Challenges and Practises in the Land Administration of Solar Farming Development in Johor, Malaysia

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SUMMARY

Approaching the year 2030, Malaysia government is committed in promoting energy efficiency and renewable energy to achieve the Sustainable Development Goal, Goal 7: Affordable and Clean Energy. Globalisation and population growth have caused the natural resources to deplete faster than the earth regeneration capacity. Therefore, in order to ensure a sustainable development, renewable energy resources appear as one of the most effective long-term potential solutions. As a result of the development in technology intelligence (TI), the Johor State Government has encouraged the public and private sectors to commercialize the solar farming. This is made viable through the supports received from legal provision and facilitated by procedural implementation. At present, there is no standardized legal framework for solar farming development in Malaysia. This article describes the legal practices, challenges, and approaches for solar farming development in Johor. The findings will serve as a foundation to standardize the solar farming development approval in Johor in accordance to sustainable land use management.

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1. INTRODUCTION

United Nation (2017) reported that the world's population is now reaching 7.6 billion and expected to increase to one billion in every 10 years; reaching 9.8 billion by the year 2050. However, the experts found that our natural resources are not lasting and able to survive for approximately 60 to 130 years (Energy Commission, 2017). The shortage of natural resources e.g. oil, coal, and natural gas contributes to the world's energy crisis due to climate change. The International Energy Agency (IEA, 2011) reported almost 1.1 billion people live without electricity in the developing countries, thus the need to find the alternative energy through renewable energy is crucial. The development of renewable energy is a step forward to mitigate the impact of climate change in the country. This situation will likely to increase the demand of energy resources which is expected to increase by 2030 despite its declining energy supply (IEA, 2007).

Malaysia is located in the northern hemisphere that is the northern part of the equator, consisting of two main areas separated by the South China Sea and commonly famous with natural resources including shoreline, dense forests, and rolling hills. As a country surrounded by the sea and near the equator, Malaysia naturally receives plenty of sunshine that is twelve hours a day. Thus far, solar energy has a huge potential to be developed in Malaysia as an alternative energy resource. Kardooni et al. (2016) stated that Malaysia is ranked third in terms of the world's solar power hub and one of the world's leading solar cell manufacturers with photovoltaic technology which is capable in generating 3693 MW of energy and this keeps increasing by years. A total of RM15.1 billion is spent annually by the energy sector to produce 120,059 GWh of electricity for the use of 8.45 million people in the Peninsular Malaysia (Energy Commission Report, 2017).

Malaysia aims to create a low-carbon economy and an efficient resource through the framework of Green Technology Master Plan (GTMP, 2017-2030). The GTMP has outlined Malaysia's determination to reduce carbon emissions by 45% by 2030 and to become fully carbon neutral by 2050; thus balancing the country's green growth and development. Malaysia also aims to achieve 20% renewable energy in energy mix by 2025. The increase of energy demand is in line with the 11th Malaysia Economic Development Plan. This situation can cause the global energy market to become more competitive in the future resources are depleted and resulting in high price. Malaysia is undeniably endowed with natural resources e.g. oil and natural gas, but it does not exclude this country from facing this situation if those resources are not properly managed. As energy resources are important as part of the driving force for a country's economy, appropriate measures must be taken to ensure that Malaysia can manage a more

competitive energy market in the future. Therefore, the country needs to develop and promote renewable energy resources e.g. solar as an alternative energy to substitute the current and diminishing energy resources available.

In order to promote the use of solar energy in Malaysia, the allocation of land is needed to develop solar farming. Appropriate siting can help to mitigate the extent to which RE implementation compromises existing land-based economies and ecosystem services. As such, an integrated approach to land-use and energy planning, or land-energy planning, can help to ensure that RE technologies can be intensively implemented while minimizing negative impacts (Calvert & Mabee, 2015). Land administration must be equipped with comprehensive and relevant procedures and policies to support the development of solar farming in Malaysia to deal with its great potential in the future. According to Sustainable Energy Development Authority (SEDA) (2017), the operation of solar farming is temporarily permitted within 20 years. However, confusion was raised by land administrator, developer and landowner when the generation of solar energy is categorised as industrial development but some of the electric powerplant are been built on agricultural land. Some developers and landowners consider the structure of the solar farm to be temporary so there is no need to change the actual conditions of the land. Then, some of them consider that only part of their land is used as solar farm and some still retain as agricultural use. It's become tendency for them to undertake the development without changing the actual conditions of the land.

This situation implicates that the landowners will take advantage to develop solar farming on agricultural land which indirectly will cause loss to the State Authority in term of land tax collection. It may also arise conflict between the land use activity and land condition that is contradict to the Section 18 under Act 172 and Section 52 NLC 1965 which state that the land use zoning must be in parallel with land activity. Consequently, there is an unclear solar farming development approval for decision-making process in Malaysia that lead to rising conflicts to the land administrator in managing land for the purpose of solar farming development. Besides that, there is problem concerning ground-mounted PV plants is often depicted in land use competition with agricultural production. For example, soil fertility or type of agricultural land were considered with different degrees of suitability for PV energy production or crop cultivation. Optimization techniques such as the agrivoltaic system, were applied to combine in a same area PV plants and agriculture production in order to maximize total energy efficiency. However, does this integration farm that is like a power plant can be categorized as agricultural and does not require any changes in the actual conditions of the land? This article attempts to describe the legal practices, challenges, and approaches for solar farming development in Johor. The findings will serve as a foundation to standardize the solar farming development approval in Johor in accordance to sustainable land use management.

