PPHJ 2030

POLISI PEMBANGUNAN HIJAU JOHOR

Guidelines

Planning and Development of Renewable Energy (RE) – Solar Energy

Guidelines

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Planning and Development of Renewable Energy (RE) – Solar Energy


MAJU
JOHOR

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List of Abbreviations

AC	Alternating Current
BAKAJ	Johor Water Regulatory Body
BAPV	Building Applied Photovoltaic
BIPV	Building Integrated Photovoltaic
BPENJ	Johor State Economic Planning Division
CCTV	Closed-Circuit Television
DC	Direct Current
DOE	Department of Environment
EIA	Environmental Impact Assessment
ESA	Environmentally Sensitive Areas
ESCP	Erosion and Sediment Control Plan
FiT	Feed-in Tariff
GPP	Planning Guidelines
IWK	Indah Water Konsortium
JKR	Malaysian Public Works Department
JMG	Department of Minerals and Geoscience
JPS	Irrigation and Drainage Department
KM	Planning Permission
KMP	Full Planning Permission
KMTT	Temporary Planning Permission
LCP	Development Proposal Report
LLM	Malaysian Highway Authority
LSS	Large Scale Solar
MASMA	Malaysia Sustainable Drainage Manual
MCMC	Malaysian Communications and Multimedia Commission
MPHNJ	Johor State Green Development Council
NEM	Net Energy Metering
NLC	National Land Code
NOVA	Net Offset Virtual Aggregation
OSC	One Stop Centre
PA	Power of Attorney
PBN	State Authority
PBPT	Local Planning Authority
PBT	Local Authority
PMU	Main Intake Substation

PTD	Land and District Office
PTG	Land and Mines Office
PV	Photovoltaic
ROW	Road Widening Reserve
SAJ	Johor Water Company
SELCO	Self-Consumption
SDGs	Sustainable Development Goals
SI	Site Investigation Report
SIA	Social Impact Assessment
ST	Energy Commission
SWCorp	Solid Waste Management and Public Sanitation Corporation
TKPM	Permanent Food Production Park
TNB	Tenaga Nasional Berhad

1.0

Purpose

This guideline is developed to ensure systematic planning in the development of solar farms, aimed at securing a sustainable and high-quality future.

The guideline covers four (4) primary methods of solar energy generation:

i. Ground-mounted solar

ii. Floating solar

iii. Building-mounted solar, which includes roof-mounted and wall-mounted systems

iv. Solar accessories

2.0 Development of Solar Farms in Johor

2.1 Definitions of Solar Farms, Building Integrated Photovoltaic (BIPV), Building Applied Photovoltaic (BAPV) & Solar Accessories

This guideline defines a **Solar Farm** as:

An area designated for generating at least 1 MW or more of electricity from solar sources using photovoltaic (PV) panels installed either on land (including agrivoltaics) or floating on water for commercial purposes, connected to the grid with electricity generation capacity as approved by the Energy Commission (ST).

The definition of **Building Integrated Photovoltaic (BIPV)** is as follows:

A building specifically designed to include solar elements, rather than being retrofitted with additional solar panels, which are considered as supplementary components on an existing building.

The definition of **Building Applied Photovoltaic (BAPV)** is as follows:

A building retrofitted with solar panels as additional components on an existing building.

The definition of **Solar Accessories** is as follows:

Electrical equipment integrated with solar PV, where the energy generated by the solar PV is solely used for the equipment itself.

2.2 Land Area Categories Based on Solar Energy Capacities

The energy generation scale for solar farm development and the estimated land requirements are categorised as follows:

Table 1 *Energy generation scale for solar farm development*

Scale	Estimated Capacity	Estimated Land Area (Acres)
Small	1–5 MW	**< 25**
Medium	6 – 30 MW	**25 – 150**
Large	More than 30 MW	**> 150**

Essentially, the calculation for solar-based electricity generation estimates that an area of 5 acres (2.02 hectares) can generate approximately 1 MW of electricity. Based on the capacity offered, which exceeds 1 MW per agreement, the development of solar farms under the large scale solar (LSS) programme by the ST involves extensive land use with a supply agreement duration typically set at 21 years (with an additional 4 years). The actual land area required depends on the solar insolation rate at the site location and is subject to the quota allocated by the ST.

solar-generated electricity with an area of

5 acres

(2.02 Hectares)

can generate approximately

1 MW

2.3 Components of Solar Farm Development

There are four (4) methods of solar energy generation, including: installation of solar PV panels on the ground, floating on water, on buildings, or integrated with electrical devices such as lights. Solar panels typically come with a warranty ranging from 20 to 25 years. The components of the solar energy generation mechanism in solar farms include:

a. Photovoltaic (PV) Panels

PV panels are the main component for electricity generation in solar farms, consisting of approximately 40 solar cells. When the solar cells are combined, they form solar arrays. PV panels can be fixed-mounted or installed with tracking systems. They can also be mounted on floating structures such as pontoons, enabling them to float on water.

Source: Advanced Renewable Power Ltd. (2020); Solar Panel Mounting, United Kingdom dan Greenpowerco (2016); Sunpower, off Grid Solar Tracking System, Victoria, Australia

***Figure 1** Floating PV panels on water and ground-mounted PV installations*

b. Inverter

The inverter functions to convert the direct current (DC) electricity generated by solar cells into alternating current (AC) before being transferred to the grid system. Generally, there are two (2) types of inverters that are commonly used in solar farms: central inverters (Refer to Figure 2) or string inverters (Refer to Figure 3). String inverters are smaller in size and can be installed alongside solar arrays. Inverters are typically placed close to the solar arrays to minimise electricity loss. For PV systems on water surfaces, inverters can be installed on floating structures or on land, depending on the size and development requirements.

Source: Fotowatio Renewable Ventures (FRV) (2017); Central Inverter Solutions Power Plants, Mafraq I and Mafraq II, Jordan dan Fenaka Corporation (2017); Sungrow PV and Energy Storage Equipment Powers - 40MW floating PV power plant Maldivian Islands

Figure 2 *Central inverter for solar farms on land and on water*

Source: Cypark Resources Bhd (2019); Integrated Renewable Energy Park Pajam, Negeri Sembilan dan Group ABB (2017); The 100 kW of TRIO-50 solar inverters, Tengeh Reservoir, Singapore

Figure 3 *String inverter for solar farms on land and on water*

c. Energy Storage

Energy storage is utilised to store surplus energy generated from solar PV (Refer to Figure 4). This allows the stored energy to be used during periods of high energy demand or when solar radiation is low. It plays a crucial role in maintaining the stability of the electricity supply and reducing dependency on the grid.

