

# **AJKED NET-METERING REFERENCE GUIDE FOR DISTRIBUTED GENERATOR**



How the application process and the installation of Net Metering  
connection works

**AJKED NET METERING WING**

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[www.ajked.gok.pk](http://www.ajked.gok.pk)

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## Glossary

|       |   |
|-------|---|
| AEDB  | Alternative Energy Development Board              |
| AJK   | Azad Jammu & Kashmir                              |
| AJKED | Azad Jammu & Kashmir Electricity Department       |
| CCE   | Connection Charge Estimate                        |
| DG    | Distributed Generator                             |
| NTDC  | National Transmission & Dispatch Company          |
| EN    | European Standard                                 |
| IEC   | International Electro-technical Commission        |
| IEEE  | Institute of Electrical and Electronics Engineers |
| KW    | Kilowatts   |
| kWh   | Kilowatt hour                                     |
| kWp   | Kilowatt peak                                     |
| MW    | Megawatt  |
| NEPRA | National Electric Power Regulatory Authority      |
| NGO   | Non-governmental organization                     |
| NOC   | No Objection Certificate                          |
| PKR   | Pakistani Rupee                                   |
| PV    | Photovoltaic                                      |
| RE    | Renewable Energy                                  |
| THD   | Total Harmonic Distortion                         |
| UL    | Underwriters Laboratories                         |

## 1. Introduction

This guide provides an overview of important points to consider when the consumer applies for Net Metering as per “AJ&K Distributed Generation (Alternative & Renewable Energy) and Net Metering Regulations, 2022” hereinafter referred to as “AJK Net Metering Regulations”. This guide attempts to walk the AJKED office and AJKED’s personnel through the different stages beginning from the application by the consumer up to the installation of Net Metering DG facility and the billing claims.

### 1.1 About Net Metering

Net metering is an electricity policy for consumers who own Renewable Energy facilities which allows them to use electricity whenever needed while getting credit for contributing their production to the grid.

The consumer may generate/produce electricity partly for own consumption, and partly for sale to the AJKED, in the region of Azad Jammu & Kashmir. Solar and Wind 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 Solar/Wind energy and can slash their power bills.

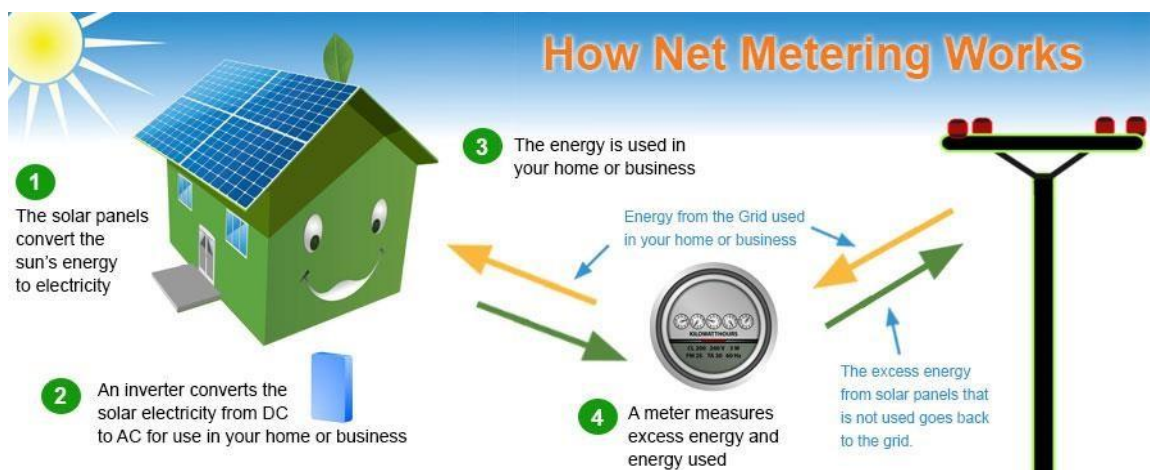


Figure 1.1 Net Metering process

The Figure 1.1 illustrates the flow of electricity from power generation via high voltage transmission and distribution utilities to the end-user who can now install a renewable energy facility and send the not needed electricity back to the distribution grid and earn credit for his export.

## 2. Eligibility & Documents Checklist for Submission of Application

### 2.1. Eligibility Criteria

| Sr. | Eligibility Criteria  |
|-----|---|
| 1.  | Vendor/Installer/Service Provider has valid AJKED Net Metering Registration Certificate |
| 2.  | Distributed Generator has 3 phase 400V or 11000V connection                             |
| 3.  | DG capacity is not greater than 1.5 times of the Sanction Load                          |
| 4.  | Name of Applicant and Name mentioned on the submitted paid Electricity Bill is same     |

### 2.2. Documents Checklist

| Sr. | Document  |
|-----|---|
| 1.  | Selected Vendor/Installer/Service Provider's AJKED issued Net Metering Registration Certificate                                 |
| 2.  | Standard Distributed Generation Application Form (Schedule-II)  |
| 3.  | Application For Grant Of License (for connections above 25kW) (Schedule-III)  |
| 4.  | Application for Exemption from Section 24 of the Companies Ordinance 1984 (Schedule-IV)   |
| 5.  | Affidavit on Judicial Paper of Rs. 50 (Schedule-VI)   |
| 6.  | Single Line Diagram   |
| 7.  | Customer Agreement (Schedule-X)   |
| 8.  | Customer Agreement (Schedule-X(a))  |
| 9.  | Customer Agreement (Schedule-X(b))  |
| 10. | Customer Agreement (Schedule-X(c))  |
| 11. | Customer Agreement (Schedule-X(d))  |
| 12. | Customer Agreement (Schedule-X(e))  |
| 13. | Load Flow Study & Electrical Inspectorate NOC (for >250kW Connections)  |
| 14. | Application Summary (Schedule-XII)  |
| 15. | Copy of last Paid Electricity Bill  |
| 16. | Technical data/Data Sheet of all components including solar modules, inverters, breakers, wires, cables, disconnect switch etc. |

All the relevant documents are signed & stamped by the Vendor/Installer/Service Provider (Y/N): \_\_\_\_\_

**NOTE:** The Schedules mentioned above can be viewed/downloaded from the AJKED's website [www.ajked.gok.pk](http://www.ajked.gok.pk).

### 3. Steps involve in Net Metering

This chapter covers the detailed overview of the each step involved in the Net Metering procedure as per AJK Net Metering Regulations along with the timeline.

#### 4.1. Overview and timeline of the Procedure for Net Metering Connections

The Government of AJK is promoting net metering and intending to provide the services to the customers at their door step. Therefore, the Government of AJK has desired that the installers of systems for net metering (DG installers) as shortlisted/registered by AJKED Net Metering Wing will be required to process the application for net metering on behalf of consumers applying for net metering connections. AJKED Net Metering Wing has devised the time period for processing net metering applications. Transport facility (if required) shall be provided by the Vendor/Installer/Service Provider to the AJKED Technical Committee & Inspection Committee for the visit of Distributed Generator facility, to avoid delay in processing of Net-Metering cases.

The Flow of steps involve in Net Metering Process along with the timeline for net metering connections are as follows.

##### 4.1.1. Application for Net Metering

Any applicant who meets the requirement of DG as defined in AJK Net Metering Regulations, submits their application along with the necessary documents to the concerning Electricity Operation Division. Application Form can be obtained from the Office of Director Planning & Monitoring AJKED and can also be downloaded from [www.ajked.gok.pk](http://www.ajked.gok.pk).

Submission of Application

##### 4.1.2. Acknowledgement of Application

The concerning Electricity Operation Division will acknowledge its receipt and inform the applicant whether the application is completed in all respect or not.

Within five (05) working days


##### 4.1.3. Incomplete application form

In case the application found incomplete, the concerning Electricity Operation Division will return the application and will ask the applicant to complete the application and re-submit it. The applicant will have to submit the application complete in all respects within seven working days.

Incomplete Applications after rectification to be resubmitted in seven (07) working days

### Initial review


Upon being satisfied that the applicant is complete in all respect, The concerning Electricity Operation Division will perform an initial review to determine whether applicant qualifies for interconnection facility or may qualify subject to additional requirements, like comparison between sanctioned load and the size of the system installed.



Initial Review will be completed in fourteen (14) working days

#### 4.1.4. Technical Feasibility in Initial Review


AJKED to carry out technical studies and approve the connections at the Sub-Division level. In case the initial review reveals that the proposed facility is not technically feasible, concerning Electricity Operation Division shall return the application and communicate the reasons to the applicant within three working days after the completion of initial review.



Technically infeasible applications will be returned with reasons in three (03) working days after completion of initial review.

#### 4.1.5. Agreement


If the concerning Electricity Operation Division is satisfied that the applicant qualifies as a DG, then the AJKED and the applicant will enter into agreement within seven working days.




Within seven (07) working days.

#### 4.1.6. Generation License

a) For Distributed Generator facility up to 25kW, the concerned Electricity Operation Division shall be the final approving authority (provided that the concerned Electricity Operation Division has obtained the NOC from Net Metering Wing AJKED for the said DG facility) and will not send the case to "Net Metering Wing" for issuance of Generation License, the concerned Electricity Operation Division will issue the "Net Metering Approval" letter within three days and will send the copy of the same to all concerning offices including Net Metering Wing through proper channel.



Within three (03) working days for connections up to 25kW & seven (07) working days for connections above 25kW.



In case, the NOC has not been obtained for the DG facilities up to 25kW by the concerned Electricity Operation Division, the payment against the DG's exceeded units to AJKED, shall not be made or such claim of payment to DG shall not be accepted.