2. SOLAR FARMING EVOLUTION IN MALAYSIA

2.1 SOLAR FARMING POLICIES

Malaysia's framework on renewable energy began with the formation of National Energy Policy in 1979, followed by National Energy Reduction Policy in 1980, 4th Fuel Diversity Policy 1981, and 5th Fuel Policy in 2000. Then, government's initiatives towards developing

renewable energy and green technology were established by the Ministry of Energy, Green Technology, and Water in 2009 (currently the Ministry of Energy, Science, Technology, Environment, and Climate Change – MESTECC). In addition, an organization focusing on green technology was established i.e. Malaysian Energy Centre in 1997, in which it was rebranded in 2010 as Malaysian Green Technology Corporation (MGTC).

Prior to the implementation of National Green Technology Policy, Malaysia mainly focused on achieving energy efficiency and renewable energy generation in the energy sector. The government also established programs e.g. Malaysian Energy Efficiency Improvement Program (MIEEIP), Small Renewable Energy Power Program (SREPP), and BioGen and Malaysia Building Integrated Photovoltaic (MBIPV). After the introduction of the policy in 2009, various programs and financing schemes to encourage community involvement were implemented e.g. green technology financing scheme, green city program, green procurement and eco-labelling, green vehicles, green awareness exhibitions, and the creation of green technology-based jobs.

In order to strengthen the renewable energy structure and technology, the government enacted Renewable Energy Act in 2011 which deals with several matters i.e. incentive tariff system for investors investing in the industry. These initiatives indirectly support the sustainable development goals under the Millennium Development Goals (MDGs), which have been agreed upon by the United Nations (UN) member states including Malaysia, on 25th September 2015. It is a new sustainable development agenda that aims to end poverty, protect the planet, and ensure prosperity for all. Each agenda has a specific goal to accomplish in the next 15 years, comprising 17 more agendas to change the world by 2030 (UN Sustainable Development Goals, 2016).

In the 11th Malaysia Plan (2016-2020), six strategic priorities are established to achieve the SDGs i.e. (i) enhance inclusiveness of the people, (ii) improve the well-being of all, (iii) accelerate human capital development for developed countries; (iv) continue green growth for sustainability and resilience; (v) strengthened infrastructure to support economic growth, and (vi) revitalize economic growth for greater prosperity (Malaysia Eleventh Plan, 2015). Through the plan, Malaysia has transformed from a raw material-based economy to a diversified economy and an export of high-tech products. Malaysia is also categorized as a mid-high-income country with inclusive economic growth (World Bank, 2015). However, these transformations pose challenges to the development of environmental sustainability as the world experiences many effects of the increased carbon footprint, global warming, and climate change that is affecting the world (Hanis Hashim, 2016).

From 2006 until 2010, photovoltaic development in Malaysia was managed by the United Nations (UN) and implemented by the government. Hence, solar energy development projects continue to evolve with the introduction of the Tariff in Feed (FiT) scheme under the Renewable Energy Act (TBB) in 2011. In addition, the government introduced several schemes or other mechanisms that assist the development of solar energy in the country i.e. Enhanced Net Energy Metering (NEM) in 2019 and the biggest one is Large Scale Solar (LSS) beginning in 2017. Other than that, the government introduced a few financial schemes and incentives to support the development of renewable energy i.e. Green Investment Tax Allowance (GITA) and Green

Income Tax Exemption (GITE) until 2023. The latest scheme to ensure continuous supports towards green technology project that has been approved by the Ministry of Finance and MESTECC is Green Technology Financing Scheme 2.0 (GTFS 2.0).

2.2 SOLAR FARMING DEVELOPMENT

In the beginning of solar power development in the country, the solar generation was used for heating water at home (Ibrahim, 2001). This was the first attempt by the government to promote the successful use of solar energy from the Malaysian Integrated Photovoltaic Building project (MBIPV) launched in 2005. MBIPV's Final Report (2011) stated that the project has led to the reduction of long-term cost and sustainability of photovoltaic technology through the integration of building design. The project focuses primarily on the development of the integrated photovoltaic buildings (BIPV) technology while enhancing the country's capacity of the market through three things i.e. (i) policy and awareness, (ii) technical efficiency and market improvement, and (iii) technology development and support.

By the end of the project, every sector involved whether the public, investors, policy makers, and the building industry will embrace photovoltaic technology and thus create a clean and sustainable BPIV market. The project which was completed in December 2010 had been extended until May 2011 to ensure a smooth transition towards the establishment of Sustainable Energy Development Authority (SEDA). Although only 1.5 MW was achieved through the photovoltaic installation, the project was considered successful because the key component of a new set of laws and frameworks was established to allowed for the legalization of sustainable photovoltaic technology market to be implemented (Haris AH, 2011).

