Guidelines for Grid Integration of Solar Irrigation Pump 2020

[Approved on 26 July 2020]

Sustainable & Renewable Energy Development Authority (SREDA)

Power Division

Ministry of Power, Energy and Mineral Resources

Government of the Peoples Republic of Bangladesh

Contents

1. Background

Electricity is essential for socio-economic progress and improvement of people's standard of living. According to Vision 2021, the government is committed to extend the facility electricity to all the citizens of the country. Providing universal electricity facilities and with the view to ensure energy security, Energy diversification has been adopted as one of the strategies by the Department of Power. Under energy diversification, apart from conventional fossil fuels, steps have been taken to generate eco-friendly electricity from renewable energy. Significant increase in the use of renewable energy is one of the targets of Sustainable Development Goals, announced by the United Nations (SDG-7). The Bangladesh Renewable Energy Policies 2020 has set a target of generating 10% of the total electricity generated by the year of 2020, that means a total about 2000 Megawatt of electricity, from renewable sources.

Agriculture is the most important sector of the economy of Bangladesh. Agriculture contributes 14.23% to GDP., while 40.62% of total workforce of the country is engaged in agriculture. Agriculture is one of the driving forces of economic growth in Bangladesh. The government has been using various technologies to meet the growing demand for food and agricultural products. Irrigation plays an important role in the agriculture of Bangladesh, because of its location in the tropical delta. 43% of agricultural expenditure is spent on irrigation. Solar-based alternative energy sources will ensure food security and reduce carbon dioxide emissions from inept diesel-based irrigation systems. Solar powered irrigation is novel and an economic and eco-friendly solution for agro-based economics.

At present, there are about 3.65 lacks electric pumps in the country that require about 2000 megawatt of electricity during summer season. In addition, about 13.4 lakh diesel powered irrigation pumps (DTW-3000, STW-12 lakh, LLP-1.4 lakh) are being used for irrigating 34 lakh hectares of land in the country. The government aims to replace diesel pump with solar pumps, which will significantly reduce use of electricity in the irrigation sector. The installed solar irrigation systems remain unused for more than half of the year, from which further expansion of solar irrigation system is possible by making the projects more profitable through proper utilization of productive electricity. Proper use of solar systems invested in grid integration of solar irrigation systems and the Government’s Renewable Energy Policy will play a role in achieving the targets.

The Guidelines are coming in force experimentally. These will be revised and refined as required in the future in view of experiences received from implementation.

Objectives of this Guidelines

This Guidelines have been formulated with the objective of expanding renewable energy through grid integration of solar irrigation system and proper utilization of surplus energy from solar energy irrigation system after its use for irrigation.

2. Definitions

Unless contrary to the subject or context, the words used in this Guidelines will express the underlisted meanings:

Word	Definition
Approved capacity	Maximum output capacity (AC) of the solar irrigation system, which is approved by the associated electricity distribution utility for grid integration with signed contract with the utility.
Interconnection point	Connecting point of AC output of the solar irrigation system after the meter at the end of solar irrigation electricity generator and the electricity line of the utility.
Eligible applicant	Solar irrigation entrepreneur, obeying all rules and regulation by the concerned distribution utility and complying with the conditions in clause 3.1 and 3.2.
STC	Standard Test Conditions (Irradiance 1000 watt/meter^2, cell temperature 25°C, air mass 1.5)
Commission/BERC	Commission established under Bangladesh Energy Regulatory Commission Act, 2003 (Act no 13) or any Commission established under any of its amended orders.
K.W.	Kilowatt
K.W.H.	Kilowatt Hour
K.V.	Kilovolt or 1000 volt
Contract	Singed contract between the distribution utility and solar irrigation entrepreneur for implementation of grid integration programme in solar irrigation system as per Annexure-3
Tariff structure order	Order issued for the license holders by the commission for electricity supply
Distribution network or grid	A distribution system, capable of supplying electricity and assembled with electricity line, cable, switchgear and other necessary machineries and able to supply 33 KV or less electricity.
Grid-tied inverter	A machine which converts DC current produced from Solar array into AC current and with available grid electricity, send AC current to Utility network in synchronization with the grid.
Capacity of renewable fuel-	Rated output AC capacity (VA) of Renewable fuel-based distribution system. In case of solar PV system, aggregated AC output of the inverter.

