Eleventh Malaysia Plan is that renewable energy installed capacity for electricity generation expected to reach 2,080 MW by 2020 contributing to 7.8% of total installed capacity in Peninsular Malaysia and Sabah.^[1] It is further noted that the target has been updated to achieve 20% of renewable energy total installed capacity in 2020, 23% by 2035 and 30% by 2030 as declared in the recently launched Green Technology Master Plan Malaysia 2017–2030.^[2] As of June 2016, the installed capacity of Solar PV in Malaysia is 249.61 MW.^[3] To achieve this ambitious target, one of the initiatives that have been put in place is the implementation of Large Scale Solar (LSS). This intention had been announced by the Minister of Energy, Green Technology and Water Malaysia in his keynote address during the launching of the 3rd International Sustainable Energy Summit (ISES) 2016 on 5th April 2016 at Putrajaya.^[4]

The power market in Malaysia is generally monopolistic in nature, with three main vertically integrated power utility providers responsible for three different areas.

- Tenaga Nasional Berhad (TNB) in Peninsular Malaysia
- Sabah Electricity Limited (SESB) in Sabah
- Sarawak Electricity Company (SESCO) in Sarawak

The Electricity Supply Act (Act 447) was initially passed in 1990, establishing a framework for the private sector to participate in the generation of power as independent power producers (IPP); the act

was later amended in 2001^[3] and recently in 2015. However, it is important to note that only Peninsular Malaysia and state of Sabah are bound by the Act 447. Sarawak electricity supply industry is governed by the state's ordinance¹⁾. Having said that, therefore implementation of LSS policy will only involve Peninsular Malaysia and Sabah.

CURRENT RENEWABLE ENERGY ELECTRICITY GENERATION IN MALAYSIA

Peninsular Malaysia

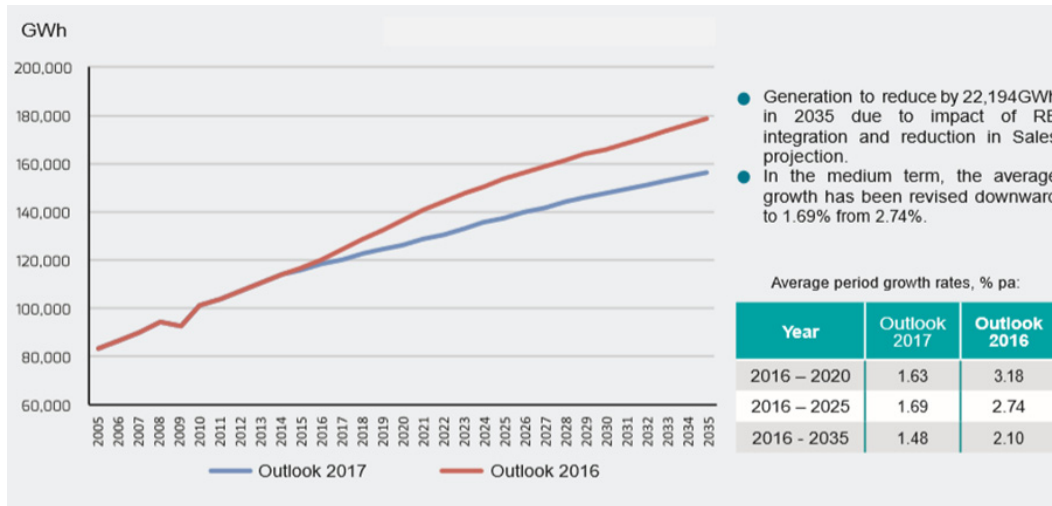
Malaysia has a total of 26,563.48 MW of installed capacity for major power plants in 2015. In Peninsular Malaysia, it was recorded that total generated electricity from Renewable Energy as much as 380.95 GWh (data until 23rd November 2016). Solar contributes the most with 54.97%, followed by Biomass at 17.62%, Biogas at 14.11% and Mini hydro 13.31%.^[5]

Energy Commission forecasted that electricity generation for 2017 Outlook will be reduced by 22,194 GWh compared to forecast that was made on 2016 due to impact of renewable energy integration and reduction in sales projection as shown in Figure 1. Revision of the forecast is made in 2017 because despite the country's healthy economic development