Malaysia's power utility company, Tenaga Nasional Berhad (TNB) is responsible to centralize the power generation, transmission, and distribution. The development of the first utility-scale PV power plant with a 50 MW capacity in Malaysia, located in the state of Kedah. The announcement was made during the visit of the President of the United States of America to Malaysia. The land requirement for this capacity is about 300–500 acres, and it will be directly connected to a 132 kV transmission line. This project is a joint venture between 1Malaysia Development Berhad (IMDB), TNB and DuSable Capital Management LLC (Sabo, Mariun, Hizam, Mohd Radzi, & Zakaria, 2016). Cypark, which is TNB's supplier, currently has five solar farms in Perlis, three in Negeri Sembilan, and one in Johor. The solar farms can benefit around 8,000 households in nearby villages, but also runs modern greenhouse agriculture using an automated fertilizer system (Bernama, 2012). In order to optimize the use of land, the solar farms in Perlis have introduced an agri-voltaic approach that are grown with crops like rock melon, *Orthosiphon stamineus* (cat whiskers), stevia, eggplant, luffa, long bean, and chilli.

The solar farms are installed with 31,824 solar panels in the area of 41.73 acres to generate 8MW capacity connected into grid. In 2012, Cypark started to export its energy into grid system and sell it to TNB. It is projected that the project is capable of producing about 11,712MW of energy annually for the next 21 years with annual sales value of more than RM11 millions. Additional 5MW solar farms have also been installed progressively in 2012 (Zanariah Zainol, 2015). Meanwhile, the Johor Structure Plan 2030 explained the development of privately

owned solar farm in Kluang; TNB is building 29MW solar farms in Kota Tinggi. Since the state of Johor has a great potential in the production of alternative energy due to its relatively flat terrain especially in the northern region of Johor, the construction of this solar farm should be intensified to promote energy utilization in the future.

In 2018 onwards, Photovoltaic market in the country is mainly driven by the LSS and NET schemes since FiT has existed in 2017 (SEDA, 2018). Based on National Survey Report of PV Power Applications in Malaysia (2018), total number of PV systems in operation are 840 systems that involves as much 382,99 MW capacity; rooftop 829 systems (72,49 MW), ground mounted 11 systems (310,50 MW). **Figure 1** shows the cumulative installed PV power in four sub-markets. The production capacity is hopefully increasing in line with growing energy demand in the country (**Figure 2**).

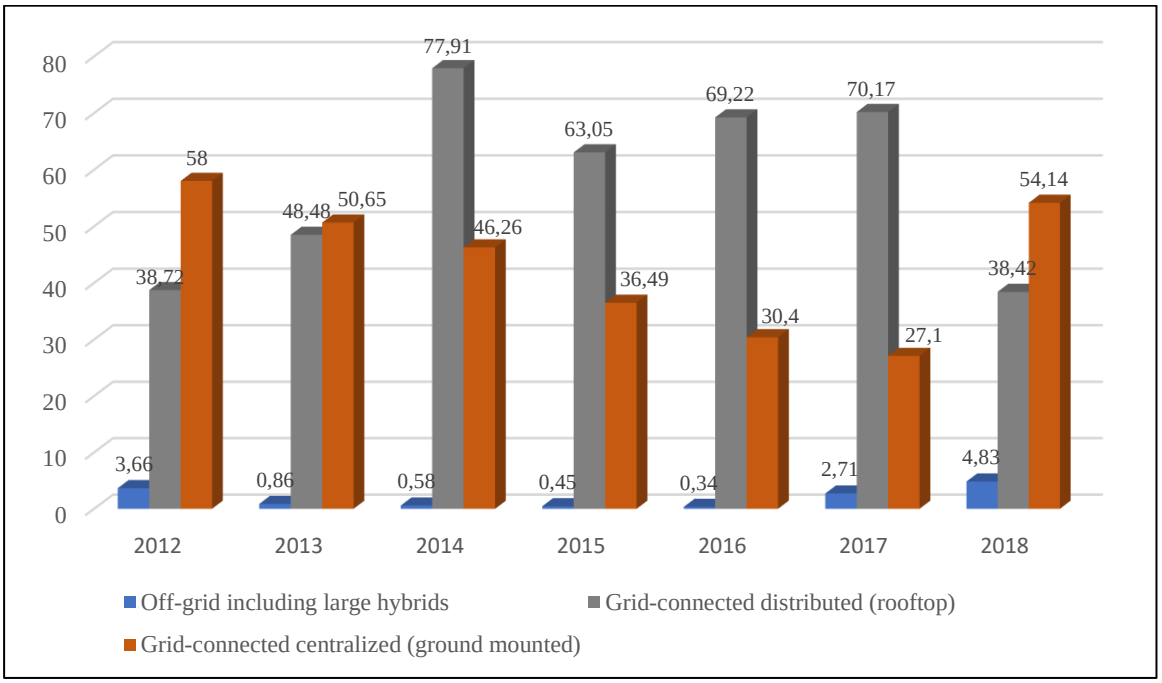

Figure 1: Percentage of Cumulative Installed PV Power in 2012 until 2018.
Source: National Survey Report of PV Power Applications in Malaysia, 2018.