- b) The concerning Electricity Operation Division will send the copy of the agreement between the applicant and the AJKED to the Net Metering Wing AJKED along with the application for the issuance of Generation license for connections above 25kW. AJKED Net Metering Wing will issue the Generation License within seven working days after receipt of requisite documents by concerning Electricity Operation Division.

#### 4.1.7. Connection Charge Estimate

After the approval of the application (up to 25KW) or issuance of Distributed Generation License for over 25KW, the concerning Electricity Operation Division will issue the Connection Charge Estimate (CCE), if any, to the applicant for the proposed interconnection facility up to the interconnection point including metering installation.

The applicant shall obtain the bi-directional meter from AJKED.

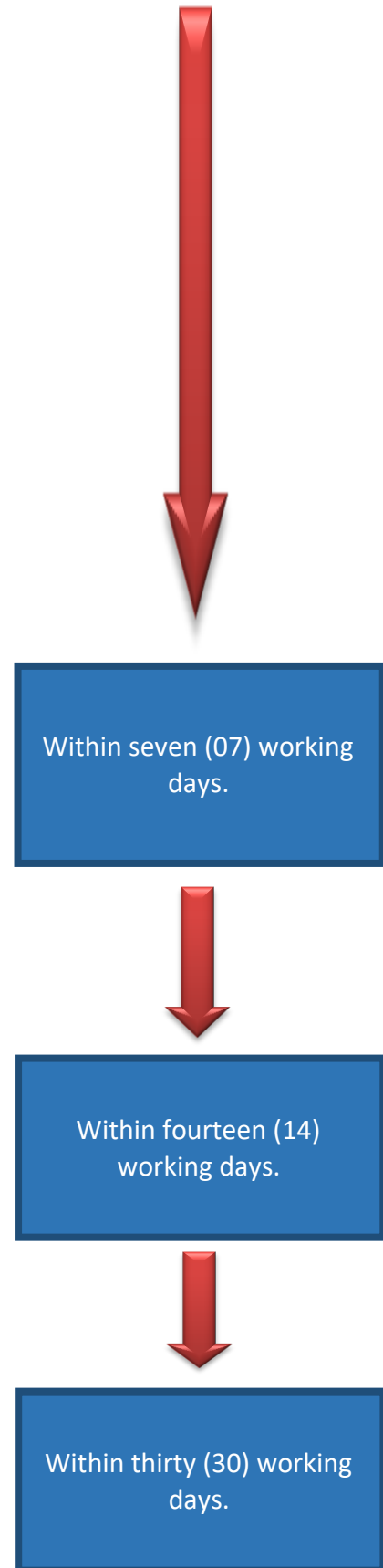
#### 4.1.8. Payment of CCE

The applicant has to obtain the meter from concerned Electricity Operation Division and if the office of Electricity Operation Division has given the notice to the applicant to make the payment of Connection Charge Estimate (CCE), the applicant will pay the same within fourteen days and notify the AJKED office.

The Applicant shall also submit the one-time DG facility fee (non-refundable) in the form of Demand Draft / Pay Order of an amount given in Schedule-V, in the name of "Accountant General AJK".

#### 4.1.9. Installation of Interconnection Facility

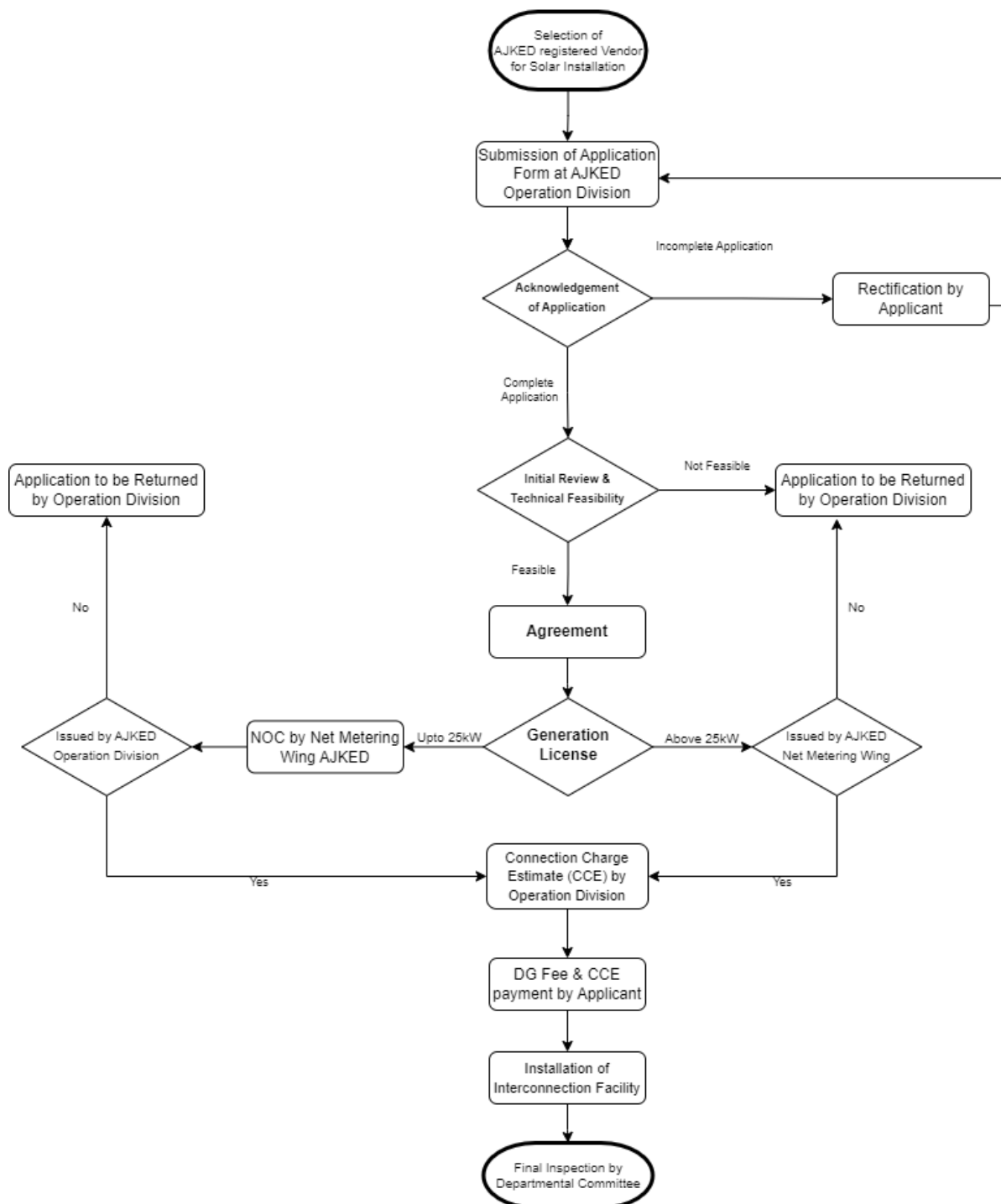
When the charges will be paid, the Electricity Operation Division will install and commission the proposed interconnection facility after the payment of demand notice by the Applicant.





**4.2. Flow Chart Diagram**

**AZAD JAMMU & KASHMIR ELECTRICITY DEPARTMENT  
DIRECTORATE PLANNING & MONITORING, NET METERING WING  
NET METERING APPLICATION PROCESS FOR CONSUMER**



## **5. Interconnection Requirements**

This chapter will cover the requirements that are needed to be checked by the Electricity Operation Division in proposed DG facility by the consumer.

### **5.1. General Requirements:**

#### **5.1.1. 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 AJKED prior to commissioning of the proposed Interconnection Facilities and a typical single line diagram.
- 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.
- 3) 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 AJKED 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.
- 4) The protective functions shall be equipped with automatic means 'to prevent reconnection of the Distributed Generation Facility with the Distribution facilities of the AJKED.
- 5) Provided that the service voltage and frequency is of specified setting and is stable and mutually agreed between the AJKED and the Distributed Generator.
- 6) 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.
- 7) 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.

#### **5.1.2. 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 AJKED'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 AJKED.
- 3) On account of any failure on part of the Distributed Generator to take timely corrective action, the AJKED may, without liability, disconnect the Distribution Generation facility from the Distribution System, in accordance with these Regulations.
- 4) Voltage and Frequency Range: A variation of  $\pm 5\%$  and  $\pm 1\%$  is permissible to the nominal voltage and frequency respectively.

### **5.2. Initial Requirements**

At the beginning of application procedure, Electricity Operation Division has to make sure that these initial requirements are to be fulfilled by the applicant:

### 5.2.1. Technical Feasibility Requirement

After receiving an application for the interconnection facility, technical feasibility report is to be prepared by the inspection committee keeping in view the following checks:

- 1) The capacity / load on the transformer should be within the technical limits.
- 2) In case, the Net Metering connections cumulative load increases more than 15% of the connected HT/LT conductor capacity, the concerned Electricity Operation Division shall not grant approval for any new DG facility.
- 3) Whether the proposed interconnection would require upgrading the capacity of existing distribution network.
- 4) Ensure phase balancing to avoid unbalancing of the load in secondary circuit of distribution line.

### 5.2.2. NOC by Electrical Inspector

NOC by AJKED Electrical Inspector is mandatory for connections above 250kW. Scope of the NOC includes grounding tests, insulation tests, wiring size suitability and general safety of complete internal wiring.

