

# NET-METERING REFERENCE GUIDE FOR ELECTRICITY CONSUMER



How to get your solar system connected to  
National Grid in Pakistan



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# Glossary

AEDB	Alternative Energy Development Board
CCE	Connection Charge Estimate
COC	Certificate of Compliance
DFI	Development Finance Institute
DG	Distributed Generator
DISCO	Distribution Company
EN	European Standard
FESCO	Faisalabad Electric Supply Company
GEPCO	Gujranwala Electric Supply company
HESCO	Hyderabad Electric Supply Company
IEC	International Electro-technical Commission
IEEE	Institute of Electrical and Electronics Engineers
IESCO	Islamabad Electric Supply Company
kW	Kilowatts
kWh	Kilowatt hour
kWp	Kilowatt peak
LESCO	Lahore Electric Supply Company
LGU	Local Government Unit
MEPCO	Multan Electric Power Company
MW	Megawatt
NEPRA	National Electric Power Regulatory Authority
NGO	Non-governmental organization
PESCO	Peshawar Electric Supply Company
PKR	Pakistani Rupee
PV	Photovoltaic
QE	Qualified End Users
QESCO	Quetta Electric Supply Company
QTP	Qualified Third Party
RE	Renewable Energy
SBP	State Bank of Pakistan
ROI	Return on Investment
SEPCO	Sukkur Electric Power Company
STC	Standard Test Condition
TESCO	Tribal Electric Supply Company
UL	Underwriters Laboratories

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# 1. Introduction

This guide provides an overview of important points to consider when planning and purchasing a small, medium or even large PV system intended for own consumption and for grid interconnection. The guide is directed towards the interested parties considering installing a grid-connected photovoltaic system. It attempts to walk the reader through different stages, beginning from the day when idea to buy a PV system is conceived, up to the realization of the PV project. This user guideline intends to give the reader a roadmap for installation and interconnection, in order that all steps are covered and considered beforehand. The system can either be a residential PV installation of a household or a larger commercial solar PV system.

## 1.A Background

Pakistan has been facing energy crisis for the past few years as the demand and supply gap has widened. The country's current energy demand far exceeds its generation resources, and it has been facing an energy shortfall of 4000MW. As a result, load-shedding and power blackouts have become severe issues.

Keeping in mind the above issues, the Government of Pakistan is promoting investment in the generation of small scale distributed Renewable Energy, through the Alternative Energy Development Board (AEDB), on the basis of the Net-Metering concept.

## 1.B About Net Metering

Net metering is an electricity policy for consumers, who own / plan to setup a Renewable Energy facility, which allows them to produce electricity (using wind and solar) for their own use and supply the excess produce to the national grid setting-off units of electricity consumed during off-peak hours or at times when the production from RE facility is not enough to meet the consumer load. The consumer will either pay reduced utility bill or get paid for access energy exported to the grid, as stated in the contract with the relevant DISCO.

NEPRA, in September 2015, issued its net-metering regulations that allow the DISCOs in Pakistan to purchase excess units of electricity produced by the consumers, and net them off against the units consumed from the grid. Renewable Energy is a long-term power solution. The Solar PV Technology gives access to affordable electricity supply during system life. Residential and commercial customers can switch their electricity load to Renewable Energy (RE) and can slash their power bills. The picture below illustrates the flow of electricity from distribution company (DISCO) to the end-user, who can now install a renewable energy facility and send the excess electricity back to the distribution grid and earn credit for his exports.

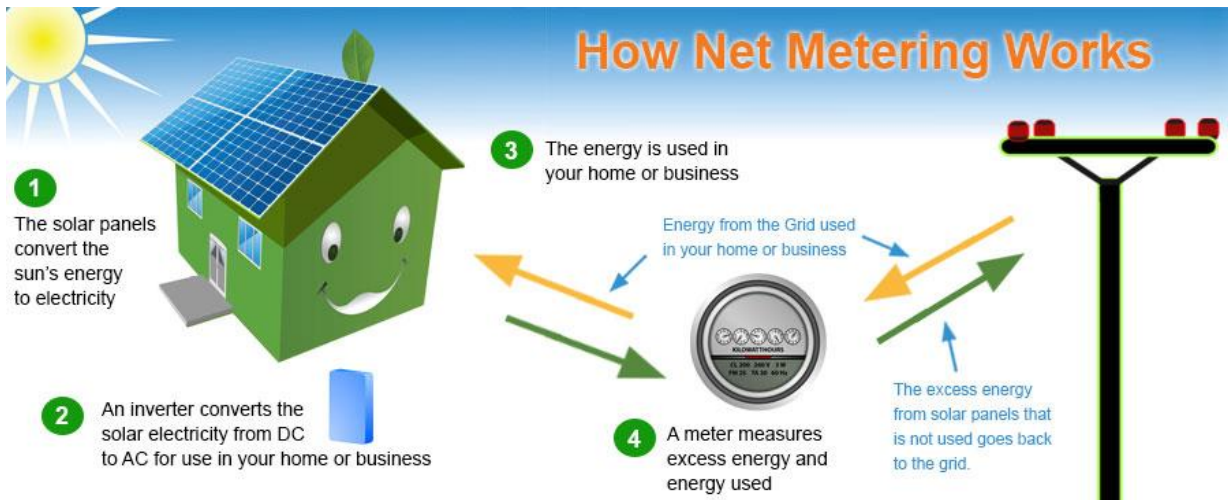


Figure 1.1: Net Metering process

### 1.C Net Metering in Pakistan

NEPRA announced the official *National Electric Power Regulatory Authority (Alternative & Renewable Energy) Distributed Generation and Net Metering Regulations* on September 1, 2015. As per these regulations, any customer of the national grid (having three-phase connection) can avail net-metering facility for small-scale (1kW to 1MW) Renewable Energy installations.

In Pakistan, net-metering is the first policy mechanism of the Policy for Development of Renewable Energy for Power Generation 2006, which has been fully implemented. Section 8.4.2 of the RE Policy provides that subject to technical considerations and without discrimination and upon request by distribution end-users, DISCOs shall enter into a net-metering agreement with qualified end-users, interested in installing the RE system.

NEPRA (Alternative & Renewable Energy) Distributed Generation and Net Metering Regulations, 2015 is at Annex I.

## 2. How to apply for net-metering

This chapter covers an overview of each step involved in the net-metering application procedure as per NEPRA's regulations. It would allow the readers to go through the steps involved in the application for the net-metering for their distributed generation facilities, and to get generation license from the authority.

### 2.A Overview and timeline of the procedure

Following are the steps involved in net-metering process along with the timeline.

#### 2.A.1 Application for net-metering

Any applicant, who meets the requirement of DG as defined in NEPRA's regulation, submits his application along with the necessary documents to the designated office of the DISCO. Application form<sup>1</sup> is at Annex II.

#### 2.A.2 Acknowledgement of application

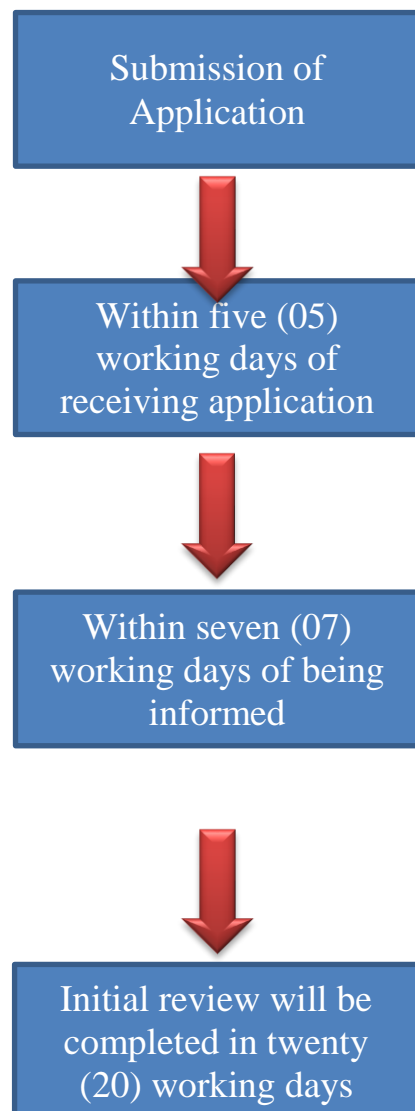
The DISCO will acknowledge receipt of application and inform the applicant whether the application is complete in all respect.

#### Incomplete application form

In case of any missing information or document, the customer will be informed in writing and the applicant would have to provide the missing information to the DISCO after receipt of the document.

#### 2.A.3 Initial review

After the receipt of complete application as per the checklist, the DISCO office will perform an initial review to determine whether the applicant qualifies for the interconnection facility and fulfills additional requirements.



<sup>1</sup> Application form can be downloaded from AEDB's website

#### 2.A.4 Technical feasibility in initial review

In case the initial review reveals that the proposed facility is technically infeasible, the DISCO will return the application and communicate the reason to the applicant.

Within three (03) working days after the completion of initial review



#### 2.A.5 Agreement

If the DISCO office is satisfied that the applicant qualifies as a DG, then the DISCO and the applicant will enter into an agreement. Agreement<sup>2</sup> (Schedule-I) is at Annex II.

Within ten (10) working days of review



#### 2.A.6 Generation license

The DISCO office will send the copy of the agreement between the applicant and the DISCO to NEPRA along with the application for issuance of generation license.

Within seven (07) working days of signing of agreement



#### 2.A.7 Connection Charge Estimate

After the agreement, if the DISCO feels that up gradation/ modification of network is required, the applicant will receive a Connection Charge Estimate (CCE) from the DISCO for the proposed interconnection facility up to the interconnection point including meter installation. Applications for which no up gradation/ modification is required, no CCE will be issued.

Right after the agreement



#### Payment of CCE

The applicant will deposit the Connection Charge Estimate (CCE) in designated Bank and notify the DISCO office in writing. The payment would be made as proposed in the CCE sent by the DISCO.