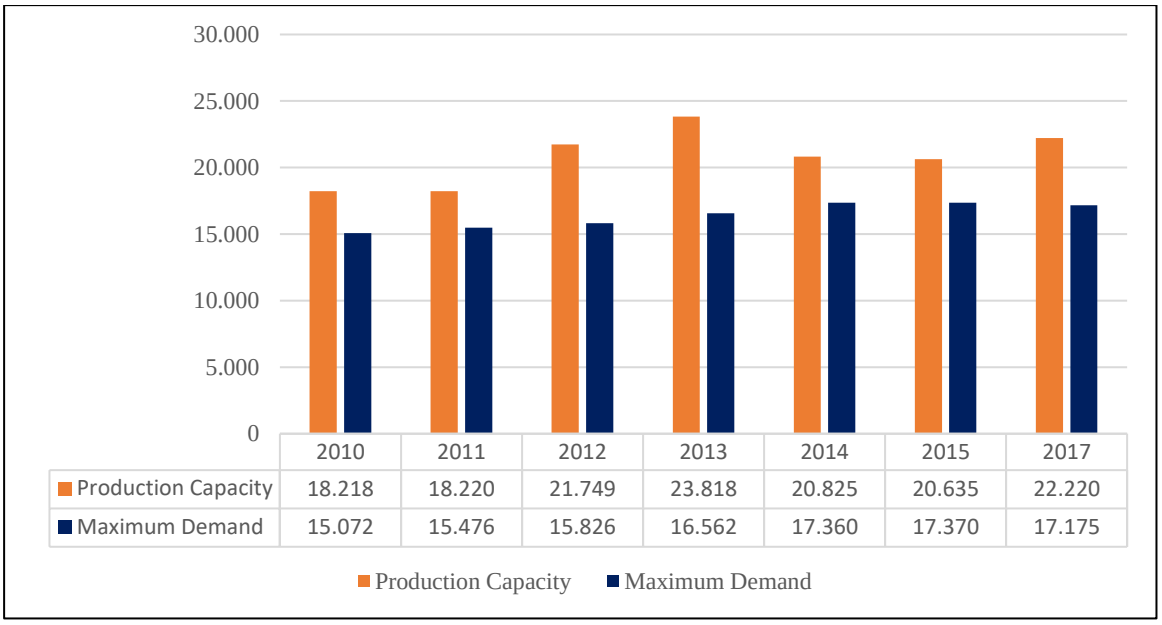

Figure 2: Peninsular Malaysia's Historical Electricity Production and Consumption (MW). Source: Energy Commission, 2017.

3. CURRENT PRACTISE OF SOLAR FARM DEVELOPMENT ACCORDING TO NATIONAL LAND CODE 1965

Land availability is a critical component for optimal solar farm plant. If the plant placed too close with residential areas, it may be hazardous to the environment and have a significant impact on urbanization and population growth. The availability of different land use categories may fluctuate. Thus, certain categories of land use types are unsuitable for PV installation including water bodies, environmentally sensitive land, and developed urban areas. Accessibility to the road and the grid are essential during the entire lifespan of a PV power plant. Issues with technical losses and the cost of developing the future transmission lines are priorities for siting large scale integrated smart-grid PV power plants. Accessibility to the existing grid saves considerable transmission losses and the additional cost of infrastructural development.

Solar radiation is the measure of solar energy strike on a unit surface area at a given period, usually a year (W/m2/year). It is of primary importance for large scale PV developments to have a site with long-term, average annual solar radiation. Acreage is a factor that defines the efficiency of economic benefits. The land required for large-scale grid-connected PV power plants has a standard acreage. The larger a candidate site is, the better for utility scale PV application. Sabo et.al (2016) in their research found that Johor has the largest optimal site area with 601,201.63 acres or 24.11 percent of the overall optimal area. **Table 1** presents the spatial distribution of optimal sites according to solar radiation for each state in Malaysia.

Table 1: Spatial Distribution of Optimal Sites According to Solar Radiation in Malaysia.

State	Area (Acre)		Total area (Acre)	Land area (%)		Total area (%)
	SR > 5	SR < 5		SR > 5	SR < 5	
Selangor	178,955.8	152,525.6	331,481.42	7.175875	6.116058	13.29193
Negeri Sembilan	32,070.74	46,687.53	78,758.27	1.285991	1.872103	3.158095
Pinang	33,482.84	0	33,482.84	1.342614	0	1.342614
Perak	256,764.9	29,6466.2	553,231.07	10.29591	11.88787	22.18378
Kedah	140,816.5	0	140,816.50	5.646541	0	5.646541
Perlis	96,10.069	0	9610.07	0.38535	0	0.38535
Kelantan	44,618.77	81,977.68	126,596.45	1.789149	3.287188	5.076337
Terengganu	10,726.74	16,8438.8	179,165.51	0.430127	6.754155	7.184282
Pahang	0	36,6125.4	366,125.45	0	14.68111	14.68111
Melaka	0	73,384.95	73,384.95	0	2.942632	2.942632
Johor	0	601,201.6	601,201.63	0	24.10733	24.10733
Total	**707,046.4**	**1,786,808**	**2,493,854.16**	**28.35155**	**71.64845**	**100**

*SR : solar radiance value

Source : Sabo et. Al, 2016.