Word	Definition
based distributed generation system	
Export meter	A bidirectional electric meter, which can separately record the outgoing and incoming electricity power in kWh and kVAR.
Producer	Solar irrigation entrepreneur, who can produce electricity and supply the surplus, after using in irrigation, to the grid under these Guidelines.
Distribution Utility	The agency that have been given license by the Commission as an empowered authority for distribution of electricity.
Distribution area	The geographical area outlined for electricity distribution by the license of the concerned distribution authority.
Electricity bill	The monthly of supplementary electricity bill, issued by the solar irrigation entrepreneur in favour of the distribution utility.
Electrical power supply/distribution	Supply of electrical power, generated from solar irrigation system, to the grid of the utility.
Billing cycle or billing period	The period for which bills are prepared by the solar irrigation entrepreneur for the distribution utility.
Medium voltage	33,000 volt same volt as 11,000 volte.
M. O.	Megawatt or 1000 KW
Solar PV system	Solar irrigation system, installed on the premises of the entrepreneur, that can generate electrical energy directly from sunrays by photovoltaic technology.
Premises of the entrepreneur	Area adjacent to the solar module, pump controller, pump, grid-tied inverter, pump house and related electrical wirings of the system applied by the solar irrigation entrepreneur.
License holder	The person or organization that have received license under Bangladesh Energy Regulatory Commission Act 2003.
Low voltage	1000 volt or less that it.
Smart inverter	The high technology inverter that has features like reactive power control, active power control, grid management etc. apart from converting DC power to AC. Smart inverter can help in keeping balance of the grid, whenever necessary.
kWp	Kilowatt peak means the peak hour. That is, the maximum DC power received from a solar system under standard test condition (STC).
MWp	1 Megawatt peak= 1000-Kilowatt peak

3. Guidelines of Grid Integration of Solar Irrigation Pump

3.1. Eligibility of the Applicant

Subject to fulfilling the following conditions, any entrepreneur will be considered suitable for grid integration of solar irrigation pumps, such as:

(A) He/she will have to apply for grid integration of solar irrigation pump to the power distribution utility in the area concerned;

(B) Only excess electricity, after use in irrigation on priority basis, generated from solar irrigation systems can be transmitted to the grid;

(C) The applicant must be the proprietor of the solar irrigation system or have a valid permission from the proprietor or his/her representative;

(D) The applicant will not be able to receive power from the grid for using the same in load through grid integration of solar irrigation pump and cannot subscribe to utility through new/existing electricity connection in the same premises (Solar Module, Pump Controller, Pump, Grid-tied Inverter, Pump House and corresponding electrical wiring area);

(E) In order to supply additional power of the solar irrigation system to the grid, the rules and norms prescribed by the concerned utility or any other existing authority should be followed.

3.2. Power and Limit on export of electricity

In order to regulate the export of electrical energy, the following conditions are primarily applied:

(A) The entrepreneur will be able to use the additional power, in excess of irrigation, generated from the solar irrigation system to water supply and various other alternative purposes. In addition, under these Guidelines, additional electricity, generated from solar irrigation systems, can be supplied to the electricity utility grid through grid integration;

(B) Depending on the capacity of the solar irrigation system or the collective capacity, the connection type will be similarly determined as single phase and three phases according to the BRC's power distribution limit in kilowatt/megawatts;

(C) Entrepreneurs will have access to single phase grid integration, if there is no three-phase distribution network of the power distribution utility within 200 meters distance in the site of solar irrigation pump. The power distribution utility will ensure equal connection system at all phases of the feeder/substation;

(D) In case of grid integration system or aggregate grid integration of some irrigation systems, the maximum output (AC) of the system cannot exceed 10 megawatts. The maximum output (AC) of each system cannot exceed 50 kilowatts in case of connection through split by single phase utility.

(E) In case of 11 KV voltage feeding, the capacity of grid integration cannot exceed 70% of the scheduled capacity of the transformer or the cumulative capacity of the transformers.

