

## FOREWARD

In the Commission's Order on "Issues related to Tamil Nadu Solar Energy Policy 2012" dated 07.03.2013, TANGEDCO was directed to furnish detailed procedures covering the following issues related to Net metering , LT connectivity and Renewable Energy Certificates for the approval of the Commission :

**1) Net metering:**

- a) Standards and location of meters
- b) Tariff for excess generation/lapsed units
- c) Period of power credit
- d) Any other related issue

**2) LT connectivity**

- a) make and standards for inverters,
- b) harmonics standards,
- c) synchronization to the grid,
- d) safety/protection norms,
- e) norms for generator capacity versus connecting voltage etc.,

**3) Renewable Energy Certificate to be issued to solar generators under the Policy**

- a) Accreditation
- b) Issuance
- c) Trading

The detailed procedure submitted by the TANGEDCO is annexed.

Comments/suggestions on the documents submitted by TANGEDCO related to the above issues may sent on or before 15/8/2013.

## **ANNEXURE**

### **PROCEDURE FOR LT CONNECTIVITY FOR LT ROOF TOP SOLAR PV PLANTS**

#### **1. Location of Meters:**

- a.** Two meters have to be installed by the solar power generator. One is for measuring solar generation and the other is for Import/Export measurement.
- b.** The first meter, the generation meter has to be installed at the generator end after the inverter at the ground floor of the premises to facilitate easy access for meter reading. The point of solar power injection may be in between the load and the Import/Export (Bidirectional) meter.
- c.** The second meter is the Bi-directional meter with AMR compatibility (Single phase or three phase as per requirement) for measuring Import/Export power. The first & the second meter have to be installed at the same locations where the present meter for consumption is installed.
- d.** The cost of Bi-directional meter and the meter at the Generation end have to borne by the consumer.
- e.** The Assessor will take two readings in the generator premises viz., one at the generation end and other at export/import meter end.
- f.** While taking the reading at the generator end, in order to ensure the correctness of the generation and also to furnish correct generation details to TEDA, the reading should be joint meter reading ie. in the presence of the Solar Power Generator (SPG).
- g.** Further in the Solar policy, hybrid generator is encouraged. In this case separate sets of meter and the meter reading procedure as above may have to be adopted at rooftop solar SPG and WEG end separately.

- h.** A new type of meter card to record the readings of generation details with the facility to incorporate both the Assessor's and consumer's initials have to be provided.
- i.** Such card may also have the details of Generator's Bank Account Number to which the GBI have to be credited directly from TEDA.
- j.** At the end of every monthly/Bi-monthly (for LTCT – monthly reading) the details of solar energy generation will be communicated to TEDA by TANGEDCO through e-mail, to facilitate direct transfer of GBI amount to the generator.

**2. Tariff for excess generation:**

- a.** At present there is no tariff rate for excess generation/Export of solar power. Commercial consumers will be allowed with power credits only. Both GBI and power credits will be allowed to domestic consumers.
- b.** In the Solar Energy Policy 2012, net metering facility has been extended to solar power systems installed in commercial establishments and individual homes connected to the electrical grid to feed excess power back to grid with power credit facility.
- c.** If the import of the energy is more than export then the net energy consumed has to be billed as per the tariff order for sale of power in vogue issued by the Hon'ble TNERC.
- d.** If the export of energy is more than the import then the net energy generated may be treated as power credit and carried over to the next monthly/Bi-monthly billing cycle. The power credit shall be carried over upto the end of the Financial Year i.e. from April to March.

**3. Period of power credit:**

- a.** For every billing period in respect of both domestic and commercial consumers, consumption may be adjusted against the solar power export. Excess generation if any available will be adjusted in the next billing. Excess energy generation if any available at the end of the

year may be paid by TANGEDCO at 75% of the solar tariff fixed by the commission as in the case of wind mill generators.

**4. Procedure for LT connectivity for solar generation:**

- a. The responsibility of operation and maintenance of the Solar SPV including all accessories and apparatus lies with the consumer.
- b. The consumer is responsible for any defect in the roof top SPV and for its isolation if it affects any other apparatus or circuit in his own premises; also the SPV should be isolated if it is found detrimental to TANGEDCO's LT network.
- c. The design and installation of the roof top SPV should be equipped with appropriately rated protective devices to sense any abnormality in the system and carryout automatic isolation of the SPV from the grid. The inverters used should meet the necessary quality requirements and should be certified for their quality; the protection logics should be tested before commissioning of the plant.
- d. The automatic isolation or islanding protection of the SPV should be ensured for, no grid supply and low or over voltage conditions and within the required response time. Adequate rated fuses and fast acting circuit breakers on input and output side of the inverters and disconnect /Isolating switches to isolate DC and AC system for maintenance shall be provided. The consumer should provide for all internal safety and protective mechanism for earthing, surge, DC ground fault, transients etc.
- e. To prevent back feeding and possible accidents when maintenance works are carried out by TANGEDCO personnel, Double pole/Triple pole isolating disconnect switches which can be locked by TANGEDCO personnel should be provided. This is in addition to automatic sensing and isolating on grid supply failure etc and in addition to internal disconnect switches.
- f. The consumer is solely responsible for any accident to human

being/animals whatsoever (fatal/non fatal/departmental/ non departmental) that may occur due to back feeding from the SPV plant when the grid supply is off.