Source: NextEra Energy Resources

Figure 4 *Energy storage for solar farms on land*

d. Transformer and Substation

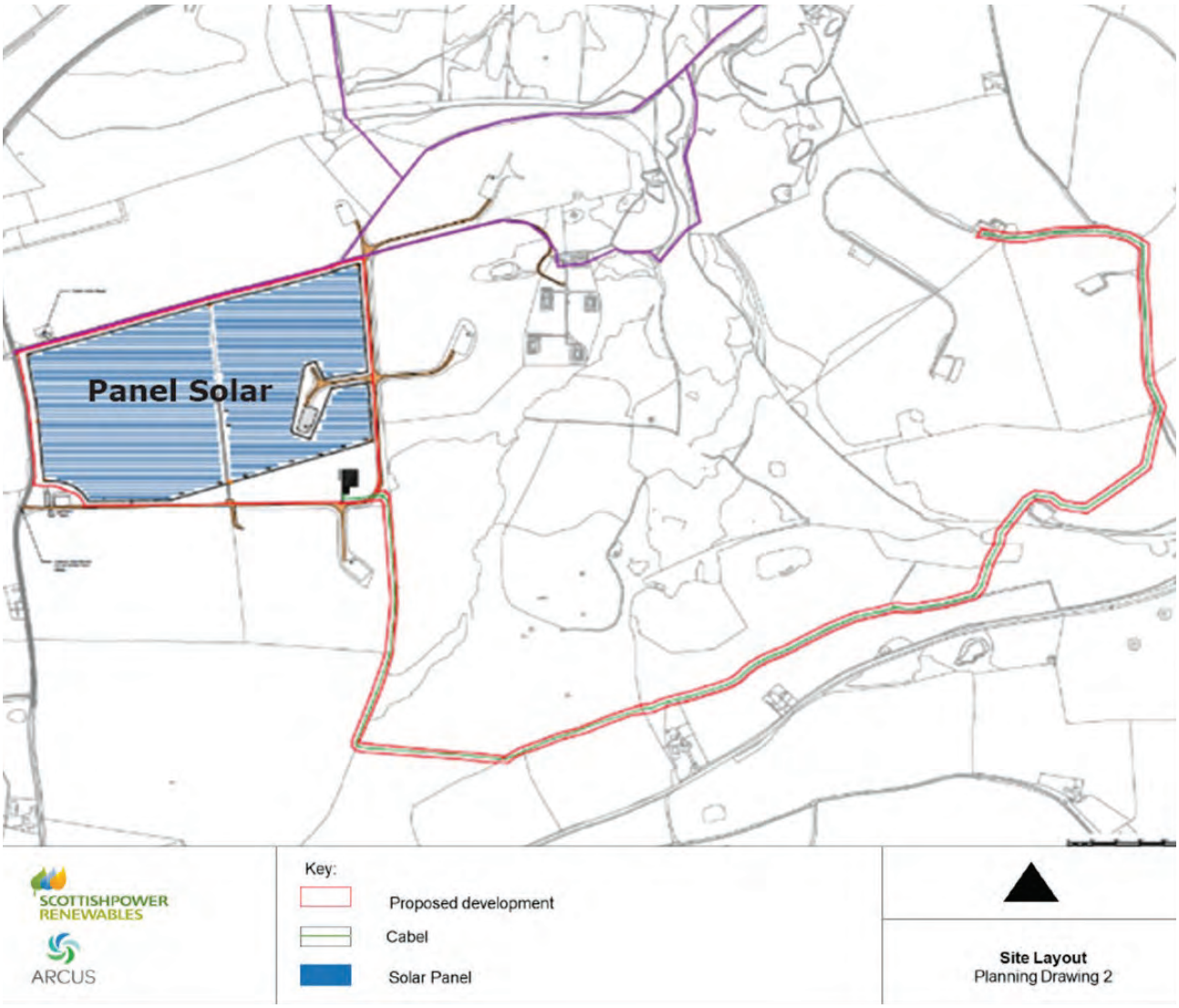
Transformers are devices designed to increase or decrease alternating current voltage. Meanwhile, substations in solar farms function to regulate, protect, and isolate electrical currents, serving as critical components in the electricity distribution system to the grid. The placement of transformers and substations is typically located close to the connection and energy distribution points to the grid (Refer to Figure 5).

Source: Daelim Belefic; Gading Kencana Sdn. Bhd. (2018); Kompleks Hijau Solar Bidor,Perak dan G8 Subsea (2020); World First Floating Solar Offshore Substation Platform,Singapore

Figure 5 *Transformer and substation for solar farms on land and on water*

e. Electric Cables and Grid

The electricity generated by solar farms is transmitted to the grid via a network of electric cables connecting the solar farm to the nearest Main Intake Substation (PMU). This connection process involves the use of electrical cable routes, which may include the construction of poles or underground cable pathways (Refer to Figure 6).



Source: Cornwall Council (2020); Solar Panel and Planning Permission.

***Figure 6** Example of a solar farm development plan showing the route of electrical cabels to the grid infrastructure (red line)*

The construction of a solar farm also involves the development of building structures for management purposes, such as office space, security control center, and other basic facilities for on-site workers (Refer to Figure 7).

Source: Gading Kencana Sdn. Bhd. (2018); Kompleks Hijau Solar Bidor, Perak

***Figure 7** Supporting Building at LSS Bidor*

g. Floating Structure, Anchoring and Mooring System for Solar PV on Water

These components are specifically designed for the implementation of solar farms on water surfaces. It involves the construction of a platform to float the solar arrays using pontoons, along with an anchoring or mooring system to ensure the structural stability of the platform on the water surface. Solar platforms can be secured to the banks (bank anchoring), the seabed (bottom anchoring), or a combination of both. The selection of a suitable system depends on factors such as location, bathymetry, soil structure, and changes in water level.

2.4 Solar Energy Generation and Distribution Methods

Source: SPG Solar Inc. (2010); Anchoring and mooring system, Far Niente Winery,Oakville, California

***Figure 8** Illustration of Bottom Anchoring System (left) and Actual Image of Bank Anchoring System (right)*

By definition, a solar farm generates at least 1 MW of electricity to be connected to the grid. The electricity generated will be converted from DC to AC before being transmitted to the grid. The grid will then distribute the generated energy to end users (Refer to Figure 9). A storage system is not mandatory if all the generated energy is supplies directly into the grid. However, in cases of excess solar energy production, an energy storage system can be employed to store the surplus energy, which can then be utilized during periods of low solar radiation.

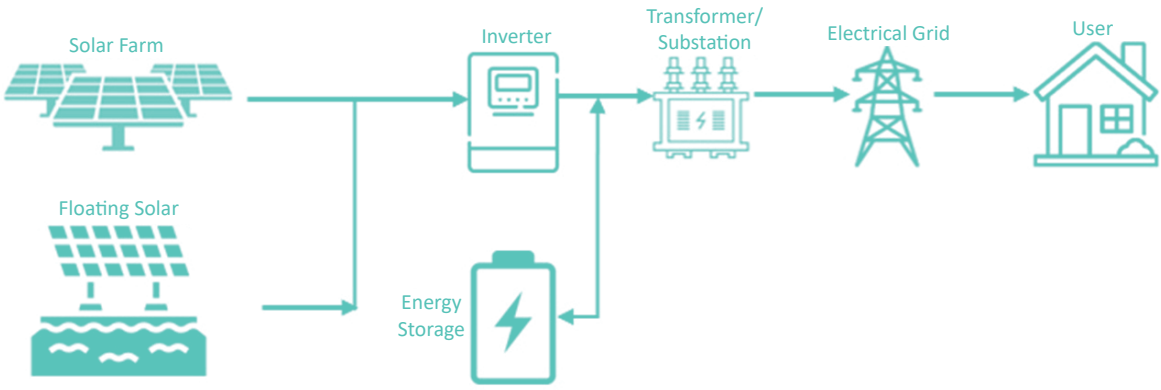


Figure 9 *Solar energy generation and distribution for ground-mounted and floating solar farms*

The generation and distribution of solar energy for building-integrated/applied solar PV systems begins with the converstion of the generated energy from DC to AC, and used by electrical equipment within the building (Self-Consumption, SELCO). If there is surplus solar energy, under the Net Energy Metering (NEM) scheme, the excess energy can be supplied to the grid. Alternatively, the solar energy can be stored in an energy storage system for later use during periods of low solar radiation.