In case of LT voltage feeding, the net metering system under the transformer and the combined capacity (AC) of grid integration of solar irrigation shall not exceed 70% of the scheduled capacity of the transformer or the cumulative capacity of the transformers.

3.3 Tariff Structure

This section describes the tariff structure including the billing process for electricity supplied by the solar irrigation power generating agency to the electricity distribution utility:

(A) The power producer from the approved solar irrigation system of grid integration will provide his bank account details while applying. Subject to submission of monthly electricity bills based on meter reading, the utility will pay the bill in favour of the bank account number of the said generating agency after verifying the same;

(B) The bills will be paid to the producer at the bulk rate of 33 KV as prescribed by the BERC of the concerned utility by integrating the import of the supplied power units;

(C) If the BRC changes the tariff structure in the middle of a billing period, the changed tariff will be applicable from that billing period;

(D) The solar irrigation power generating agencies will submit the bill to the power distribution utility in the format mentioned in Appendix-4.

3.4. Metering programme

The metering programmes will be completed, subject to the following conditions:

(A) As per section-3.2, after identifying 3-phase or single-phase meters and completing testing by the distribution utility, the electric supply meter will be placed on the pole of the distribution utility, or in an open space not more than 100 meters away from the pole.

(B) Under these Guidelines, the solar irrigation entrepreneur under grid integration will be able to maintain its system components such as grid-tied inverters, energy meters, relay, magnetic contract, indicator light etc., by receiving power from the electricity utility not more than 1 (one) **kilowatt hour** per month for every kilowatt AC of the permitted capacity, which will be integrated with the supplied electricity. This power is only for running the specified system and will not to be used for load in any way.

(C) The distribution utility will notify the solar irrigation entrepreneur in writing if excess electricity beyond the limit, specified in sub-paragraph (B), is found to have been used from the distribution utility during verification of energy meter readings. The solar irrigation entrepreneur, after undertaking necessary corrective measures with urgency, will inform the same to the distribution utility in writing. Even after the solar irrigation entrepreneur has been informed in writing by the distribution utility, such limit of receiving electricity is exceeded without reasons acceptable to the utility, the distribution utility will disconnect its connection.

(D) In case of disconnection as per sub-paragraph (C), application for restoring connection can be done after paying fine for every kWh hour of excess electricity received at the rate of 15 Taka for the first time, 20 Taka for the second time, 25 Taka for the third time and 30 Taka for the fourth and each more times to the distribution utility.

(E) The concerned distribution utility will procure, inspect, install or replace meters. The producer can purchase the meter himself and install it through the distribution utility. However, in that case the brand and model of the meter must be approved by the concerned distribution utility and the Sustainable and Renewable Energy Development Authority (SREDA).

(F) The applicant entrepreneur will maintain the meter and take regular meter readings.

(G) The cost of the meter and other related costs will be borne by the concerned applicant entrepreneur.

(H) Reading of meters, installed as prescribed in sub-paragraph (A), will be the primary basis for calculation.

(I) The distribution utility will ensure application of Automatic Meter Reading (AMR) technology at the earliest.

(J) If any feeder of the distribution utility has enough grid integrated systems of solar irrigation, the electricity distribution meters of the respective grid sub-stations need to be bi-directional as required.

3.5 Process for submitting application.

The appropriate solar irrigation power producer, if interested in taking advantage of grid-integration of his/her solar irrigation system, will follow the procedure described in the following paragraph.

(A) An appropriate solar irrigation power producer will submit application to the relevant utility for grid integration of his/her solar irrigation system.

(B) When applying, the applicant will use the application template attached in Appendix-1 of this Guideline. All the columns of the template have to be filled and all related documents have to be submitted along with the application for consideration by the concerned distribution utility.

(C) After receiving the completely filled up application with all related documents (with proof of payment of cost, if any), the relevant distribution utility will acknowledge the same within 5 working days mentioning the date.

(D) The applicant and the respective distribution utility should agree to install the solar irrigation system (if no similar system already exists) for grid integration of the proposed capacity of solar irrigation system, establish interconnection, verify, certify, approve and sign the agreement.