1) The laws and rules that regulate Sarawak Electricity Supply Industry under the purview of the Ministry are as follows:

- The Electricity Ordinance (Cap 50);
- The Electricity (Amendment) Ordinance, 2003 (Cap A109);
- The Electricity Rules, 1999;
- The Electricity (State Grid Code) Rules, 2003;
- The SESCO Ordinance, 1962 (Cap 51); and
- The Sarawak Electricity Supply (successor Company) Ordinance, 2004

This information is taken from the Official Website of Ministry of Utility Sarawak. (http://www.mou.sarawak.gov.my/modules/web/pages.php?lang=en&mod=webpage&sub=page&id=40&menu_id=0&sub_id=12)



Source: Energy Commission

Figure 1. Peninsular Malaysia Electricity Generation Forecast

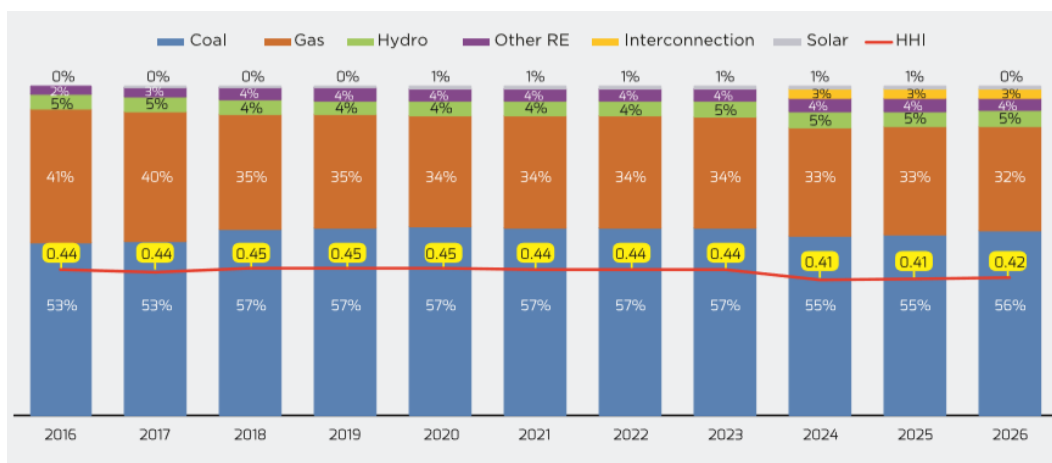
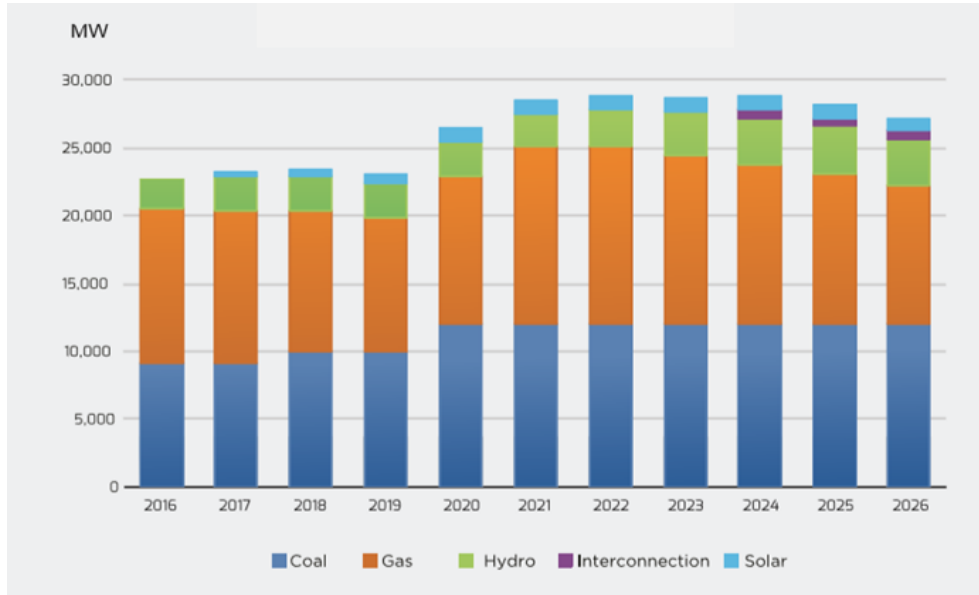