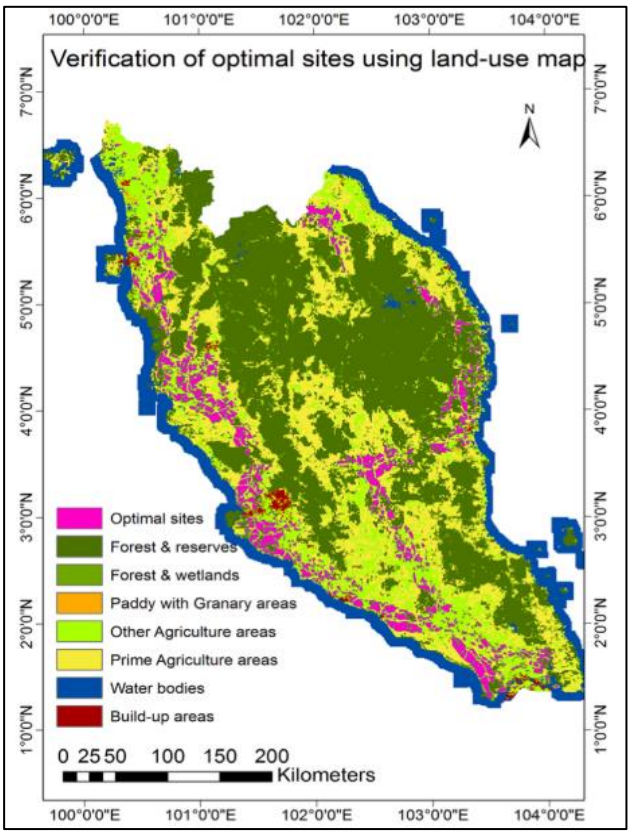

Figure 3 shows that the State of Johor has the potential to leverage potential lands to develop with Solar farms. The question is whether existing legislation can help authorities manage and process development applications received. This is important because it will encourage investments that will be brought in while helping the country achieve 20 percent of renewable energy generation by 2030.

Because of this new solar development, the authorities still have no specific legislation to evaluate and process solar farm development applications. Information to leverage potential locations is only used by developers to ensure their investment can provide optimum results. The provisions of Section 52 under National Land Code (NLC) 1965 only specify the types of land use in three categories namely as building, agriculture and industry. These permanent conditions are stated on the document of title and must be followed by the respective landowner. Unless, if the landowner intends to alter the condition, he must apply for the amendment of terms to the State Authority. The problem arises when an agricultural land is use for the purpose of other than agriculture. In this case, the solar farm development is built on agriculture land, but the generation of solar energy is categorized as industry, thus contradict with Section 52 NLC 1965.

Planning and development control of land uses in Malaysia is exercised primarily by the local and state authorities. According to Omar, I., (2002) National Land Code 1965 embodied a practical way to administer land for development purposes, it has some implementation and

integration problems. The main difficulty is that the implementation of the National Land Code 1965 is different in each state since they have differing urban land policy measures known as the State Land Rules. Land is a state matter (Article 74 of the Malaysian Constitution) and each state has control over its own land. The power of every State over land includes compulsory purchase (Article 83) and Malay reservation (Article 89) and any matters concerning all dealings in lands. There are cases where the conflict of interests between federal and state authorities has led to unresolved situations over decisions to acquire land for development. To a certain extent, the relationship between federal and state governments may restrict the supply of land for development purposes.

The control on land subdivisions and partitions of the land, conversion of category of land use and the amalgamation to land offices and land registrars throughout the country empowers by Part Nine (Sections 135 to Section 150 of the National Land Code (1965). Thus, Sections 136 and 147 of the National Land Code (1965) provides conditions for application to be considered for approval such as consent of every person (multiple land ownership) or body having interests in the land. In another example, Section 204, Part Twelve, deals with a special procedure to undertake land development through surrender and realienation where the restricted lands may be given back to the State Authority and then re-alienated to the landowners so as to remove the constraints or restriction in interests, wherever possible. Part Seven of the National Land Code (1965) specifies the conditions and restrictions in interest of alienated land in relation to the category of land use and the procedure to remove the restrictions and conditions.

Omar, I,. (2002) also outlines the restrictions in land dealings known as encumbrances such as lien, leasing and charging (Part Sixteen of the National Land Code, 1965) which may restrict the supply of land being transferred to the land developer or to lengthen the land development duration taken to remove these constraints. Any land title is bound with express and implied condition by the state authority's power. National Institute of Land and Survey (INSTUN, 2017) stated that express conditions is a command or prohibition imposed and specified in the ownership of a land alienated for the purpose of controlling its use while the implied condition is a command or prohibition on the use of land.

Solar farm is a new industry in Malaysia and there is no specific procedure or regulations to guide and promote its development. The provisions of Section 52 under National Land Code (NLC) 1965 only specify the types of land use in three categories i.e. building, agriculture and industry. These permanent conditions are stated on the title of document and must be followed by the respective landowner. Unless the landowner intends to alter the condition, he must apply for the amendment of terms to the State Authority. The problem arises when an agricultural land is used for the purpose of other than agriculture. In this case, the solar farm development is built on agriculture land, but the generation of solar energy is categorized as industry, thus contradict with Section 52 NLC 1965.
The development of solar farms in Malaysia is using a Special Permit issued by the Land Administrator. The issuance of Special Permit works as an enabler to permit and approve a non-agricultural development carried out in agriculture land. It is more appropriate and cost-effective rather than having to apply and alter the land category in accordance to Section 124 or 124A NLC 1965. In order to enable the non-agricultural development to be carried out

without any elements of violation that will lead to forfeiture by the State Authority, the issuance of Special Permit is one of the methods to assist Land Administrator in decision-making as there is no specific guideline and procedure available. Currently, there are a few methods that used by the state authority in terms of land approval to develop solar farm. So far, state of Kedah and Johor using Special Permit to develop solar farm. Meanwhile, some cases in Selangor change their land's express conditions and some do not change it at all in order to get planning permission approval. In Negeri Sembilan and Melaka, there are no need to change the express conditions to develop solar farm in their states. So, its resulting in incompatibility issues in term of land planning approval especially for solar farm development. Finally, it gives implications to financial because the variable fee is usually higher and will affect the initial cost of development.