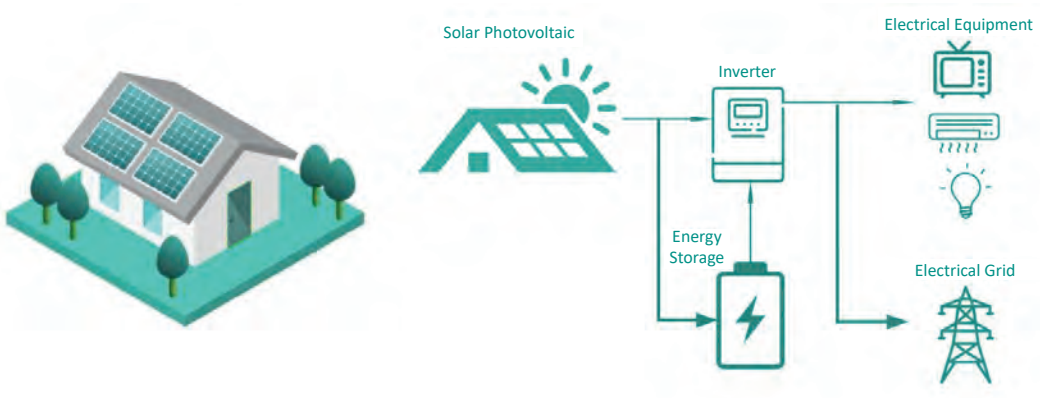


Figure 10 *Solar energy generation and distribution for buildings*

3.0 Legal Provisions and Policies

The development of solar farms must comply with the requirements outlined in development plans, policies, or guidelines such as:

National Land Code (Amendment 2020) (Act 828);

Town and Country Planning Act 1976 (Act 172);

Local Government Act 1976 (Act 171);

Renewable Energy Act 2011 (Act 725);

Uniform Building By-Laws 1984;

Environmental Quality (Prescribed Activities) (Environmental Impact Assessment) Order 1987;

Planning Guidelines (GPP) for the Conservation and Development of Environmentally Sensitive Areas (ESA);

Planning Guidelines (GPP) for the Identification and Redevelopment of Brownfield Areas;

Planning Guidelines (GPP) for Development in Hill and Highland Areas;

Sustainable Development Goals (SDGs); and

Relevant and current laws and regulations.

4.0 Scope of the Guidelines

These guidelines focus on the planning of solar farms under the LSS programme by the ST, whether established on land or as floating solar farms on water. The generation of solar energy through building-integrated/applied systems or other methods under the SELCO and NEM programmes is also subject to the application of these guidelines.

In general, the scope of these guidelines encompasses the following aspects:

a. General Guidelines

- Criteria for Environmental and Social Impact
- Criteria for Safety Components
- Criteria for Glare and Reflection
- Criteria for Landscape Elements
- Monitoring, Maintenance, and Modifications
- Decommissioning

b. Specific Guidelines

- Planning of Solar Farm Sites on Land
- Planning of Solar Farm Sites on Water
- Building Integrated Photovoltaic (BIPV)
- Building Applied Photovoltaic (BAPV)
- Solar Accessories

c. Mechanism for Implementation of Development

- Flowchart of Development Applications

5.0 Planning and Development Guidelines for Solar Farms

5.1 General Guidelines

These general guidelines can be apply to the planning and development of both land-based and water-based solar farms, depending on the suitability.

5.1.1 Criteria for Environmental and Social Impact

The development of solar farms is a non-polluting activity. However, its environmental impact, though minimal, arises primarily from large-scale land clearing and the floating of structures on water surfaces. Solar farm development affects flora and fauna, particularly in rural areas, and carries the risk of reduced land productivity for agriculture. Hence, specific mitigation measures are required to ensure sustainable solar farm development. Applications for solar farm development must consider the impact on water bodies and aquatic ecosystems affected by these activities.

The following aspects must be addressed to minimise the environmental impact of solar farm development:

1. Solar farm activities are categorised as industrial activities for renewable energy generation and the preparation of the Environmental Impact Assessment Report is subject to the requirements of the Department of Environment under the Environmental Quality (Prescribed Activities) (Environmental Impact Assessment) Order 2015;

2. Solar farm development is not subject to the requirements for preparing a Social Impact Assessment (SIA) Report under Section A. However, solar farm development under Section B of the SIA depends on the stipulations of the State Authority or Local Authority;

3. For developments not subject to the preparation of Environmental Impact Assesment (EIA) and SIA Reports, the environmental and social impacts must be detailed in the Development Proposal Report (LCP).

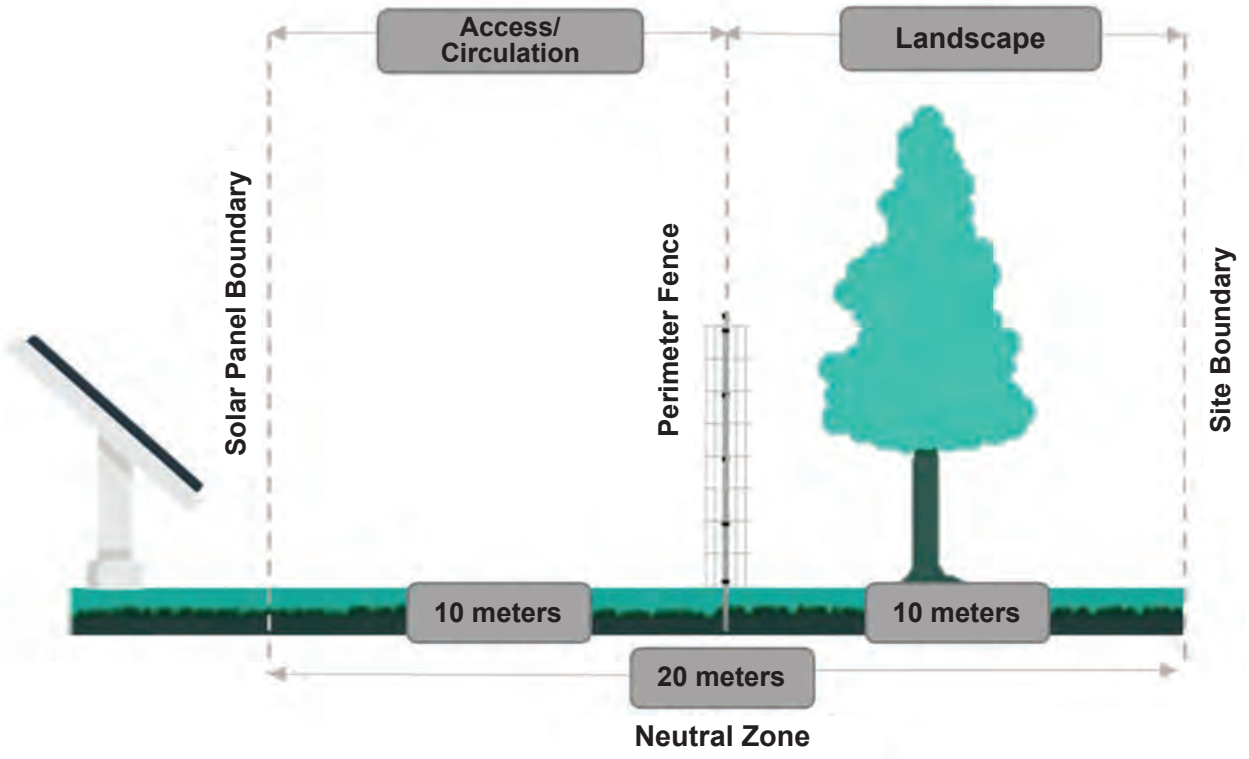
4. Site clearing and earthworks should be minimal to ensure the site's original topographic features are preserved and limited to the farm's construction, operation, and maintenance areas only.