- 1) Arrange testing of grounding along with other related requirements by a licensed electrician.
- 2) Make a formal written request to concerned AJKED Electrical Inspectorate along with copy of test report.
- 3) Electrical Inspector shall depute an individual from his office or visit himself for verification
- 4) If satisfied, shall issue the NOC
- 5) If not satisfied, shall advise removal of faults/deficiencies.
- 6) After rectification, repeat the request and get NOC

The NOC by Electrical Inspector is to be attached with the Application for Net Metering system.

**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 complete internal wiring. Therefore, he may like to check all these elements.

### 5.3. Grid Interconnection Standard: Electrical Parameters

The DG shall operate and inject power when the network is within the parameters mentioned hereafter. DG system shall disconnect itself from the utility network when the electrical parameter of the network falls out of the specified range.

#### 5.3.1. Range of Operation: Voltage

The under voltage and over voltage levels and the corresponding trip times shall be in accordance with IEC 61727 or better.

| Voltage                | Maximum Trip Time (Seconds) |
|------------------------|-----------------------------|
| $V < 50\%$             | 0.1                         |
| $50\% \leq V < 85\%$   | 2.0                         |
| $85\% \leq V < 110\%$  | Continuous Operation        |
| $110\% \leq V < 135\%$ | 2.0                         |
| $135\% \leq V$         | 0.05                        |

### 5.3.2. Range of Operation: Power Factor

The power factor must comply with requirements as per IEC 61727. The DG system shall have power factor greater than 0.9 when the output is greater than 50% of System rating. The Power Factor requirements set for respective consumer type by the utility company will be will remain applicable and larger DG (such as industrial connections) may be required to install additional systems for power factor correction.

### 5.3.3. Range of Operation: Frequency

The under frequency and over frequency levels and the corresponding trip times shall be as follows:

| Frequency Range (Hz)              | Maximum Trip Time (Seconds) |
|-----------------------------------|-----------------------------|
| $f_{nominal} < 47.5$              | 0.1                         |
| $47.5 \leq f_{nominal} \leq 51.5$ | Continuous Operation        |
| $51.5 < f_{nominal}$              | 0.1                         |

### 5.3.4. Harmonics

The inverter shall meet the Harmonic current injections in accordance with IEC 61727. The total harmonic distortion shall be less than 5% at 100% rated power of the inverter. Distortion limits for Even Harmonics and odd Harmonics are listed below:

| Odd Harmonics               | Distortion Limit |
|-----------------------------|------------------|
| $3^{rd}$ through $9^{th}$   | Less than 4.0%   |
| $11^{th}$ through $15^{th}$ | Less than 2.0%   |
| $17^{th}$ through $21^{st}$ | Less than 1.5%   |
| $23^{rd}$ through $33^{rd}$ | Less than 0.6%   |
| $33^{rd}+$                  | Less than 0.3%   |

Even Harmonics in these ranges shall be less than 25% of the odd harmonics listed. THD should be less than 5%.

### 5.3.5. DC Current injection

The DC Current injection must be in accordance with IEC 61727. The PV system shall not inject DC current greater than 1% of the rated inverter output current into the utility interface.

### 5.3.6. Islanding Protection

Islanding protection shall be in accordance with IEC 61727. A PV system that ceases to energize the utility line in case of a voltage and frequency situation outside of the ranges stated in IEC 61727 within the timeframes set in the IEC 61727 is considered to be sufficiently protected against islanding.

### 5.3.7. Reconnection to the network

In case of utility line outage, fault or out of range, the inverter shall remain disconnected and provide Islanding Protection. The inverter shall not energize the utility line for at least 1 minute after the service voltage and frequency have recovered to the continuous operations range parameters as defined above.

## 5.4. Inverter standards

As per by AJK Net Metering Regulation, the grid connected inverters shall comply with UL 1741 standard which addresses the electrical interconnection design of various form of generating equipment. Other standards that the DG facility should adopt to are:

- 1) IEEE 1547 2003 (standard of interconnecting distributed resources with electric power system).
- 2) IEC 61215 for crystalline PV modules
- 3) IEC 61646 for thin film PV modules

## 5.5. Safety and EMC Standard

For system greater than 10kW, the inverter needs to comply with additional certifications and meet additional Electromagnetic compatibility and Safety Standards such as:

- 1) IEC EN 61000-6
- 2) UL1741
- 3) EN 62109-1/2
- 4) IEEE1547

## 5.6. Load flow study

For the Distributed Generators having an installed capacity of more than 250kW, load flow study (on any standard software) is compulsory.

Load flow study for the facility having capacity up to 250kW is not required.

## 5.7. Upgrading the Transformer

In case if the load capacity due to already installed DG facilities at any transformer reaches 80%, the concerned Electricity Operation Division shall not grant approval for any new DG facility at that transformer unless the new DG Facility operator agrees and pay for the cost of augmenting the transformer capacity.

## 5.8. Mandatory requirements

According to AJK Net Metering Regulation, concerned Electricity Operation Division and applicant have to comply with some safety requirements as stated below:

### 5.8.1. Interconnection disconnect switch

Electricity Operation Division personnel has to make sure that the applicant has installed 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 should be locked and can be accessible by both DG and the Electricity Operation Division personnel and shall meet the applicable IEC and IEEE standards.

### 5.8.2. Anti-islanding

Anti-islanding is an in built feature in inverter which trips the flow of energy to the grid on grid failure. During the connection inspection, anti-islanding feature must be tested by the respective officers of the Electricity Operation Division. The inspection authority shall ensure the anti-islanding and any other protection requirement before commissioning.

### 5.8.3. Single line diagram

The protection and control single line diagrams for the interconnection of the Distributed Generator is to be approved by the Electricity Operation Division prior to the commissioning of the system.

### 5.8.4. 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:

- 1) Equipment earth (DC)
- 2) 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.

### 5.8.5. Lightning and surge protection

Electricity Operation Division officials also have to make sure that the DG facility is separately grounded and the lightning arrestors are provided with the DG facility. The circuit breakers of rated voltage are also installed at the facility. Surge protection shall be provided on the DC and AC sides of DG facility.

#### **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.

#### 5.8.6. 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 to protect your devices from becoming more seriously damaged if there is a short circuit. Keep in mind it is also very important to properly size your cables and wires to prevent excessive heat and possible fire.

Wire gauge scale should be considered while installing inverter and circuit breakers should also be installed according to the rating of the panel and wire.

#### 5.8.7. Extra precautions

Installation of DG facility requires some additional checks/precautions which are listed below for guidance:

- 1) PV mountings and other metallic structure must be grounded using adequately sized good quality cable. The earth connection must also be tested for its continuity and resistance value to see that 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 itself should be properly secured with base/floor to ensure it can withstand wind storms and other climatic vagaries.
- 4) The PV modules should be attached to the mountings by stainless steel nut bolts using SS spring washers.
- 5) PV module's electrical cables should not be cut and twisted together for any kind of inter-connection.
- 6) For paralleling PV strings, adequately sized combiner box or other similar accessories

**NOTE:** The Single line diagram, Earthing, anti-islanding feature of the inverter and the lightning arrestors are all checked and cleared in the NOC by the Electrical Inspector mentioned in the initial requirements.

## 6. Operating Procedure

This chapter will cover all the process involved and the requirements of the DGs and the AJKED after the installation of Net Metering at DG's premises.

### 6.1. Billing procedure

According to AJK Net Metering Regulation, following procedures are to be adopted for the billing process:

- 1) The consumer shall receive a monthly net import or net export bill indicating net import or net export to 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 export energy is more than the import, the net kWh shall be credited against Distributed Generator next billing cycle.
- 5) And on next month if the exported energy is again more than the imported energy, the net kWh shall be credited against next billing cycle unless the net energy exported is more quarterly (in 3 months), the off peak net kWh shall be paid to the Distributed Generator by the AJKED.
- 6) AJK Net Metering Regulations for net metering clearly state netting of electricity units on off-peak rates. Whether the consumer supplies units during off-peak or peak time, the units and rates the AJKED will use for netting the units and electricity bill will be the off-peak time units and rates.
- 7) Calculation of Sales Tax on sale of electricity is to be done on net electricity units. This is because that consumer and AJKED are trading the electricity units. In accounting terms, both are liable for Sales Tax. One way of settling Sales Tax is that both parties may settle their Sales Tax at their own, which is cumbersome and much difficult for the consumers to handle. Easy way is that the net of electricity units be calculated and the party having supplied surplus units may charge be liable for Sales Tax settlement. In most cases (because of solar PV/micro wind system sizes and consumption of electricity by the consumers), it would be the AJKED who would have supplied more units, and therefore would have to collect Sales Tax from the consumers, based on net electricity units. The Sales Tax would be calculated for off-peak and peak units separately, calculations for Sales Tax of only off-peak billed units will be used for netting off.
- 8) Calculations of other surcharges or tariff rationalization charges etc. should be done on the basis of total electricity units supplied by the AJKED. This is because, AJK Net Metering Regulations allows netting of electricity units on off-peak rates only. Surcharges or tariff rationalization charges etc. does not fall in calculations of netting of off-peak electricity units.

### 6.2. Periodical inspection

- 1) Both uni-directional and the bi-directional energy meters are to be tested once in 6 months.
- 2) The inverter functionality of every installation is to be checked once in 6 months.





- 3) Periodical test reports shall be made by AJKED's personnel (concerned Electricity Operation Division, Electric Inspector or anyone nominated for the said purpose by Net Metering Wing AJKED/Chief Engineer AJKED Muzaffarabad) and submitted to the Net Metering Wing AJKED.