(E) After successful completion of all the necessary steps by the distribution utility as prescribed in sub-paragraph (D) above, the concerned distribution utility will issue a permit for grid integration of the solar irrigation system in favour of the applicant;

otherwise will inform the applicant mentioning proper reasons and steps to undertake.

(F) Within 10 working days after submission of the application as described in sub-section (A) above, the distribution utility will complete the process as above and issue permit as mentioned in sub-section (E).

(G) The applicant will take steps to install the solar irrigation system (in case of necessity to install a new system) within the stipulated timeframe and/or set up necessary interconnection with the help of respective distribution utility.

(H) Applicants will fill up the grid integration checklist, described in Appendix-2 of this Guideline.

(I) Applicant will complete all installation works of solar irrigation system within maximum of 3 months of getting permission, submit the filled-up grid integration checklist to the relevant distribution utility and then apply for verification, according to criteria, set by this Guideline and the appropriate authority.

(J) The respective distribution utility will inspect and approve the system to ensure that the components of the solar irrigation system and interconnection measurements are in accordance with this Guideline and the criteria set by the respective distribution utility.

(K) The grid integration agreement for solar irrigation system will be prepared according to the template described in Appendix-3 of this Guideline. The applicant producer of solar irrigation power will sign the contract with the concerned distribution utility on the scheduled day.

(L) Within not more than 10 days after submission of the application, as described in sub-section (I) above, by the solar irrigation power producer, the concerned utility shall complete all the necessary procedures and sign contract with the applicant under sub-section (K). In case of non-compliance of the prescribed criteria, the applicant shall be informed within the said period stating appropriate reasons and action to be taken.

(M) The applicant for grid integration of solar irrigation system should bear the cost of any change undertaken in the distribution utility system for grid integration of solar irrigation system by the solar irrigation power producer.