Within twenty (20) days of its issuance



<sup>2</sup> Agreement can be downloaded from AEDB's website

### 2.A.8 Installation of interconnection facility

After the applicant makes the payment, the DISCO office will install and commission the proposed interconnection facility after the confirmation of generation license to the DG by NEPRA.

Within thirty (30) days  
of payment by the  
applicant

## 2.B Fee

Charges to be paid by DG for the commissioning of Net Metering at the proposed facility are as follows:

- 1) DG is responsible for all the cost associated with interconnection facilities up to the interconnection point including meter installation.
- 2) DG is also responsible for any costs reasonably incurred by DISCO in providing, operating or maintaining interconnection facilities and distribution system improvements.
- 3) A Distributed Generator has to pay a one-time fee through pay order in favor of NEPRA for issuance of generation license as per the following fee schedule.

**Table 2.1: Generation license fee structure**

Sr,#	Size of DG facility	Fee to be paid by Applicant
1.	0-20 KW	Free of Cost
2.	20-50 KW	Rs. 500/-
3.	50-100 KW	Rs. 1000/-
4.	100-1000 KW	Rs. 5000/-



## 3. Interconnection Requirements

This chapter will cover all the requirements and recommendation for getting a net-metering connection installed at a DG's facility.

### 3.A Initial requirements

When applying for the net-metering, the distributed generation facility has to fulfill the following requirements according to NEPRA's regulations.

#### 3.A.1 NOC by Electrical Inspector

Before applying for the net-metering through DISCO, Distributed Generator would have to follow the suggested process for getting the NOC by an electrical inspector.

- a. Arrange testing of grounding along with other related requirements by a licensed electrician.
- b. Make a formal written request to the concerned electrical inspector along with copy of the test report.
- c. Electrical inspector shall detail an individual from his office or visit himself for verification
- d. If satisfied, shall issue the NOC
- e. If not satisfied, shall advise removal of faults /observations
- f. After rectification, repeat the request and get NOC

The NOC by the electrical inspector is to be attached with the application for net-metering. The contact addresses of electrical inspectors in different regions can be found at chapter 7..

**NOTE:** The scope of inspection by the Electrical Inspector is not limited to grounding testing only. It includes insulation tests, wiring size suitability, and general safety of the whole internal wiring. Therefore, the inspector may check all these elements.

#### 3.A.2 Single line diagram

The protection and control single line diagrams for the interconnection are to be provided by the

DG for commissioning of net-metering.

### 3.A.3 Technical standards

As per NEPRA's regulations, the grid-connected inverters shall comply with UL 1741 standard. Other standards for the components are:

- a. IEEE 1547 2003
- b. IEC 61215
- c. EN or other international standards

### 3.A.4 Load flow study

For the DGs having an installed capacity of more than 500kW, load flow study (on PSSE software) is compulsory, and for the distributed generation facilities having a capacity less than 500kW, load flow study can be carried out using FDRANA.

Load flow study for the facility having capacity up to 10kW is not required

## 3.B Mandatory safety requirements

According to NEPRA's regulation for net-metering, mandatory safety requirements for the interconnection facility are to be fulfilled by the applicant before submitting the application. In the absence of such requirements, the DISCO will call the technical feasibility of the distributed generation facility for review.

### 3.B.1 Anti-islanding

Anti-islanding is a built-in feature in an inverter, which trips the flow of energy to the grid on grid failure. Installing an anti-islanding enabled inverter is mandatory as per the net-metering regulations.

### 3.B.2 Interconnection disconnect switch

The applicant has to install an interconnection disconnect switch rated for its voltage and fault current requirements, which will cut the flow of energy back to the grid, if required. That disconnect switch shall be locked and be accessible to both the applicant and the DISCO personnel, and shall meet applicable IEC and IEEE standards.

## 3.C Safety recommendations

Apart from mandatory requirements for the processing of net-metering, further safety steps have to be considered for the protection of inverters, solar panels, DC wiring, and mounting frames.

### 3.C.1 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:

- a. Equipment earth (DC)
- b. System earth (AC)

### 3.C.2 Lightning and surge protection

Lightning (surge) arrestors are designed to absorb voltage spikes caused by electrical storms and effectively allow the surge to bypass power wiring and your equipment. The applicant has to make sure that the distributed generation facility is separately grounded and the lightning arrestors are provided.

### 3.C.3 Circuit breakers

Fuses and circuit breakers are primarily used to protect the PV system wiring from getting too hot and catching fire. They are also used for protection of appliances from electricity. It is also very important to properly size your cables and wires to prevent excessive heat /fire.

Wire gauge scale is given in the DC wiring section of Chapter 3, which should be considered while installing solar system. Moreover, circuit breakers should also be installed according to the rating of the panels and inverters.

## 3.D Extra precautions

Installation of the distributed generation facility requires some additional checks and precautions, which are listed below.

- 1) PV mountings and other metallic structure must be grounded using properly sized, good quality cable. The earth connection must also be tested for its continuity and resistance value to see that the grounding is adequate. The preferred ohm value is less than 5 ohms (for small scale home hold system).
- 2) PV modules mountings arrangement should be sturdy, long lasting, galvanized steel or aluminum channels.
- 3) The mountings should be properly secured with a strong base to ensure that they can withstand windstorms and other climatic changes.
- 4) PV modules should be attached to the mountings by stainless steel nuts and bolts using SS spring washers.
- 5) PV module cables should not be cut and twisted together for any kind of inter-connection.
- 6) For paralleling of PV strings, adequately sized combiner box or other similar accessories should be used.

- 7) All cables should be properly secured using properly sized ties, not tied with metal wire or ordinary string.
- 8) Current carrying cable from PV modules to inverter should be DC cable of proper rating, should have separate colors to identify positive/ negative, and should be in UPVC conduit, **not** normal PVC conduit.
- 9) AC circuit breakers should not be used for DC circuits.
- 10) All terminations should be done using properly sized terminals. These terminals should have insulation sleeves and be attached to cables by proper crimping tools.
- 11) The AC input /output of inverters should be properly protected by proper amperage circuit breakers.
- 12) If batteries are to be used, it is necessary that battery leads and terminations should be done using properly size terminals.

## 4. How to buy a solar system from your installer

The most important decision that one should make when setting up a solar energy plant is selecting what materials to use or which company to trust for the project execution phase. Cost is a critical factor but one must be very clear that the system being installed is able to meet load requirements, its long-term durability is guaranteed, and the roof has enough space for the installation of solar panels.

The basic components of a solar PV system are:

- Solar Panels
- Inverters
- Batteries
- Mounting structure

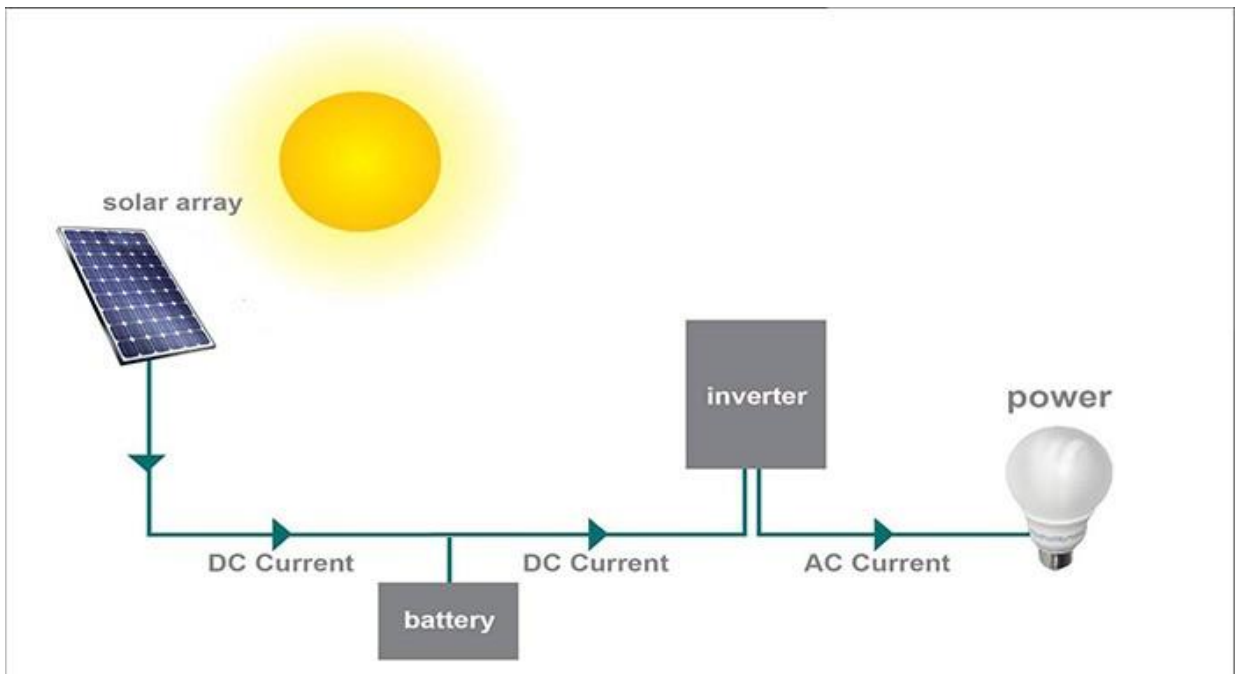


Figure 4.1: solar PV system

### 4.A Selecting components for solar system

#### 4.A.1 Which modules to buy

The solar panels (photovoltaic or PV modules) convert sunlight into electricity. A number of modules are connected together to increase the electrical power that can be generated. The entire set of modules may be referred to as the array. There are two basic types of modules in the market.

1. Crystalline silicon modules (c-Si)
2. Thin Film

Crystalline silicon (c-Si) cells have high efficiency rate, high stability, ease of fabrication, and high reliability. Other benefits include high resistance to heat and lower installation costs. They are further divided into two categories: mono-crystalline and poly-crystalline. Poly-crystalline modules are more frequently used than the mono-crystalline modules, although they are a bit less efficient than the mono-crystalline modules. The cost difference between the two types, however, compensates for the difference in efficiency of the modules.

