

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

STANDING OPERATING PROCEDURE (SOP) **FOR PROCESSING DISTRIBUTED GENERATION APPLICATIONS**

Pursuant to NEPRA SRO issued vide SRO-892 (1)/2015 dated 1st September, 2015 for the regulation of Distributed generation by using alternative and renewable energy and net metering to encourage large scale generation in the sector. In this regard following SOP is hereby proposed for guidance of the field staff of DISCOs for expeditious implementation.

A Definitions:

In this SOP, the words and phrases have the same meanings as provided in the Regulation of Generation, Transmission and Distribution of Electric Power Act, 1997(XL of 1997), the National Electric Power Regulatory Authority (Alternative and Renewable Energy Distributed Generation and Net. Metering Regulation 2015, the Electricity Act 1910 including Electricity Rules, 1937 except as mentioned below.

- a) Office or DISCO's Office means Office of Focal person.
- b) Focal person means the local Deputy Manager (Operation) of the concerned Division and the applications will be submitted / registered in the office.
- c) *Regulation means* National Electric Power Regulatory Authority (Alternative and Renewable Energy Distributed Generation and Net. Metering Regulation 2015) issued vide SRO-892 (1)/2015 dated 1st September, 2015 which can be downloaded from NEPRA Website www.nepra.org.pk.
- d) Schedule means Schedule appended to the Regulation
- e) Inspection Committee means the committees as mentioned in para 10 of Clause C of this SOP
- f) Inspection Authority means the Authority in para 5 of Clause D of this SOP
- g) "Import"- means energy supplied by the DISCO grid to DG
- h) "Export"- means energy delivered to the DISCO grid by the DG.

All other words shall have the same meanings as mentioned in the Regulation

B. Registration of Application

1. Any person who meets the requirements of a Distributed Generator as defined under the Regulations 2(k) is required to submit application (as specified in Schedule-II of Regulations duly filled along with necessary documents) in the office relevant DISCO's focal person.
2. Application can be down loaded from NEPRA's website www.nepra.org.pk. (Appendix-1)
3. The filled in application along with necessary document shall be submitted by the intending Distributed Generator to the focal person of the Distribution Company.
4. The focal person shall accord solar net metering approvals on a first come first served basis until the grid connected Solar PV installed Capacity reaches 80% of the closest upstream Distribution Transformer rated capacity based on the verification by the Assistant Manager Operation concerned. The priority for such applications shall be maintained at division level for which a separate register shall be maintained for such applications.

C. Application Processing

1. Within in five working days of receiving an application the DISCO shall acknowledge its receipt and inform the applicant whether the application is complete in all respect. This includes verification of arrear if any, spot inspection by the inspection committee and submission of technical feasibility report to be prepared by the Inspection committee.

2. While preparing the Technical Feasibility of proposed interconnection Inspection Committee shall keep in view following checks:
 - i. The sanctioned DG load on any T/F should not be more than 80% of its capacity.
 - ii. To check whether the proposed interconnection will require upgrading the capacity of existing distribution network.
 - iii. Phase balancing has to be checked to avoid unbalancing of load in secondary circuit of distribution line.

