



Single Buyer Technical Guide for Grid Connected GENCO (Solar)

Second Edition (2026)

Single Buyer



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Dated: 13 April 2026

A handwritten signature in black ink, appearing to read 'Zainudin', written in a cursive style.

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Ir. Zainudin Md Yusof
Chief Executive Officer/Head
Single Buyer

Document Control

Version	Effective Date	Approved By	Amendments
1.0	8 January 2021	Charanjit Singh	-
2.0	13 April 2026	Ir. Zainudin Md Yusof	<ol style="list-style-type: none">1. Inserted Cyber Security Clause2. To incorporate the revised Guidelines for NEDA

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Abbreviations

This section describes a list of abbreviations that appear in this document.

Abbreviations	Description
DDC	Declared Daily Capacity
GSO	Grid System Operator
IT	Information Technology
MMF	Meteorological Measuring/Monitoring Facilities
MW	Megawatt
MWac	Megawatt in alternating current
MWh	Megawatt hour
NEDA	New Enhanced Dispatch Arrangement
PV	Photovoltaic
TNB	Tenaga Nasional Berhad

Glossary of Terms

1. This section describes a list of terms that appear in this document.
2. Unless otherwise defined in this Single Buyer Technical Guide (as defined below), all capitalised terms used in this Single Buyer Technical Guide shall have the same meanings ascribed to them in the Connection Agreement and/or the Technical Guide, as the case may be.

Term	Definition
<i>Annual Generation Profile</i>	means the forecasted annual generation profile (in MWac) of the Facility's output for every hourly interval to be generated and delivered to the Grid System at the Interconnection Point from the Facility for each Contract Year;
<i>Business Day</i>	means any day on which commercial banks are open for business in Kuala Lumpur, Wilayah Persekutuan but excludes public holidays in Kuala Lumpur, Wilayah Persekutuan and Sundays;
<i>Commercial Operation Date or COD</i>	means the day after all the conditions precedent as set forth under <i>Conditions Precedent to Commercial Operation</i> in the Connection Agreement having been satisfied or waived, starting from 00:00 hours;
<i>Connection Agreement</i>	means an agreement entered between GENCO and Grid Owner, together with the appendices attached to it, to connect the Facility to the Grid System to allow the transfer of electricity generated from the Facility to the Grid System under NEDA;
<i>Contract Year</i>	means the period which begins on: <ol style="list-style-type: none"> (a) the Commercial Operation Date and ends on December 31 of the year in which the Commercial Operation Date occurs; (b) each subsequent period which begins on January 1 and ends on December 31 of the same year; and (c) January 1 and ends on the date of expiry of the Term under the Connection Agreement;
<i>Control Centre</i>	has the meaning assigned to it under the Grid Code;
<i>Effective Date</i>	means the date on which all conditions precedent listed under <i>Conditions Precedent to the Effectiveness of Agreement</i> in the Connection Agreement have been satisfied;
<i>Declared Annual Quantity</i>	means the annual quantity (in MWh) of solar photovoltaic energy declared by GENCO to be generated and delivered to the Grid System at the Interconnection Point from the Facility for each Contract Year;
<i>Declared Daily Capacity</i>	means on any given day of a Contract Year, the forecasted daily capacity (in MWac) of the Facility's output for every fifteen (15) minutes interval to be generated and delivered to the Grid System at the Interconnection Point from the Facility, as may be declared from time to time by GENCO for such day pursuant to Clause 4.1.2 of this Single Buyer Technical Guide;