Thin-film solar panels are less expensive than c-Si wafer cells. Available in thin wafer sheets, they are more flexible and easier to handle. They are also less susceptible to damage than crystalline silicon modules (c-Si) but are less efficient.



Figure 4.2: Thin Film Module



Figure 4.3: Crystalline Silicon module (c-Si)

When buying a module, it is important to ensure that the module confirms to the design qualification (see below the section “test specifications”).

<ul style="list-style-type: none"> <li>• Manufactured for maximum energy yield per m<sup>2</sup>.</li> <li>• Manufactured mostly with aluminum profile frame, which protects glass edges, facilitates mounting, improves statics of modules and can be used for fixation on mounting structures.</li> <li>• Most frames are produced with mounting holes and holes for water discharge.</li> </ul>	<p><b>Crystalline Silicon Modules</b></p>
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Table 4.1: c-Si specifications

<ul style="list-style-type: none"> <li>• Choose the module with at least 8 years of warranty.</li> <li>• Most manufacturers guarantee a 25-year limited warranty on the power output, usually 90% of the minimum output power rating of the modules during the first 10 years of operation, and 80% during the following 15 years. Sometimes, manufacturer provides a warranty stating guaranteed power output of 97% of the minimum output power rating during the first year of operation and a guaranteed maximum linear degradation of 0.5% p.a. until the 25th year.</li> </ul>	<p><b>MODULE WARRANTY</b></p>
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Table 4.2: Module warranty

**Useful Tips:**

- Check the module type with IEC standards and type of warranty.
- Buy modules with measurement record and serial numbers as reference.
- Do not use modules with different ratings for a system in order to minimize power losses.

#### 4.A.2 Choosing inverters

The inverter represents the connection between the photovoltaic system and the public distribution grid. It converts the direct current (DC) generated by the PV system into alternate current (AC). Therefore, the inverters have to adapt to grid frequency (50 Hz) and the voltage (3 phase 400V OR single phase 220V for up to 5kW system).

There are grid-connected, stand-alone (off-grid) and hybrid inverters. As the name suggests, grid-connected inverters are directly linked to the public electricity grid through the in-house electrical network.

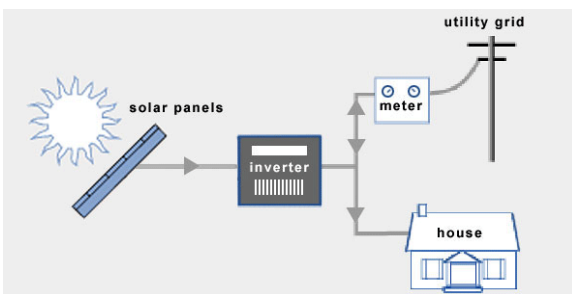


Figure 4.4: Grid connected inverter

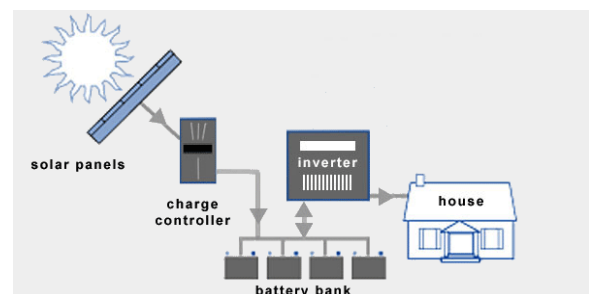


Figure 4.5: Stand-alone inverter

A hybrid solar inverter possesses features of grid-tied and off-grid inverter. These inverters can either be described as off-grid solar inverter with utility backup, or grid-tied solar inverter with extra battery storage. In simple words, a system with hybrid solar inverter takes solar input as preferred power source and can export to the grid as well as power in-house load. In absence of grid, these inverters operate in off-grid mode and provide battery stored power to the load.

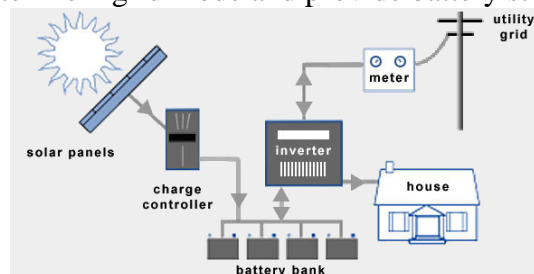


Figure 4.6: Hybrid inverter

<ul style="list-style-type: none"> <li>• As much as possible, the inverter should be installed nearest to the PV modules. Shorter the DC cabling, lesser will be the power loss of the solar PV system.</li> <li>• Inverters get slightly warm during their operations. To achieve higher performance, there should be adequate ventilation. (</li> <li>• Always comply with the external conditions demanded by the manufacturer, particularly permissible humidity and ambient temperature.</li> </ul>	<p><b>PLACE OF INSTALLATION</b></p>
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Table 4.3: Placement of inverter

**Useful Tips:**

- Ensure adequate ventilation
- Consider range of permissible ambient temperature for inverter (avoid power limitation due to high temperatures)
- If an inverter is mounted outdoors (other than IP 65 compliant) it has to be protected against rain and insulation. Avoid keeping the inverter under direct sunlight.
- Adherence to installation manual provided by the inverter manufacturer can be helpful for placement of inverter

### Renowned inverter manufacturers

Below is the list of manufacturers that provide inverters, which support net-metering.

- |                 |             |                  |
|-----------------|-------------|------------------|
| ABB             | Fronius.USA | Solectria        |
| Advanced Energy | Growwatt    | Sungrow          |
| APS system      | Satcon      | Sun Power        |
| BAYKEE          | Schneider   | Voltronics Power |
| Delta           | Sharp       | Outback Power    |
| Direct Grid     | SMA-America |                  |
| Enphase Energy  | Solar Edge  |                  |

### 4.A.3 Choosing batteries

A brief overview of the different types of batteries that may be used for storing electricity generated by solar power system is as under.

Lead Acid batteries are used in most of the solar home systems for backup purposes. However, new deep-cycle/OpzS and OpzV lead batteries should be preferred.

Deep-cycle batteries are designed to regularly deep discharge using most of its capacity. OpzS and OpzV batteries have tabular plates especially designed for all industrial level applications, which demand low-maintenance as well as average and long discharges. The tabular design with lead selenium alloy guarantees best operating life, minimum maintenance and optimal performance in cyclic and standby applications.

By comparing the cost and the performance of the batteries, it is recommended that Lead Acid batteries with deep-cycle should be installed for small PV systems and for the large PV systems OpzS/OpzV batteries should be preferred.

### Useful Tips:

- Deep-cycle batteries last 4-5 years with good care, however, on average lead acid batteries last from one to two years, and the life of the batteries varies depending upon the frequency and pattern of usage and maintenance.
- A new battery should be checked every few weeks to estimate the water level. However, dry-maintenance free batteries should be procured to avoid the hassle and have a long battery life.
- Batteries should be kept in shade, away from sunlight or high temperature to ensure better performance and long life.

#### 4.A.4 Selecting mounting systems and warranty

Unlike in the past, manufacturers now offer easy to install mounting systems for flat roofs. For large roofs on industrial and commercial buildings, frames are now generally lightweight, aerodynamic, self-supporting, and without roof penetration challenges.

When installing the modules, drilling holes into the module frame should be avoided. Check with your module supplier about warranty before you drill any hole.

#### Penetrating mounting Structure – GI

Low cost compact structure is suitable for flat roofs and small to mid-sized installations

- Compact structure for flat roofs made of roll formed GI profiles
  - Stainless steel fasteners, SS stud bolts for foundations
  - Designed to withstand wind gusts of 150 km/h
  - Tilt adjustable to latitude
  - Area required per kW: 8 to 12 square-meter without shading.



Figure 4.7: GI mounting structure

#### Fixing of modules

When fixing or clamping the solar panels on the rails of the chosen mounting system, following points have to be considered.

- Weight of the modules varies from 60-80kg/kW approx.

- In case the manufacturer provides no information, the module attachment should be along the longer side of the module, at around  $\frac{1}{4}$  of the module length. The pre-drilled module holes are mostly in this part of the frame.

#### **Useful Tips:**

- Choose a corrosion-resistant and statically tested mounting system.
- Check if chosen mounting system complies with the requirements of module manufacturer.
- Consider maximum local wind loads.
- Structure should be protected by 2 layers of paint i.e. red oxide and galvanized paint for protecting it from corrosion throughout the life of the solar panels

#### 4.A.5 DC Wiring

DC wires should be selected carefully for connecting panels to the inverters. Wires are rated according to the current rating (Amps) that can safely pass along it, higher the current, thicker will be the wire. Allow at least 35% margin in the rating of wire and the load. Consult a qualified electrician, having knowledge of DC wiring and solar system to decide the best wires for the system

The distance between the inverter and the panel should also be minimum to minimize losses.

#### **Useful Tips:**

- One thing to remember though is that the individual runs to all appliances must be connected to a fuse box.
- A breaker should be installed on DC wiring before inverter for safety purpose.

The wire gauge guide on the next page is a quick reference for choosing the correct wire thickness.