5.1.2 Criteria for Safety Components

Safety aspects concerning crime threats and accident risks, particularly fire hazards, must be considered in the design of a solar farm. The following is a list of safety components that must be installed at solar farm sites.

Table 2 *Safety component criteria for solar farms on land*

Safety Component	Description
Closed-Circuit Television (CCTV)	Enhances security and monitoring of the solar farm. Can be supported by providing of a security control room.
Perimeter Security Fencing for Solar Farms on Water Surfaces	Constructed with a height of 2 metres around the site or floating barrier. Protects solar farm assets from theft and intrusion risks. Encouraged to be integrated with landscape planting to minimise visual impact (landscape screening) while serving as an additional security layer.
Perimeter Security Fencing and Neutral Zone with Landscaping	Constructed when the solar farm is adjacent to/next to/ bordering low-intensity land use areas (e.g., agriculture, forest, or water bodies). Must have a width of 20 metres or as determined by local planning authorities, considering local conditions (Refer to Figure 11).
Warning Signs	Placed at entry points, around the security fence, and at high-risk areas. Inform the public of potential electrical hazards.



Source: Study of Planning and Development Guidelines for Solar Farms (2020)

***Figure 11** Width of Perimeter Safety Fencing and Neutral Zone*

5.1.3 Criteria for Glint and Glare Impact

To ensure that reflected light and glare from solar panels do not impact aviation operations;

a. All LSS farm developments must conduct a glint and glare impact assessment if the site is near an aerodrome or aviation infrastructure.

b. Land-based solar farms and building-integrated/applied solar generation sites should ideally be located at least 10 km from airports.

c. Encourage the use of non-reflective structural finishes and non-reflective solar panel frames to reduce glint and glare impacts from solar farms located within aerodrome zones.

d. Implement landscape screening using appropriately tall trees.

5.1.4 Criteria for Landscape Elements

To minimise negative visual impacts from large-scale land-based solar farm developments, mitigation measures must be considered at the early stages of construction:

a. Incorporate soft landscape elements within the neutral zone surrounding the site boundary to minimize visual impact on the surrounding areas.

b. The selection of plants for screening purposes should have sufficient height, width, and leaves density upon maturity to obstruct the view into the solar farm area.

c. Tree planting must begin early in the construction phase. Regular maintenance must be performed to ensure that tree height does not obstruct the operational efficiency of solar arrays due to shading effects.

5.1.5 Monitoring, Maintenance, and Modifications

a. Solar farm sites must be monitored and maintained by the project developer to ensure all infrastructure, device, and equipment function safely and efficiently without environmental harm. Maintenance includes:
    - PV Panels
    - Inverters
    - Energy Storage Systems
    - Transformers and Substations
    - Electrical Cables and Grid Connections
    - Supporting Buildings
    - Floating Structures, Anchoring and Mooring Systems for Water-Based Solar PV Installations.

b. Developers must submit an annual report on the amount of solar energy generated to the Special Solar Committee under Johor Economic Planning Division (BPENJ) for Johor Government monitoring purposes.

c. Should there be any proposed modifications involving an increase in the capacity of the approved solar energy generation system, the developer shall resubmit an application to the Local Authority (PBT) for endorsement and approval.

5.1.6 Decommissioning

a. Project developers must prepare a Decommissioning Plan and submit it to PBT during the planning application phase.

   Decommissioning works include:

   i. Restoring the land to its original condition, including disconnecting (unplugging) any connections of the solar farm from the national grid.

   ii. Removing components, equipment, and physical structures of the solar energy system, internal transmission cables, temporary access routes, perimeter fencing, and other related elements.

   iii. Disposing of solid waste and hazardous waste. The management of scheduled waste generated from solar farm activities must comply with the Scheduled Waste Regulations 2005, and solid waste must be disposed of in accordance with the methods prescribed by the National Solid Waste Management Department and related legislation.

   iv. Conducting soil stabilisation or re-vegetation works. PBT may impose conditions on the developer to carry out remedial works through landscaping.

b. The developer is required to remove all system components and equipment on-site within a period not exceeding three months from the date operations are ceased or terminated. All decommissioning costs, whether due to the expiry of licensing, project termination, or abandonment, must be borne by the developer.

c. PBT must include a clause in the planning approval conditions granting PBT the right to access any solar farm project site if the developer fails to remove the components and equipments within three months of the cessation date. Enforcement action under the provisions of Act 172 will be taken against any developer or landowner who constructs without approval or violates the planning approval conditions.

d. Any site left non-operational for more than a year without notification and consent from PBT is categorised as an abandoned project.

5.2 Specific Guidelines

These specific guidelines provide detailed instructions for the planning and development of solar energy projects, including:

i. Planning of Solar Farm Sites on Land
ii. Planning of Solar Farm Sites on Water
iii. Building-Integrated/Applied Photovoltaic – BIPV/BAPV
iv. Solar Accessories

5.2.1 Planning of Solar Farm Sites on Land

Table 3 *Site criteria for solar farms on land*

Land Use Zones	Site Criteria		Notes
	Allowed	Not Allowed	

Industrial and Agricultural	• Industrial Areas.
	• Non-productive agricultural land (classified as Class 3, 4, and 5 by the Department of Agriculture).
	• Greenfield areas.
	• Brownfield areas:
	  • Former mines/ quarries.
	  • Former solid waste disposal sites.
	  • Former factory/ business sites.
		• Residential Areas.
		• Urban Centres.
		• Agricultural land of Class 1 and 2, as classified by the Department of Agriculture.
		• Permanent Food Production Park (TKPM) Areas.
		• Areas with aesthetic or historical value.
		• Environmentally Sensitive Areas (ESA) Level 1.
			Proposed sites are encouraged to be within a 5-kilometer radius of grid connection infrastructure to improve economic value.
			