Figure 2. Projected Generation Mix in Peninsular Malaysia

in 2015, negative peak demand growth recorded for the first time in history. Based on the forecast performance, a variation of -3.8% between the forecasted and actual peak demand has challenged forecasters in the quest to response to the seemingly less correlation between the economic growth and electricity demand. In addition, electricity sales growth continued to decline especially for the last three consecutive years, even though the forecast-actual variation only deviated less than 1.0% .^[6]

Consequently, Energy Commission had also projected that renewable energy (excluding hydro) will contribute as much 4% to the total electricity generation in Peninsular Malaysia beginning 2018 until 2026 as shown in Figure 2²⁾. This projection has already taken into account implementation of LSS policy. This means that even though the percentage

2) HHI - In managing the resources efficiently, the Herfindahl-Hirschman Index (HHI) has been adopted with a target to maintain below 0.5 by 2020 for electricity subsector. HHI exceeding 0.5 reflects over-dependence on certain fuel resource and HHI for 2014 is 0.45 which indicates a healthy index.



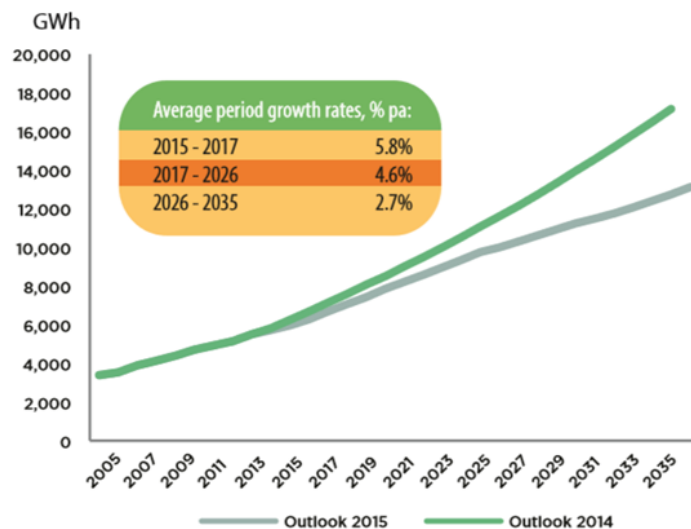
Source: Energy Commission

Figure 3. Projected Capacity Mix in Peninsular Malaysia

of renewable energy electricity generation is maintained but the actual generation will be increased as forecasted. Projected capacity mix in Figure 3 displays that there will be slight increase annually for solar power installed capacity beginning 2017.

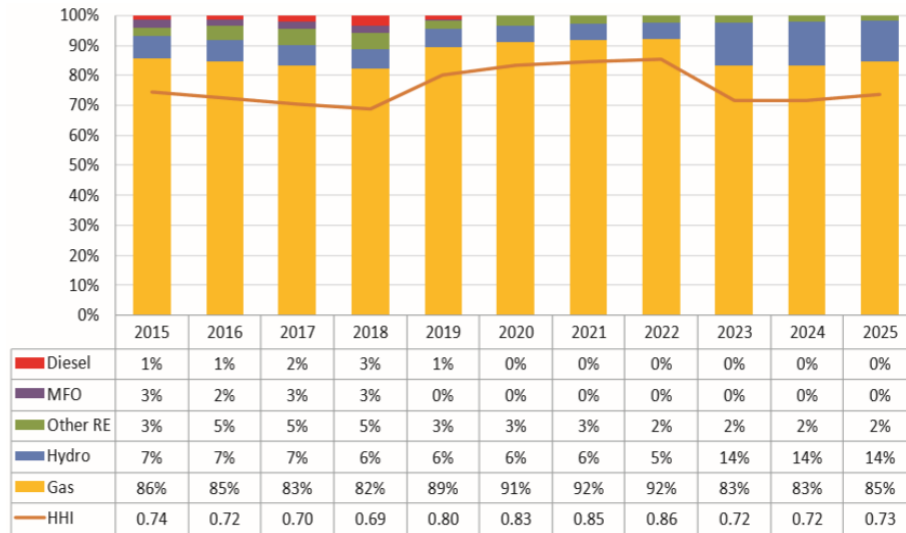
Sabah

Meanwhile in Sabah, total electricity generated from Renewable Energy was recorded at 279,53 GWh. However, the renewable energy generation mix was majority from Biomass at 88.65%, followed by Biogas at 5.83%, Mini Hydro at 3.19% and finally Solar with