AWG	12 3mm <sup>2</sup>	10 5mm <sup>2</sup>	8 8mm <sup>2</sup>	6 13mm <sup>2</sup>	4 21mm <sup>2</sup>	2 32mm <sup>2</sup>
4 Amps	7m	11.1m	17.7m	28.2m	44.9m	71.4m
6 Amps	4.6m	7.4m	11.8m	18.8m	30m	47.7m
8 Amps	3.5m	5.6m	8.8m	14.1m	22.5m	35.7m
10 Amps	2.8m	4.4m	7.1m	11.3m	18m	28.5m
12 Amps	2.3m	3.7m	5.9m	9.4m	14.9m	23.7m
14 Amps	2m	3.2m	5.1m	8.1m	12.8m	20.4m
16 Amps	1.7m	2.8m	4.5m	7m	11.2m	17.8m
18 Amps	1.6m	2.5m	4.0m	6.3m	10m	15.9m
20 Amps	1.4m	2.2m	3.6m	5.6m	9m	14.3m
25 Amps	1.1m	1.8m	2.9m	4.5m	7.2m	11.4m
30 Amps	0.9m	1.4m	2.4m	3.7m	6m	9.5m
35 Amps	0.8m	1.29m	2m	3.2m	5.1m	8.1m
40 Amps	0.7m	1.1m	1.8m	2.8m	4.5m	7.1m

Table 4.4: Reference wire gauge

## 4.B Important aspects of a PV system

### 4.B.1 Household solar system

The electrical power of a PV system is measured in kilowatt peak (kWp) and refers to the maximum power under standard test conditions (STC). For the installation of a 1 kWp power plant, you will need an area of about 8 to 12 m<sup>2</sup>. If you have a small roof area, you may want to choose solar modules with higher efficiency.

Remember that only a portion of your household electricity demand will be covered by the PV system. It is therefore important to get a rough estimate of the overall capacity of the PV system obtained - based on the space allowed on your roof – and match the PV energy output with your consumption.

In order to size the system, figure out the load that you want to run on the PV system, the number of hours you want to run it for, and maximum load to be run at any point in time on the system. The vendor would be able to size a system for you on the basis of this data. You can get multiple quotations from different vendors for your system to check which system suits you best.

Moreover, it is essential to improve the demand pattern of your home by utilizing the loads whenever the PV system delivers maximum electricity and reaches peak capacity. Managing your load this way will help utilize solar to its maximum.

#### 4.B.2 Commercial and industrial scale PV system

The commercial and industrial system designs can be done on similar grounds as done for the domestic customers, however, the industrial and commercial customers can choose to reduce the battery size or avoid the batteries in the system by having a diesel-hybrid system for the night times if they work during the night. This can reduce their system costs and improve the economics by replacing diesel with solar during the daytime.

Nevertheless, the installation of a PV system can be a good investment for the industrial and commercial customers as this can provide uninterrupted electricity supply, at least during the day time hours, at competitive price to the diesel electricity rates because of the load shedding.

#### 4.C How do I find a good vendor?

The first question to ask is: Where will I find a good PV installation company? PV system vendors can be found through advertisements in print media, internet searches, and talking to people who have already installed systems. Another way can be to get in touch with solar associations and get quotations from different vendors from their members. Websites of the companies providing solar installation service can be easily searched and there are some solar associations in Pakistan as per the list provided in chapter 7.

Sometimes, component providers and their local distributors frequently offer lists of authorized installers of their components.

It is recommended that when choosing a vendor/supplier, choose the one with the best quality in optimum pricing. Providing the facility to register for net-metering can be an added benefit but should not be made the sole point of consideration for selecting the vendor.

In order to compare different offers, it is necessary that all basic items are listed. Some components can be useful add-ons, but not critical to the operations of the PV system - like a data logger, however, an offer containing options like an operation and maintenance contract, warranty extensions, and insurance policy for the PV system can be added benefits and such offers can be given preferences, if quality of the system is comparable.

In case of comparable offers, a company that has local representation and/or willing to provide after sale services should be preferred. Moreover, a company offering realistic time frame for installing the solar PV system with adequate technical capacity as well as trained and professional manpower should be given preference.

For determining the financial returns from the system, the consumer can ask the service provider/vendor to carry out a financial analysis of the total investment (capital cost plus operational cost) of the system on the basis of savings that may accrue due to saving in the electricity bills.

## 4.D Important aspects considering the installation

### 4.D.1 Quality aspects of installation and mounting

On flat roofs, protection mats should be provided as an installation foundation, as these protect the roof membrane. Enough space should be provided in between PV arrays for accessibility in times of servicing and repair purposes. The commissioning of the PV system has to be carried out by a registered electrician. During the commissioning a protocol has to be written by the PV plant installer. This document points out important data about the PV plant and records measured electrical values.

### 4.D.2 Quality assurance during operation time

The installer should offer a warranty on construction works for at least one year or more. This has to be deliberated and agreed upon with the installer, and should form part of the documentation of the solar PV system. The inverter should be checked on a regular basis (on vision panel or data logger).

### 4.D.3 Maintenance of the PV system

Major maintenance of the solar PV system includes cleaning the solar PV panels, checking connections of wires from PV panel to inverters and batteries and to the load, maintenance of the batteries (in case a liquid lead acid battery is used, water levels of the battery should be monitored) and performance of the system. In case the consumer is educated and has the capacity to understand the connections of the systems, routine maintenance requirements can be performed like wire checking, connection checking, switches etc. Operational manual for the solar PV system and documentation of the installation provided by the installer can be consulted for necessary maintenance. However, if the consumer is not qualified, then he/she should not interfere with the system. Moreover, in no case, the consumer, whether qualified or not, should try to resolve any error in the inverter or metering system.



## 5. Financing solar system

Solar technology is characterized by high capital cost requirements but has a low operating cost and a long service life. The ability to finance a PV system eases up the burden on the initial cost of procuring the system and spreads this cost over the long term while the system is already generating savings on electricity costs. This makes solar affordable to more users who cannot afford to pay upfront for the system in a single payment.

### 5.A State Bank of Pakistan's Refinancing Scheme for Renewable Energy

According to the refinancing facility scheme as announced by the State Bank of Pakistan (SBP), consumers (domestic, commercial or industrial) willing to install RE facility ranging from 4kW to 1 MW will be provided with financing facilities through all commercial banks and DFIs on first come first serve basis. The consumers intending to install the solar PV system at their premises can apply for loans to the commercial banks and DFIs as per the facility. A copy of the circular by the SBP is attached at Annex-IV for ready reference. All terms and conditions for the loan are stated in the said circular.

Any commercial bank or DFI affiliated with the SBP can be contacted for any further queries regarding RE refinancing scheme.



## 6. FAQs

Basic questions about net-metering process, policy, regulations, and standards are addressed in this section.

### 6.A About Net Metering

Q1. What is net-metering?

A1. Net-metering allows customers of Distribution Companies (DISCOs) to install an on-site Renewable Energy (RE) facility, not below 1 kilowatts (kW) and not exceeding 1 megawatts (MW) in capacity, so they can generate electricity for their own use. At the end of each billing cycle, the DISCO will net off the off-peak kWh supplied by the DG against the kWh supplied by the DG.

Q2. Is net-metering already available in the Pakistan?

A2. On 1<sup>st</sup> September 2015, the National Electric Power Regulatory Authority adopted regulation of Generation, Transmission and Distribution of Electric Power Act 1997 section 7(1), approving the Rules & Regulations enabling the Net-Metering Program for Renewable Energy. Thus, the net-metering rules came into effect in Pakistan on September 01, 2015.

Q3. What types of power generating facilities are eligible for net-metering?

A3. RE facilities such as solar, and wind energy systems, not exceeding 1 MW in power generating capacity, capable of being installed within the customer's premises, are eligible to participate in the net-metering program.

### 6.B Eligibility criteria for Net Metering

Q4. Who are qualified to participate in the net-metering program?

A4. Any person who meets the requirements of a Distributed Generator as defined under the regulations 2(k) in NEPRA's net metering rules qualifies to participate in the net-metering program.

2(k): "Distributed Generator" means a distribution Company's 3 phase 400V or 11kV consumer i.e. domestic, commercial or industrial and who owns and/or operates the Distribution Generation Facility, and is responsible for the rights and obligations related to Agreement and licensed by Authority under these regulations.

Q5. If I am a customer getting my power supply from a bulk supplier like Bahria Town, am I qualified to participate in the net-metering program?

A5. NEPRA's Rules and Regulations clearly state that the consumers of a distribution company are qualified for the net metering process. In case of Bahria Town, it buys electricity from IESCO and distributes it to the consumers, which makes it a

distribution company.

Therefore, any consumer that is getting electricity from a bulk supplier like Bahria Town can become eligible for net metering, depending upon the willingness of the bulk supplier, if it qualifies as per the criteria stated in the NEPRA Net Metering Regulations 2015.

Q6. If I am a customer directly-connected to the transmission grid, am I qualified to participate in the net-metering program?

A6. No. Customers directly-connected to the transmission grid are not DISCO's customers but are transmission load customers of the National Transmission & Dispatch Company (NTDC).

## 6.C How Net Metering works

Q7. How will my DISCO meter import and export energy?

A7. The DISCO will install a single bi-directional meter that can both import and export energy. The DISCO may also opt to install two uni-directional meters – one to meter the energy you buy from your local DISCO, and the other to meter the energy you export to the DISCO.

Q8. Who will get the energy I am exporting through my meter?

A8. Exported solar electricity mostly serves nearby customers' loads.

## 6.D Benefits of Net Metering

Q9. What benefit will I get if I go into net-metering?

A9. By generating electricity for own use, you reduce the amount of electricity you buy from your local DISCO. The rate of savings on electricity generated for own use is equivalent to the DISCO's retail (off-peak) rate consisting of charges for generation, transmission, system loss, distribution, subsidies, taxes and other charges.

You also get credit on your electricity bill of next billing cycle on any excess electricity exported to the DISCO equivalent to the DISCO's blended generation cost, excluding other generation adjustments.

Q10. Would the energy I export to the grid will be subtracted from the energy I will be importing from the grid?

A10. Customer will receive monthly net export/import bill indicating either net export to the grid or net import from the grid in case of net import bill, the DG will be billed for net kWh in accordance with the applicable tariff.

Q11. What if the energy exported exceeds the energy I import?