			The minimum area for LSS solar farm sites must support a generation capacity of at least 1 MW.

Notes:

1. Agricultural Land Classes:

Class 1 Land with no or minimal obstacles to crop growth.

Class 2 Land with one or more moderate obstacles to crop growth.

Class 3 Land with one serious obstacle to crop growth.

Class 4 Land with more than one serious obstacle to crop growth (e.g., hill terrain or peat soil).

Class 5	Land with at least one very serious obstacle to crop growth (generally suitable for forestry).

2. ESA Level 1 refers to the 4th National Physical Plan.
    - Existing gazetted terrestrial and marine protected areas.
    - Permanent Reserved Forests (Production Class).
    - Forest plantation zones within Permanent Reserved Forests (Production Class).
    - Areas with biodiversity importance but not gazetted as protected areas.
    - Areas exceeding 1000 meters in elevation.

3. The definition of a greenfield area refers to a newly explored location that has not yet been developed.

4. The definition of a brownfield area refers to a site that was previously used for industrial or commercial purposes, which may or may not be contaminated, but holds potential for redevelopment after undergoing cleaning or restoration.

a. Accessibility Level

Accessibility aspects must be considered in the development, although traffic flow generated is not as high as industrial or commercial activities.

Considerations include:

i. Solar farm sites must have entrance and exit roads with a minimum width of 40 feet;
ii. The access hierarchy of a solar farm is classified as internal roads or local roads and does not require road reserve handover to the government;
iii. If the proposed site faces an existing road reserve, an appropriate road widening reserve (ROW) must be provided. However, slip roads are exempted.
iv. Development must not block or obstruct legal public rights-of-way, such as easements under Section 282 of the National Land Code (NLC) or village roads. If development crosses existing pathways, replacement routes must be provided by the project proponent; and
v. Internal road circulation, particularly for solar farm development on agricultural land, should be temporary to preserve the original condition of the land.

b. Topographic and Hydrological Features

Solar farms are best developed on sites with flat and gently sloping topography to maximize sunlight absorption. Slopes exceeding 10 degrees are not suitable for such developments.

The natural hydrological aspects of the site and surrounding areas, particularly existing drainage systems such as streams or ditches, must be preserved in their original state. The drainage system design should comply with the Malaysia Sustainable Drainage Manual (MASMA) established by Irrigation and Drainage Department (JPS). Suitable vegetation should be planted within the solar farm area to minimize surface runoff, reduce the risk of erosion, and enhance water infiltration.

c. Development Setbacks/Neutral Zone

Development setbacks are referred to as Neutral Zones, with a minimum width of 20 meters (66 feet) from the site boundary which consists of an internal circulation area (10 meters) and a landscaped area (10 meters) (Figure 11). It aims to mitigate the impacts of development activities, particularly heat, noise pollution, and visual disturbances.

d. Relevant Guidelines

Developers may refer to the guidelines for LSS installation and generation developed by ST as follows:

- Guidelines on Large Scale Solar Photovoltaic Plant for Connection to Electricity Networks.
- Renewable Energy Guideline on Solar Photovoltaic (Large) Project Development in Malaysia.
- Guide for Cross-Border Electricity Sales.

5.2.2 Planning of Solar Farm Sites on Water

a. Site Selection Criteria

Proposed sites for floating solar farms are only permitted on the following water bodies:

Table 4 *Site criteria for solar farms on water*

Land Use Zones	Site Criteria		Notes
	Allowed	Not Allowed	
Water Body	• Artificial lakes. • Abandoned lakes. • Disused mining ponds or water retention ponds that are stagnant or not connected to rivers or raw water supply sources. • Coastal/marine areas (within 3 nautical miles from the coastline). • Drinking water supply dams.** • Agricultural irrigation dams.**	• Residential areas. • Environmentally Sensitive Areas (ESA).* • Recreational lake areas. • Areas designated as 'areas of scenic beauty'.	These developments are subject to ESA, floodplains, wetlands, disused mines, lakes, and rivers. The use of hydroelectric dams is subject to approval from Tenaga Nasional Berhad (TNB) and the State Government. The utilisation of water surfaces is subject to the consideration of the respective state water regulatory body.

Notes:

*The specified ESA are:

- Coastal ESA
- Water catchment and groundwater source ESA

** Approval is required from the responsible agency, accompanied by supporting documents such as an EIA report (including National Security Council approval).

Permissions and Conditions for Floating Solar Farms:

- Proposed sites for floating LSS farms on water bodies located on privately owned land (subject to agreements with the landowner) must obtain written approval from BAKAJ as the Water Regulatory Body in Johor. Meanwhile, proposed sites for floating LSS farms on water bodies situated on government land must obtain written approval from BAKAJ, Johor Water Company (SAJ), and Land and Mines Office (PTG).
- LSS site selection must ensure that the usage limit of water body surface allowed does not exceed 60% of the total surface area and is subject to BAKAJ's evaluation of the suitability of the PV panel structure placement on the water body surface.

b. Accessibility Standards

Accessibility aspects must be considered even though these developments do not generate high traffic like industrial and commercial activities. The following aspects must be considered:

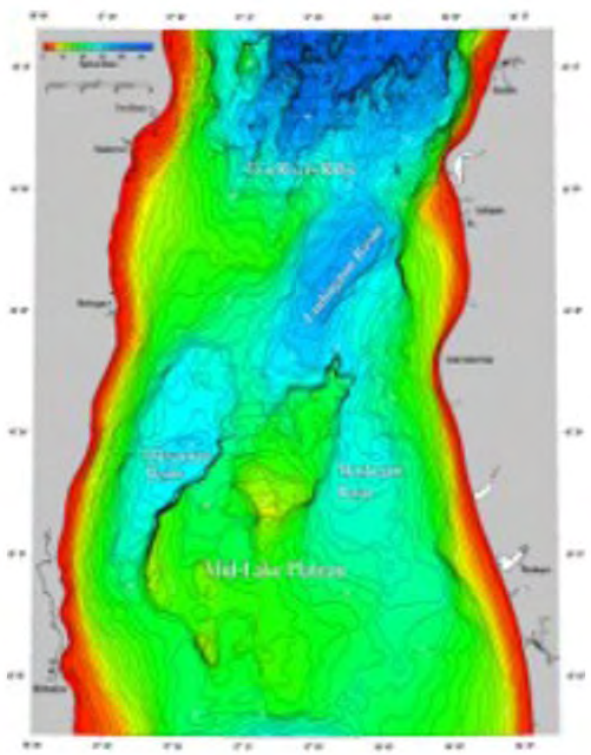
- Land-based accessibility must include entry and exit roads with a minimum width of 40 feet.
- Suitable access to the floating structure must be provided either by boat or via a floating walkway, designed to be sturdy and safe (Figure 12).
- Land-based access is classified as internal or local roads, and road reserves are not required to be surrendered to the government.