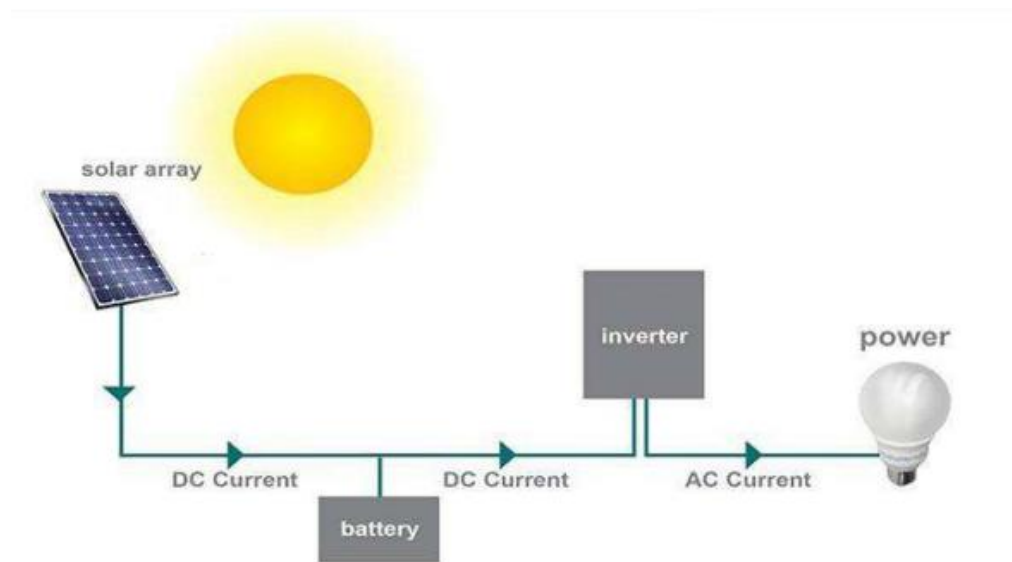
### 6.3. General

- 1) The applicant will bear the meter replacement cost or any system enhancement cost.
- 2) The DG Facility installed by the consumer must comply with the standards and specifications as specified by AEDB and AJKED time to time.
- 3) The applicant of net metering connections are required to install their DG Facility through the AEDB and AJKED certified installers/vendors/service providers only. The applicants of net metering connections shall ensure that the installers/vendors/service providers shall have adequate experience, expertise and knowledge in design, supply and installation of DG Facility.
- 4) In case the installed (also read proposed) capacity of the DG Facility is higher than the sanctioned load (maximum up to 1.5 times of the sanction 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.

## 7. Technical Considerations for a Solar PV System for Net Metering

The most important decision that one should make when setting up a solar energy plant is selecting what materials to use or in which company we will place the trust throughout the project execution phase. Cost is a critical factor, but we must be fully assured that the system we are installing can be completely adapted to meet project needs and that its long-term durability is guaranteed and the roof is eligible for installation of solar system. The basic Components of a Solar PV System are:

- Solar Panels
- Inverters
- Batteries
- Mounting structure



### 7.1. Selecting Components for Solar System

#### 7.1.1. Type of Solar PV Modules

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

On the other side of the fence, thin-film solar cells are less expensive than older c-Si wafer cells. Available in thin wafer sheets, they are more flexible and easier to handle. They're also less susceptible to damage than crystalline silicon modules (c-Si) but are less efficient.



**Thin Film Module**



**Crystalline Silicon Module (c-Si)**

When buying a module, it is important to check if the module passes 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> | <b>Crystalline Silicon Modules</b> |
|---|------------------------------------|

**Table 5.1: 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> | <b>Module Warranty</b> |
|---|------------------------|

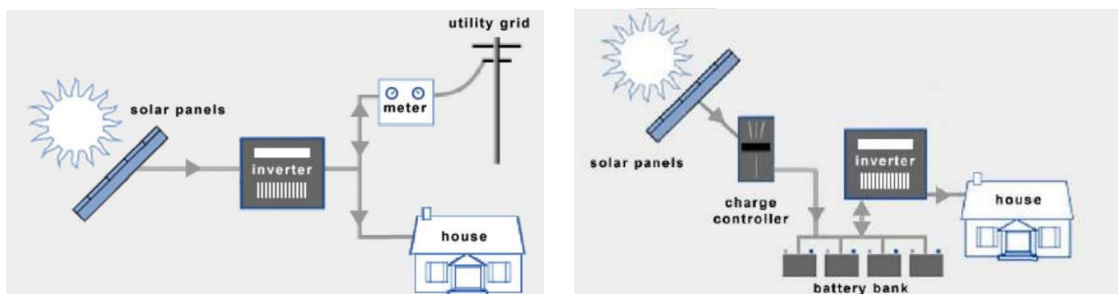
**Table 5.2: Module warranty**

|   |
|---|
| <p><b>Useful Tips:</b></p> <ul style="list-style-type: none"> <li>• Check the module type with IEC standards and type of warranty.</li> <li>• Buy modules with measurement record and serial numbers as reference.</li> <li>• Do not use different rated modules for the system in order to minimize power losses.</li> </ul> |
|---|

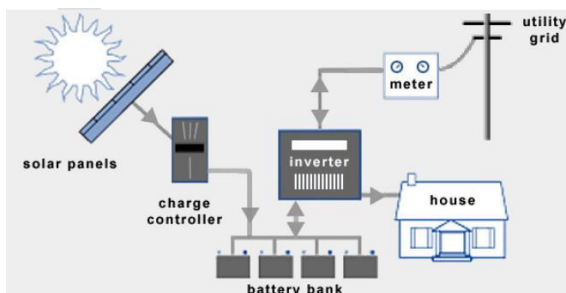
### 7.1.2. Choosing Inverters

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

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



A hybrid solar system combines the best from grid-tied and off-grid solar systems. These systems can either be described as off-grid solar with utility backup power, or grid-tied solar with extra battery storage.



|   |   |
|---|---|
| <ul style="list-style-type: none"> <li>• As much as possible, the inverter should be installed near the utility meter. Shorter the DC cabling less will be the power loss of solar 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<br/>OF<br/>INSTALLATION</b></p> |
|---|---|

**Table 5.3: 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 it has to be protected against rain and insulation.

### Renowned Inverter's Manufacturers

Below is the list of manufacturers that provides inverters which support Net Energy Metering.

- ABB
- Advance Energy
- APS System
- Baykee
- Crown Micro
- Delta
- Direct Grid
- Enphase Energy
- Fronius USA
- Growatt
- Huawei
- Salton
- Schneider Electric
- Sharp
- SMA America
- Solar Edge
- Solectria
- Sungrow
- Sun Power
- Voltronics Power
- Outback Power

#### 7.1.3. Choosing Batteries

Below is the brief overview of different types of batteries that may be used in solar electric and backup power systems.

- **Lead Acid batteries** are used in 99 % of the solar system for the backup purpose. New deep cycled/OpzS and OpzV lead batteries should be preferred.
- **Deep-cycled 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 demands low-maintenance as well as average and long discharges. The tabular battery design with lead-selenium alloy guarantees best operating life, minimum maintenance and optimal performances in cyclic & 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:

- On average deep cycled batteries lasts 4-5 years and with good care. Lead Acid batteries can even last longer
- A new battery should be checked every few weeks to estimate the acid level.

#### 7.1.4. 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, no holes should be drilled into the frame. Call your module manufacturer before you drill further holes, as warranty commitment may be invalidated.

### Penetrating Mounting Structure – GI

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

- Compact structure for flat roofs made of roll formed GI profiles
- Between 50-70 kg per kW, based on latitude
- Stainless steel fasteners, SS stud bolts for foundations designed to withstand wind gusts of 150 km/h.
- Tilt adjustable to latitude
- Area required 8 to 12 square meters without shading.



### Fixing of Modules

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

- The weight of the modules is approx. 20 kg per module. Always check the kind of roof surface.
- In case no information is provided by the manufacturer, the module attachment should be along the longer side of the module, at around  $\frac{1}{4}$  of the module length. The predrilled 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

#### 7.1.5. DC Wiring

DC wires should be selected carefully for connecting panel 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. If you are in doubt of your own ability then consult a qualified electrician with knowledge of DC wiring and Solar System.

The distance between inverter and the panel should also be minimum, longer the wire, more likely there will be a chance for voltage drop.

**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 below is a quick reference for choosing the correct wire thickness:

| AWG     | 12<br>3mm <sup>2</sup> | 10<br>5mm <sup>2</sup> | 8<br>8mm <sup>2</sup> | 6<br>13mm <sup>2</sup> | 4<br>21mm <sup>2</sup> | 2<br>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                   |

## **7.2. Sizing of PV system**

### **7.2.1. 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 10 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 power of the PV system obtained - based on the space allowed on your roof – and match the PV energy output with your consumption.

Solar allows you to reduce your consumption during the daytime. It is essential to improve the demand profile of your home by utilizing the loads whenever the PV system delivers a lot of electricity and reaches peak capacity. Managing your load this way will reduce the peak demand for electricity.

### **7.2.2. Commercial and Industrial Scale PV System**

The installation of a PV system is a good investment, which can provide higher returns than a savings deposit.

Larger PV systems for commercial use will make sense if you can arrange loads to coincide with high solar generated electricity.

## **7.3. How to Recognize a Good Offer from Installer**

The first question to ask is: Where will I find a good PV installation company? System installation can be found by advertisements in printed media and internet search. 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 its local distributors frequently offer lists of authorized installers of their Components.

It is recommended that when choosing a vendor/supplier select the one which offers the installation of the PV system along with the application process for Net Metering on consumer's behalf.