Source: Energy Commission

Figure 4. Sabah Electricity Generation Forecast



Source: Energy Commission

Figure 5. Sabah Electricity Generation Fuel Mix Projection

only 2,32%.^[5]

The 2015 forecast is revised downwards in view of lower than expected electricity demand recorded in year 2014 which was at only 2,5%. For year 2015, the demand is forecasted to growth at a rate of 5,6%, compared to 7,8% as previously forecasted.^[7] Figure 5 indicates electricity generation fuel mix projection whereby electricity generation by solar PV is very small in the already low percentage of renewable energy. As of July 2015, Dependable Capacity in Sabah is in total of 1,324MW. Therefore, by having implementation of LSS policy will significantly increase future electricity generation by solar PV.

LARGE SCALE SOLAR POLICY IMPLEMENTATION

Implementation Target

Malaysia has targeted to increase installed capacity of 1,200 MW of LSS farms by 2020, whereby 200 MW

in Sabah and 1,000 MW will be in Peninsular Malaysia.^[2]

Therefore, the plan will be to put in place 50 MW installed capacity in Sabah and 250 MW new installed capacity annually beginning year 2017.

Procedures

This column shows the legal and regulatory framework for the Peninsular Malaysia and Sabah areas. Sarawak is bound by different laws and regulations regarding the governance of electricity supply, thus excluded in the LSS implementation policy. However, it is good to note that some efforts had been taken by the Sarawak state government such as applying for Green Climate Fund (GCF) to finance the off-grid solar programs to ensure that solar power generation will be one of the main electricity supply alongside their abundant hydro-electricity potential.^[8]

Energy Commission conducted the bidding process to build, own and operate Large Scale Solar PV (LSSPV) plants to supply and sell energy to the



Source: Energy Commission

Figure 6. LSS Bidding Schedule

utilities under long term power purchase agreements. A pre-qualification exercise in March 2016 had short-listed private companies with suitable technical and financial capabilities as per criteria set in the Request for Qualification (RFQ) document. Depending on the qualifications, the entities that satisfy the requirements in the pre-qualification exercise are invited to participate in the Request for Proposal (RFP)³⁾ for the LSSPV plants.^[6]

Through the recent RFP bidding exercise, a total solar capacity of 434MW in Peninsular and 16.9MW in Sabah are expected to be commissioned in 2017 and 2018 with levelized tariff ranging from 39.95–44.95 sen/kWh in Peninsular and 45–51 sen/kWh in Sabah. Information on new biddings can be viewed at the Official Website of Energy Commission (<http://st.gov.my/index.php/en/>).

3) RFP is a bidding invitation from Qualified Participants to finance, design, supply, build, own, operate and maintain LSSPV plants to supply and sell energy produced by the solar PV plants to the electricity supply utilities in Peninsula, Sabah or Federal Territory Labuan. Successful Bidders will be required to enter into a power purchase agreement for a term of 21 years with the electricity supply utility.

Recent Bidding Exercise and Potential Future Projects

The Energy Commission has successfully completed the competitive bidding exercise for the development of LSSPV plants in Peninsular Malaysia and Sabah for commercial operation date (COD) in 2017–2018. RFP was offered in five packages and shortlisted bidders are as follows:

I. Package P1 (1 MW_{ac} to 5 MW_{ac}) in Peninsular Malaysia:

No	Shortlisted Bidders	Export capacity (MW _{ac})	Location
1	SBU Power Sdn Bhd	3,996	UniMAP Pau Campus, Arau, Perlis
2	Consortium Tesdec Services Sdn Bhd and Suria Infiniti Sdn Bhd	3,5	Mukim Sura, Dungun, Terengganu
3	Revenue Vantage Sdn Bhd	3,0	Jejebu, Negeri Sembilan