Term	Definition
Facility	means a solar generating facility owned by GENCO at one Interconnection Point and ancillary equipment and facilities and includes any modification thereto;
GENCO	means a solar generator company with its Facility connected to the Grid System and is registered under the NEDA scheme;
Genco Interconnection Facility	means the new substation and associated facilities to be designed, constructed, owned, operated and maintained by GENCO as further described in the Technical Guide to enable GENCO to deliver energy from the Facility and to maintain the stability of the Grid System;
GENCO Interconnector	means the transmission line(s)/underground cable(s) and associated facilities to be designed, constructed, owned, operated and maintained by GENCO as further described in the Technical Guide that interconnect the GENCO Interconnection Facility and the Grid System;
GENCO Works	means the design, engineering, procurement, supply, manufacturing, construction, installation, erection, testing, commissioning, labour, services, facilities, equipment, supplies and materials to be furnished, supplied or performed by GENCO at the TNB Interconnection Facility and if applicable including transmission lines and loop-in loop-out (LILo) works as further described in the Technical Guide;
Grid Code	means the Grid Code for Peninsular Malaysia, containing a set of technical rules and procedures that facilitate coordinated planning, coordinated design, coordinated development, and coordinated operation of the Grid System, as amended, modified or replaced from time to time;
Grid Owner	has the meaning assigned to it under the Grid Code;
Grid System	has the meaning assigned to it under the Grid Code;
Grid System Operator or GSO	means the entity who has a responsibility for operational planning, real-time rescheduling, dispatch and control of the Grid System in compliance with the provisions of the Grid Code;
Initial Operation Date	means the date after all the conditions precedent as set forth under <i>Conditions Precedent to Initial Operations</i> in the Connection Agreement having been satisfied, starting from 00:00 hours;
Interconnection Point	means the demarcation line for ownership and maintenance between TNB and GENCO;
Single Buyer	shall have the meaning given to it in the Electricity Supply Act 1990;
Single Buyer Technical Guide	means this Single Buyer Technical Guide for Grid Connected GENCO (Solar);
TNB Interconnection Facility	means the existing or new TNB's substation to receive energy from GENCO Interconnection Facility;

Term	Definition
<i>Technical Guide</i>	means the TNB Technical Guide For Transmission Connected Power Producer, GSO Technical Guidelines, and any other technical guide as may be issued by TNB, Single Buyer or GSO from time to time and in relation to Connection Agreement, as amended, replaced and supplemented from time to time;
<i>Transmission System Reliability Standards</i>	The Reliability Standards comprising the: <ol style="list-style-type: none"> 1. Generation Reliability Standard; and 2. Transmission Security Reliability Standard.

1. Introduction

This Single Buyer Technical Guide for Grid Connected GENCO (Solar) has been prepared by Single Buyer to provide guidance to prospective GENCO seeking connection to the Grid System in Peninsular Malaysia.

This Single Buyer Technical Guide comprises requirements from Single Buyer and shall be complied by GENCO.

This Single Buyer Technical Guide details out the technical requirements for connection to the Grid System in adhering to the following documents:

- (i) Grid Code (latest version);
- (ii) Transmission System Reliability Standards (latest version); and
- (iii) Any other prevailing reference documents by Grid Owner, Grid System Operator and Single Buyer.

In the event of any conflict between the terms and requirements stipulated in this Single Buyer Technical Guide with the terms and requirements of the above documents, the latest version of the above documents shall prevail. GENCO shall obtain confirmation from TNB, Grid System Operator and Single Buyer in case of any discrepancy.

This Single Buyer Technical Guide is supplementary to and does not authorize any departure from the Grid Code, Electricity Supply Act 1990, Electricity Regulations 1994 and TNB Supply Rules and/or any successor act or rules and the Connection Agreement.

2. Objectives of the Single Buyer Technical Guide

The main objectives of this Single Buyer Technical Guide are as follows:

- (i) to serve as guidance for GENCO on the technical considerations/aspects of interconnection to the Grid System and other salient requirements with regards to system security, availability and reliability of supply in the Grid System;
- (ii) to ensure GENCO is in compliance with the Grid Code and the Transmission System Reliability Standards; and
- (iii) to enable GENCO to better plan, procure and design facilities in accordance to Single Buyer's requirements.

3. Scope and Coverage

The scope and coverage of this Single Buyer Technical Guide is limited to GENCO connected directly to TNB Interconnection Facility at Grid System in Peninsular Malaysia.

This Single Buyer Technical Guide does not cover GENCO pursuing connection to the distribution network in Peninsular Malaysia.

This Single Buyer Technical Guide is not intended to cover all required authorizations, permits and/or licenses which the GENCO is required to obtain from the relevant bodies and/or authorities for the purpose of the development of their facilities.

Single Buyer and/or TNB shall bear no responsibility for any error, inaccuracy or omission of any kind and no warranty or representation is given in respect thereof. GENCO accepts full responsibility for conducting an independent analysis of the accuracy, correctness and completeness of any and all data and for gathering and presenting all necessary information.

4. Requirement from Single Buyer

4.1 Scheduling & Forecasting Requirements

4.1.1 Website and real-time online forecast

Beginning from the Initial Operation Date, GENCO shall publish the details of the rolling seventy-two (72) hour generation forecast on a real-time basis (time interval of ten (10) minutes) via GENCO's website.

