Solar PV – User Guide for Residential Consumers

Table of Contents

Solar PV – User Guide for Residential Consumers

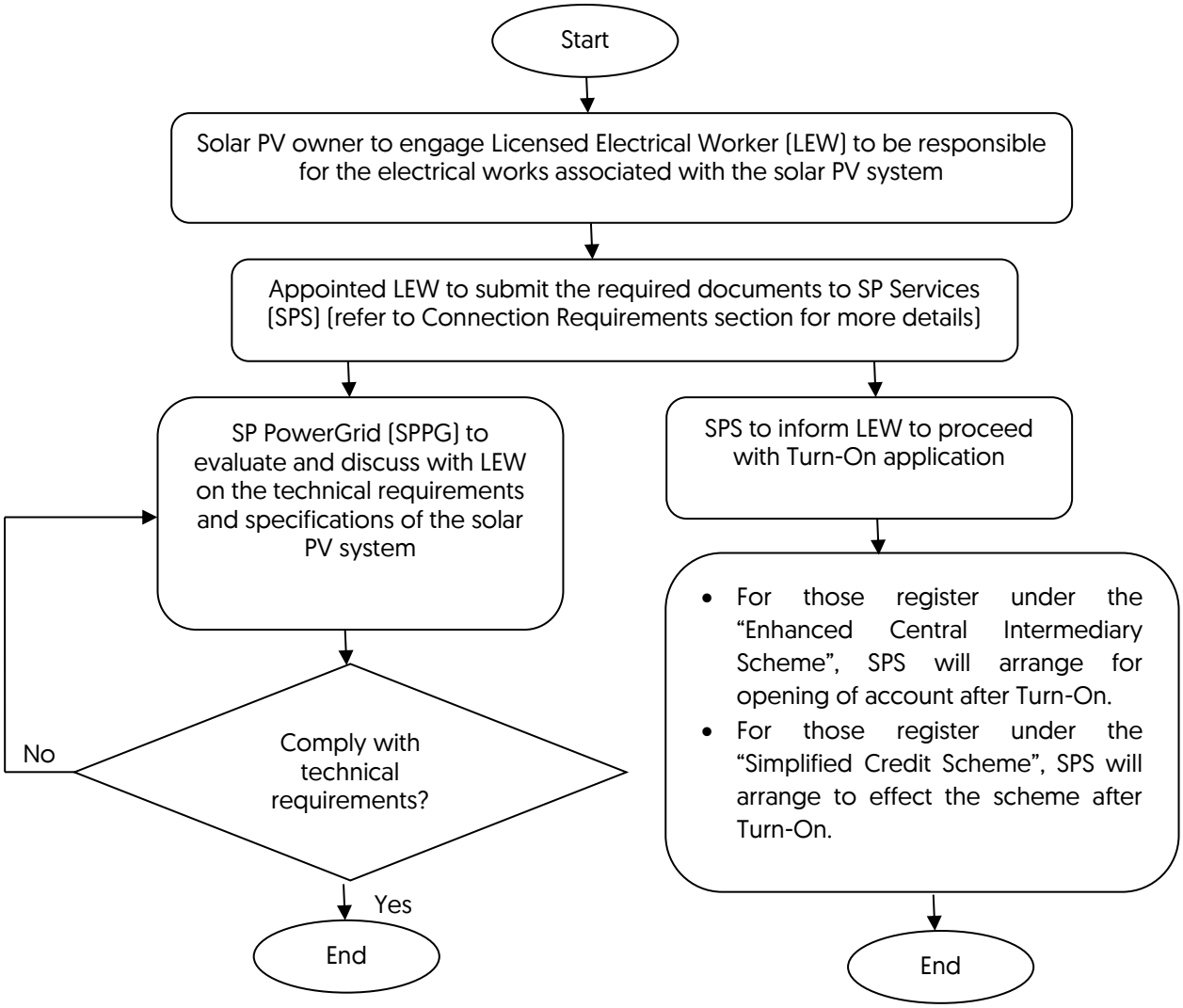
1. Introduction

This section provides information applicable for residential consumers with embedded solar PV systems (i.e. consumers who install solar PV systems on their rooftops to reduce their electricity consumption).