### **7.3.1. Commercial, Agricultural and Industrial Scale PV System**

In order to compare different offers, it is necessary that all basic items are listed. Some components can be a useful add-on, but not critical to the operations of the PV system - like a data logger, an operation and maintenance contract, warranty extensions and insurance policy for the PV system.

In case of comparable offers, a local company is preferable. Another useful aspect to consider is the possible date of installation of the PV system.

The quote for the PV installation should also include an estimate of cost-effectiveness. This calculation has to be based on the expected yield, the electricity demand and the achievable degree of self-consumption. Besides, the energy produced which is not consumed onsite and is fed into the grid will be credited to the next billing cycle.

## **7.4. Important Aspects Considering the Installation**

### **7.4.1. 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.

#### **7.4.2. Quality Assurance during Operation Time**

The installer should offer a warranty on construction works for a certain period of time (at least one year). This has to be reviewed with the installer and should form part of the documentation of the PV plant. The inverter should be checked on a regular basis (on vision panel or data logger).

#### **7.4.3. Maintenance of the PV System**

For maintenance measures by the PV plant owner, regularly monitor the performance to avoid disruptions. Maintenance work consists mainly on control of operational readiness of the system in order to rapidly resolve any failures. Operational manual for the inverter and a documentation of the installation provided by the installer are necessary for maintenance.

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

### **8.1. Term of Agreement**

- 1) The term of the Agreement between Distributed Generator and AJKED shall be Seven years with effect from commissioning of Distributed Generator Facility.
- 2) At the expiry of initial term, the Agreement may be automatically renewed between the Distributed Generator and AJKED for another term of Seven years and so on unless the Distributed Generator or AJKED terminated the agreement in accordance with the regulations.

### **8.2. 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 AJKED.
- 2) The Electricity Operation Division shall not terminate the Agreement in any event without prior approval of the "Net Metering Wing".
- 3) All rights and obligations accrued up to termination shall continue in force upon termination.

## **9. Interconnection Facility Financing**

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 AJKED in providing, operating, or maintaining Interconnection Facilities and Distribution System improvements required solely for the interconnection of the Distributed Generation Facility with AJKED's Distribution System.
- 3) In case of non-availability of meter(s) with AJKED, the Distributed Generator may procure such meter(s) directly subject to testing by AJKED, before installation.

## **10. Power of the AJKED to give Directions, Instructions and Guidelines**

- 1) For carrying out the purposes of these Regulations, the AJKED may issue directions, instructions and guidelines to the Distributed Generator and the concerning Electricity Operation Division/Net Metering Wing in the form and manner determined by the AJKED, which shall be complied with by the Distributed Generator and the he concerning Electricity Operation Division/Net Metering Wing.

- 2) The AJKED 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.

## **11. Power to require information**

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

## **12. Resolution of disputes**

Any dispute or disagreement between Distributed Generator and concerning Electricity Operation Division/Net Metering Wing relating to any matter arising out of, or in connection with, the activities covered under the Regulations shall be submitted for decision to the AJKED.

## **13. Penalty**

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 AJKED 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**.

## **SCHEDULE – I**

### **DISTRIBUTED GENERATION INTERCONNECTION AGREEMENT (OF \_\_ KW) BETWEEN AJK ELECTRICITY DEPARTMENT (AJKED) & DISTRIBUTED GENERATOR (DG) (As specified in Rule 2(c))**

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

### **RECITALS**

- A. AJKED is the owner of the electric distribution system in the state of Azad Jammu & Kashmir (AJ&K).
- 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 AJKED’s distribution system.
- C. AJKED 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 AJKED’s distribution system and AJKED is willing to permit such interconnection subject to the terms and conditions set forth: (1) The completed Application approved by AJKED; (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 AJKED and Applicant agree as follows:

#### **1. Design Requirement:**

The DG Facility shall be installed in compliance with the AJ&K Distributed Generation (Alternative & Renewable Energy) and Net Metering Regulations, 2022.

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

Applicant represents and warrants that:

- i The DG Facility is fully and accurately described in the Application;
- ii All information in the Application is true and correct;
- iii The DG Facility has been installed to Applicant's satisfaction;
- iv Application has been given warranty information and an operation manual for the DG Facility;
- v Applicant has been adequately instructed in the operation and maintenance of the DG Facility.

**3. Interconnection Disconnect Switch:**

AJKED 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 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 AJKED personnel, and shall be capable of being locked in the open position. The Applicant shall follow AJKED's recommended switching, clearance, tagging, and locking procedures.

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

Applicant shall notify AJKED 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 AJKED. Applicant agrees not to commence installation of any material modification to the DG Facility until AJKED 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 AJKED in writing that installation of DG Facility is complete and that the interconnection equipment is available for testing by AJKED at least fifteen working days duly certified by Electrical Inspector AJK before Applicant interconnects the DG Facility with AJKED's Distribution System. AJKED shall thereupon have the right to test the DG Facility. AJKED shall also have the right to witness any testing by Applicant of the DG Facility. Any AJKED 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 AJKED to be witnessed by representatives of both parties within thirty eight days.

**7. Access to DG Facility:**

Applicant shall permit AJKED'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 AJKED 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. AJKED shall have the right to witness any testing by Applicant of the DG Facility.

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

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

#### **9. Disputes; Right to Appeal to AJKED:**

In case of any dispute between the applicant and concerning Electricity Operation Division/Net Metering Wing of AJKED, the applicant may file a petition to concerning Chief Engineer Electricity. The decision of the Chief Engineer shall be final and binding on both the applicant and Electricity Operation Division/Net Metering Wing AJKED.

#### **10. Amendments; Non-Waiver:**

Any amendment or modification to this Agreement must be in writing and executed by Applicant and AJKED. The failure of Applicant or AJKED's 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 AJKED shall be seven 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 AJKED for another term of seven years and so on.

- a) AJKED may limit the operation and/or disconnect or require the disconnection of a DG facility from AJKED's Distribution System at any time, with or without notice, in the event of fault. AJKED may also limit the operation and/or disconnect or require the disconnection of DG facility from AJKED'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 AJKED's Distribution System;
  - Upon AJKED'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 AJ&K Distributed Generation (Alternative & Renewable Energy) and Net Metering Regulations, 2022.
- 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 AJKED.
- d) The concerning Electricity Operation Division shall not terminate the Agreement in any event without prior approval of the Net Metering Wing AJKED/Chief Engineer.
- 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 AJKED, which consent



shall not be unreasonably withheld or unduly delayed. AJKED 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 AJKED. AJKED 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 AJKED Signature and Seal:**

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

| <b>Applicant Signature &amp; Date</b>      | <b>AJKED's Signature with Seal &amp; Date</b> |
|--|---|
|  |   |
| <b>Title</b>                               | <b>Title</b>                                  |
|  |   |
| <b>Witness No.1 (Name &amp; Signature)</b> | <b>Witness No.1 (Name &amp; Signature)</b>    |
|  |   |
| <b>Witness No.2 (Name &amp; Signature)</b> | <b>Witness No.2 (Name &amp; Signature)</b>    |
|  |   |





**SCHEDULE-II**

**AJK ELECTRICITY DEPARTMENT  
STANDARD DISTRIBUTED GENERATION APPLICATION FORM  
(As specified in Rule 3(1))**

| This Portion to be Filled by the AJKED |                        |
|--|------------------------|
| Application Tracking ID                | NM/____/____/____/____ |
| Receiving Date                         |                        |

**1. Contact Information:** The applicant is the person that is legally responsible for the generating system.

| Applicant's Name | Applicant's Father Name |
|------------------|-------------------------|
|                  |                         |

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

|                                     |
|-------------------------------------|
| <b>Applicant's Mailing Address:</b> |
|                                     |

|  |        |
|--|--------|
| Applicant's Phone Number & Email Address |        |
| Office:                                  | Fax:   |
| Cell:                                    | Email: |

|                           |
|---------------------------|
| Emergency Contact Numbers |
|                           |

|  |
|--|
| <b>2. Location of Generation System</b>                |
| Address at which the DG Facility is located            |
|  |
| Latitude-Longitude (i.e. E-49° 32' 06", N-91° 64' 18") |
|  |

|   |
|---|
| <b>3. Applicant / consumer electricity account reference number</b> |
|   |

|   |
|---|
| <b>4. Applicant's Ownership Interest in the Generation System</b> |
| Owner _____ Co-Owner _____ Lease _____ Other _____                |



|   |           |
|---|-----------|
| <b>5. Primary Intent of the generation system</b>                       |           |
|   |           |
|   |           |
| (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 purchase (i.e. (a) minus (b))        | (kWh)/yr. |
|   |           |

|   |                       |
|---|-----------------------|
| <b>7. Installing Contractor Information</b> |                       |
| <b>Contractor's Name</b>                    |                       |
|   |                       |
| <b>Name of Firm</b>                         |                       |
|   |                       |
| <b>Contractor's Phone Number</b>            | <b>E-Mail Address</b> |
|   |                       |
| <b>Mailing Address</b>                      |                       |
|   |                       |

|                                     |
|-------------------------------------|
| <b>8. Requested In-Service Date</b> |
|                                     |

|  |                 |
|--|-----------------|
| <b>9. Provide One-Line Schematic Diagram of the System</b> |                 |
| Schematic is Attached                                      | Number of pages |
|  |                 |

|   |            |
|---|------------|
| <b>10. Generator / Inverter Information</b> |            |
| Manufacturer                                | Model No.  |
|   |            |
| Version No.                                 | Serial No. |
|   |            |



|   |                                      |                                   |                                      |
|---|--------------------------------------|-----------------------------------|--------------------------------------|
| 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)   |                                      |                                   |                                      |
| _____ kW      _____ kVA      _____ volts  |                                      |                                   |                                      |
| Primary Energy Source   |                                      |                                   |                                      |
|   |                                      |                                   |                                      |
| Note: if there is more than one inverters, attach an additional sheet describing each |                                      |                                   |                                      |

|  |
|--|
| <b>11. Site Plan showing location of the External Disconnect Switch (attach additional sheets as needed)</b> |
|  |

|  |
|--|
| <b>12. Design Requirements</b>   |
| (a) Has the proposed distributed generation paralleling equipment been certified by Electrical Inspector?<br>Y _____ N _____ |

|  |
|--|
| <b>13. Other Comments, Specification and Exceptions (attach additional sheets if needed)</b> |
|  |

|   |
|---|
| <b>14. Application and Installer Signature</b>  |
| To the best of my knowledge, all the information provided in this application form is completed and correct |

|  |             |
|--|-------------|
| <b>Applicant Signature</b>                 | <b>Date</b> |
|  |             |
| <b>Installer Signature (If Applicable)</b> | <b>Date</b> |
|  |             |