Source: PV Magazine (2023); Malaysia launches 30 MW solar tender

***Figure 12** Floating walkways for floating solar farms*

c. Topography, Hydrology, and Bathymetry Characteristics

Studies for determining boundaries, depth, substrate features of water bodies, sedimentation, bank structures, and hydrological characteristics, particularly variations in water levels through bathymetric measurements, should be conducted to ensure maximum site suitability for floating solar farm development. Water bodies with regular shapes, minimal wave activity, and no shading interference from surrounding topography are more suitable for floating solar development (Refer to Figure 13).



Source: US Department of Commerce National Oceanic & Atmospheric Administration National Environmental Satellite Data and Information Service (2019); Lake Michigan

Source: Solarvest Holdings Berhad (2019); Floating Solar Power Project with 13 MW Capacity, Sepang, Selangor.

***Figure 13** Bathymetric plan (top) and development of a floating solar farm on a uni-form-shaped former mining lake in Sepang, Selangor (bottom)*

d. List of Relevant Guidelines

Developers may refer to the following guidelines issued by the ST for LSS energy generation and installation:

- *Guidelines on Large Scale Solar Photovoltaic Plant For Connection To Electricity Networks.*
- *Renewable Energy Guideline on Solar Photovoltaic (Large) Project Development in Malaysia.*
- *Guide For Cross-Border Electricity Sales.*

5.2.3 *Building Integrated/Applied Photovoltaic – BIPV/BAPV*

a. Site Selection Criteria

Proposed sites for Building Integrated Photovoltaic (BIPV) installations must meet the following requirements:

***Table 5** Site criteria for Building Integrated Photovoltaic (BIPV)*

Land Use Zones	Site Criteria		Notes
	Allowed	Not Allowed	
Installation of solar panels on building roofs (roof-mounted) and walls (wall-mounted).	• Installation of solar accessories on rooftops or walls of buildings, whether residential, commercial, industrial, institutional, or community facilities.	• Heritage Buildings - Heritage Zones as identified in the Local Plan • Specifically, walls/ rooftops facing the street. • Installation of solar panels that disrupt the aesthetic value of the building façade and surrounding image.	Need to obtain approval for the Building Plan/ Minor Permit and other requirements from the PBT and relevant agencies. Permission from the building owner is required if it involves a private building.

b. Structural Safety

- Ensure the roof or wall structure can support the load of the installed solar panels (Refer to Figure 14). Inspection by a structural engineer is required.
- Consider wind strength and direction when determining panel placement.
- Install a waterproof layer during the solar panel installation.

Source: Solarvest (2020); Alor Setar Kedah

***Figure 14** Building Integrated/Applied Photovoltaic – BIPV/BAPV*

c. Design

- Solar panel placement must be suitable to maximize sunlight generation.
- Solar panel installation must not exceed the highest point of the building's roof or the edge of the roof (Refer to Figure 15).
- Installation should harmonize with the aesthetics of the building and surrounding environment.
- Solar panels must be removed from the structure when no longer in use.

Source: Solarvest (2020); Alor Setar Kedah dan PLUS (2019); Rehat dan Rawat Machap, Johor

***Figure 15** Example of PV installed following design and not exceeding the highest or edge of the building roof*

d. List of Relevant Guidelines

Developers may refer to the guidelines for solar energy installation and generation integrated with buildings, as developed by ST, including:

- *Guideline For Solar Photovoltaic Installation on Net Energy Metering Scheme.*
- *Guidelines for Solar Photovoltaic Installation Under Net Offset Virtual Aggregation (NOVA) Programme For Peninsular Malaysia.*

- *Guideline for Solar Photovoltaic Installation Under the Programme Of NEM Rakyat And NEM GoMEn In Peninsular Malaysia.*
- *Guidelines on the Connection of Solar Photovoltaic Installation for Self-Consumption*

5.2.4 Solar Accessories

The use of solar-based accessories is an initiative that PBT can implement to save on electricity costs and reduce environmental pollution caused by carbon emissions. Examples of solar-powered accessories that can be implemented in landscape furniture and streets include:

- Solar-powered streetlights
- Solar-powered traffic/emergency signal controls
- Solar-powered CCTV controls
- Solar trees (for charging purposes)
- Solar-powered emergency telephones

a. Solar Criteria for Installing Solar Accessories

The installation of solar accessories on land and building structures must comply with the requirements and details outlined below:

***Table 6** Installation criteria for solar accessories*

Solar Accessories Installation	Site Criteria		Notes
	Allowed	Not Allowed	
On Land	• Residential, commercial, industrial, institutional, and public facilities land. • Open spaces • Pedestrian pathways • Road reserves	• Locations obstructing pathways and visibility	• Subject to requirements from Land and District Office (PTD) and PBT • Must obtain permission from the landowner if involving private land.
On Building Structures	• Building structures, including residential, commercial, industrial, institutional, and public facilities.	• Heritage building	• Subject to PBT requirements • Must obtain permission from the building owner if involving private buildings.

6.0 Mechanism for Development Applications

Figure 16 illustrates the process flow for applying solar farm development on land. Meanwhile, Figure 17 shows the application process for development on lakes and seas.