(**Appendix- A** is attached for guidance).
3. In case of any missing information or document, the Applicant shall provide the same to the DISCO Office within seven working days of being informed by the office.
4. The DISCO's Office shall perform an initial review to determine whether the Applicant qualifies for Interconnection Facility, or may qualify subject to additional requirements. Provided that the initial review shall be completed within twenty working days.
5. In case the initial review reveals that the proposed facility is not technically feasible, the DISCO's Office shall return the Application and communicate the reasons to the Applicant within three working days after the completion of initial review.
6. If the DISCO's Office is satisfied that the Applicant qualifies as Distributed Generator, and an approval in writing from Provincial Electric Inspector as mentioned in Clause 6 of Schedule I appended to the Regulation has been submitted by the Applicant, the DISCO's Office and the Applicant shall enter into an Agreement (as per schedule-I of Regulation) within ten working days and DISCO's Office shall send a copy of the Agreement to the NEPRA within seven working days of the signing of the Agreement. The DISCO's office shall forward the Application for grant of License as specified in Schedule -III of the Regulation, to the Authority along with followings;
 - i. Agreement
 - ii. Application for exemption from the requirement of section 24 of the Act as specified in Schedule-IV,
 - iii. Evidence of deposit of fee as may be specified by the Authority as specified in Schedule-V
 - iv. Affidavit by Distributed Generator as specified in Schedule-VI
7. Within seven working days of execution of the Agreement, the DISCO's Office shall issue the Connection Charge Estimate to the Applicant for the proposed interconnection facility up to the Interconnection Point including the metering installation.
8. The Applicant shall make the payment of Connection Charge Estimate within twenty days of its issuance and will intimate the office in writing.
9. The DISCO's office shall install and commission the proposed interconnection facility within thirty days of the payment of demand notice by the Applicant. Provided that the net metering arrangement shall commence upon grant of license to the Distributed Generator in accordance with Regulation 4 of these Regulations.

10. Following will be competent to check the interconnection facility before parallel operation, issue connection charge estimates and to sign the agreement with Distributed Generators:
- a. For the categories of consumers for which SDO(Operation) or XEN (Operation) are competent to sanction the connection then following shall be the procedure to complete the process. :
 - i. Interconnection facility checking/inspection by: Dy. Manager (Operation), AM (M&T), AM (P&I)
 - ii. Issuance of connection charge estimate by: Dy. Manager (Operation)
 - iii. Signing of agreement by: Dy. Manager (Operation) and Witnessed by AM (O)& LS
 - b. If Manager (Operation) office is competent to sanction the connection in respect of that category of consumers:
 - i. Interconnection facility Checking/inspection by: Manager (Operation), DM (M&T), DM (P&I)
 - ii. Issuance of connection charge estimate by: Manager (Operation)
 - iii. Signing of agreement by: Manager (Operation) and witnessed by DM (O)&AM (O)
 - c. If CE (P&E) / CEO office is competent to sanction the connection in respect of that category of consumers:
 - i. Interconnection facility Checking/inspection by:CE (P&E), Manager (Operation), RM (M&T), Manager GSO,
 - ii. Issuance of connection charge Estimate by: CE (P&E)
 - iii. Signing of agreement by: CE (P&E) and witnessed by DM (Planning)& AM (Planning)

D. Some important pre-requisites:

1. Load flow study (on PSSE software) will be compulsory for all distributed generators having installed capacity of more than 500 KW.
2. For distributed generator having capacity <500 KW and >10KW may submit load flow study on FDRANA.
3. The DG capacity upto 10 KW is absolved from interconnection study.
4. When the accumulative capacity of (already allowed) Distributed Generators become 80% of loading capacity of installed distribution transformer, agreements with new Distributed Generator will be signed subject to the augmentation of existing distribution transformer on cost deposit basis by the new distributed generator.
5. Safety inspection for DG should be obtained from the appropriate authorities (the inspection authority) as mentioned below:

Load up to 10 KW	A committee comprising of the concerned Deputy Manager (M&T) and Assistant Manager (Operation) shall be the inspecting authority.
Load above 10 KW	A committee comprising of the concerned Deputy Manager (M&T) and Deputy Manager (Operation) shall be the inspecting authority.

Safety inspections shall be carried out by the inspection authority within 10 (Ten) working days from the date of readiness intimation by the applicant. Safety certificates shall be issued within 5 (five) working days from the date of safety inspection or rectification of defects, if any.