- A11. In this case the net kWh will be credited against DG's next billing cycle for consumption.
- Q12. Will I ever get paid in PKR by the DISCO for exporting excess energy to the grid?
- A12. If the DG is receiving a net export bill each month, then the DISCO will pay for the net export energy as per off peak rate in PKR quarterly (every 3 months).
- Q13. If I install a PV plant on my own without using net metering, what difference does it make?
- A13. Any energy that a solar PV system may generate in excess of what is being used at that moment would be wasted if the consumer does not have a net-metering contract with the distribution company. If the system is net-metered, the electricity meter will run backwards to provide a credit against the electricity that is consumed at night or other periods when the electricity consumption exceeds the output of the system.

## 6.E RE system for Net Metering

- Q14. What is the optimum size of an RE facility that I should install at my premises?
- A14. The optimum size of the RE facility can only be determined after considering the load of the household, number of hours of operation, demand pattern, availability of space on the rooftop for a solar system etc.

## 6.F Economics of Net Metering

- Q15. At what rate will the DISCO buy energy generated by my system?
- A15. Off-peak rate, as determined by NEPRA from time to time, is applicable as your tariff rate for sale of electricity to the DISCO. You can check your off-peak rate from the utility bill issued by your DISCO.
- Q16. How long will it take to return my investment?
- A16. The payback period varies depending upon the size of the system and its utilization. The normal payback period for residential consumers varies from 7-10 years, for commercial consumers, varies from 6-9 years and for industrial consumers, it varies from 5-8 years depending upon system size, its utilization, solar resource availability, sunny days and optimal O&M of the system.

## 6.G Post installation

- Q17. What if I want to modify my distributed generation facility?
- A17. If you are planning for any modification of material at your distributed generation facility, you have to notify the DISCO providing at least forty working days of advance notice.

Q18 What if I want to terminate the net-metering process?

A18 If the DG wants to discontinue the selling of electricity to the DISCO, DG should send a thirty days advance notice to the DISCO in order to terminate the agreement between DG and DISCO.

## 7. List of useful links and organizations

This chapter provides a listing of government and private organizations directly or indirectly connected to Energy/RE sector in Pakistan

### 7.A National Electric Power Regulatory Authority (NEPRA)

Director Customer Affair

Address: NEPRA Tower Attaturk Avenue (East), Sector G-5/1,  
Islamabad, Pakistan

Website: [www.nepra.org.pk](http://www.nepra.org.pk)

Tel: +92 51 2013200 Fax: +92 51 2600021

Email: [cad@nepra.org.pk](mailto:cad@nepra.org.pk)

### 7.B DISCOs in Pakistan

#### Faisalabad Electric Supply Company (FESCO)

Address: West Canal Road, Abdullah Pur, Faisalabad

Website: [www.fesco.com.pk](http://www.fesco.com.pk)

Tel: +92- 41- 9220184-9220229

Fax: 041-9220233

#### Gujranwala Electric Power Company (GEPCO)

Address: 565/A, Model Town, Gujranwala

Website: [www.gepco.com.pk/](http://www.gepco.com.pk/)

Tel: (055) 9200995

Fax: 055-9200122

Email: [ceogepeco@yahoo.com](mailto:ceogepeco@yahoo.com)

#### Hyderabad Electric Supply Company (HESCO)

Address: WAPDA Complex, Hussainabad,  
Hyderabad, Pakistan

Website: [www.hesco.gov.pk/](http://www.hesco.gov.pk/)

Tel: 022-9260025, 361

Email: [psoc\\_eshesco@yahoo.com](mailto:psoc_eshesco@yahoo.com), [akhttaralirandhawa@gmail.com](mailto:akhttaralirandhawa@gmail.com)

#### Islamabad Electric Supply Company (IESCO)

Address: St, 40, Sector G-7/4  
Islamabad, Pakistan

Website: [www.iesco.com.pk](http://www.iesco.com.pk)

Tel: 051-9252937, 9252938, 9252939

Email: [ceo@iesco.com.pk](mailto:ceo@iesco.com.pk)

### K-Electric

Address: KE House, 39-B, Sunset Boulevard, Phase-II, DHA, Karachi, Pakistan

Website: [www.ke.com.pk](http://www.ke.com.pk)

Tel: 92-21-3263 7133, 92-21-3870 9132

Fax: 021-213-9205192

Email: [customer.care@ke.com.pk](mailto:customer.care@ke.com.pk)

### Lahore Electric Supply Company (LESCO)

Address: 22/A Queens Road

Lahore, Pakistan

Website: [www.lesco.gov.pk](http://www.lesco.gov.pk)

Tel: 99204820-30, Ext: 100

Fax: 042-39203148

Email: [ceo@lesco.gov.pk](mailto:ceo@lesco.gov.pk)

### Multan Electric Power Company (MEPCO)

Address: MEPCO HQ, Khanewal Road

Multan, Pakistan

Website: [new.mepco.com.pk](http://new.mepco.com.pk)

Tel: 061-9220222

Fax: 061-9220204

Email: [rashid.tariq@mepco.com.pk](mailto:rashid.tariq@mepco.com.pk), [ceo\\_mepco@yahoo.com](mailto:ceo_mepco@yahoo.com),

### Peshawar Electric Supply Company (PESCO)

Address: 166 Wapda House, Shami Rd

Peshawar, Pakistan

Website: [pesco.gov.pk](http://pesco.gov.pk)

Tel; 9211990, 9212041-47 Ext 214

Email: [info@pitc.com.pk](mailto:info@pitc.com.pk)

### Quetta Electric Supply Company (QESCO)

Address: Main Zarghoon Road, Beside CCPO Office

Quetta Cantt, Pakistan

Website: [www.qesco.com.pk](http://www.qesco.com.pk)

Tel: 081-9202211

Fax: 0812836554

Email: [ceo\\_qesco@yahoo.com](mailto:ceo_qesco@yahoo.com)

### Sukkur Electric Power Company (SEPCO)

Address: Head Office St, 40

Sukkur, Pakistan

Website: [www.sepco.com.pk](http://www.sepco.com.pk)  
 Tel: 071-9310795  
 Fax: 071-9310801  
 Email: [ceo\\_speco@yahoo.com](mailto:ceo_speco@yahoo.com)

### Tribal Electric Supply Company (TESCO)

Address: 213-Mini WAPDA House, Shami Road,  
 Peshawar, Pakistan  
 Website: [www.tesco.gov.pk](http://www.tesco.gov.pk)  
 Tel: 091-9212964  
 Fax: 091-9212950  
 Email: [contact@tesco.gov.pk](mailto:contact@tesco.gov.pk)

## 7.C List of electrical inspector

### 7.C.1 Punjab

#### Electric Inspector Lahore region

Name	Engr. Tariq Masood
Address:	First Floor, Block No.1, Irrigation Office Complex, Canal bank, Mustafabad (Dharampura), Lahore
Area of Jurisdiction:	Lahore, Kasur and Okara
Office Phone:	042-99250191
Fax:	042-99250380
Mobile:	0300-9438516
Email:	<a href="mailto:ep.eil@energy.punjab.gov.pk">ep.eil@energy.punjab.gov.pk</a>

#### Electric Inspector Multan region

Name	Engr. Muhammad Khuram Zahoor
Address:	249-G, Shah Rukn-e-Alam Colony, Multan
Area of Jurisdiction:	Multan Division (Distt: Multan, Khanewal, Lodhran, Vehari) D.G.Khan Division(Distt: D.G.Khan, Rajanpur, Layyah, Muzaffargarh) Bahawalpur Division (Distt: Bahawalpur, Rahim Yar Khan, Bahawalnagar) Distt: Sahiwal and Pakpattan of Sahiwal Division
Office Phone:	061-9220179
Fax:	061-6771499
Mobile:	0333-2573333
Email:	<a href="mailto:cep.eim@energy.punjab.gov.pk">cep.eim@energy.punjab.gov.pk</a>

#### Electric Inspector Faisalabad region

Name	Engr. Zafar Abbas
Address:	Opposite commissioner office civil line Faisalabad
Area of Jurisdiction:	Faisalabad Division (Distt: Faisalabad, Chiniot, Toba Tek Singh, Jhang)

Office Phone: Sargodha Division (Distt: Sargodha, Khushab, Mianwali, Bhakkar)  
041-9200551  
Fax: 041-9201143  
Mobile: 0321-66745183  
Email: cep.eif@energy.punjab.gov.pk

### Electric Inspector Gujranwala region

Name: Engr. Tariq Nazeer  
Address: Sialkot Road, Gala Baraf Khana, Khokhar Ke, Gujranwala  
Area of Jurisdiction: District: Gujranwala, Sialkot, Hafizabad and Narowal of Gujranwala Division, and District Sheikhpura and Nankanah Sahib of Lahore Division  
Office Phone: 055-9200044  
Fax: 055-9200548  
Mobile: 0321-5105310  
Email: cep.eig@energy.punjab.gov.pk

### Electric Islamabad region

Name: Muhammad Iqbal Tahir  
Address: Small Dam Colony, Park Road, Islamabad  
Area of Jurisdiction: Distt: Islamabad  
Rawalpindi Divison (Distt: Rawalpindi, Chakwal, Attock, Jhelum), and District Gujrat and Mandi Bahauddin of Gujranwala Division  
Office Phone: 051-9255899  
Fax: 051-2841833  
Mobile: 0321-6866778  
Email: cep.eii@energy.punjab.gov.pk

### 7.C.2 Khyber Pakhtunkhwa

Region	Contact Person	Contact Number
Office of the Electric Inspector Peshawar	Mr. Ismail	091-9210343
Electrical Inspectorate of Sawat	Vacant	
Electrical Inspectorate of Bannu	Vacant	
Electric Inspectorate of Naushera	Vacant	
Electric Inspectorate of Abbottabad	Vacant	

### 7.C.3 Sindh

Region	Contact Person	Contact Number
Electrical Inspectorate of Karachi Region I		021-99204465
Electrical Inspectorate of Karachi Region II		021-99206591
Electric Inspectorate of Hyderabad	Mr. Razaq Ahmed Laghari	022-9200223
Electric Inspectorate of Larkana	Mr. Barkat Sheikh	074-9410100