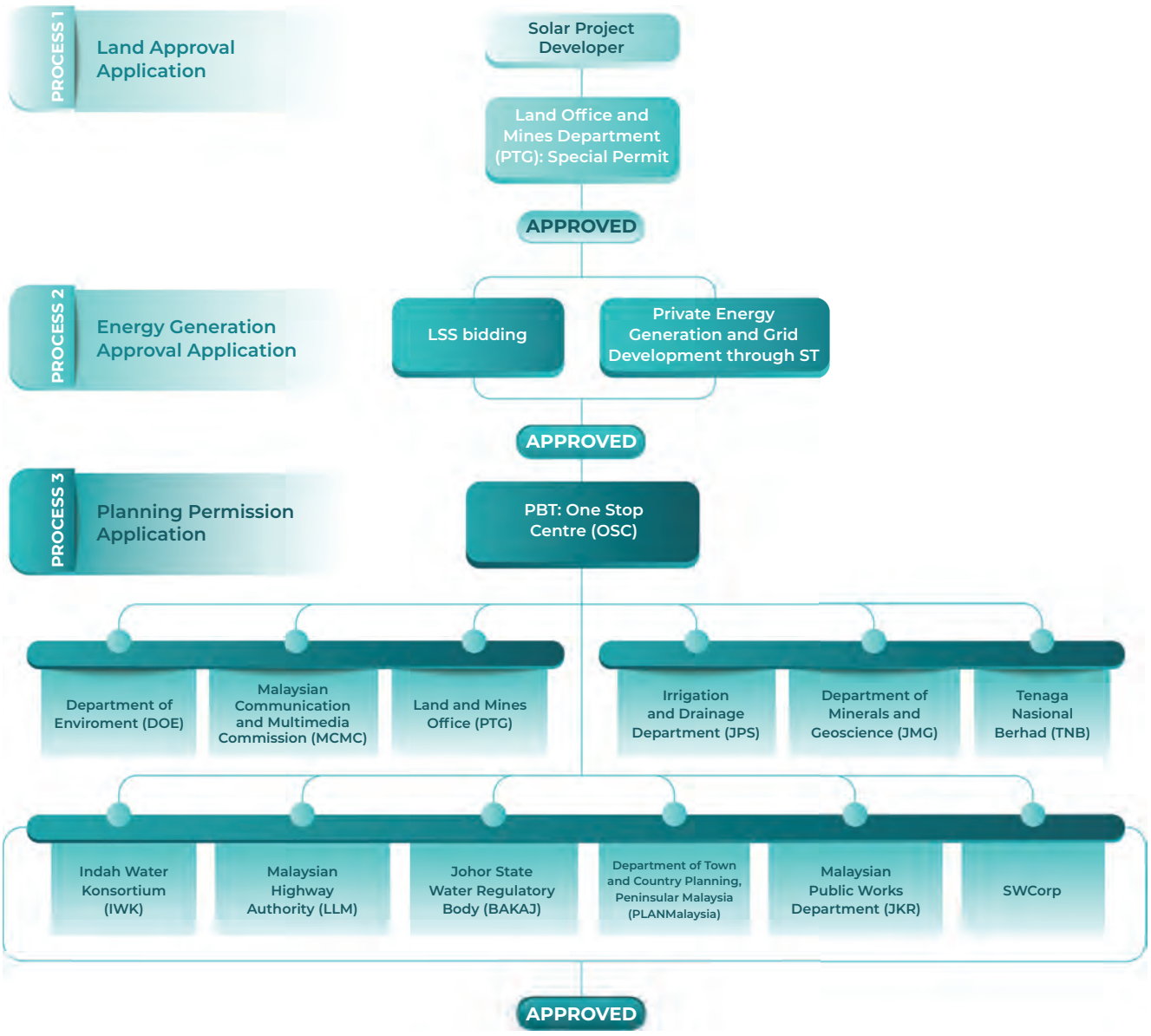


Figure 16 *Flowchart for solar farm on land development applications*

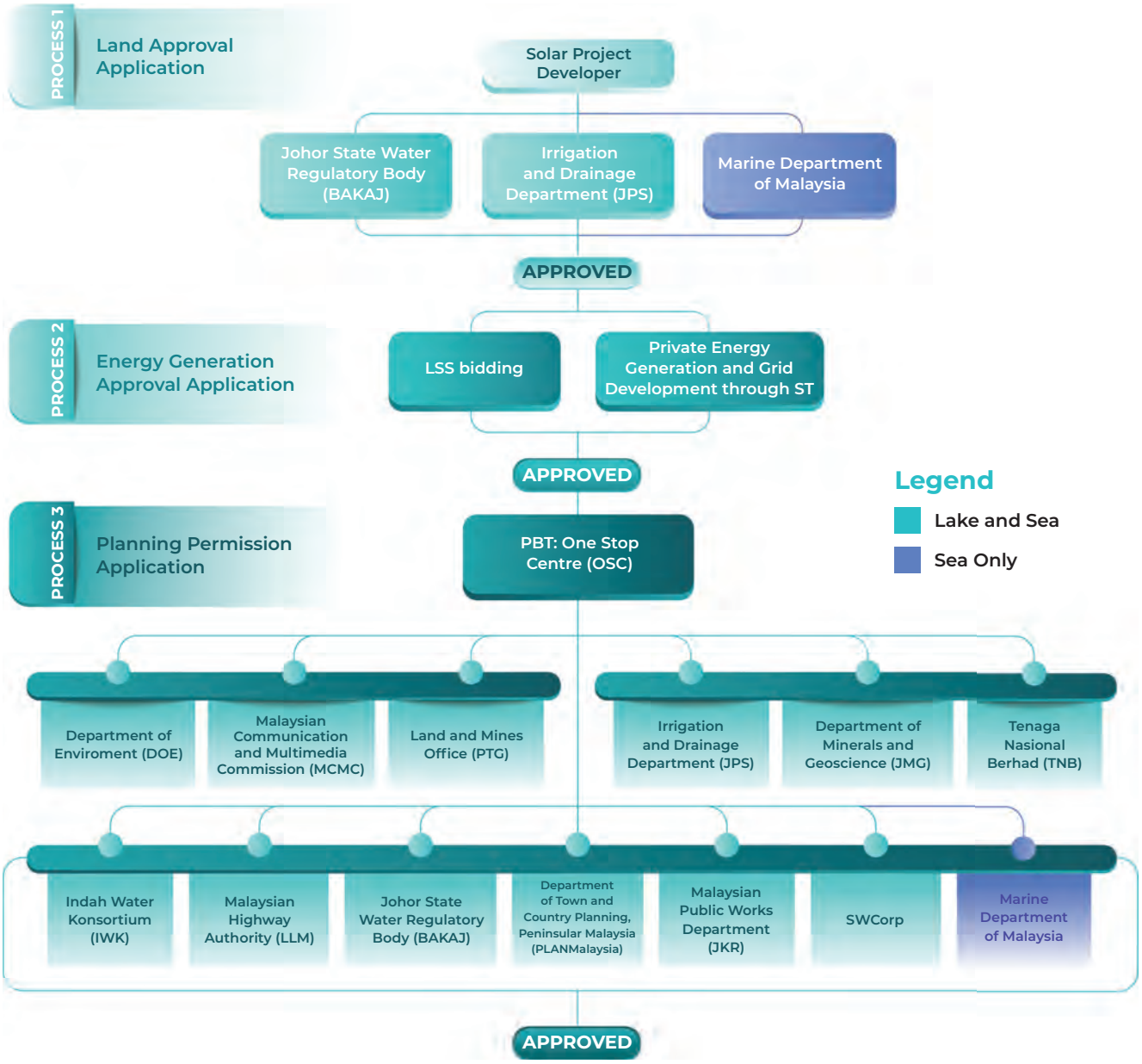


Figure 17 *Flowchart for solar farm on lakes and seas development applications*

As illustrated in Figures 16 and 17, the implementation processes for developing solar farms on land, lakes, and seas begin with the following steps:

a. **Application for Land Approval:** Applications for land approval must be submitted to the relevant agencies as follows:
   i. Solar farms on land: Approval must be obtained from PTG. For solar farm developments on agricultural land, a special permit from PTG is required for development approval.
   ii. Solar farms on lakes: Approval must be obtained from BAKAJ and JPS.
   iii. Solar farms on seas: Approval must be obtained from BAKAJ, JPS, and the Marine Department of Malaysia.

b. **Application for Energy Generation Approval:** Developers must obtain energy generation approval from TNB/ST for bidding purposes. For energy generation and private grid development, only approval from ST is required.

c. **Application for Planning Permission:** Project developers must submit a planning permission application to the One-Stop Centre (OSC) under PBT. The OSC will process the application and review all submitted documents to ensure the project complies with the regulations and requirements of thirteen (13) agencies.