**SCHEDULE-III**

**AJK ELECTRICITY DEPARTMENT**

**APPLICATION FOR GRANT OF LICENSE (ABOVE 25KW)**

(As specified in Rule 4(2))

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

**Applicant's Signature**

|  |
|--|
|  |
|--|

**Date**

|  |
|--|
|  |
|--|



**SCHEDULE-IV**

**AJK ELECTRICITY DEPARTMENT**

(As specified in Rule 4(2(b)))

**Application for Exemption from Section 24 of the Companies Ordinance 1984**

**As Adapted in AJ&K**

I/we (**Name of the Distributed Generator**) for the purpose of grant of License of Distributed Generator under AJ&K Distributed Generation (Alternative & Renewable Energy) and Net Metering Regulations, 2022, hereby request the AJKED for grant of exemption from the requirement of being registered as a company under the Companies Ordinance, 1984 (XLVII of 1984) under section 24 of the Act.

**Name & Address of Distributed Generator**

**Stamp**



**SCHEDULE-V**

**AJK ELECTRICITY DEPARTMENT**

**FEE SCHEDULE**

**(As specified in Rule 4(2(c)))**

A Distributed Generator shall be bound to pay the onetime fee through pay order in favor of  
AJK Electricity Department (AJKED) as per following fee schedule.

| <b>Sr.#</b> | <b>Size of DG Facility</b> | <b>Amount</b> |
|-------------|----------------------------|---------------|
| 1.          | 0-25 KW                    | Rs. 1000/-    |
| 2.          | >25-250 KW                 | Rs. 2000/-    |
| 3.          | Above 250 KW               | Rs. 5000/-    |



**SCHEDULE-VI**

**AJK ELECTRICITY DEPARTMENT**

**AFFIDAVIT**

**(On Judicial paper of Rs. 50/-)**

**(As specified in Rule 4(2(d)))**

I/we **(Name of the Distributed Generator)** hereby confirm the I/we have read the AJ&K Distributed Generation (Alternative & Renewable Energy) and Net Metering Regulations, 2022, AJKED License Agreement and agree to abide by its Terms and Conditions and the content of the Application are true and correct to the best of my knowledge and belief and nothing has been concealed thereof.

**Deponent**

**Oath Commissioner**



**SCHEDULE-VII**

**AJK ELECTRICITY DEPARTMENT**

**GENERATION LICENSE TEMPLATE FOR ABOVE 25KW**

**(As specified in Rule 4(3))**

Application Tracking ID: NM/\_\_\_/\_\_\_/\_\_\_/\_\_\_

Date: \_\_\_\_\_

1. AJKED hereby grants Generation license to ( \_\_\_\_\_ )  
under Regulation 4 of the AJ&K Distributed Generation (Alternative & Renewable Energy) and Net Metering Regulations, 2022 for a period of \_\_\_\_\_ Years. This License is valid upto 20\_\_.
2. The License shall abide by the provision under AJK Distributed Generation (Alternative & Renewable) and Net Metering Regulation 2022, during the currency of the License.
3. The technical parameters of the net metering arrangement are shown hereunder;
  - i. Primary Energy Source: Solar/Wind
  - ii. Size of DG Facility: \_\_\_\_\_ KW
  - iii. Generator/Inverter information:  
Manufacturer \_\_\_\_\_, Model No. \_\_\_\_\_
  - iv. Generation Type: Inverter/Other
4. This License may be renewed subject to AJ&K Distributed Generation (Alternative & Renewable Energy) and Net Metering Regulations, 2022.

\_\_\_\_\_  
**AJKED**

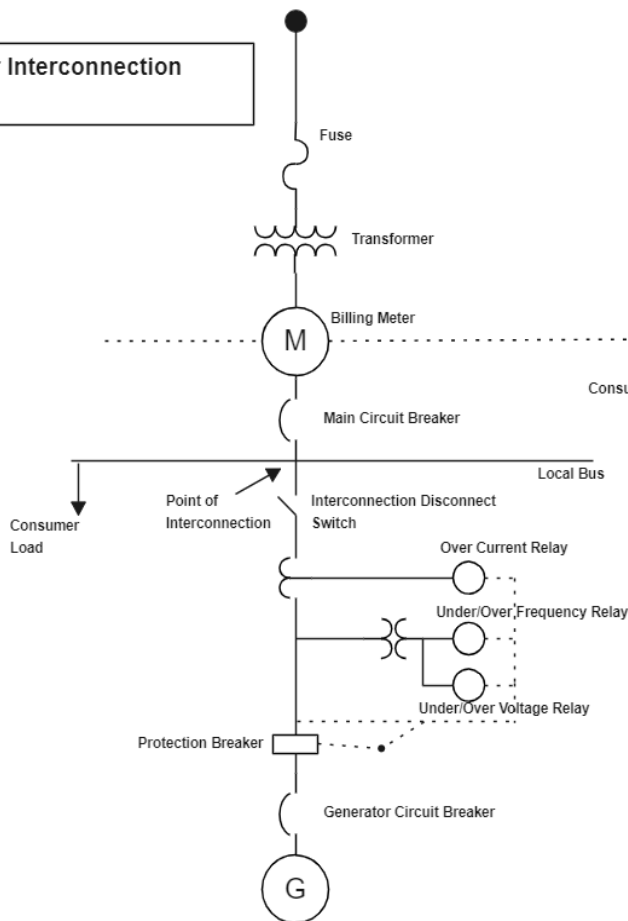
\_\_\_\_\_  
**Name & Address of  
Distributed Generator**



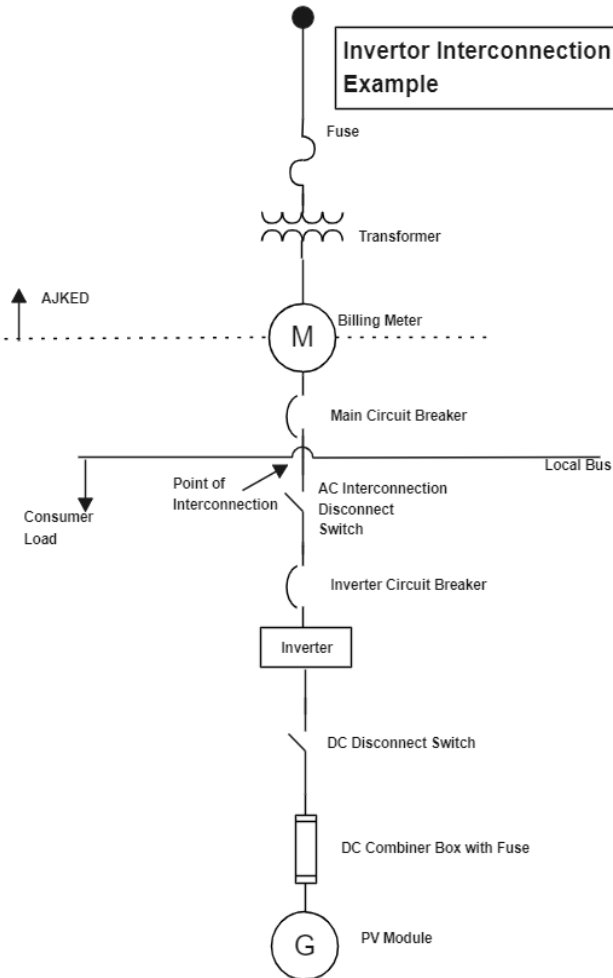
**SCHEDULE-VIII**

**(As specified in Rule 9)**

**Generator Interconnection Example**



**Inverter Interconnection Example**



Note:  
a) Trip of either Breaker is acceptable  
b) Compliance with IEEE 1347 & UL 1741 required



**SCHEDULE-IX**

**AJK ELECTRICITY DEPARTMENT  
NET METERING APPROVAL  
(As specified in Rule 3(7-a))**

No. \_\_\_\_\_

Dated \_\_\_\_\_

To,

Applicant Name: \_\_\_\_\_

Applicant Address: \_\_\_\_\_

Contact No.: \_\_\_\_\_

**Subject: NET METERING APPROVAL**

1. The Executive Engineer Operation Division \_\_\_\_\_ AJK Electricity Department hereby grants Net Metering approval to *write applicant name*, for \_\_\_\_\_ KW photovoltaic solar based Distributed Generation facility, having **Application Tracking ID** NM/\_\_\_\_/\_\_\_\_/\_\_\_\_/\_\_\_\_, located at *write applicant address*, under the AJ&K Distributed Generation (Alternative & Renewable Energy) and Net Metering Regulations, 2022, for a period of seven (7) Years. This approval is valid upto *write expiry date*.
2. The Net Metering approved Distributed Generator shall abide by the provisions under the AJ&K Distributed Generation (Alternative & Renewable Energy) and Net Metering Regulations, 2022, during the currency of Net Metering connection.
3. The Technical parameters of Net-Metering arrangement are as under:

|    |   |          |
|----|---|----------|
| 1. | Primary Energy Source                   | Solar    |
| 2. | Size of Distributed Generation Facility | _____ kW |
| 3. | Generator/Inverter Information          |          |
|    | Manufacture                             | _____    |
|    | Mode No.                                | _____    |
| 4. | Vendor/Installer                        | _____    |
| 5. | Generation Type                         | Inverter |

4. This approval may be renewed subject to AJ&K Distributed Generation (Alternative & Renewable Energy) and Net Metering Regulations, 2022.