A brief summary of the relevant processes can be found in the flow chart below. Please refer to the following sections for more information.

For more information on the policy and regulatory framework for solar, please refer to EMA's website.

Figure 1: Overview Process for Residential Consumers with Embedded Solar PV Systems



Note: Residential consumers refer to residential consumers not under master-sub arrangement

2. Electricity Generation Licence

The electricity licensing requirements for solar PV systems will be based on the aggregate of the Alternating Current (AC) inverter capacities ("installed generation capacity") at the point of connection[1] to the grid.

Any person who engages in the generation of electricity with a solar PV system with installed generation capacity of 1 MWac or more but less than 10 MWac is required to apply to EMA for a Wholesaler (Generation) Licence. For installed generation capacity of 10 MWac or more, he has to apply for a Generation Licence.

All relevant licences should be obtained before any turn-on of solar PV installations.

A summary of the licensing requirements is shown in the table below.

Table 1: Licensing Requirements for Solar PV Systems

Installed Capacity of Solar PV System	Connected to the Power Grid?	Type of Licence*
Below 1 MWac	Yes	Exempted
	No	
1 MWac or more but less than 10 MWac	Yes	Wholesaler (Generation) Licence
	No	Exempted
10 MWac or more	Yes	Generation Licence
	No	

* An Electrical Installation Licence may still be required.

Application for the wholesaler or generation licence can be made on EMA's website: http://www.ema.gov.sg/Licensees_Electricity_Licences.aspx

3. Electrical Installation

An electrical installation refers to any electrical wiring, fitting or apparatus used for the conveyance and control of electricity in any premises. A solar PV system installed within such premises forms part of the consumer's electrical installation and should comply with the requirements stipulated in the Electricity Act (Cap. 89A), the Electricity (Electrical Installations) Regulations and the Singapore Standard CP5 Code of Practice for Electrical Installations.

[1] The point of connection refers to the point at which the solar PV system is connected directly or indirectly to SP PowerAsset's substation.

All electrical work for an electrical installation, including a solar PV system, must be undertaken or carried out by a Licensed Electrical Workers (LEWs). Such electrical work includes new wiring, rewiring and extensions which have to be tested before the supply is turned on. When consumer needs any electrical work to be done at his premises, he is advised to check that the person whom he intends to engage to undertake or perform the electrical work has a valid electrical worker licence issued by the Authority.

It is an offence for a person:

i. To carry out or caused to be carried out any electrical work unless he holds a valid electrical worker licence; or
ii. To engage knowingly any person who is not a licensed electrical worker to carry out any electrical work.

For more details, you may wish to refer to ELISE website for the list of LEW and SP Group website for the preferred PV partners of SP Group.

Electrical Installation Licence

All electrical installations used exclusively for domestic purposes except multi-metered premises are exempted from this requirement.

Safety requirements

Solar PV system requires regular inspection and maintenance to ensure that the system remains efficient and safe for operation. In most cases, equipment manufacturers will provide maintenance guidelines for their specific components. It is important to ensure that the maintenance requirement is carried out according to the recommendation and certified by a LEW.

4. Connection Requirements

If you intend to connect and operate your solar PV system in parallel to the power grid, your appointed LEW will have to complete the online Application Form and submit the following documents to SPS via Singapore Power (SP) eBusiness Portal:

- Document Checklist and Declaration of Compliance to SP Powergrid's (SPPG) Technical Requirements
- Application for Net Export Rebate Form
- Letter of Consent
- PQ Compliance Report
- Inverter(s) Specifications
- Solar panel(s) Specifications
- Inverter(s) Type Test Reports (Harmonics, Flicker, DC Injection)
- Single Line Diagram (from PV system to Point of Common Coupling (PCC)
- PSO Data Form (only applicable for solar PV system 1 MWac and above)

Thereafter, your appointed LEW will have to consult SPPG on the connection scheme and technical requirements.

The simplified connection and turn-on application process for solar PV systems are illustrated in Figure 2 and 3.