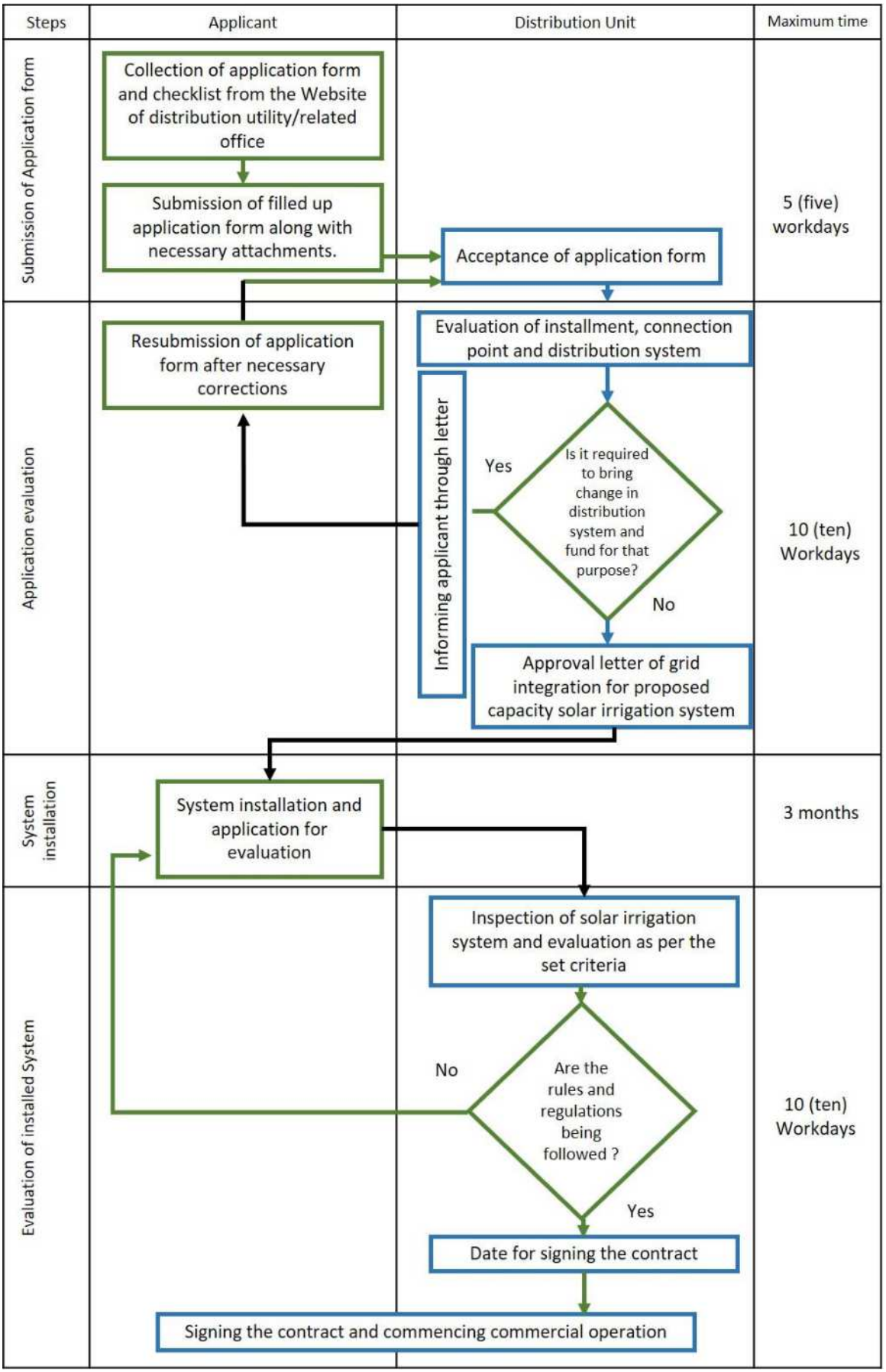

Image 2: Flowchart of Solar Irrigation Grid Integration Application Process

4 Interconnection Requirements

4.1 Details of grid integrated solar irrigation power generation system under this Guideline.

4.1.1 Feeding Process

The following picture shows the system of Variable Frequency Drives (FVD) pump controller with facilities of Maximum Power Point Tracking (MPPT):

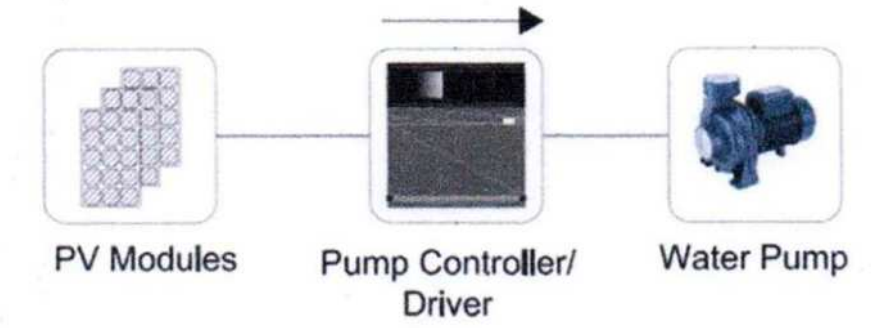

Figure-1: Outline of indirect connection to the grid

The vital components/features of off-grid solar irrigation pump system are mentioned below:

A) Solar PV Module/Panel;
B) AC or DC Pump;
C) Motor with minimum 0.8 power factor and "F" class insulation;
D) Variable frequency drive (VFD) for pump control, which may have MPPT facility.

This is the most commonly used method of solar irrigation pump system, but there are exceptions.

4.1.2 Standard of Machineries

In terms of design, operation, maintenance and environmental standards, the main components of a solar irrigation system, including modules, inverters and converters, must comply with the relevant national standards. In addition, grid-tied inverters should comply with the latest version of IEC 61727 (presently IEC 61727:2004) or the latest version of IEEE 1547 (presently IEEE 1547:2018) or the equivalent SREDA-recognized utility interface standards.

4.2 The nature of the electrical connections of the solar irrigation system

A technical framework has been formulated for the supply of additional electricity of the solar irrigation system to the grid. The connecting procedure is divided into two (2) parts on the basis of individual grid integration of a single solar irrigation system or collective grid integration of multiple solar irrigation systems.