II. Package P2 (6 MW_{ac} to 29 MW_{ac}) in Peninsular Malaysia:

No	Shortlisted Bidders	Export capacity (MWac)	Location
1	Consortium Greenviro Solutions Sdn Bhd and PLB Terang Sdn Bhd	20	Tajak Pelupusan Pulau Burung Fasa 3, Penang
2	Consortium Zelleco Engineering Sdn Bhd, Pengkalan Bumijaya Sdn Bhd and Amlad Illumination (M) Sdn Bhd	29	Kulai, Johor
3	Eastern Pacific GD Solar Sdn Bhd	18,5	Mukim Telok Kalong, Kemaman, Terengganu
4	HNG Capital Sdn Bhd	29,0	Kuala Muda, Kedah
5	Selasih Mentari Sdn Bhd	8,0	Ladang Tanah Merah, Negeri Sembilan
6	IL Solar Sdn Bhd	10,0	Bandar Bukit Kayu Hitam, Kedah

III. Package P3 (30 MWac to 50 MWac) in Peninsular Malaysia:

No	Shortlisted Bidders	Export capacity (MWac)	Location
1	Tenaga Nasional Bhd	50,0	Sepang, Selangor
2	Consortium UiTM Property Management Sdn Bhd, BJ Power Co, Ltd and Perwira Al-Shura Consulting Engineers Sdn Bhd	50,0	Gambang, Pahang
3	Mudajaya Corporation Bhd	49,0	Sungai Siput, Kuala Kangsar, Perak
4	Consortium Malakoff Corporation Bhd and DRB-HICOM Environmental Services Sdn Bhd	50,0	Tanjung Malim, Perak
5	Gading Kencana Sdn Bhd	30,0	Bidor, Perak
6	Consortium Synergy Generated Sdn Bhd, SCOMI Group Berhad and Lembaga Tabung Angkatan Tentera	30,0	Bandar Sungai Petani, Daerah Kuala Muda, Kedah
7	Solar Management (Chembong) Sdn Bhd	50,0	Mukim Pedas, Rembau, Negeri Sembilan,

IV. Package S1 (1 MWac to 5 MWac) in Sabah/Labuan:

No	Shortlisted Bidders	Export capacity (MWac)	Location
1	Sabah Energy Corporation Sdn Bhd	5,0	Kampung Tanjung Kubong, Wilayah Persekutuan Labuan, Sabah
2	RUSB-BTS Joint Consortium	5,9	Kota Marudu, Sabah

V. Package S2 (6 MWac to 10 MWac) in Sabah/Labuan:

No	Shortlisted Bidders	Export capacity (MWac)	Location
1	Beau Energy East Sdn Bhd	6,0	Beaufort, Sabah

Source: Energy Commission

Even though there are only three shortlisted bidders with total of 16,9 MW LSS projects in Sabah for 2017–2018 COD, a LSS project of 50 MW has been awarded to Tadau Energy Sdn. Bhd. The project is located in Kudat, a northern part of Sabah with the intention of making the area as green energy hub.^[9,10]

A study by Huda (et.al) explores potential locations for 5 MW solar power plant with objective to replace diesel power plants all over Sabah. Two scenarios were introduced to observe capability of one single 5 MW plant and another scenario with number of plants to replace the diesel generation plants in the next 10 years. This study found that for the selected locations as suggested in Figure 7, the proposed system can generate electricity annually with average of 8,377 GWh/year. This proposed system also proves that it can reduce the CO₂ emission at least 260 kT CO₂ in Scenario 1 and an amount of 1,55 GT CO₂ mitigated for Scenario 2.^[11] This study can be a potential reference for future LSS projects especially in Sabah.

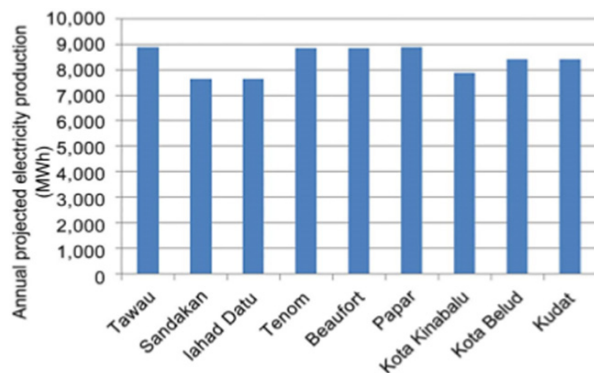


Figure 7. Proposed Locations of 5 MW Solar PV and Annual Projected Electricity Production