Electric Inspectorate of Mirpurkhas	Mr. Eijaz Rohi	0333-2281122
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#### 7.C.4 Balochistan

Region	Contact Person	Contact Number
Electric Inspector Quetta Region	Mr. Ashfaq Baloch	081-3211742 0333-7923492
Electrical Inspectorate	Muhammad Fareed Ansari	0853-310172 0321-2955313
Electric Inspectorate	Vacant	

#### 7.D Private Solar Associations in Pakistan

##### Renewable & Alternative Energy Association of Pakistan (REAP®)

Mir Ahmad Shah  
 Executive Secretary  
 Address: Plot No. 140, Street No. 9, Sector I-10/3  
 Islamabad, Pakistan.  
 Website: [www.reap.org.pk](http://www.reap.org.pk)  
 Cell: +92-300-5221718  
 Tel: +92-51-4100084  
 Email: [write@reap.org.pk](mailto:write@reap.org.pk)

##### Pakistan Solar Association (PSA)

Address: 09-Egerton Road, Lahore, Pakistan  
 Website: [www.pakistansolarassociation.org/](http://www.pakistansolarassociation.org/)  
 Tel: +92 320 8180180  
 E-mail: [info@pakistansolarassociation.org](mailto:info@pakistansolarassociation.org)





TO BE PUBLISHED IN THE GAZETTE OF PAKISTAN  
EXTRAORDINARY, PART-II

**National Electric Power Regulatory Authority (NEPRA)**



**NOTIFICATION**

Islamabad, the 1<sup>st</sup> day of September, 2015

S.R.O 892 (1)/2015.— In exercise of the powers conferred by section 47 read with section 7 (1) of the Regulation of Generation, Transmission and Distribution of Electric Power Act, 1997 (XL of 1997), the National Electric Power Regulatory Authority, is pleased to make the following Regulations to establish a framework for the regulation of Distributed Generation by using alternative and renewable energy and net metering, namely: -

**1. Short title, commencement and application.** — (1) These Regulations may be called the National Electric Power Regulatory Authority (Alternative & Renewable Energy) Distributed Generation and Net Metering Regulations, 2015.

(2) They shall come into force at once.

**2. Definitions.** - (1) In these Regulations unless there is anything repugnant in the subject or context,—

- (a) "Act" means the Regulation of Generation, Transmission and Distribution of Electric Power Act, 1997 (XL of 1997)
- (b) "Agreement" means the agreement between the Distribution Company and the Distributed Generator on the Authority's approved format as per **Schedule I**;
- (c) "Applicable Documents" means the rules and regulation issued in pursuance of the Act by the Authority, from time to time, the generation, distribution and transmission licences, the Grid and Distribution Codes and any documents, instruments, approvals, directions or authorizations issued or granted by the Authority in exercise of its powers under the Act and any document in each case of a binding nature applicable to the licensee;
- (d) "Applicable Tariff" means tariff approved by the Authority for the relevant period and category of consumers of the Distribution Company;
- (e) "Applicant" means a consumer of a Distribution Company which submits an Application to interconnect its Distributed Generation Facility to the Distribution

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System of the Distribution Company and who applies for grant of the license to operate a Distributed Generation Facility as a Distributed Generator;

- (f) "Application" means the application submitted by an Applicant to Distribution Company, for interconnection of a Distributed Generation Facility to the Distribution System of a Distribution Company and includes application for grant of license to the Authority;
- (g) "Authority" means the National Electric Power Regulatory Authority established under the Act;
- (h) "Billing Cycle" means energy recorded by the meters in a period of thirty days;
- (i) "Distributed Generation Facility" means a facility set up by a Distributed Generator using Solar or Wind energy resource for generation of electricity up to 1 MW;
- (j) "Distributed Generation" means electrical power generation by solar or wind that is interconnected to the Distribution System of the Distribution Company at Interconnection Point;
- (k) "Distributed Generator" means a Distribution Company's 3 phase 400V or 11kV consumer i.e. domestic, commercial or industrial and who owns and/or operates the Distributed Generation Facility, and is responsible for the rights and obligations related to the Agreement and licensed by the Authority under these Regulations;
- (l) "Distribution System" means the distribution facilities situated within the Service Territory owned or operated by the licensee for distribution of electric power including, without limitation, electric lines or circuits, electric plant, meters, interconnection facilities or other facilities operating at the distribution voltage, and shall also include any other electric lines, circuits, transformers, sub-stations, electric plant, interconnection facilities or other facilities determined by the Authority as forming part of the distribution system, whether or not operating at the distribution voltage;
- (m) "Fault" means an equipment failure, conductor failure, short circuit, or other condition resulting from abnormally high or low amounts of current from the power system;
- (n) "Grid Code" means the guidelines, standards and procedures of technical and commercial aspects for the access, use and operation of transmission system and transmission facilities of NTDC as modified and approved by Authority from time to time;
- (o) "Interconnection Facilities" means the equipment, including, without limitation, electrical lines or circuits, transformers, switch gear, safety and protective devices, meters or electrical plant, used for interconnection services;
- (p) "Interconnection Point" means the point where the metering, installation and protection apparatus of the Distributed Generator is connected to the Distribution System of the Distribution Company;

- (q) "kWh" means kilowatt hour;
- (r) "MW" means megawatt;
- (s) "Net Energy Billing" means a billing and metering practice under which a Distributed Generator is billed on the basis of net energy over the billing cycle;
- (t) "Net Energy" means a balance (positive or negative) of the kWh generated by Distributed Generator against the kWh supplied by Distribution Company at the end of Billing Cycle;
- (u) "Net Metering Facility" means a facility comprising of one or two meters for measuring the kWh generated by Distributed Generator and supplied by Distribution Company for determining the net energy;
- (v) "Registrar" means a person designated by the Authority to register and record the receipt of communications, applications and petitions filed with the Authority and to perform such other duties under these Regulations as may from time to time be assigned by the Authority; and
- (w) "Tariff" means the rates, charges, terms and conditions for sale of electric power to consumers as approved by the Authority and duly notified by the Federal Government from time to time.

2) The words and expressions used but not defined in these Regulations shall have the same meaning as are assigned to them in the Act.

## **APPLICATION AND INTERCONNECTION PROCESS**

### **3. Application Process for Interconnecting Distributed Generation Facility.—**

(1) Any person who meets the requirements of a Distributed Generator as defined under the regulations 2(k) is eligible for submitting application as specified in **Schedule-II** to a Distribution Company.

Provided that the Distribution Company shall be bound to provide information and Authority's approved documents in response to the request from Applicant free of cost within two working days.

(2) Application to Distribution Company along with necessary documents shall be submitted by intending Distributed Generator to Distribution Company.

(3) Within five working days of receiving an Application, the Distribution Company shall acknowledge its receipt and inform the Applicant whether the Application is completed in all respect.

Provided that in case of any missing information or documents the Applicant shall provide the same to Distribution Company within seven working days of being informed by

Distribution Company.

(4) Upon being satisfied that the Application is complete in all respect, the Distribution Company 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 Distribution Company shall return the Application and communicate the reasons to the Applicant within three working days after the completion of initial review.

(6) If the Distribution Company is satisfied that the Applicant qualifies as Distributed Generator, then the Distribution Company and the Applicant shall enter into an Agreement within ten working days and Distribution Company shall send a copy of the Agreement to the Authority within seven working days of the signing of the Agreement.

(7) Within seven working days of execution of the Agreement, the Distribution Company 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.

(9) The Distribution Company 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.

**4. Licensing.**— (1) Notwithstanding anything contained in NEPRA Licensing (Application and Modification Procedure) Regulations, 1999 any consumer who enters into an Agreement with the Distribution Company under net metering arrangement qualifies for grant of a Distributed Generator License.

(2) Distribution Company shall forward the Application for grant of License as specified in **Schedule -III** to the Authority along with following;

- (a) Agreement
- (b) Application for exemption from the requirement of section 24 of the Act as specified in **Schedule-IV**,
- (c) Evidence of deposit of fee as may be specified by the Authority as specified in **Schedule-V**
- (d) Affidavit by Distributed Generator as specified in **Schedule-VI**

(3) The Authority may, on receipt of the Application and the documents specified in sub-regulation (2), grant a license as specified in **Schedule VII** to the Applicant.

**5. General Powers, Rights and Obligations of the Distribution Company.**— (1) A Distribution Company shall.—

- (a) allow any of its consumers to establish Distributed Generating facilities to be interconnected with its Distribution System using either (a) a standard meter capable of registering the flow of electricity in two directions, or (b) two separate meters one for selling electricity to the Distribution Company and other for purchasing electricity from the Distribution Company.
- (b) enter into an Agreement with the Distributed Generator, and shall grant interconnection approval under Regulation 3 (6) after following due process

Provided that the approval of interconnection facility shall not be unreasonably withheld.

- (c) have the right to review the design of a Distributed Generation Facility and Interconnection Facilities and to inspect the same prior to the commencement of parallel operation with its Distribution System and may require the Distributed Generator to make modifications as necessary to comply with the requirements of these Regulations.
- (2) A Distribution Company may limit the operation and/or disconnect or require the disconnection of a Distributed Generation Facility from its Distribution System at any time, with or without notice, in the event of Fault.
- (3) A Distribution Company may also limit the operation and/or disconnect or require the disconnection of Distributed Generation Facility from its Distribution System upon the provision of thirty days written notice for the conditions which include as follows:
  - a) To allow for routine maintenance, repairs or modifications to the Distribution System of the Distribution Company;
  - b) Upon Distribution Company's determination that Distributed Generation Facility is not in compliance with these Regulations;
  - c) Upon termination of the Agreement.

**6. Rights and Obligations of the Distributed Generator.**— (1) A Distributed Generator shall operate and maintain its Distributed Generation Facility and Interconnection Facilities in accordance with prudent electrical practices.

(2) The Distributed Generator shall not have any right to utilize Distribution Company's Interconnection Facilities for the sale of electricity to any other person.