GENCO's website shall be accessible to Single Buyer and equipped with web services facilities to enable automatic extraction of such data into the Single Buyer's IT system via internet or by any other manner or form as may be prescribed from time to time by Single Buyer.

GENCO shall establish such GENCO's website and web services facilities prior to the Initial Operation Date and notify Single Buyer.

4.1.2 Declaration of the Declared Daily Capacity

Beginning from the Initial Operation Date, GENCO shall declare the details of the following Declared Daily Capacity via e-mail and web services facilities to enable automatic extraction of such data into the Single Buyer's IT system via internet or by any other manner or form as may be prescribed from time to time by Single Buyer:

- (a) No later than the twenty-fifth (25th) day of each calendar month or such other time as Single Buyer shall otherwise notify, GENCO shall declare to Single Buyer the Declared Daily Capacity for the following four (4) rolling months' period (the **4 Month Ahead Declared Daily Capacity**) with time interval of fifteen (15) minutes in such manner or form as may be prescribed from time to time by Single Buyer.
- (b) At 12.30 pm every Wednesday or such other time as Single Buyer shall otherwise notify, GENCO shall declare to Single Buyer the Declared Daily Capacity for a period of nine (9) days beginning from the coming Saturday to the next Sunday (the **Week Ahead Declared Daily Capacity**) with time interval of fifteen (15) minutes in such manner or form as may be prescribed from time to time by Single Buyer.
- (c) At 10.00 am every day or such other time as Single Buyer shall otherwise notify, GENCO shall declare to Single Buyer the Declared Daily Capacity for the following five (5) days' period (the **Day Ahead Declared Daily Capacity**) with time interval of fifteen (15) minutes in such manner or form as may be prescribed from time to time by Single Buyer.
- (d) GENCO may resubmit the Declared Daily Capacity at any time to take into account of any deration or change in the Declared Daily Capacity.
- (e) In the event GENCO could not generate due to unplanned or forced outage, GENCO shall notify Single Buyer immediately of the failure and indicate the next possible time GENCO would be back in service.

4.1.3 Declaration of the Declared Annual Quantity

- (i) At least ninety (90) days prior to the proposed Commercial Operation Date, GENCO shall furnish Single Buyer with the Declared Annual Quantity for the Contract Year in

which the Commercial Operation Date occurs (the **Initial Contract Year**), the Annual Generation Profile and the proposed schedule of planned outages.

In addition to furnishing the Declared Annual Quantity for the Initial Contract Year, if the Commercial Operation Date occurs in any of the months of October, November and December, GENCO shall also simultaneously furnish Single Buyer with the Declared Annual Quantity, the Annual Generation Profile and the proposed and indicative schedules of planned outages for the following Contract Year immediately following the Initial Contract Year.

- (ii) Except as otherwise provided in Clause 4.1.3 (i) above, GENCO shall, at least thirty (30) days prior to the Commercial Operation Date, and thereafter not later than ninety (90) days before the end of each Contract Year, submit the Declared Annual Quantity, the Annual Generation Profile and the proposed and indicative schedules of planned outages.

4.2 Meteorological Measuring/Monitoring Facilities

GENCO shall install the Meteorological Measuring/Monitoring Facilities (**MMF**), which shall comprise of the following but not limited to:

- (a) number of pyranometer is in accordance to the Technical Guide provided by GSO;
- (b) number of full weather station is in accordance to the Technical Guide provided by GSO; and
- (c) online access to the MMF signals data described in Clause 4.2.1 through a web service is available via internet at all times,

for the purpose of monitoring meteorological conditions including but not limited to solar irradiance at the Facility.

The MMF and the web service shall be available at all times including periods of shutdown and outage of the Facility, the GENCO Interconnection Facility, the GENCO Interconnector and/or the TNB Interconnection Facility and during any periods of disconnection of the Facility, the GENCO Interconnection Facility, the GENCO Interconnector and/or the TNB Interconnection Facility from the Grid System.

GENCO shall include the MMF and associated equipment in the conceptual design report of the Facility not later than sixty (60) days prior to the Effective Date, which shall be in accordance with the requirements as stated in the Technical Guide provided by GSO and shall include but not limited to the elevation of the meteorological collection devices as well as the location, elevation and orientation angles of the solar panels.