50 MW LSS PROJECT BY TADAU ENERGY SDN. BHD.

In 2012, Sabah had been acknowledged by Sustainable Energy Development Authority (SEDA) Malaysia to have high potential to become a renewable energy hub for Malaysia.^[12] Kudat specifically has been identified by some studies as one of the best location with wind energy potential in Malaysia.^[13,14] Scientific and Industrial Research Institute of Malaysia (SIRIM) also have conducted research on Kudat for solar and wind electricity generation capacities since 2013.^[15] Recently, Renewable Energy and Greentech (REGTECH) Sabah 2017 in their November press release indicates that Kudat will be transformed into Sabah's centre for renewable energy.^[16]

Kudat has the average of daily solar radiation (horizontal) of 5.41 kWh/m²/day according to RETScreen

Table 1. Average of daily solar radiation (horizontal) for some locations in Sabah

	Location	Average of daily solar radiation (horizontal) kWh/m ² /day ⁴
1	Tawau	4.90
2	Sandakan	5.01
3	Kota Kinabalu	5.02
4	Kudat	5.41

database provided from NASA, thus making the area one of the most ideal location for a large solar PV plant. The high daily solar radiation in the area should be capitalized for electricity generation that will significantly reduce carbon emissions with the implementation of LSS.

Tadau Energy Sdn. Bhd. had been awarded to build a 50 MW large scale solar facility in Kudat. The company is a renewable energy and sustainable technology investment firm established in 2015 and the headquarter is in Damansara Heights, Kuala Lumpur. The shareholders of Tadau Energy are Kagayaki Energy Sdn. Bhd. (80%) and Edra Solar Sdn. Bhd. (20%). This company had two 21-year power purchase agreements (PPAs) with Sabah Electricity Sdn Bhd (SESB) for this project. The scheduled commercial operations dates under the first agreement is June 30, 2017 and the second on March 31, 2018.^[17]

Other than just for the apparent objective to reduce carbon emissions from electricity generation, the implementation of LSS from this particular project has opened a window of opportunity to introduce the first green Sukuk⁵⁾ in Malaysia. The 50 MW LSS

4) Figures are retrieved from RETScreen Expert Version 6.0.7.55 b31679 on 10th December 2017

5) Sukuk is Islamic bonds, structured in such a way as to generate returns to investors without infringing Islamic law (that prohibits riba or interest). Sukuk represents undivided shares in the ownership of tangible assets relating to particular projects or special investment activity. A sukuk investor has a common share in the ownership of the assets linked to the investment although this does not represent a debt owed to the issuer of the bond. In the case of conventional bonds the issuer has a contractual obligation to pay to bond holders, on certain specified dates, interest and principal. In contrast, under a sukuk structure the sukuk holders each hold an undivided beneficial ownership in the underlying assets. Consequently, sukuk holders are entitled to a share in the revenues generated by the Sukuk assets. The sale of sukuk relates to the sale of a proportionate share in the assets. Source: Philip Molyneux, professor of banking and finance, Bangor Business School, Wales ([http://lexicon.ft.com/Term?term=sukuk-\(islamic-bonds\)](http://lexicon.ft.com/Term?term=sukuk-(islamic-bonds)))



project by Tadau Energy has been rated **Dark Green** (n6) for the Tadau Green Sukuk Framework from Center for International Climate Research (CICERO)^[18] which means this project was acknowledged to be very good to the environment. Called Green SRI Sukuk Tadau, the RM250 million Sustainable Responsible Investment (SRI) shariah-compliant bond holds a tenure of up to 16 years and was assigned a long-term rating of “AA3” by RAM Rating Services Bhd prior to its issuance. SRI Sukuk Framework, is the result of a collaboration between Bank Negara Malaysia, the Securities Commission (SC) and the World Bank. The financing scheme was being acknowledged by the World Bank as very much in line with their twin goals, which are poverty eradication and shared prosperity. This is a very good first step for future LSS projects to be funded by Islamic financing schemes which has been a niche market in the mid to late 2000s.^[19]

OUTCOMES

There are three notable outcomes expected by the implementation of this policy. The first is carbon emission reductions. According to simple analysis using RETScreen, for a 50 MW capacity of solar PV