### **Terms of Agreement, Termination of Agreement and Dispute Resolution**

**7. Term of Agreement.**— (1) The term of the Agreement between Distributed Generator and Distribution Company shall be three years with effect from commissioning of Distributed Generator Facility.

(2) At the expiry of initial term, the Agreement may be automatically renewed by the mutual understanding between the Distributed Generator and the Distribution Company for another term of three years and so on.

**8. Termination of Agreement.**— (1) The Distributed Generator may terminate the Agreement

upon thirty days written notice if the Distributed Generator decides to discontinue the sale of electricity to the Distribution Company.

(2) The Distribution Company shall not terminate the Agreement in any event without prior approval of the Authority.

(3) All rights and obligations accrued up to termination shall continue in force upon termination.

## **DISTRIBUTED GENERATION FACILITY DESIGN AND OPERATING REQUIREMENTS**

**9. Protection Requirements.**— (1) The protection and control diagrams for the interconnection of the Distributed Generator shall be in accordance with the provisions of the Grid and Distribution Codes and approved by the Distribution Company prior to commissioning of the proposed Interconnection Facilities and a typical single line diagram as specified in **Schedule-VIII**.

(2) The Distributed Generator shall be responsible for the installation of equipment, including, without limitation, electrical lines or circuits, transformers, switch gear, safety and protective devices, meters or electrical plant, to be used for interconnection.

Provided that, if the Distributed Generator is unable to install equipment, including, without limitation, electrical lines or circuits, transformers, switch gear, safety and protective devices, meters or electrical plant, used for interconnection, the Distribution Company may execute the requisite work in case the Distributed Generator offers to deposit the cost to be incurred on the requisite work at mutually agreed terms.

(3) The protective functions shall be equipped with automatic means to prevent reconnection of the Distributed Generation Facility with the Distribution facilities of the Distribution Company;

Provided that the service voltage and frequency is of specified setting and is stable and mutually agreed between the Distribution Company and the Distributed Generator.

(4) The Distributed Generator will furnish and install a manual disconnect device that has a visual break to isolate the Distributed Generation Facility from the Distribution facilities.

(5) The grid connected inverters and generators shall comply with Underwriter Laboratories UL 1741 standard (Inverters, Converters, Controllers and Interconnection System Equipment for Use with Distributed Energy Resources) which addresses the electrical interconnection design of various forms of generating equipment, IEEE 1547 2003, IEC 61215, EN or other international standards.

**10. Prevention of Interference.**- (1) The Distributed Generator shall not operate such equipment that superimposes upon the Distribution System a voltage or current that interferes with Distribution Company's operations, service to its consumers, or communication facilities.

(2) In the event of such interference, the Distributed Generator must diligently pursue and take corrective action at its own expense after being given notice and reasonable time to do so by the Distribution Company.

(3) On account of any failure on part of the Distributed Generator to take timely corrective action, the Distribution Company may, without liability, disconnect the Distribution Generation facility from the Distribution System, in accordance with these Regulations.

**11. Voltage and Frequency Range.-** A variation of  $\pm 5\%$  and  $\pm 1\%$  is permissible to the nominal voltage and frequency respectively.

## **INTERCONNECTION FACILITY FINANCING**

### **12. Responsibility for Costs of Interconnecting a Distributed Generation Facility.—**

(1) A Distributed Generator shall be responsible for all costs associated with Interconnection Facilities up to the Interconnection Point including metering installation.

(2) The Distributed Generator shall also be responsible for any costs reasonably incurred by Distribution Company in providing, operating, or maintaining Interconnection Facilities and Distribution System improvements required solely for the interconnection of the Distributed Generation Facility with Distribution Company's Distribution System.

(3) In case of non-availability of meter(s) with Distribution Company, the Distributed Generator may procure such meter(s) directly subject to testing by Distribution Company, before installation.

## **NET ENERGY METERING SERVICES**

**13. Metering Requirements.—** (1) The equipment installed for net metering shall be capable of accurately measuring the flow of electricity in two directions.

Provided that in case two separate meters are installed, the net energy metering calculation shall yield the same result as when a single meter is used.

(2) The Net Energy Metering Facility, shall meet all safety and protection requirements that are necessary to assure safe and reliable operation of the Distributed Generation Facility when connected to the Distribution System of the Distribution Company and that have been approved by the Authority.

**14. Billing for Net Metering.—** (1) At the end of each Billing Cycle following the date of final interconnection of Distributed Generation Facility to the Distribution System of the Distribution Company, the Distribution Company shall net off the kWh supplied by Distributed Generator against the kWh supplied by it.

Provided that the meter readings shall be carried out preferably through Hand Held

Units (HHU) and through automated means as directed by the Authority from time to time.

(2) In case the kWh supplied by Distribution Company exceed the kWh supplied by Distributed Generator, the Distributed Generator shall be billed for the net kWh in accordance with the Applicable Tariff.

(3) In case the kWh supplied by Distributed Generator exceed the kWh supplied by Distribution Company, the net kWh shall be credited against Distributed Generator's next billing cycle for future consumption, or shall be paid by the Distribution Company to the Distributed Generator quarterly.

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.

(4) The tariff payable by the Distribution Company 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 Distribution Company.

**15. Power of the Authority to give directions, instructions and guidelines.**— (1) For carrying out the purposes of these Regulations, the Authority may issue directions, instructions and guidelines to the Distributed Generator and the Distribution Company in the form and manner determined by the Authority, which shall be complied with by the Distributed Generator and the Distribution Company.

(2) The Authority may, on representation made to it or on its own motion modify or cancel any direction, instruction or guidelines issued under sub-rule (1), and in so modifying or cancelling any direction, instruction or guidelines may impose such conditions as it thinks fit.

**16. Power to require information.**—The Authority may, at any time, by notice in writing require any director, officer and member of the Distribution Company and/or the Distributed Generator, generally or in particular to furnish it within the time specified therein or such further time as the Authority may allow, with any statement or information and without prejudice to the generality of the foregoing power, may call for information, at such intervals as the Authority may deem necessary.

**17. Resolution of disputes.**— Any dispute or disagreement between Distributed Generator and Distribution Company relating to any matter arising out of, or in connection with, the activities covered under the Regulations shall be submitted for decision to the Authority.

**18. Penalty for failure, refusal to comply with, or contravention with any provision of the Regulations.**— If any person fails or refuses to comply with, or contravenes any of the provisions of these Regulations or any direction or order passed by the Authority under these Regulations or knowingly or willfully authorizes or permit such failure, refusal or contravention, he shall, be punishable with a fine which may extend to 100 million rupees.



**APPLICATION FOR GRANT OF LICENSE  
NATIONAL ELECTRIC POWER REGULATORY AUTHORITY (NEPRA)**

1.Name of Applicant:	
1(a) CNIC of Applicant/CUIN in case of Company(Copy to be attached)	
1(b) Address:	
1(c) Contact Nos:	Office _____ Fax _____ Cell _____
1(d) Email Address:	
2. Location of DG facility:	
3. Name of DISCO with which the DG facility is proposed to be interconnected	
4. Size of DG facility:	
5. Approximate monthly energy proposed to be supplied to DISCO(kWh):	
6. Fee to be deposited: (Non-Refundable)	

Applicant's Signature

--

Date

--

## Standard Distributed Generation Application Form for Distribution Company

Distributed by	Approved by
Name & Address of DISCO	
	<b>National Electric Power Regulatory Authority (NEPRA)</b>

### 1. Contact Information--The applicant is the person that is legally responsible for the generating system

Applicants Last Name	First Name

CNIC of Applicant/CUIN in case of Company (Copy to be attached)

--

Applicant's Mailing Address


Applicant's Phone Number & Email Address

Office:	Fax:
Cell:	Email:

Emergency Contact Numbers

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### 2. Location of Generation System

Address at which DG facility is located


Latitude - Longitude (i.e. 49o 32' 06" N -- 91o 64' 18"-- optional)

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### 3. Applicant/Consumer Reference Number

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### 4. Applicant's Ownership Interest in the Generation System

<input type="checkbox"/> Owner <input type="checkbox"/> Co-owner <input type="checkbox"/> Lease <input type="checkbox"/> Other: _____
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### 5. primary Intent of the Generation System

<input type="checkbox"/> Onsite Use of Power	<input type="checkbox"/> Net Energy Billing
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(a) Anticipated annual electricity consumption of the facility or site:	(kWh)/yr.
(b) Anticipated annual electricity production of the generation system:	(kWh)/yr.
(c) Anticipated annual electricity purchases (i.e., (a) minus (b))	(kWh)/yr.
* Value will be negative if there are net sales to the DISCO.	

**7. Installing Contractor Information (If Applicable)**

Contractor's Last Name	First Name
<input style="width:95%;" type="text"/>	<input style="width:95%;" type="text"/>
Name of Firm	
<input style="width:95%;" type="text"/>	
Contractor's Phone Number	E-mail Address
<input style="width:95%;" type="text"/>	<input style="width:95%;" type="text"/>
Mailing Address	
<input style="width:95%;" type="text"/>	
<input style="width:95%;" type="text"/>	
<input style="width:95%;" type="text"/>	

**8. Requested In-Service Date**

<input style="width:95%;" type="text"/>
---

**9. Provide one-line Schematic Diagram of the System**

<input type="checkbox"/> Schematic is Attached	Number of Pages
<input style="width:95%;" type="text"/>	<input style="width:95%;" type="text"/>

**10. Generator / Inverter Information**

Manufacturer	Model No.
<input style="width:95%;" type="text"/>	<input style="width:95%;" type="text"/>
Version No.	Serial No.
<input style="width:95%;" type="text"/>	<input style="width:95%;" type="text"/>
Generation Type (check one)	Generation Type (check one)
<input type="checkbox"/> Single Phase <input type="checkbox"/> Three Phase	<input type="checkbox"/> Inverter <input type="checkbox"/> Other: _____
Name Plate AC Ratings (check one)	
<input type="checkbox"/> _____ kW	<input type="checkbox"/> _____ kVA
<input type="checkbox"/> _____ volts	
Primary Energy Source	
<input style="width:95%;" type="text"/>	

Note: If there is more than one inverters, attach an additional sheet describing each

**11. Site Plan Showing Location of the External Disconnect Switch (attach additional sheets as needed)**

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**13. Design Requirements**

(a) Has the proposed distributed generation paralleling equipment been certified by Electrical inspector?	<input type="checkbox"/> Y	<input type="checkbox"/> N
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**14. Other Comments, Specification and Exceptions (attach additional sheets if needed)**

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**15. Application and Installer Signature**

To the best of my knowledge, all the information provided in this application form is completed and correct.