4.2.1 Data and signals requirement of the Meteorological Measuring/Monitoring Facilities (MMF)

No later than the Initial Operation Date, GENCO shall provide to Single Buyer, with online access to the MMF data on real time basis via a web service available in the internet shall include the following but not limited to:

- (a) Pyranometer
 - total global horizontal irradiance or direct normal insolation (W/m²);
 - global irradiance on the module plane (W/m²); and
 - total global radiation (Wh/m²) (calculated starting from 00:00hours every day).

- (b) Full Weather Station
- air ambient temperature (°C);
 - wind speed (m/s);
 - wind direction (°) (using range of 0° to 360°);
 - standard deviation of wind direction (°) (based on measurement samples from the last 5 hours);
 - relative humidity (%);
 - precipitation (mm/h);
 - barometric pressure (hPa);
 - atmospheric pressure (atm);
 - average PV module temperature (°C); and
 - any other data that would be reasonably applicable, which shall be mutually agreed by both Parties.

For any month in which the above information in this Clause 4.2.1 and/or online access to the Control Centre for such information becomes unavailable to Single Buyer, GENCO shall notify the Control Centre and take immediate actions to restore the availability of such information and/or online access to the Control Centre. GENCO shall also provide a report to Single Buyer no later than twenty-four (24) hours of the occurrence of such unavailability, describing the nature of such unavailability and remedial actions to restore the availability of information and/or online access to the Control Centre. Upon Single Buyer's request, GENCO shall promptly provide to Single Buyer any additional and supporting documentation necessary for Single Buyer to audit and verify any matters set forth in the report. Single Buyer shall exercise reasonable efforts to notify GENCO of any deficiency by GENCO in meeting the requirements of this Clause 4.2.1 provided that any failure by Single Buyer to provide such deficiency notice shall not result in any additional liability to Single Buyer under this Single Buyer Technical Guide. During unavailability of the above information in this Clause 4.2.1 and/or online access to the Control Centre for such information becomes unavailable to Single Buyer, GENCO shall transmit data to Single Buyer through alternate means of communication (i.e., cellular communications from onsite personnel, facsimile, or equivalent mobile e-mail) and as agreed by Single Buyer.

For any occurrence in which GENCO's telecommunications system is not available or does not provide quality data from the MMF and Single Buyer notifies GENCO of the deficiency or GENCO becomes aware of such occurrence, GENCO shall transmit data to Single Buyer through alternate means of communication (i.e. cellular communications from onsite personnel, facsimile, or equivalent mobile e-mail) and as agreed by Single Buyer until the telecommunications link is re-established. GENCO shall take immediate actions to restore the availability of the GENCO's telecommunication system.

GENCO shall maintain at least a minimum of one hundred and eighty (180) days' historical data for all data required pursuant to this Clause 4.2.1, which shall be available on a minimum time interval of half hour basis or a half-hourly average basis. GENCO shall provide such data to Single Buyer within five (5) Business Days of Single Buyer's request.

4.2.2 Maintenance of the Meteorological Measuring/Monitoring Facilities (MMF)

GENCO shall maintain and ensure the continuous availability of the secure communication link in order to provide Single Buyer with access to the data required in Clause 4.2.1 above at all times.

GENCO shall maintain the MMF, the secure communication link and associated equipment necessary to provide accurate data to Single Buyer. GENCO shall promptly repair and replace as necessary any component of the MMF, the secure communication link and associated equipment and shall notify Single Buyer and/or the Control Centre as soon as GENCO

becomes aware of any occurrence of equipment failure or that the data being provided to Single Buyer is faulty or incorrect.

If Single Buyer notifies GENCO that the MMF data being provided to Single Buyer is faulty or incorrect, the GENCO shall maintain, repair or replace such equipment immediately but no later than five (5) days of receipt of such notice.

4.3 Cyber Security

- (a) GENCO shall, at its own cost and expense, install or procure the installation of all reasonable cyber security protection including anti-virus and malware, firewalls or functionally equivalent technology and authentication controls for the protection against unauthorised access, misuse, damage, destruction and other cyber security threats.
- (b) GENCO shall notify TNB and Single Buyer and take the necessary action to remedy the event as soon as practicable in the event of any actual or suspected unauthorised access or compromise to any communication and information system links between GENCO and TNB and Single Buyer, and comply with the directions of TNB and Single Buyer in respect of any additional or different security measures as may be required to respond to such cyber security threats.

4.4 Testing Guideline

The following table summarizes the test required and shall be successfully completed prior to commercial operation of the GENCO.