**Executive Engineer**

Operation Division \_\_\_\_\_  
AJK Electricity Department

**Copy to:**

1. Superintending Engineer (E), Circle \_\_\_\_\_
2. Deputy Director (Net Metering Wing), Directorate P&M AJKED Muzaffarabad.
3. Sub Divisional Officer Operation Sub Division \_\_\_\_\_.
4. Revenue Officer (E), Operation Division \_\_\_\_\_.

**Executive Engineer**

Operation Division \_\_\_\_\_  
AJK Electricity Department

## SCHEDULE-X

### CUSTOMER AGREEMENT (in pursuant to regulation 3 sub-regulation 10)

(to be signed between DG Installer and Customer)

1. This Agreement is made on \_\_\_\_\_ Day \_\_\_\_\_ Month \_\_\_\_\_ Year between M/s \_\_\_\_\_ having a registered office at \_\_\_\_\_, registered with AJKED as certified Vendor/Installer/Service Provider (hereinafter called “the DG Installer”) having Registration Number AJKED/NM/\_\_\_\_/\_\_\_\_/\_\_\_\_ and \_\_\_\_\_ Mr./Ms. \_\_\_\_\_ having an address: \_\_\_\_\_ (hereinafter referred to as “the Customer”).

Whereas:-

- 2.1. The Customer has agreed to purchase Wind / Photovoltaic Distributed Generating (DG) system of \_\_\_\_\_ KWp with \_\_\_\_\_ KW grid tie inverter amounting to PKR \_\_\_\_\_.
- 2.2. The DG Installer is involved in the business of designing, supply and installation of Wind / PV systems including after sale support.
- 2.3. The Customer is desirous of installing Wind / Photovoltaic Distributed Generation Facility (hereinafter referred to as “the DG Facility”) at the address of \_\_\_\_\_.
- 2.4. The DG Installer is registered with AJK Electricity Department Net Metering Wing, listed under the Directory of the Registered DG Installers with registration number AJKED/NM/\_\_\_\_/\_\_\_\_/\_\_\_\_ and is listed at AJKED’s website at www.ajked.gok.pk.

Whereby it is agreed as follows:

- 3.1. The agreement includes (enter Yes or NO at appropriate column)

| Sr.# | Services   | Yes/No | Remarks   |
|------|--|--------|---|
| 1    | Supply and Installation DG Facility based on net metering, complete in all respect.  |        | Does not include provisioning and installation of bi-directional energy meter |
| 2    | Consultancy services for technical design and supervision of the planned DG Facility |        | Technical matters only  |

|   |  |  |   |
|---|--|--|---|
| 3 | Services for documentation and its processing with relevant institutions till award of Net Metering license/connection |  |   |
| 4 | Maintenance services for DG Facility   |  | On annual or other terms basis                        |
| 5 | Services related to bi-directional meter   |  | May include provisioning and support in installation  |
| 6 | Any other related to net metering subject  |  | To be decided by installer and customer independently |

- 3.2. The Customer hereby appoints the DG Installer to Supply and Install the DG Facility at the Address as stated in Regulation 3 sub-regulation 10 as per requirements of AJ&K Distributed Generation (Alternative & Renewable Energy) and Net Metering Regulations, 2022 as amended time to time. The DG Installer shall strictly comply with the specifications and requirements as stated in the Regulations and standards for the components of the DG Facility as specified by AEDB/AJKED. Compliance certificate shall also be rendered by DG Facility as per Schedule-X(e) attached.
- 3.3. The DG Installer shall be responsible to initiate and get processed application of net metering connection on behalf of the Customer from start till energization of the connection.
- 3.4. The Products and Components and services required for the DG Facility are as set out the quote which has been agreed between the two parties and are set out in the Schedule-X(a) and Schedule-X(b) attached.  
Any changes (after signing this agreement) to the brand of the products as set out in the Schedule-X(a) have to be mutually agreed, in writing and made a part of this agreement, by both the Customer and the DG Installer. Copy of the same has also to be provided to concerned Operation Division of AJKED for update of its records.
- 3.5. The DG Installer hereby agrees to provide the Customer the DG Facility performance expectancy as set out in the Schedule-X(d), attached.
- 3.6. The Customer hereby agrees to pay the DG Installer for the products (including components) and installation charges as set out in the Schedule-X(c).
- 3.7. All payments by the Customer to the DG Installer shall be in the form of cheque, bank draft (cashier's order) or electronic transfer. No payment in CASH, shall be made by the Customer to the DG Installer. All payments must be acknowledged by official receipts issued by the DG Installer.
- 3.8. The Customer and DG Installer hereby agree to abide and comply with all rules, regulations, directives and any written requirement as set out by AJKED / NEPRA / AEDB / any other relevant authority.
- 3.9. All documents in respect of AJKED for the DG Facility shall be executed by the Customer. However, DG Installer shall provide services in completing the documentation and processing for obtaining Net Metering Connection as per Regulations.

- 3.10. The Customer hereby agrees and covenants to allow the DG Installer, its employees and person/persons authorized by the DG Installer to enter the address of the Customer for the purpose of carrying out site survey prior to commencement of works, the supply and installation of the DG Facility and any other related services and maintenance.
- 3.11. The DG Installer agrees to provide a warranty as set out Schedule-X(d). Minimum warranties required are as follows.
  - a. Warranty, PV Modules against manufacturing defects, 10 Years.
  - b. PV Modules, standard performance warranty, 25 Years.
  - c. Workmanship including locally supplied parts (Except Frames), 5 Years.
  - d. PV mounting Frames and associated parts, 25 Years.
  - e. Grid tie inverters, including hybrid, 5 years.
- 3.12. The DG Installer shall be responsible to the Customer on any warranty claims on components and equipment.
- 3.13. Both the Customer and the DG Installer hereby agree and covenant that they shall not, for the duration of this Agreement executed between them, terminate this Agreement without the written consent of the other party. Provided that written consent shall only be granted when the party that intends to terminate the agreement has met all its obligations under this Agreement. The Customer may terminate the agreement if the DG Installer fails to deliver satisfactory performance as per agreed schedule. Similarly DG Installer may terminate this agreement if payment schedule is not met.
- 3.14. The duration of this agreement shall start from the date of signing this Agreement and will continue for the period mentioned in warranty clauses.
- 3.15. The Schedules attached i.e. Schedule-X(a), Schedule-X(b), Schedule-X(c), Schedule-X(d), Schedule-X(e), to this Agreement shall form part and parcel of this Agreement and shall be read as part of this Agreement.
- 3.16. Any date or period mentioned in this Agreement may with the written consent of the parties be extended failing which time shall be of the essence of this Agreement.
- 3.17. The provisions of this Agreement shall be binding upon the personal representatives of each of the parties being an individual.
- 3.18. Each party confirms that this Agreement sets out the entire agreement and understanding between the parties and that it supersedes all prior agreement, arrangement and understanding between them and that they are not entering into this Agreement or any arrangement contemplated or in reliance upon any representation or warranty not expressly set out in this Agreement.
- 3.19. No failure or delay by any party in exercise of any right, power or privilege under this Agreement shall operate as a waiver of it nor shall any single or partial exercise by such party of any right, power or privilege preclude any further exercise of it or the exercise of any other right or privilege.
- 3.20. No party shall have the right to assign any of the rights, liabilities or benefits set out in this Agreement without the prior written consent of the other party having been first obtained.
- 3.21. Each party shall bear its own costs, legal fees and other expenses. The stamp duty for this Agreement, if any, shall be borne by the Customer.



- 3.22. No provision of this Agreement shall be amended, modified, varied, waived or discharged otherwise than by the express written agreement of the parties to it nor may any breach of any provision of this Agreement be waived or discharged except by the written consent the other party.
- 3.23. In the event of any conflict between the provisions of this Agreement and any other document, the provision of this Agreement shall prevail.
- 3.24. All notices required to be given under this Agreement shall be in writing and shall be given or sent to the party concerned by hand or by Registered Post at the address set out in this Agreement or at such other address as the parties may so inform the other in writing.
- 3.25. This Agreement shall be deemed to be a contract made in AJ&K and shall be interpreted in all respect in accordance with Laws of AJ&K/Pakistan.

IN WITNESS WHEREOF the parties hereto have hereunto set their hands the day and year first above written.

SIGNED by \_\_\_\_\_, Designation \_\_\_\_\_,  
CNIC \_\_\_\_\_ for and on behalf of \_\_\_\_\_  
Registration with AJKED No.: AJKED/NM/\_\_\_\_/\_\_\_\_/\_\_\_\_ (as the **DG Installer**) in the  
presence of:-

Company Stamp

Witness

Name, \_\_\_\_\_, Designation \_\_\_\_\_,  
CNIC \_\_\_\_\_.