6. Mandatory safety precautions/features which have to be taken into consideration as part of the grid connected installations are:-
 - (a). An inbuilt Inverter relay which trips on grid failure and thus prevents any solar power injection to the Grid when there is no power in Grid (anti islanding protection shall be tested by the respective officers during routine service connection inspections), and necessary protection arrangements shall be made when there is no grid supply on single/two/three phases. The inspection authority shall ensure the protection before commissioning. The applicant's installation shall be disconnected in the event of such exigencies to prevent accident or damage to men and material.
 - (b). The DG Facility should be separately grounded/ earthed. Lightning arrestors also to be provided for DG Facility. Manual isolator switch with locking facility shall be provided at 'Ground Floor'.
7. A single bi-directional service connection meter shall be installed to measure import and export (kWH) separately. For existing service connections, the uni-directional service connection meter shall be replaced with a bi-directional service connection meter. Bi-directional service connection meter accuracy and facilities shall be the same as applicable to the standard uni-directional meters for the relevant type of service connection and tariff.

E. Distributed Generation Facility Design and Operating Requirements:

Pursuant to Clause-9 "Protection Requirements" of the Alternative and Renewable Energy Distributed Generation and Net. Metering Regulation 2015 for implementing net metering policy, following protection requirements are hereby proposed to be incorporated in design of the system.

- 1) **Single Line Diagram:**
The protection and control diagrams for the interconnection of the Distributed Generator shall be in accordance with Single Line Diagram as proposed at **Appendix -E** to be approved by the Distribution Company prior to the commissioning of the system.
- 2) Distributed Generator shall be responsible for installation of all of the equipment and protective devices to be used for the interconnection.
- 3) **Earthing Protection:**
A minimum of two separate dedicated and interconnected earth electrodes must be used for the earthing of the solar PV system support structure with a total earth resistance not exceeding 5 ohms as below:

- (i) Equipment earth (DC) &
- (ii) System earth (AC)

Both equipment earth (DC) and system earth (AC) shall be checked for proper earthing.

- **Equipment earth (DC):** All metallic parts of DG Facility such as PV modules, DCDB, generator, iron clad Switches will be connected to earth with two separate and distinct earth connections to Avoid any loss of property or Human being.

4) **Surge Protection:**

- i. Surge protection shall be provided on the DC side and the AC side of the DG facility.
 - ii. The DC surge protection devices (SPDs) shall be installed in the DC distribution box adjacent to the solar grid inverter and generator.
 - iii. The AC SPDs shall be installed in the AC distribution box adjacent to the DG facility.
 - iv. The SPDs earthing terminal shall be connected to earth through the above mentioned dedicated earthing system.
 - v. The Lightning Arresters need to be provided for the buildings which are of more than 15 meters height only.
- 5) Earthings shall be done in accordance with Standard Design Instructions to be issued by DISCO in consultation with Chief Engineer (D&S) NTDC.
- 6) The Applicant/ consumer shall be present at the time of synchronization of the installation.
- 7) The consumer shall provide suitable capacity of Porcelain Cutouts (100 Amps, or 200 Amps) to enable line man to disconnect the installation so as to provide a safe zone for maintenance works.
- 8) If the installation satisfies all the above conditions the synchronization of the DG Facility shall be carried out by the concerned Assistant / Deputy Manager (Operation) along with M&T staff within 3 working days from the issue of approval for synchronizing and commissioning.
- 9) At the time of commissioning, the meters installed shall be jointly inspected and sealed on behalf of both the parties and shall be interfered / tested or checked only in the presence of the representatives of the consumer.
- 10) The concerned Assistant / Deputy Manager (Operation) will issue synchronization certificate to the applicant DG Facility after synchronization and commissioning

F. **Periodical inspections:**

- 1) Both uni-directional and bi-directional energy meters are to be tested as per schedule by M&T staff once in 6 months.
- 2) The inverter functionality of every installation is to be checked by M&T staff once in 6 months.

- 3) Periodical test reports/inspection reports shall be submitted to the concerned Assistant Manager (Operation) and Deputy Manager (Operation).