Table 1: Test Required

No.	Test	Test Requirement	Standard
1	Declared Daily Capacity and Meteorological Measuring/Monitoring Facilities (MMF)	To verify that a valid Declared Daily Capacity and MMF signals data is available via a web service through the internet	Guideline for submission of Declared Daily Capacity

5. Attachment

Attachment 1: Guideline for submission of Declared Daily Capacity

The following table summarizes the detailed submission of Declared Daily Capacity via e-mail.

Table 2: Detailed Submission of Declared Daily Capacity via E-Mail

No.	Declared Daily Capacity	Email Subject	Column Description of the Excel file
1	Day Ahead Declared Daily Capacity	[GENCO Name] DDC_Day Ahead with one attachment of Microsoft Excel (.csv)	COLUMN A Column Name: YEAR Description : refers to the forecast year COLUMN B Column Name: MONTH Description : refers to the forecast month <ul style="list-style-type: none"> • 1: represents January • 2: represents February • and • 12: represents December
2	Week Ahead Declared Daily Capacity	[GENCO Name] DDC_Week Ahead with one attachment of Microsoft Excel (.csv)	COLUMN C Column Name: DAY Description : refers to the forecast day <ul style="list-style-type: none"> • 1: represents 1st day of the month • 2: represents 2nd day of the month • and so on
3	4 Month Ahead Declared Daily Capacity	[GENCO Name] DDC_4months Ahead with one attachment of Microsoft Excel (.csv)	COLUMN D Column Name: PERIOD Description : refers to the 15-minute interval of the forecast period <ul style="list-style-type: none"> • 1: represents 0000 – 0015 hours • 2: represents 0015 – 0030 hours • 3: represents 0030 – 0045 hours • until • 96: represents 2345 – 2400 hours COLUMN E Column Name: [GENCO Name] such as “xxLS” refers to plant mnemonics Description : refers to the forecasted daily capacity (in MW) during the 15-min forecast interval for the Facility

The following table summarizes the detailed submission of Declared Daily Capacity via web services facilities. The format of the web service is similar to GSO as stipulated in GSO EMS Interfacing, Testing and Commissioning Guidelines for Solar.

Table 3: Detailed Submission of Declared Daily Capacity via Web Services Facilities

No.	Declared Daily Capacity	Naming for Web Service Function	Unit	Web Service Response
1	Day Ahead Declared Daily Capacity	DayAhead	MW	Forecasted 5 days ahead capacity's array of 480 results
2	Week Ahead Declared Daily Capacity	WeekAhead	MW	Forecasted 9 days ahead capacity's array of 864 results
3	4 Month Ahead Declared Daily Capacity	FourMonthsAhead	MW	Forecasted daily capacity for the following four months
4	4 Month Ahead Declared Daily Capacity	FourMonthsAhead1	MW	Forecasted daily capacity for the following first month
5	4 Month Ahead Declared Daily Capacity	FourMonthsAhead2	MW	Forecasted daily capacity for the following second month
6	4 Month Ahead Declared Daily Capacity	FourMonthsAhead3	MW	Forecasted daily capacity for the following third month
7	4 Month Ahead Declared Daily Capacity	FourMonthsAhead4	MW	Forecasted daily capacity for the following fourth month

Attachment 2: Guideline for submission of Annual Generation Profile

The following table summarizes the detailed submission of Annual Generation Profile via e-mail.

Table 4: Detailed Submission of Annual Generation Profile via E-Mail

No.	Annual Generation Profile	Email Subject	Column Description of the Excel file
1	Annual Generation Profile	[GENCO Name] AGP with one attachment of Microsoft Excel (.csv)	<p>COLUMN A Column Name: YEAR Description : refers to the forecast year</p> <p>COLUMN B Column Name: MONTH Description : refers to the forecast month</p> <ul style="list-style-type: none"> • 1: represents January • 2: represents February • and • 12: represents December <p>COLUMN C Column Name: DAY Description : refers to the forecast day</p> <ul style="list-style-type: none"> • 1: represents 1st day of the month • 2: represents 2nd day of the month • and so on <p>COLUMN D to AA Description : refers to the hourly interval of the forecast period</p> <ul style="list-style-type: none"> • 1: represents 0000 – 0100 hours • 2: represents 0100 – 0200 hours • 3: represents 0200 – 0300 hours • until • 24: represents 2300 – 2400 hours

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