- g. TANGEDCO reserves the right to disconnect the installation at any time in the event of damage to its grid, meter, etc or to prevent accident or damage.
- h. The consumer shall abide by all the codes and regulations to the extent applicable and in force from time to time. The consumer shall take necessary steps to abide these regulations and also comply with TNERC/TANGEDCO/CEIG requirements with respect to safe, secure and reliable function of the SPV plant and the grid. The power injected into the grid shall be of the required quality in respect of wave shape, frequency, absence of DC components etc.
- i. In the event of TANGEDCO's LT supply failure, the promoter has to ensure that there will not be any solar power being fed to the LT grid of TANGEDCO.
- j. The SPG shall restrict the harmonic generation within the limit to be issued by the Central Electricity Authority.
- k. The SPG (Domestic/Commercial consumer) may establish LT grid interactive solar power plant in the roof top or surface level with the following options.
  1. Grid interactive solar PV system without battery.
  2. Grid interactive solar PV system with full load battery backup.
  3. Grid interactive solar PV system with partial load battery backup.
  4. Grid interactive solar PV system with full load DG backup.
  5. Grid interactive solar PV system with partial load DG backup.
  6. Grid interactive solar PV system with full load battery backup & DG.
  7. Grid interactive solar PV system with partial load battery backup & DG.

The inverter standard shall be such that it should not allow solar power/battery power/DG power to extend to TANGEDCO's LT grid on failure of TANGEDCO's grid supply, irrespective of the above LT connectivity options.

5. **Standards of Meter:** The standards for single phase and three phase bi-directional energy meters are furnished in **Annexure A**

6. **Harmonics Standard:** The required Harmonics standards are furnished in **Annexure B**.

7. **Inverter Standard:** The required Inverter standard for three phase and single phase solar power are furnished in **Annexure C**.

## **ANNEXURE A**

### **TECHNICAL PARTICULARS OF SINGLE PHASE (5-20A)/THREE PHASE 10-60 OR 20-80 ENERGY METERS**

#### **1.0 FUNCTIONAL SPECIFICATION:**

1.1	Applicable IS	IS 13779 or IS 14697 depending upon accuracy of meters.
1.2	Regulations	CEA Regulations on "Installation and Operation of Meters:", 2006
1.3	Accuracy Class Index	1.0 or better up to 650 V
1.4	Voltage	415 Volt(P-P), +20% to -40% Vref, however the meter should withstand the maximum system voltage i.e. 440 volts continuously.
1.5	Display	a) LCD (Six digits), pin type
1.6	Power factor range	Zero lag –unity- zero lead
1.7	Display parameters	a) Display parameters : LCD test, KWH import, KWH export, MD in KW export, MD in KW import, Date & Time, AC current and voltages, power factor and meter cover open tamper with date and time (Cumulative KWH will be indicated continuously by default & other arameters through push-button) b) Display order shall be as per Annexure
1.8	Power Consumption	Less than 1 Watt & 4VA in Voltage circuit and 2 VA for Current circuit
1.9	Starting current	0.2 % of Ib
1.10	Frequency	50 Hz with + / - 5% variation
1.11	Test Output Device	Flashing LED visible from the front
1.12	Billing data	a) Meter serial number, Date and time, KWH import, KWH export, MD in KW (both export and import), History of KWH import and export, & MD(both export & import) for last 6 billing cycles along with TOD readings. b) All these data shall be accessible for reading, recording and spot billing by downloading through optical port on MRI or Laptop computers at site.
1.13	MD Registration	a) Meter shall store MD in every 30 min. period along with date & time. At the end of every 30 min, new MD shall be compared with previous MD and store whichever is higher and the same shall be displayed. b) It should be possible to reset MD automatically at the defined date (or period) or through MRI.