In Johor, the Land Administrator has issued a special circular to permit the issuance of Special Permit which is read together with the Circular No. 1/2003 of Department of General Director of Lands and Mines (JKPTG), Special Permit Issuance of Temporary Agricultural Land for the Mean Other Than Agriculture and Its Practice in Johor. This circular is the basis for states to formulate a special permit issuance policy to be implemented at their respective state level. For the issuance of Special Permit on agricultural land in Johor, Circular No. 3/2006 has listed only two types of use; first of which the management of matter relating to the telecommunications tower or structure, and second of which the management of matters relating to the use of agricultural land for non-agricultural purpose. The first purpose involves government land, agricultural land, and building structure, while the second purpose involves private agriculture land. **Table 2** simplifies this matter.

Table 2: Form of Approval Issued Based on Land Type.

Purpose	Matter	Land/ Building	Form of Approval
1	Tower/ matter management telecommunication transmitter	Government Land	Temporary Occupancy License (LPS)
		Land (Agriculture/ Unconditional)	Temporary Special Permit
		on building	Permit under Uniform Building By-Laws (UBBL) 1984
2	Management of matters relating to the use of agricultural land for non-agricultural purposes	Land (Agricultural)	Temporary Special Permit

Source : Johor Land and Mines Office Circular No. 3/2006.

Table 2 above shows that not all application processes made in accordance with Johor PTG Circular Number 3/2006 will be issued a temporary Special Permit by the state of Johor's land administration. Some of the application processes specified in the circular will be issued with another approval in the form of Temporary Occupancy License (LPS) or permit under specific law. Regarding the alienated land in Circular No. 3/2006, it refers to any land that is subject to the provisions of Section 53 and 55 of the NLC 1965 where the use of such land is subject to the terms of implied condition for agriculture land. The implementation of this circular assist

to standardized the guidelines and rates of Special Permit payments for the purpose of building telecommunications towers or structures and the use of agricultural land for non-agricultural purposes throughout the State of Johor.

For each Special Permit application approved by the Director of Lands and Mines of Johor, a document will be issued in the form of permit made in Form 19C (Regulation 2) of the Johor Land Rules 1966 (Amendment 2004). Application for a Special Permit for the purpose of establishing a telecommunications tower that has been approved will be subject to a 10-year approval period. The fee for permit issuance is RM80.00 per 100 square meters or part thereof per annum. Although special permits issued on the agricultural land are for a period of 10 years, renewal of such special permits still needs to be applied annually. This means that the cost of renewal of Special Permits must be paid annually because Land Administrator will not accept full payment for 10 years. For applications for renewal of permits, the consideration and approval shall only be made by the Land Administrator on the district level.

4. ISSUES AND CHALLENGES BASED ON EXISTING LEGAL PRACTISE OF LAND APPROVAL

Currently, there are many telecommunication transit towers built on agricultural land. This is considered inappropriate as it is not a fixture (temporary structure) and only utilize a small portion of the land. However, Circular No. 3/2016 stated that the provisions of Sections 115 (4) (f) and (g) of the National Land Code has provided flexibility to the State Authority to authorize and allow the use of agricultural land for the purpose of other than agriculture use as permitted under the State Land Code.

The issuance of permit was recommended to prevent landowner to incur high cost if application is made to change the variation of condition under the Section 124 or subdivision and change the variation of condition under Section 124A NLC 1965. The permits will help the State Authority to increase revenue collection and prevent enforcement actions that must be taken in violation of requirements under Section 125 of the National Land Code. In regard to this, several issues have been identified based on the existing legal practice towards solar farm development in Johor.

The specific and general purposes in Special Permit through Johor Land and Mines Office Circular No.3/2006 have limitation. For general purposes such as unrelated activities to agriculture, it could be difficult for the Land Administrator to make decision since the use of such a purpose is not specifically listed in the circular or in the regulation of state land. Then, Johor Land and Mines Office Circular No. 3/2006 does not specify any conditions relating to the area or section of the land applied for Temporary Special Permit. This means that any space limit for a Special Permit application may be submitted for approval by the Land Administrator.

Referring to Section 115 (1) NLC 1965 stated that only 1 over 5 of the agricultural land is allowed to be built with the building. In the early stages of the introduction of the use of this special permit only a small portion of agricultural land was built for non-agricultural purposes. Therefore, the development of solar farm covering large areas of land and eliminating its nature

as an agricultural land is it still appropriate to use this special permit? Because the development of solar is temporary, the decision to use this special permit is seen as appropriate to help promote solar development. But it remains controversial among legal practitioners as some states direct developers to change the terms of the agricultural land. However, if the land used is rented or leased for a period of time, then the original landowner would have no intention of making a revocation application because the original agreement with the developer would only allow them to use the land for solar development. As such, it is seen that this special permit will address the concerns of developers in order to get land approval to develop solar farm.

Other than that, land suitability is an essential element of large-scale PV installation. However, the suitability does not constitute land availability because it is a scarce resource and acquiring it for large-scale project (Chi Man Hui et.al, 2009). It is also a difficult process in any society because the unwillingness of landowners to give out their valuable land resources and even given the high cost of compensation constitutes a threat to smooth project implementation. Aside from that, lack of willingness of landowners to transfer their ownership is a part of challenges that constitute a hindrance to project execution (M.L Sabo et. al, 2017). Outside private ownership for residential use, land use for agricultural purposes, culture or spiritual use, and reserve lands are much more difficult to acquire. Most of these problems arise from local factors such as public perception, political system and policy formulation.