4.2.1 Grid integration of individual solar irrigation systems

The solar irrigation entrepreneur will be able to make necessary changes in his system and using DC circuit breaker, grid-tied inverter and export meter etc. may provide connections in the following procedures:

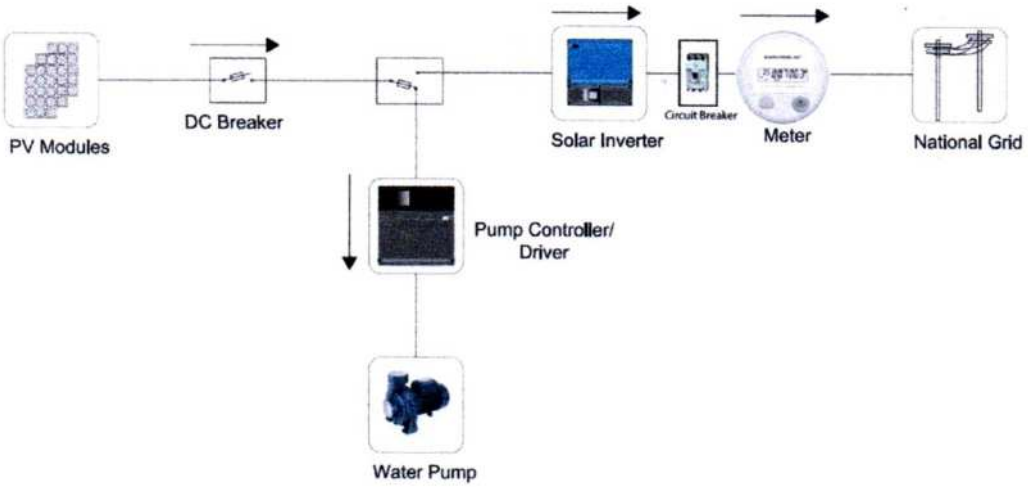

Figure 2: Grid integration of individual off-grid solar irrigation system's connection process

4.2.2 Cumulative Grid Integration of multiple solar irrigation system

Several nearby solar irrigation systems as per their technical capacity can be cumulatively grid integrated by using one or multiple grid-tied inverters following the two methods. If one grid-tied inverter is used, multiple MPPT inputs are to be used. Connection procedure is as followed:

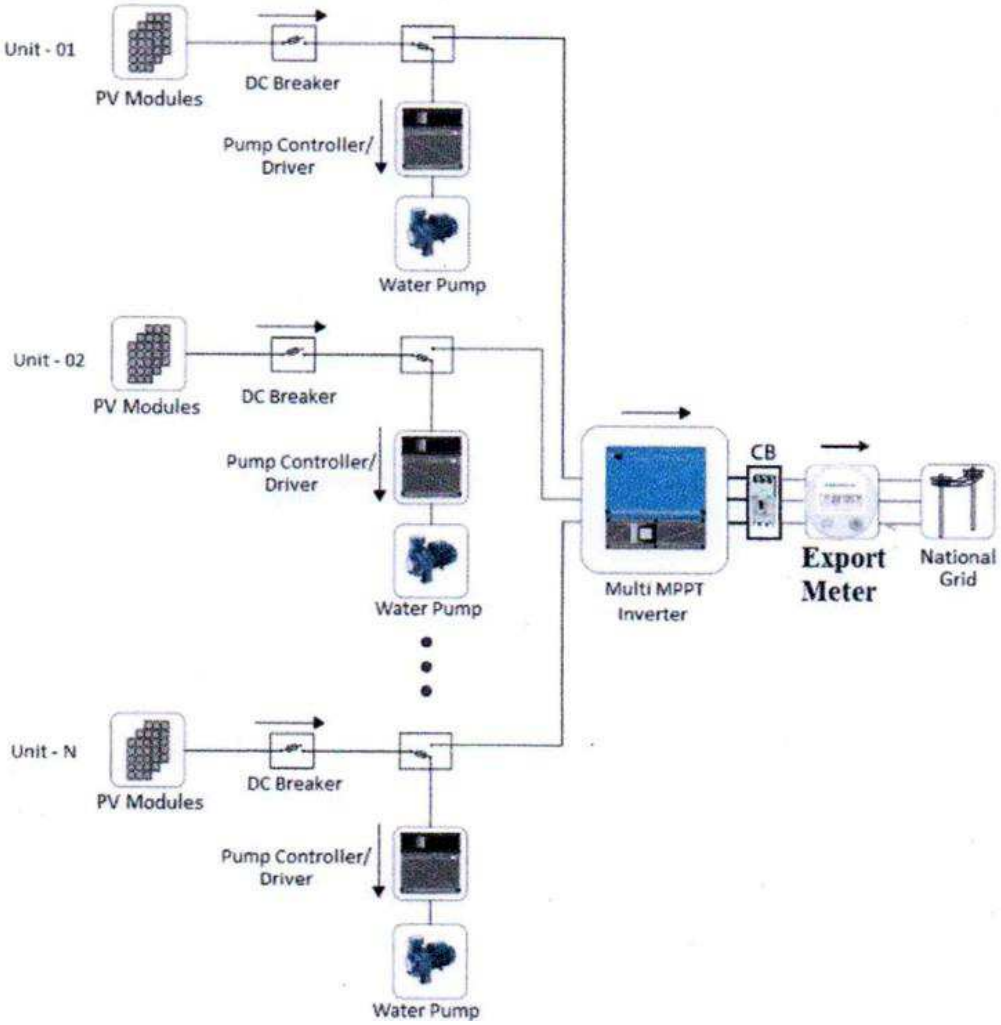

Figure 3: Connection procedure of using multiple MPPT inputs of one inverter

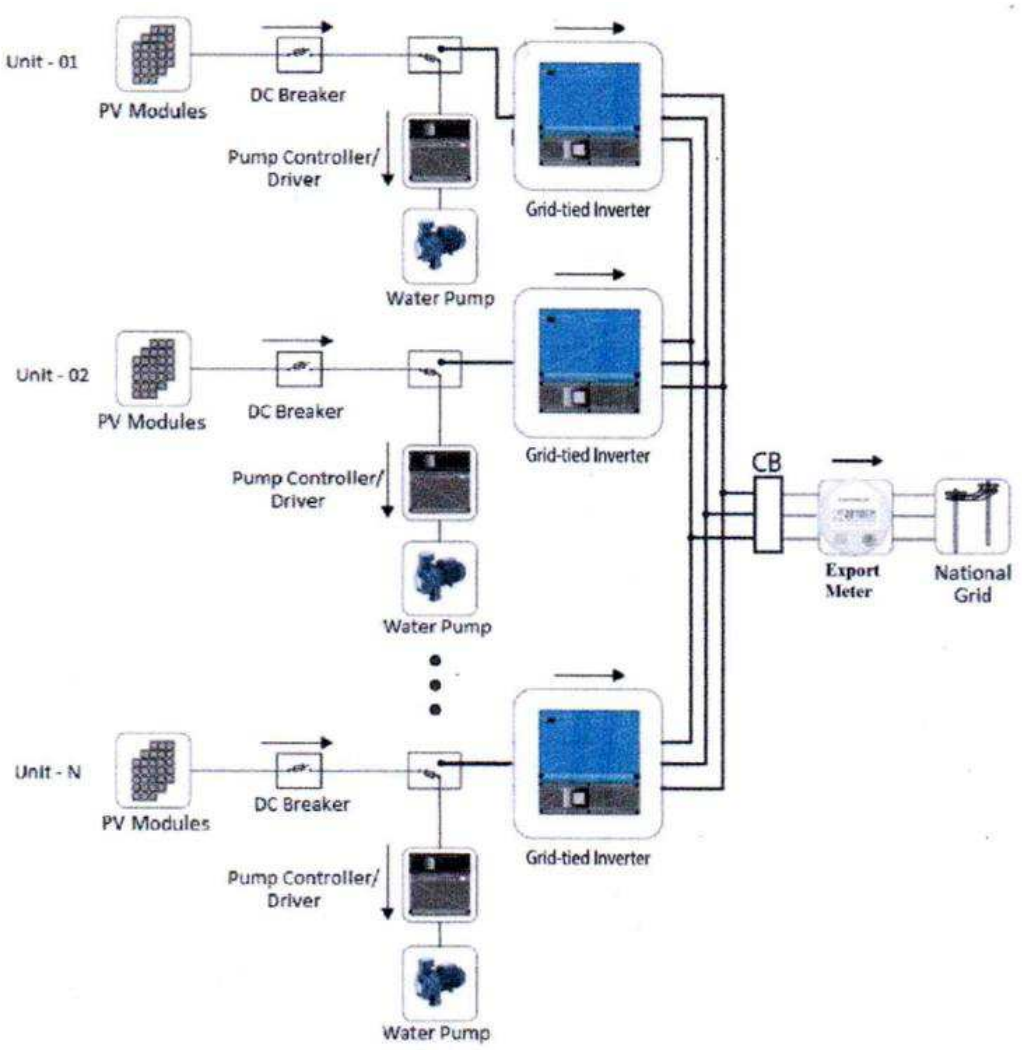

Figure 4: Connection procedure by using multiple inverters

4.3 General terms and conditions of interconnection

In case of interconnection, if any change is necessary in the existing power supply infrastructure of the distribution utility, such as cables, fuses, switch gears, transformers etc. and in the security management of the distribution utility, the applicant of the solar irrigation system has to bear the cost.

The entrepreneur will select the grid-tied inverter considering the conditions of earthing and neutral line of the respective electricity distribution utility. The quality of the electricity supplied at the interconnection site shall not be below the standard of existing electricity in the supply line, as described in paragraph 4. The quality of electricity supplied will be measured according to the criteria set by the appropriate authority regarding voltage, flicker, frequency, harmonics and power factor. If there is any deviation from the standards, it should be understood that the capacity of the system has surpassed. In the event of such a deviation, the grid-integrated solar

irrigation system will be able to detect it and disconnect itself from the distribution grid.

In order to ensure that the interconnection does not adversely affect the power supply system, the concerned entrepreneur has to abide by the following conditions:

4.3.1 Voltage level under normal condition

Acceptable level of voltage for power supply from solar irrigation system to the distribution grid:

i. The grid integrated solar irrigation system connected through low voltage (LV) interconnection will operate within the voltage limits shown in table- 1:

Table-1: General conditions for interconnection management

Nominal voltage [V]	Steady state voltage limit
400	-15% to +10%
230	-15% to +10%

ii. The grid integrated solar irrigation system connected through medium voltage (MV) interconnection will operate within the voltage limits shown in table- 2:

Table-2 General conditions for managing MV interconnection

Nominal voltage [kV]	Steady state voltage limits