		c) Manual MD resetting using sealable push button is an optional.
1.14	Auto Reset of MD	Auto reset date for MD shall be indicated at the time of finalizing GTP and provision shall be made to change MD reset date through MRI even after installation of meter on site.
1.15	TOD metering	Meter shall be capable of Time of use metering for KWH, and MD in KW with 8 time zones (programmable on site through CMRI)
1.16	Security feature	Programmable facility to restrict the access to the information recorded at different security level such as read communication, communication write etc
1.17	Memory	Non volatile memory independent of battery backup, memory should be retained up to 10 year in case of power failure
1.18	Software & communication compatibility	a) Optical port with RS 232 compatible to transfer the data locally through CMRI & remote through PSTN / Optical fiber / GSM / CDMA / RF / any other technology to the main computer. b) The Supplier shall supply Software required for CMRI & for the connectivity to AMR modules. The supplier shall also provide training for the use of software. The software should be compatible to Microsoft Windows systems (Windows 98 system). The software should have polling feature with optional selection of parameters to be downloaded for AMR application. c) Copy of operation manual shall be supplied. d) The data transfer (from meter to CMRI / AMR equipment) rate should be minimum 1200 bps. e) The Supplier shall provide meter reading protocols.
1.19	Climatic conditions	a) IS: 13779 or IS: 14697 for climatic conditions. b)The meter should function satisfactorily in India with high end temperature as 60°C and humidity up to 96%.
1.20	Meter Sealing	As per CEA Regulations, Supplier shall affix one Utility /buyer seal on side of Meter body as advised and record should be forwarded to Buyer.
1.21	Guarantee / Warranty	10 Years.
1.22	Insulation	A meter shall withstand an insulation test of 4 KV and impulse test at 8 KV



1.23	Resistance of heat and fire	The terminal block and Meter case shall have safety against the spread of fire. They shall not be ignited by thermal overload of live parts in contact with them as per the relevant IS.
1.24	Battery	Lithium with guaranteed life of 15 Years
1.25	RTC & Micro controller	The accuracy of RTC shall be as per relevant IEC / IS standards
1.26	P.C.B.	Glass Epoxy, fire resistance grade FR4, with minimum thickness 1.6 mm
1.27	<b>Power ON/Off hrs:</b>	Along with billing history parameters, meter shall log monthly ON/ Off hrs as history.
1.28	<b>Tamper Logging</b>	Last 200 events of Magnetic tamper; single wire tamper and top cover tamper shall be logged in memory along with Occurrence and restoration event data. Logic of defining tamper and OBIS code shall be agreed before supply of meter.
1.29	<b>Protection against HV spark:</b>	Meter shall continue to record energy or log the event, incase it is disturbed externally using a 35KV spark gun/ ignition coil.

## 2. TAMPER & ANTI-FRAUD DETECTION/EVIDENCE FEATURES

The meter shall not get affected by any remote control device & shall continue recording energy at least under any one or combinations of the following conditions:

2.1	I/C & O/G Interchanged	Meter should record forward energy
2.2	Phase & Neutral Interchanged	Meter should record forward energy
2.3	I/C Neutral Disconnected, O/G Neutral & Load Connected to Earth.	Meter should record forward energy
	I/C Neutral disconnected, O/G Neutral Connected To Earth Through Resistor & Load Connected To Earth.	Meter should record forward energy
2.5	I/C Neutral connected, O/G Neutral Connected To Earth Through Resistor & Load Connected To Earth.	Meter should record forward energy
2.6	I/C (Phase & Neutral) Interchanged, Load Connected To Earth.	Meter should record forward energy
2.7	I/C & O/G (Phase or Neutral) Meter should record forward energy	

Disconnected,Load Connected To Earth.

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### **3.0 INFLUENCE PARAMETERS**

The meter shall work satisfactorily with guaranteed accuracy limit under the presence of the following influence quantities.

- a) External magnetic field – 0.5 Tesla.
- b) Electromagnetic field induction,
- c) Radio frequency interference,
- d) Vibration etc,
- e) Waveform 10% of 3rd harmonics,
- f) Voltage variation,
- g) Electro magnetic H.F. Field,
- h) D.C. immunity test,

### **ANNEXURE**

#### **DISPLAY SEQUENCE FOR THE PARAMETERS**

##### **A Default Display:**

Cumulative KWH to be displayed continuously without decimal

##### **B On-demand Display:**

After using pushbutton the following parameters should be displayed.

1. LCD test
2. Date
3. Real Time
4. Current MD in kW
5. Current kW generated by solar system
5. Last month billing Date
6. Last month billing KWH reading
7. Last month billing Maximum Demand in KW
8. Last month billing Maximum Demand in KW occurrence Date
9. Last month billing Maximum Demand in KW occurrence Time
10. Instantaneous AC Current and Voltages
11. Power Factor
12. Display for Tamper
13. MD reset count
14. % THD of current harmonics R,Y,B
15. % THD of voltage harmonics R,Y,B
16. % THD above threshold value with date and time

**Note: The meter display should return to Default Display mode (mentioned above) if the 'push button' is not operated for more than 6 seconds.**

## **ANNEXURE B**

### **HARMONICS STANDARD**

As per the standard of IEEE 519, the permissible individual harmonics level shall be less than 3% (for both voltage and current harmonics) and Total Harmonics Distortion (THD) for both voltage and current harmonics of the system shall be less than 5%.