Figure 2: Application Process for Solar PV System Connection

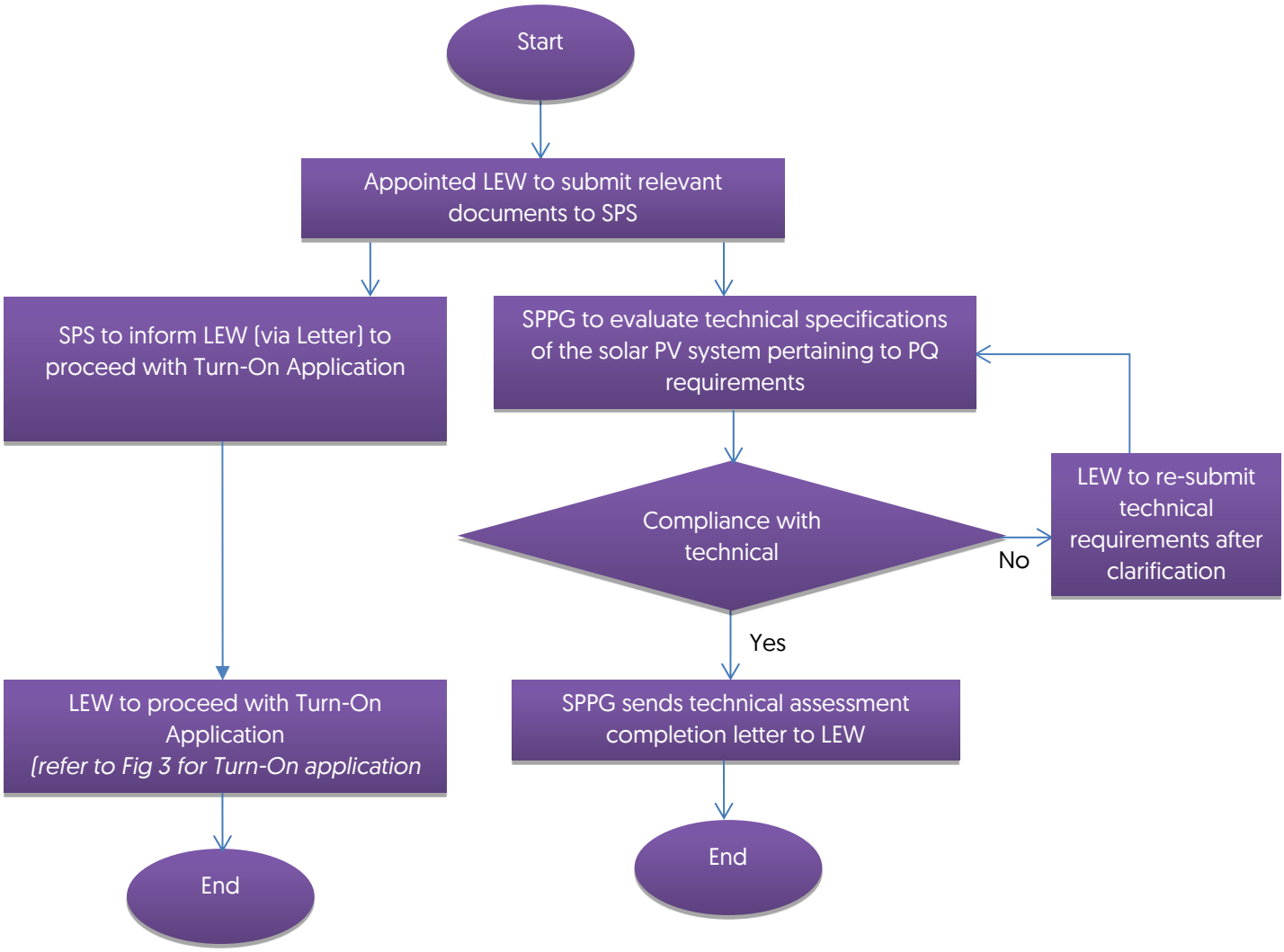
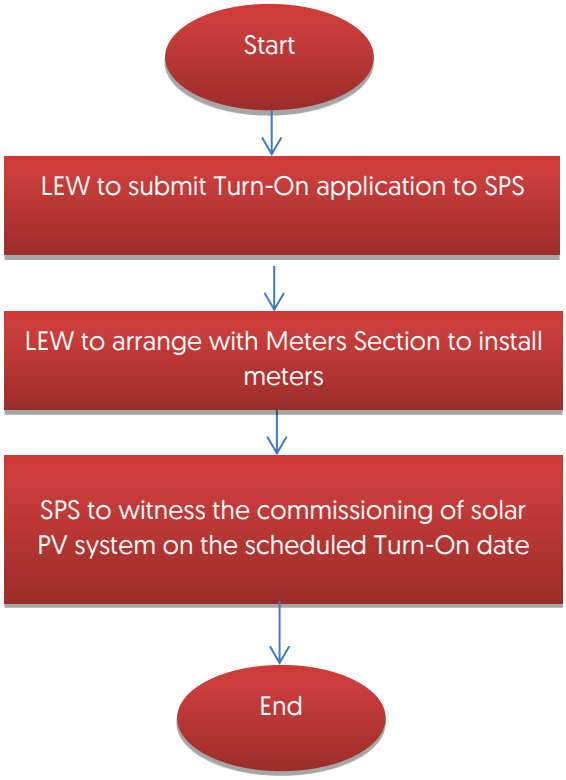