Next, large-scale renewable energy projects are distributed network systems that require large expanse of land beyond the base power plant. Fthenakis and Kim (2009) asserted in a study that land requirement for large scale PV projects goes beyond identification of optimal sites. Additional land areas are required for several other components of the projects such as network connection between the existing system and a new project, and access road both of which are not limited to the grid line, but some substantial areas recognized as ROW (right of way) along the route. Ideally, new grid and road networks will traverse land areas owned by different holders including state, public, private or tribal lands some of which may even have access restrictions (Belfiore et. al, 2013). Besides that, land use is among the most influential criteria with regard to PV site selection for energy investment that include forest and reserves, granary areas, paddy land, water bodies, wetlands and built-up area; these areas may not be used because of economic and environmental interest (Carrión et al, 2008; Charabi et. al, 2011; Uyan, 2013; Van Haaren et.al, 2011; Sánchez-Lozano et. al, 2013; Ong et. al, 2013). The standard land requirement (acreage) for large-scale PV implementation is 3.31 acres per 1MW.

There is no constant revision of land use policies that accommodate changes in the accelerated global development to reduce unnecessary hindrances to land acquisition.. Hernandez et. Al (2014) reveals that one way to minimize the cost of large renewable energy project and to avoid privately own land is by making use of degraded lands through co-location with agriculture and feasibility of deployment alongside canals and aqueducts (flovoltaics). Power plant site is the only landed property needed for PV installation. Considerations for the primary and secondary land requirement entails among the aforementioned strategies making provision for local solar policies and solar resource map to guide decision making, encouraging hybrid power system, engaging community participation in the planning and execution processes, identifying location

to avoid installation and utilizing suitable prime agricultural land (Tsoutsos et. al, 2005; Fthenakis et. al, 2009; Tian et. al, 2009; Hernandez et. al, 2014).

5. CONCLUSION

Solar farm is a new industry in Malaysia, but solar energy has a huge potential to be developed in this country as an alternative energy resource. In order to fulfil and meet the increasing demand, land administration must be equipped with comprehensive, relevant procedure and policies to support its development in the future. Land policy need to control the implementation process of the development so as to avoid conflicts with land use occupancy. As such, exploiting renewable energy sources clearly provides a new form of competition for land, which brings pressure to all territories, resulting from the need for urbanization and at the same time the preservation of forest areas, natural resources and lands with recognized agricultural features.

The implementation of renewable energy sources thus requires the formulation new land zoning, which is compatible with protecting the landscape, preserving biodiversity which can be coherently integrated within authority planning and management. The correct implementation of renewable energy sources which are planned at the local level, constitutes a key aspect in ensuring that decision making is undertaken within the principles of sustainable rural areas planning. But renewable energy sources do not only involve the problem of their allocation and the preservation of agricultural features and natural and cultural values. They are part of a comprehensive model that has to be associated with matching energy supply and demand at global scale. Here, the role that authority can play in the definition of specific strategies in order to ensure an efficient, balanced and sustainable renewable energy zoning in rural areas will therefore be crucial. As such, it is to conclude that, while the opportunity to promote renewable energy resources is recognized, it must be the case that a sustainable energy planning process is defined for rural areas, to enable this to be operationalized in an integrated manner with considerations firmly based on the municipal context. This process should be accompanied by the current regime for land use planning, so that the issue of renewable energies is regulated specifically by territorial management instruments.

Guidelines and legislation also should be supported by the use of technology to help facilitate judgment and decision making. The use of technologies such as GIS, Remote Sensing, Light and Radar (LiDAR) and satellite image should be used to help optimize land use. Ability to identify very specific locations for solar farm location can encourage future land zone for the development. It can serve as a guide to authority and investors. It can be a development control tool and can help to sustain the agriculture land rather than be converted by another use.

REFERENCES

BELFIORE F, TAYLOR T, MOISAN B, ZAPPIA M, CINARELLI E. Risks and opportunities in the operation of large solar plants. Solar Power Gen; 2013.

CARRIÓN JA, ESTRELLA AE, DOLS FA, TORO MZ, RODRÍGUEZ M, RIDAO AR. Environmental decision-support systems for evaluating the carrying capacity of land areas: optimal site selection for grid-connected photovoltaic power plants. Renew Sustain Energy Rev 2008;12:2358–80.

CHARABI Y, GASTLI A. PV site suitability analysis using GIS-based spatial fuzzy multi-criteria evaluation. Renewable Energy 2011;36:2554–61.

CHI MAN HUI E, OMAR I, ISMAIL M. Kotaka's model in land acquisition for infrastructure provision in Malaysia. J Financial Manage Property Construct 2009;14:194–207.

COZZI, L., CHEN, O., DALY, H., & KOH, A. (2018). Population without access to electricity falls below 1 billion. *IEA Blog, October, 30*.

EGGLESTON, S., BUENDIA, L., MIWA, K., NGARA, T., & TANABE, K. (Eds.). (2006). *2006 IPCC guidelines for national greenhouse gas inventories* (Vol. 5). Hayama, Japan: Institute for Global Environmental Strategies.