6) This Second Opinion by CICERO will allocate a ‘shade of green’ as follows:

- **Dark green** for projects and solutions that are realizations today of the long-term vision of a low carbon and climate resilient future. Typically, this will entail zero emission solutions and governance structures that integrate environmental concerns into all activities.
- **Medium green** for projects and solutions that represent steps towards the long-term vision, but are not quite there yet.
- **Light green** for projects and solutions that are environmentally friendly but do not by themselves represent or is part of the long-term vision (e.g. energy efficiency in fossil-based processes).
- **Brown** for projects that are irrelevant or in opposition to the long-term vision of a low carbon and climate resilient future.

installed in Kudat area using the assumed specifications as shown in Table 2 will be able to reduce up to 62,008 tCO₂/year for electricity generation.

The analysis exhibits a good estimation for the amount of carbon emission reduction for a large scale solar project in Malaysia. As noted earlier, Kudat has the average of daily solar radiation (horizontal) of 5.41 kWh/m²/day, whereby according to study by Khatib (et.al.) the average solar radiation per annum in other parts of Malaysia are not too far off as shown in Table 1 and Table 3.^[20]

Next is the job creations. According to International Renewable Energy Agency (IRENA), Malaysia’s solar PV industry jumped to 27,900 jobs in 2016 from 19,110 in 2015. Malaysia has also become a major solar-cell manufacturing hub for export markets.^[21] As claimed by Malaysia Investment Development Authority (MIDA) in the article by Publicover, “About 95% of investments in solar production in Malaysia comes from outside of the country”.^[22]

Table 2. Solar PV Specification Sample from RETScreen for LSS in Kudat

Photovoltaic		
Type		mono-Si
Power capacity	MW	49.68
Manufacturer		Sunpower
Model		mono-Si - SPR-X21-345
Number of units		144,000
Efficiency	%	21.5%
Nominal operating cell temperature	°C	45
Temperature coefficient	% / °C	0.4%
Solar collector area	m ²	231,070
Miscellaneous losses	%	18%

Table 3. Annual global solar radiation averages for five different sites in Malaysia

Site	Average E_T per annum (Measured) (KWh/m ²)	Average E_T per annum (Predicted) (KWh/m ²)
Kuala Lumpur	4.84	4.83
Johor Bahru	4.51	4.55
Ipoh	4.54	4.64
Alor Setar	4.66	4.8
Kuching	4.62	4.66



MIDA reported to have attracted an addition of 7 more solar manufacturing projects and 83 renewable energy projects in the solar industry worth RM1.77 billion and RM0.65 billion respectively in year 2016. The biggest investment was contributed by Longi, a major solar giant producing solar ingot, wafer cells and modules. Other investments approved include Jinko Solar and JA Solar.^[23] Recently, it was reported that ET Energy, the global solar project development arm of Chinese PV company ET Solar, with Northwest Electric Power Design Institute Co., Ltd. of (NWEPTI) China Power Engineering Consulting Group, and local solar PV developer UiTM Solar Power Sdn. Bhd. to build the LSS project located at Gambang.^[24] PV CellTech is one of the leading conferences on the solar photovoltaics calendar to encourage investors. The first conference was held in March 2016 Kuala Lumpur, then continued in March 2017 at Penang. The event will be open again tentatively from 13 to 14 March 2018 also in Penang (<https://www.pv-tech.org/events/list>). After the first exercise of LSS bidding by Energy Commission coupled with events such as the PV CellTech, more investors are expected to contribute in the growth of Malaysia's solar PV industry.

CONCLUSION

LSS implementation policy shows continuous commitment towards carbon emission reduction in line with Malaysia's Nationally Determined Contribution (NDC) for the Paris Agreement. This will be one of the major contributor for carbon emission reduction as intended in the Eleventh Malaysia Plan and Green Technology Master Plan. Conventional fuel still currently

dominates electricity generations in Malaysia and projected to remain status quo. However, renewable energy technology is still emerging and have big potential to be more competitive in future. Furthermore, the outcomes from this policy indicates that there are growing interests for the banking sectors to be more supportive towards green financing and attracts a lot of investors in solar PV industry. Therefore, this five-year period of LSS implementation will be the stepping stone for future investments in renewable energy technologies.

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