Figure 3: Turn-On Application Process for Solar PV System



5. Market Settlement

An overview of the available payment schemes can be found on EMA's website.

Non-contestable consumers (NCCs)

Currently for residential NCCs with solar PV system, the solar energy produced is first offset by their consumption of that premise. Should there be excess solar energy to be exported back to the grid, they will receive payment (the prevailing low-tension electricity tariff minus grid charge) from SP Services (SPS) by way of credit adjustment to the monthly electricity bill. The quarterly revised low-tension electricity tariff can be found at the SP Group website (www.spgroup.com.sg).

Contestable consumers (CCs)

With the introduction of the Open Electricity Market "OEM", residential CCs with solar PV system less than 10 MWac, is eligible to sell his excess output through SPS under the Enhanced Central Intermediary Scheme (ECIS). SPS will act as a central intermediary,

by passing through the payment and relevant market charges to consumers. Excess solar electricity sold back to the grid will be paid the weighted average nodal price.

Such consumers can either choose (a) to install a meter to accurately measure the solar electricity generated, or (b) to estimate their solar generation. For option (a), consumers will need to install the relevant metering arrangement at each generation point. More details on the meters can be found in Section 7, AMI Meter Charges. For option (b), the solar generation will be estimated based on the Solar Generation Profile (SGP)[2] for the calculations of the relevant payment and market charges. Consumers need not install any meters.

6. Monitoring Requirements

With the expected increase in solar PV systems in Singapore, the Power System Operator (PSO) would need to manage the intermittent nature of such sources to ensure that the security and reliability of the power system is not compromised. Most importantly, PSO also needs to ensure that sufficient reserve capacity is available to respond to sudden fluctuations in solar output.

Hence, PSO shall require solar PV systems with an installed capacity of 1 MWac and above at each site/facility to provide the Active Power output (AC-side) of its solar PV system(s), sampled at one-minute intervals and solar irradiance from sensor installed in close proximity to the PV panels.

For more detailed technical requirement, please contact EMA at EMA_PSO_EMA@ema.gov.sg.

7. AMI Meter Charges

This section is only applicable to residential consumers who register their embedded solar PV systems under the ECIS and chose to install an AMI meter.

The owner of the generation facility (i.e. solar PV system) is the Meter Equipment Service Provider (MESP) for the meter installation associated with it. However, consumers with embedded generation facility (with installed capacity of less than 10 MWac) may choose to engage SPPG to provide, install and maintain the generation meter.

The fees applicable for providing such services by SPPG are shown in the table below:

[2] The SGP is approved by the Energy Market Authority ("EMA") and is based on factors such as Singapore's historical average solar irradiance from 7am to 7pm. This is standardised for all consumers with embedded solar PV systems and will be updated by EMA as new information becomes available.