The technical agencies involved are:

a. Department of Environment (DOE)
b. Malaysian Communications and Multimedia Commission (MCMC)
c. State Land and Mines Office (PTG)
d. Irrigation and Drainage Department (JPS)
e. Department of Minerals and Geoscience (JMG)
f. Tenaga Nasional Berhad (TNB)
g. Indah Water Konsortium (IWK)
h. Malaysian Highway Authority (LLM)
i. State Water Authority (BPAN)
j. PLANMalaysia@Johor
k. Malaysian Public Works Department (JKR)
l. SWCorp
m. Marine Department of Malaysia (for sea-based solar farms)

There are two types of planning permission (KM) which are Temporary Planning Permission (KMTT) which refers to temporary developments with a specific time frame and Full Planning Permission (KMP) which refers to permanent developments. If the project meets all conditions and regulations outlined by the agencies, the OSC will approve the application. Once approval is granted, the project developer can commence the solar farm development. The PBT will monitor and oversee the project to ensure compliance with the conditions:

a. Relevant Plans:

i. **Layout Plan:** The document clearly outlines the proposed solar development, including components of the project, arrangement of solar panels, underground utility networks, an inset plan showing the proposed site in the macro context (including cable routes), cross-sectional plans of the panel structure's inclination, and drainage plans.

ii. **Temporary Building Permit Plan/Building Plan:** If the obtained Planning Permission (KM) is a Temporary Limited Planning Permission (KMTT), any building structure on the land must obtain approval for a Temporary Building Permit Plan. Applications applied for Full Planning Permission, will required a Building Plan must be prepared.

iii. **Engineering Plan:** This document contains the technical plans for the implementation of the project, including details on the installation of solar panels, electrical distribution systems, and other infrastructure, such as: earthworks plan; road and drainage plan.

iv. **Landscape Plan** is provided if Full Planning Permission is obtained.

v. **General Mitigation Plan:** Large-scale and floating solar developments must provide an EIA report (subject to Department of Environment or State Authority - PBN requirements).

vi. **Erosion and Sediment Control Plan (ESCP)** must comply with MASMA guidelines.

vii. **Emergency Management Plan** to detail actions for handling disaster incidents and intrusions.

viii. **Decommissioning Plan:** Includes land restoration work to its original state, unplugging solar panels from the National Grid, and site clean-up.

b. Supporting Reports:

i. **EIA Report:** Subject to Department of Environment (DOE) or PBT requirements.

ii. **SIA Report:** Subject to PLANMalaysia requirements.

iii. **Development Proposal Report (LCP)**

iv. **Site Investigation Report (SI):** Prepared based on JMG and PBT conditions.

v. **Evaluation Report:** Includes Glint and Glare Assessments depending on the location, particularly near aerodromes, or as required by the Civil Aviation Authority of Malaysia.

The list of required documents for applications is detailed in Table 7.

***Table 7** Required documents for application*

Document	
1.	• Official application letter from the applicant (project developer).
2.	• Copy of the appointment letter as a consultant.
3.	• Copy of the land grant/title.
4.	• Copy of the latest Official Search Certificate (valid for six months).
5.	• If the applicant is not the landowner: Letter of Undertaking (between the applicant and landowner)/copy of site lease agreement/Power of Attorney (PA)–PA must be registered with the High Court/Land Office.
6.	• The Proposed Solar Farm Layout Plan, which includes the Key Plan and Location Plan, as well as the access road to the site, confirmed by the owner/administrator of the route (provided in full colour with a minimum size of A3, depending on the clarity and scale of the development).
7.	• CD containing soft copies of: i. Application information/documents 1–6. ii. Photos of the site and surrounding area. iii. Other relevant documents.
8.	• Other documents as determined by the Johor State Solar Farm Special Committee.

Figure 18 shows the flowchart for modification applications for rooftop solar PV installations. Applicants must obtain approval from TNB under the NEM or SELCO programme. BPENJ will obtain data on the installed solar PV capacity in Johor from TNB. The required documents for the application can be referred in the NEM guidelines.

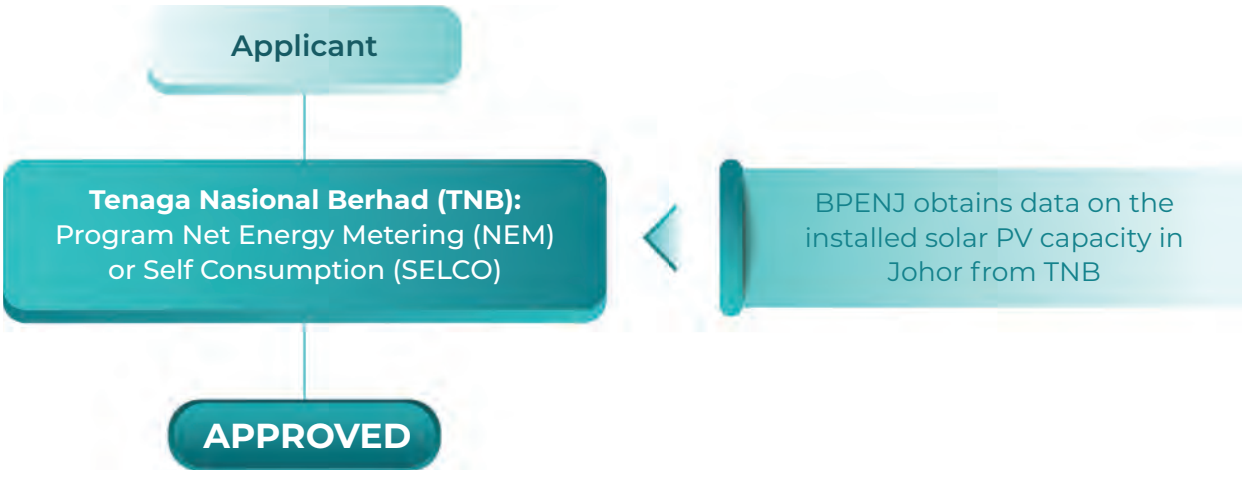


***Figure 18** Flowchart for modification application for roof-mounted solar PV installations*

6.1 Land Use Categories

The development of solar farms on land in the State of Johor is subject to the Circular of the Director of Land and Mines Johor and the Johor Land Rules (Amendment) 2020 (J.P.U. 49). A change in land use category is not required as the industrial and industrial-related land categories align with the permitted land types for solar farm development activities. This consideration is based on the temporary nature of solar structures.

The Circular of the Director of Land and Mines of the State of Johor will be referred to enable the issuance of a Special Permit for the Use of Agricultural Land for Non-Agricultural Purposes in processing land-related approvals for solar farm development. This special permit is granted for a limited duration, with priority given to unproductive agricultural land.

6.2 Solar Farm Development Charges and Fees

The developer is required to pay related charges, fees, and taxes for the development of the solar farm project. The developer must pay land tax and special permit fees to PTG. In addition, planning permission fees, land work fees, drain and road fees, building plan fees, and trust funds must be paid to the PBT. Developers are required to provide the following information for the feasibility study report of the proposed solar farm development project:

- Distance to the grid
- Solar intensity level
- Type of land
- Type of usage (whether for local use or export)

7.0

Application of Guidelines

These guidelines apply to all new applications and applications currently under consideration at the State Authority Level.