G. Billing procedure:

Pursuant to Clause-14 “Billing for Net Metering” of the Alternative and Renewable Energy Distributed Generation and Net Metering Regulation 2015 for implementing net metering policy, following procedure is hereby proposed to be adopted:

- 1) The consumer shall receive a monthly net import/export bill indicating either net export to the grid or net import from the grid.
- 2) The meter reader has to capture import & export energy and other billing parameters recorded by the bi-directional meter.
- 3) In case of net import bill, the Distributed Generator shall be billed for the net kWh in accordance with applicable tariff.
- 4) In case, the energy exported to DISCO is more than the import, the net kWh shall be credited against Distributed Generator next billing cycle for future consumption. After continuous credit of three months DG is liable to claim energy cost from DISCO.. Provided that where the Distributed Generator is to be paid, the kWh in a month will be charged at the tariff of that respective month.
- 5) The tariff payable by DISCO shall only be the off-peak rate of the respective consumer category of the respective month and other rates such as variable charges for peak time, fixed charges, fuel price adjustment, duties / levies will not be payable by the DISCO.

H. General Guidelines

1. The applicant is required to install the DG Facility through system installer who has experience in design, supply and installation of DG Facility.
2. The DG Facility should comply with the relevant IEC technical standards.
3. The installation work has to be carried out as per the approved drawing and as per standards.
4. In case the installed (also read proposed) capacity of the DG Facility is higher than the sanctioned load of the consumer, which consequently requires an up-gradation in the infrastructure (service line meter with CT (if required), transformer upgrading (if required)), the consumer will have to upgrade at his / her / its own cost.
5. The applicant shall provide check meters when the DG Facility is more than 20 kWp.

Net Metering Technical Feasibility Report

A. Particulars of the Applicant:

- i. Name of the Applicant:
- ii. Address:
- iii. Telephone No/Mobile No:
- iv. Email address:
- v. Reference No. of existing connection
- vi. Sanctioned Load in kW (A):
- vii. Applicable tariff:
- viii. Detail of existing energy meter
 - a) Make and type
 - b) Single / three phase:
 - b) Capacity in ampere:
 - c) Direct reading or CT operated:

B. Name of:

- a) Operation Sub-Division
- b) Feeder/code
- c) 132/11.5 KV Grid Station:

C. Details of Distribution Transformer:

- i. Capacity of Distribution Transformer in KVA (B)
- ii. Voltage ratio of Distribution Transformer
- iii. Solar PV capacity already connected to this Distribution Transformer in KW (C):
- iv. Proposed Solar PV capacity in KW (D):
- v. Total Solar PV capacity including the proposed new capacity: (E = C + D):

Note: The proposed solar PV capacity addition is technically feasible if

- a) The total solar PV capacity (E) in kW is not more than 80% of the Distribution Transformer capacity in KVA (B) [$E \leq B \times 80\%$] and
- b) The proposed solar PV capacity in kW (D) does not exceed the sanctioned load of the service connection in kW (A) [$D \leq A$].

D. Feeder Details (Applicable for the HT consumers applied for LT connectivity).

- i. Name of the feeder/code
- ii. Name of Grid Station from which the feeder is emanating with voltage ratio
- iii. Type and size of the conductor
- iv. Current carrying capacity of the feeder
- v. Maximum load reached on the feeder in KW
- vi. Total connected Distribution Transformer capacity on this 11KV feeder(KVA)
- vii. SPV generators connected on this feeder, if any, and their capacity in KW.

E. Conclusion:

Whether it is technically feasible to connect the proposed solar PV system to the service connection (Yes or No):

Deputy Manager (Operation)_____

Deputy Manager (M&T)_____

Inspection / Test Check Proforma

A. Service Connection Details:

- i. Name of the Consumer:
- ii. Address:
- iii. Telephone No/Mobile No:
- iv. Email address:
- v. Reference No. of existing connection
- vi. Applicable tariff:
- vii. Details of already existing (removed energy meter)
 - a) Make and type
 - b) Meter Readings
 - c) Serial number
 - d) Month / year of manufacture

B. Details of the Newly Installed Bidirectional Meter

- i. Make and type
- ii. Serial number
- iii. Month / year of manufacture
- iv. Capacity:
- v. Meter constant (for CT-operated meters):
- vi. Import register reading (kWh):
- vii. Export register reading (kWh):
- viii. Accuracy

C. Solar Generation Check

- i. Make and type
- ii. Serial number
- iii. Month / year of manufacture
- iv. KWH Reading
- v. Meter constant (for CT-operated meters):
- vi. Accuracy.....