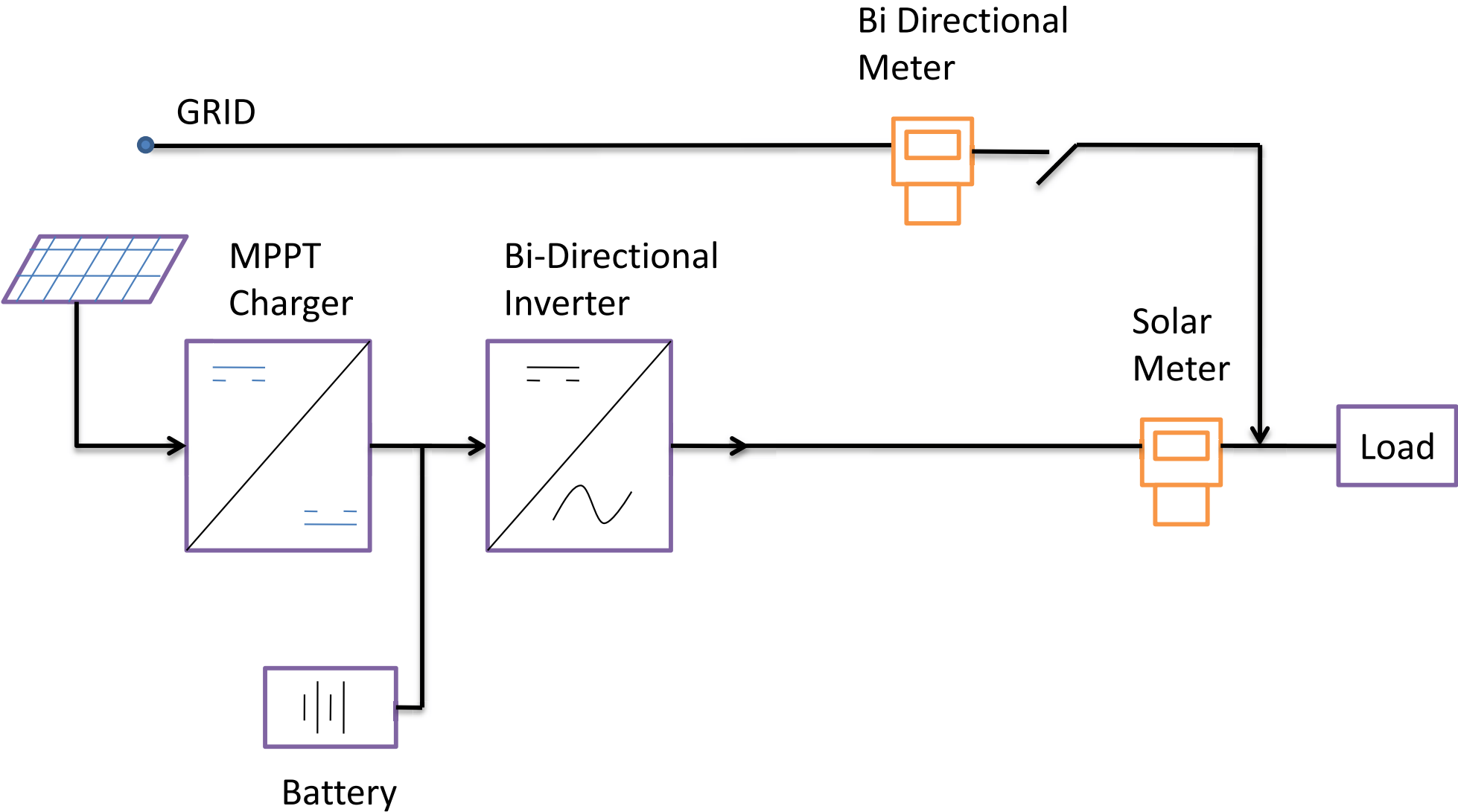
## **ANNEXURE C**

### **Inverter Standards**

Inverter should comply with IEC 61683/IS 61683 for efficiency and Measurements and should comply IEC 60068-2 (1,2,14,30) / Equivalent BIS Standard for environmental testing.

Inverter should supervise the grid condition continuously and in the event of grid failure (or) under voltage (or) over voltage, Solar System should be disconnected by the circuit Breaker / Auto switch provided in the inverter

# Roof Top Solar with Battery



# Roof Top Solar without Battery