Applicant Signature

Date

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Installer Signature (if applicable)

Date

--	--

**Distributed Generation Interconnection Agreement (1 KW to 1MW) between  
Distributed Generator and DISCO**

The Distributed Generation Interconnection Agreement (the “Agreement”), is made and entered in to this \_\_\_\_\_ (day) of \_\_\_\_\_ (month), \_\_\_\_\_ (year) by and between \_\_\_\_\_ hereinafter called “DISCO” and \_\_\_\_\_ hereinafter called the “Applicant”. Applicant shall be 3 phase 400V or 11kV DISCO’s consumer. DISCO and the Applicant are hereinafter collectively referred to as the “Parties” and individually as a “Party”.

**Recitals**

- A. DISCO is the owner of the electric distribution system serving \_\_\_\_\_ [Insert legal description of property or address] “DISCO’s Distribution System”.
- B. Applicant desires to install a Distributed Generator (DG) facility or energy storage device using solar or wind energy resources with a capacity greater than 1 KW but no more than 1 MW, including related interconnection equipment (the “DG Facility”) and to interconnect the DG Facility to the DISCO’s distribution system.
- C. DISCO has previously reviewed and approved Applicant’s DG Interconnection Applicant Form dated \_\_\_\_\_, and supporting materials (the Application”). The completed Application is attached as Exhibit 1 and incorporated into this Agreement.
- D. Applicant wishes to interconnect the DG Facility to DISCO’s distribution system and DISCO is willing to permit such interconnection subject to the terms and conditions set forth: (1) the completed Application approved by DISCO; (2) this Agreement.
- E. No agency or partnership is created with the interconnection of the applicants DG Facility.

**Agreement**

NOW THEREFORE, in consideration of the foregoing Recitals and for good and valuable consideration, the DISCO and Applicant agree as follows:

**1. Design Requirement**

The DG Facility shall be installed in compliance with NEPRA ARE Distributed Generation/ Net Metering Rules 2014.

**2. Applicant’s Representations and Warranties**

Applicant represents and warrants that:

- a. The DG Facility is fully and accurately described in the Application;
- b. All information in the Application is true and correct;

- c. The DG Facility has been installed to Applicant's satisfaction;
- d. Application has been given warranty information and an operation manual for the DG Facility;
- e. Applicant has been adequately instructed in the operation and maintenance of the DG Facility.

### **3. Interconnection Disconnect Switch**

The DISCO may require that the Applicant furnish and install an interconnection disconnect switch that opens, with a visual break, all underground poles of the interconnection circuit. The interconnection disconnect switch shall be rated for the voltage and fault current requirements of the DG Facility, and shall meet all applicable IEC, IEEE Standards, as well as applicable requirements of the NEPRA Grid Code. The switch enclosure shall be properly grounded. The interconnection disconnect switch shall be accessible at all times, located for ease of access of DISCO personnel, and shall be capable of being locked in the open position. The Applicant shall follow the DISCO's recommended switching, clearance, tagging, and locking procedures.

### **4. Modifications to the DG Facility**

Applicant shall notify DISCO of plans for any material modification to the DG Facility by providing at least forty working days of advance notice. "Material Modification" is defined as any modification that changes the maximum electrical output of the DG Facility or changes the interconnection equipment. The notification shall consist of a completed, revised Application and such supporting materials as may be reasonably requested by DISCO. Applicant agrees not to commence installation of any material modification to the DG Facility until DISCO has approved the revised Application.

### **5. Insurance, Indemnification, Liability**

5.1 Distributed Generator shall obtain and maintain appropriate insurance for third party personal injury and general commercial liability.

5.2 Each party as indemnitor shall defend, hold harmless, and indemnify the other party and the directors, officers, employees, and agents of the other party against and from any and all loss, liability, damage, claim, cost, charge, demand, or expense (including any direct, indirect or consequential loss, liability, damage, claim, cost, charge, demand, or expense, including attorneys' fees) for injury or death to persons, including employees of either party, and damage to property, including property of either party, arising out of or in connection with (a) the engineering, design, construction, maintenance, repair, operation, supervision, inspection, testing, protection or ownership of the indemnitor's facilities, or (b) the making of replacements, additions, betterments to, or reconstruction of the indemnitor's facilities. This indemnity shall apply notwithstanding the active or passive negligence of the indemnitee. However, neither party shall be indemnified hereunder for its loss, liability, damage, claim, cost, charge, demand, or expense resulting from its sole negligence or willful misconduct.

5.3 The indemnitor shall, on the other party's request, defend any suit asserting a claim covered

by this indemnity and shall pay for all costs, including reasonable attorney fees, that may be incurred by the other party in enforcing this indemnity.

5.4 The provisions of this Section shall not be construed to relieve any insurer of its obligations to pay any insurance claims in accordance with the provisions of any valid insurance policy.

5.5 Except as otherwise provided in this section, neither party shall be liable to the other party for consequential or remote damages incurred by that party.

## **6. DG Facility commissioning Testing**

Applicant shall notify DISCO in writing that installation of DG Facility is complete and that the interconnection equipment is available for testing by DISCO at least fifteen working days duly certified by Electrical Inspector before Applicant interconnects the DG Facility with DISCO's Distribution System. DISCO shall thereupon have the right to test the DG Facility. DISCO shall also have the right to witness any testing by Applicant of the DG Facility. Any DISCO testing of the DG Facility shall be completed within ten working days. After the testing which is to the satisfaction of both parties, the DG facility may be interconnected with the distribution system of DISCO to be witnessed by representatives of both parties within thirty eight days.

## **7. Access to DG Facility**

Applicant shall permit DISCO's employees and agents to enter the property on which the DG Facility is located at any reasonable time for the purposes of inspecting and/or testing Applicant's DG Facility to ensure its continued safe and satisfactory operation and the accuracy of DISCO meters. Such inspections shall not relieve Applicant from its obligation to maintain the DG Facility and any related equipment owned by Applicant in safe and satisfactory operating conditions. DISCO shall have the right to witness any testing by Applicant of the DG Facility.

## **8. Temporary Disconnection of a DG Facility**

DISCO may limit the operation and/or disconnect or require the disconnection of a DG facility from DISCO's Distribution System at any time, with or without notice, in the event of fault. DISCO may also limit the operation and/or disconnect or require the disconnection of DG facility from DISCO's Distribution System upon the provision of 30 days written notice for the conditions to allow for routine maintenance repairs or modifications to DISCO's Distribution System:

## **9. Disputes; Right to Appeal to Authority**

Nothing in this agreement prevents Applicant from filing a petition with the Authority to appeal any requirement imposed by DISCO as a condition to interconnection of DG Facility, that applicant alleges is unreasonable. In case of a dispute, the decision of the Authority shall be final and binding on both the parties.

## 10. Amendments; Non-Waiver

Any amendment or modification to this Agreement must be in writing and executed by Applicant and DISCO. The failure of Applicant or DISCO to insist on performance by the other Party of any provision of this Agreement shall not waive the right of the Party who failed to insist on performance to enforce the same provision at a later time.

## 11. Term and Termination of Agreement

The term of Agreement between Distributed Generator and DISCO shall be three years with effect from the date of commissioning of DG facility. At the expiry of initial term, the Agreement may be automatically renewed by the mutual understanding between Distributed Generator and DISCO for another term of three years and so on.

- a. DISCO may limit the operation and/or disconnect or require the disconnection of a DG facility from DISCO's Distribution System at any time, with or without notice, in the event of fault. DISCO may also limit the operation and/or disconnect or require the disconnection of DG facility from DISCO's Distribution System upon the provision of 30 days written notice for the conditions which including as follows:
  - To allow for routine maintenance, repairs or modifications to DISCO's Distribution System;
  - Upon DISCO's determination that DG facility is not in compliance with these Rules;
  - Upon termination of the Agreement.
- b. This Agreement may be terminated in accordance with the sub rule (7) of Rule 4 of these Rules.
- c. The Distributed Generator may terminate the agreement upon thirty days written notice if the Distributed Generator determines to discontinue the sale of electricity to the DISCO.
- d. The DISCO shall not terminate the Agreement in any event without prior approval of the Authority.
- e. All rights and obligations accrued up to termination shall continue in force upon termination.

## 12. Successors and Assigns

- a. Assignment by Applicant: Applicant shall not assign its rights and obligations under this Agreement in whole or in part without the prior written consent of DISCO, which consent shall not be unreasonably withheld or unduly delayed. DISCO may withhold its consent to any proposed assignment if the proposed assignee fails to assume the obligations of Applicant under this Agreement in writing.
- b. Assignment by DISCO. The DISCO shall have the right to assign this agreement in whole upon written notification to the Applicant.
- c. Successors. This Agreement shall be binding upon the personal representatives, heirs, successors, and permitted assigns of the respective Parties.



### 13. Applicant and DISCO Signature and Seal

IN WITNESS WHEREOF, Applicant and Company have executed this Agreement as of the year and date first set forth above.

**Applicant Signature & Date**

**DISCO's Signature with Seal & Date**

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Title

Title

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**Witness No.1 (Name & Signature)**

**Witness No. 1(Name & Signature)**

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**Witness No. 2 (Name & Signature)**

**Witness No. 2 (Name & Signature)**

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