D. Solar Grid Inverter

- i. Make:
- ii. Serial number:
- iii. Capacity:
- iv. Input DC voltage range:
- v. Output AC voltage range:
- vi. Anti-Islanding Protection Check - if the grid fails the status of the contactor (on or off)

E. Solar PV modules

Total capacity of solar modules (kW):

Deputy Manager (Operation) _____ Deputy Manager (M&T) _____

Sample Specifications of Solar Grid Inverter for guidance purpose

Total output power (AC)	To match solar PV plant capacity while achieving optimum system efficiency
Input DC voltage range	As required for the solar grid inverter DC input.
Maximum power point (MPPT) tracking	Shall be incorporated
Number of independent MPPT inputs	1 or more
Operation AC voltage	Single phase 280V or Three phase 415V (+12.5%, -20%)
Operating Frequency range	47.5 – 52.5 Hz
Nominal frequency	50 Hz
Power factor of the inverter	>0.98 at nominal power
Total harmonic distortion	Less than 3%
Built-in Protection	AC high / low voltage; AC high /low frequency
Anti-islanding protection	As per VDE 0126-1-1, IEC 60255.5 / IEC 60255.27
Operating ambient temperature range	-10°C to +60 °C
Humidity	0 – 95% Rh
Inverter efficiency	>=95%
Inverter weighted efficiency	>=94%
Protection degree	IP 65 for outdoor mounting, IP 54 for
Communication interface	RS 485 / RS 232 / RJ45
Safety compliance	IEC 62109-1, IEC 62109-2
Environmental Testing	IEC 60068 - 2 (1,2,14,80)
Efficiency Measurement Procedure	IEC 61683
Cooling	Convection
Display type	LCD for data display. LCD / LED for status display
Display parameters to include	Output power (W), cumulative energy (Wh), DC voltage (V), DC current (A), AC voltage (V), AC frequency (Hz), AC current (A), cumulative hours ofoperation (h).

Note:**Inverter Standards**

Inverter should comply with IEC 61683 for efficiency and measurements and should comply IEC 60068 -2 (1, 2, 14, 80) / 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.

MULTAN ELECTRIC POWER COMPANY**CHECKLIST FOR DG's GRID SAFETY QUALIFICATION****1.0. Solar RTPV – Customer and Location Data**

1	Customer Name	
2	Address	
3	Customer Contact - Email	
4	Customer Contact – Mobile No.	
5	DG Installer – Name & Address	
6	MEPCO Officer in Charge	

2.0 Component Inspection Checklist

Sr. No	Item Type	YES	NO
1	Installation layout – is it as per drawing?		
2	Inverter IEC standards qualified		
3	PV panel / DG IEC standards qualified		
4	PV isolators / PV cables IEC standards qualified		
5	AC disconnect manual switch provided		
6	Meters checked by M&T		
7	Any other critical component IEC standards certified		

3.0 Grid Functional Safety Checklist

Sr. No	Item Type	YES	NO
1	Check-PV Inverter and islanding (utility side) Disconnect Grid and check whether PV generator seizes Generation immediately		
2	Check Reconnect time Reconnecting the Grid, PV Generator reconnects minimum 60 seconds later (Single Phase) or minimum 800 seconds later (three Phase connectivity)		
3	Bi directional flow recorded on MEPCO Meter		
4	Consumption (import) only mode OK?		
5	PV inverter anti islanding tested at array side		
6	Solar Generation meter OK?		
7	Check all earthings provided at ACDB/DCDB/LA		

It is certified that the PV installation is qualified to be connected to MEPCO Grid.

Dy. Manager (Operation)

Division MEPCO