SIGNED by \_\_\_\_\_ for and on behalf of \_\_\_\_\_  
\_\_\_\_\_ (as the **Customer**) in the presence of:-

Witness

Name, \_\_\_\_\_, Designation \_\_\_\_\_,  
CNIC \_\_\_\_\_.

**SCHEDULE-X(a)**

**Products and Components to be supplied by the DG Installer for the DG Facility**

| S# | Product description               | Brand | S# of Equipment | Remarks |
|----|-----------------------------------|-------|-----------------|---------|
| 1  | PV Modules                        |       |                 |         |
| 2  | Inverter                          |       |                 |         |
| 3  | DC cables                         |       |                 |         |
| 4  | AC cables                         |       |                 |         |
| 5  | PV frames                         |       |                 |         |
| 6  | Earthing                          |       |                 |         |
| 7  | AC breakers , fuse links          |       |                 |         |
| 8  | DC breakers and fuse links        |       |                 |         |
| 9  | AC surge protectors               |       |                 |         |
| 10 | DC surge protectors               |       |                 |         |
| 11 | Residual Current detector (RCD)   |       |                 |         |
| 12 | Bus bar                           |       |                 |         |
| 13 | Manual disconnect                 |       |                 |         |
| 14 | Any other accessories/attachments |       |                 |         |

Please attach a separate page if required.



**SCHEDULE-X(b)**

**Quotation by DG installer (on company letter head and bearing company stamp) and bearing acceptance signatures, name, date and CNIC Number of the customers**





**SCHEDULE-X(c)**

**PAYMENT SCHEDULE**

| <b>S#</b> | <b>Milestone</b>   | <b>% of the Total Amount</b> | <b>Amount (PKR)</b> |
|-----------|--|------------------------------|---------------------|
| 1         | Upon signing of Agreement                                  |                              |                     |
| 2         | Upon completion of installation, testing and commissioning |                              |                     |
| 3         | On receipt of license from AJKED                           |                              |                     |
| 4         | Any other term   |                              |                     |
|           | <b>Total</b>   | 100                          |                     |



## **SCHEDULE-X(d)**

### **SYSTEM AND COMPONENTS WARRANTIES**

1. Warranty, PV Modules against manufacturing defects: \_\_\_\_\_ Years
2. PV Modules, standard performance warranty: \_\_\_\_\_ Years
3. Workmanship including locally supplied parts (Except Frames): \_\_\_\_\_ Years
4. PV mounting Frames including fixing screw, nut/bolt and washers etc.: \_\_\_\_\_ Years
5. Grid tie inverters, including hybrid (On-grid/Off-Grid as one unit): \_\_\_\_\_ Years
6. Guaranteed Annual Energy Yield at given site: \_\_\_\_\_ KWh/Yr.

#### **Note:**

- I. In case the system does not yield promised yield, installer promises to rectify till guaranteed yield is delivered.
- II. This guarantee is subject to:
  - a. No tempering by any un-authorized person
  - b. Regular maintenance services hired from installer.
  - c. Not valid under force majeure condition, natural or man-made disasters.
  - d. Yield could vary  $\pm 10\%$  depending upon location.

## SCHEDULE-X(e)

### CERTIFICATE BY INSTALLER ABOUT COMPLIANCE TO STANDARDS

Certificate by Installer about compliance to standards as specified by AJ&K Distributed Generation (Alternative & Renewable Energy) and Net Metering Regulations, 2022 and AJKED Net Metering Wing guidelines and as amended time to time.

#### **Certificate of Compliance with Mandatory requirements**

We, \_\_\_\_\_ (Name, address, contact info of installer) having been prequalified by AJK Electricity Department Net Metering Wing vide reference number AJKED/NM/\_\_\_\_/\_\_\_\_/\_\_\_\_ have installed the system as per requirements of AJ&K Distributed Generation (Alternative & Renewable Energy) and Net Metering Regulations, 2022 and all other standards of the components of the DG Facility as specified by AJKED. We specifically certify the following:-

- 1. Compliance to quality, safety and environmental standards and technical requirements as specified by AJKED:**
  - a) The design of the DG facility and its sizing complies with minimum technical requirements and specifications
  - b) The components of the DG Facility as supplied to customer complies with the quality, safety and environment standards
  - c) The warranties given to the customer for components of DG Facility complies with the requirements
  - d) The installation of the DG Facility complies with the quality and safety requirements, recommendations and precautions
  
- 2. Compliance to Protection Requirements as specified by AJKED:**
  - a) The protection and control diagrams for the interconnection of the DG Facility has been designed in accordance with the provision of Grid and Distribution codes and approved by AJKED prior to commissioning of proposed interconnection facilities. Reference has been derived from typical single line diagram specified at Schedule VIII of the net metering regulations.
  - b) The distributed generator is provided with equipment including without limitation, electrical lines/circuits, transformer, switch gear, safety and protective devices. Meters to be used for interconnection shall be either arranged in consultation with or (after submission of fee/charges) to be obtained from AJKED.
  - c) The protective functions are equipped with automatic means to prevent reconnection of distributed generation facility with the distribution facilities of AJKED.
  - d) The distributed generator is equipped with a manual lockable disconnect switch that has a visual break to isolate the distributed generator facility from distribution facilities.
  - e) The Grid connected generator complies with Underwriter laboratories UL1741 standards and addresses the electrical interconnection design of various forms of generating equipment IEEE 1547 2003, IEC 61215. Compliance proof or Manufacturers certificate to this effect is attached.



**3. Compliance to Prevention of interference:**

The DG Facility is designed to free from interference generation. Proper shielding and earthing is provided to avoid any such generation and suppression. The THD of the inverter used is \_\_\_\_\_(Value) which is less than permitted 3%.

**4. Compliance to Voltage and Frequency Range:**

- a) The maximum variation in output voltages of the inverter used \_\_\_\_\_ (Value) which is less than permissible  $\pm 5\%$
- b) The maximum variation in output frequency of the inverter used \_\_\_\_\_(Value) which is less than permissible  $\pm 1\%$

**5. Technical details of the inverter**

The serial number of the inverter installed is \_\_\_\_\_. Its capacity is of \_\_\_\_\_ KW and (Manufacturers, type and Make) \_\_\_\_\_. The literature containing technical specifications of the inverter is attached.



**SCHEDULE-XI**

**LOAD FLOW STUDY**

Software used: \_\_\_\_\_

DG Capacity (kW): \_\_\_\_\_

**SCHEDULE-XII**

**APPLICATION SUMMARY**

| <b>CLIENT INFORMATION</b>      |                                   |                      |             |
|--------------------------------|-----------------------------------|----------------------|-------------|
| Name                           |                                   |                      |             |
| CNIC                           |                                   |                      |             |
| Address                        |                                   |                      |             |
| Mailing Address                |                                   |                      |             |
| Cell Ph. #                     |                                   | Email Address        |             |
| Subdivision                    |                                   | Feeder Name          |             |
| Reference No.                  |                                   | Customer ID          |             |
| Meter Number                   |                                   | Bill Tariff          |             |
| Issuance Date of Attached Bill |                                   |                      |             |
| Sanction Load                  |                                   | Required Load        |             |
| Net Metering Details           | Residential Consumption of Client | Total kWh Production | Surplus kWh |
|                                |                                   |                      |             |

| <b>VENDOR/INSTALLER/SERVICE PROVIDER'S INFORMATION</b> |                         |                   |  |
|--|-------------------------|-------------------|--|
| Company Name   |                         |                   |  |
| Company Address  |                         |                   |  |
| AJKED Net Metering Registration Number                 | AJKED/NM/____/____/____ |                   |  |
| Installing Engineer                                    |                         |                   |  |
| Installer's CNIC                                       |                         |                   |  |
| Installer's Phone#                                     |                         | Installer's Email |  |

| <b>SYSTEM INFORMATION</b>  |                                      |                                     |                                     |                                       |                                     |  |
|--|--------------------------------------|-------------------------------------|-------------------------------------|---------------------------------------|-------------------------------------|--|
| PV System Category   | Residential <input type="checkbox"/> | Commercial <input type="checkbox"/> | Industrial <input type="checkbox"/> | Agricultural <input type="checkbox"/> |                                     |  |
| Supply Voltage Level   | 11 kV <input type="checkbox"/>       | 400 V <input type="checkbox"/>      |                                     |                                       |                                     |  |
| System Size  |                                      |                                     |                                     |                                       |                                     |  |
| Panel Make   |                                      |                                     | Panel Model                         |                                       |                                     |  |
| Inverter Capacity  | Rated Capacity =                     |                                     | Inverter Type                       | On Grid <input type="checkbox"/>      | Off Grid <input type="checkbox"/>   |  |
| Inverter Make  |                                      |                                     | Inverter Model                      |                                       |                                     |  |
| Inverter Serial No.  |                                      |                                     |                                     |                                       |                                     |  |
| For more than one make/model of panels on a single inverter, use this area to define the additional solar panels |                                      |                                     |                                     |                                       |                                     |  |
| Second Set of Solar Panels   | Make                                 | Model                               | No. of Panels                       | Watts/Panel                           | kW of 2 <sup>nd</sup> Set of Panels |  |
|  |                                      |                                     |                                     |                                       |                                     |  |
| Second Set of Solar Panels   | Make                                 | Model                               | Rated Capacity                      | Inverter Serial Number                |                                     |  |
|  |                                      |                                     |                                     |                                       |                                     |  |
| Overall System Size (kW)   |                                      |                                     |                                     |                                       |                                     |  |