CALVERT, K., & MABEE, W. (2015). More solar farms or more bioenergy crops? Mapping and assessing potential land-use conflicts among renewable energy technologies in eastern Ontario, Canada. *Applied Geography*, *56*, 209–221. https://doi.org/10.1016/j.apgeog.2014.11.028

Department of Director General of Lands and Mines Circular No. 1/2003.

Energy Commission. (2017). Energy in Malaysia. *Suruhanjaya Tenaga*.

SABO, M. L., MARIUN, N., HIZAM, H., MOHD RADZI, M. A., & ZAKARIA, A. (2016). Spatial energy predictions from large-scale photovoltaic power plants located in optimal sites and connected to a smart grid in Peninsular Malaysia. *Renewable and Sustainable Energy Reviews*, *66*, 79–94. https://doi.org/10.1016/j.rser.2016.07.045

FUNABASHI T. A GIS approach for estimating optimal sites for grid-connected photovoltaic (PV) cells in Nebraska. University of Nabraska; 2011.

HASHIM, N. (2013). *Strategi Penambahbaikan Proses Pelupusan Melalui Pemberimilikan Tanah Kerajan Di Pejabat Daerah Dan Tanah Ipoh* (Doctoral dissertation, Universiti Teknologi Malaysia).

HASHIM, H., & HO, W. S. (2011). Renewable energy policies and initiatives for a sustainable energy future in Malaysia. *Renewable and Sustainable Energy Reviews*, *15*(9), 4780-4787.

HERNANDEZ R, EASTER S, MURPHY-MARISCAL M, MAESTRE F, TAVASSOLI M, ALLEN E, et al. Environmental impacts of utility-scale solar energy. Renew Sustain Energy Rev 2014;29:766–79.

INTERNATIONAL ENERGY AGENCY. Renewables in Global Energy Supply IEA, Paris (2007)

IBRAHIM, K. *Buku sumber guru: tenaga diperhabarui dan kecekapan tenaga*. Pusat Pendidikan dan Latihan Bagi Tenaga Diperbaharui dan Kecekapan Tenaga (CETREE), Universiti Sains Malaysia.

FTHENAKIS V, KIM HC. Land use and electricity generation: a life-cycle analysis. Renew Sustain Energy Rev 2009;13:1465–74.

LINDAHL, J., STOLTZ, C., OLLER-WESTERBERG, A., & BERARD, J. (2018) National Survey Report of PV Power Applications in Malaysia.

MCNABB, D. E. (2019). The population growth barrier. In *Global Pathways to Water Sustainability* (pp. 67-81). Palgrave Macmillan, Cham.

Johor Land and Mines Office Circular No. 3/2006

Johor Land Rules 1966.

KARDOONI, R., YUSOFF, S. B., & KARI, F. B. (2016). Renewable energy technology acceptance in
Peninsular Malaysia. *Energy policy*, *88*, 1-10.

National Land Code (NLC) 1965.

NILSSON, M., GRIGGS, D., & VISBECK, M. (2016). Policy: map the interactions between Sustainable Development Goals. *Nature*, *534*(7607), 320-322.

OMAR, I.,(2002). Rules Affecting the Land Development Process in Malaysia A Review on Regulation of Environmental Impact Assessment (EIA). Paper presentation at the 8th Pacific Rim Real Estate Society Conference. Lincoln University, Christchurch, New Zealand.

SABO, M. L., MARIUN, N., HIZAM, H., MOHD RADZI, M. A., & ZAKARIA, A. (2016). Spatial energy predictions from large-scale photovoltaic power plants located in optimal sites and connected to a smart grid in Peninsular Malaysia. *Renewable and Sustainable Energy Reviews*, *66*, 79–94. https://doi.org/10.1016/j.rser.2016.07.04

SEKSYEN PERUNDANGAN TANAH (2014). *Laporan Kajian Prosedur Siri 2: Pengeluaran Permit Khas Penggunaan Sementara Tanah Pertanian Bagi Maksud Yang Tidak Berkaitan Pertanian : Praktis Negeri Johor*.

ENERGY COMMISSION. Peninsula Malaysia Electricity Supply. Furuku eizo (Hatsubai); 2017.

TISZA K. GIS-based suitability modeling and multi-criteria decision analysis for utility scale solar plants in four states in the Southeast US. Clemson University; 2014.

TSOUTSOS T, FRANTZESKAKI N, GEKAS V. Environmental impacts from the solar energy technologies. Energy Policy 2005;33:289–96.

UNIT, E. P. (2015). Eleventh Malaysia plan, 2016-2020: Anchoring growth on people. *Putrajaya: Prime Minister's Department*.

UYAN M. GIS-based solar farms site selection using analytic hierarchy process (AHP) in Karapinar region, Konya/Turkey. Renewable Sustain Energy Rev 2013;28:11–7.

ZAINOL, Z. (2015). *The Impact of PV Location on Voltage Profile and Line Losses* (Doctoral dissertation, Universiti Teknologi Malaysia).

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Mohd Shahrizan Sahid graduated with a bachelor's degree in 2004 in Land Administration and Development of a Malaysian Technology University and then studied at the same degree in 2014. He has started his career as a State Administrative Officer since 2007 and has serves as the Chief Unit in the Corporate Management Unit of The Government Secretariat (SSI). In addition, he also held the role of Deputy President in the Administration of The Sovereign State, one of the state government companies. During his tenure of service, he has been directly involved in land administration and development matters as well as carrying out government property management processes.

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