Table 2.1: Metering Charges for Generation Meters (inclusive of 7% GST before 1st Jan 2023)

	Main & Check Meters	Main & Check Meters	Main & Check Meters	Main Meters Only
Per Generation Unit / Metering Point	At 66kV and above	At 6.6kV / 22kV	At Low Tension	At Low Tension
Upfront charge (One time)	$5,938.50	$5,938.50	$2,247.00	$1,498.00
Monthly charge (Recurring)	$214.00	$85.60	$42.80	$21.40
Miscellaneous charge				
a) Attending to request for site enquiry during office hours (minimum 3 hours per request).	$42.80 per hour	$42.80 per hour	$42.80 per hour	$42.80 per hour
b) Attending to communication / meter failure during office hour. Charges will be waived if it is due to equipment failure.	$85.60 per trip	$85.60 per trip	$85.60 per trip	$85.60 per trip
c) Attending to adhoc request by customer for meter accuracy test with SAC-SINGLAS test report.	$1,926.00 per meter	$1,926.00 per meter	$706.20 per meter	$706.20 per meter

Table 2.2: Metering Charges for Generation Meters (inclusive of 8% GST with effect from 1st Jan 2023)

	Main & Check Meters	Main & Check Meters	Main & Check Meters	Main Meters Only
Per Generation Unit / Metering Point	At 66kV and above	At 6.6kV / 22kV	At Low Tension	At Low Tension
Upfront charge (One time)	$5,994.00	$5,994.00	$2,268.00	$1,512.00
Monthly charge (Recurring)	$216.00	$86.40	$43.20	$21.60
Miscellaneous charge				
d) Attending to request for site enquiry during office hours (minimum 3 hours per request).	$43.20 per hour	$43.20 per hour	$43.20 per hour	$43.20 per hour
e) Attending to communication / meter failure during office hour. Charges will be waived if it is due to equipment failure.	$86.40 per trip	$86.40 per trip	$86.40 per trip	$86.40 per trip
f) Attending to adhoc request by customer for meter accuracy test with SAC-SINGLAS test report.	$1,944.00 per meter	$1,944.00 per meter	$712.80 per meter	$712.80 per meter

8. Decommissioning Requirements

If you intend to decommission the entire solar PV system installed in your premises any time after they have been connected to the Transmission System, your appointed LEW will have to complete the decommissioning form and submit to SP Powergrid Ltd at least 30 days in advance before the intended decommission commences.

However, if the intent is to revise the solar PV capacity installed in your premises any time after they have been connected to the Transmission System, your appointed LEW will have to complete the online Application Form and submit the following documents to SPS via Singapore Power (SP) eBusiness Portal:

- Document Checklist and Declaration of Compliance to SP Powergrid's (SPPG) Technical Requirements
- Application for Net Export Rebate Form
- Letter of Consent
- PQ Compliance Report
- Inverter(s) Specifications
- Solar panel(s) Specifications
- Inverter(s) Type Test Reports (Harmonics, Flicker, DC Injection)
- Single Line Diagram (from PV system to Point of Common Coupling (PCC)
- PSO Data Form (only applicable for solar PV system 1 MWac and above)

9. PV Directory

For enquiries on the following matters pertaining to solar PV systems, you may wish to contact the following:

Energy Market Authority (EMA)	
Matters on:	**Contact Information**
Electricity Licences	**Economic Regulation & Licensing Department** Email: ema_enquiry@ema.gov.sg Tel: 6835 8000
Electrical Installation Licence **Licensed Electrical Workers (LEWs)**	**Electricity Resilience & Regulation Department** Email: lei_ema@ema.gov.sg Tel: 6835 8000
Policy and Regulatory Framework	**Policy Department** Email: ema_ppd@ema.gov.sg Tel: 6835 8000

Monitoring Requirements	Energy Management Systems Department Email: EMA_PSO_EMS@ema.gov.sg Tel: 6835 8000

Energy Market Company (EMC)	
Matters on:	**Contact Information**
Market Registration Market Payment / Charges	Market Administration Email: MPRegistration@emcsg.com Tel: 6779 3000

SP PowerGrid (SPPG)	
Matters on:	**Contact Information**
Technical Clarification regarding Connection to the Grid	Asset Management & Projects Department Email: DERenquiries@spgroup.com.sg Tel: 6916 8888

SP Services (SPS)	
Matters on:	**Contact Information**
Application for Connection to the Grid and Market Settlement with SPS	Electrical Installation Section Email: install@spgroup.com.sg Tel: 6916 7200