11	-15% to +10%
33	-15% to +10%

4.3.2 Voltage Fluctuation

Variations in solar radiation cause variations in the amount of electricity generated from grid integrated solar irrigation system. As a result, when the power generated from the system is supplied to the distribution utility network, it can cause voltage fluctuations between the interconnection points and other places within the grid.

Variations in solar radiation can cause a maximum voltage deviation of 6% for LV and MV. A higher deviation might lead to overheating of electrical equipment of other customers of the utility. If necessary, an appropriate voltage control system needs to be adopted to minimize voltage deviations.

4.3.3 Power factor for power generation from renewable energy

i. If the inverter operates at a load higher than 20% of the rated inverter output, the leading or lagging power factor should be greater than 0.9 for renewable electrical systems. When a smart inverter is used, it will automatically make required adjustment so that the voltage rise due to the power factor does not exceed the permissible limit.

ii. The required amount of plant power factor will be determined during the technical evaluation.

4.3.4 Flow of direct current

In any operating condition, the PV system cannot supply more than 1% of the rated inverter output to the direct current utility interface.

4.3.5 Harmonic

i. The PV system output must have a low current distortion level to avoid adverse effects on other systems connected to the distribution utility.

ii. Total harmonic current distortion at the interconnection point should be less than 5% of the rated inverter output.

4.3.6 Voltage Unbalance

The limits of voltage unbalance, that is the proportion of negative voltage sequence components and positive voltage sequence components will be applicable as below:

i. 2% irregular peak may be allowed to occur for a maximum of 1 minute due to voltage unbalance;

ii. When several single-phase PV systems are to be installed, the voltage unbalance should be evenly distributed among the three phases of the power system;

iii. The unbalanced voltage shall not exceed 1% more than 5 times during any 30 minutes period at the end of customer installations.

4.3.7 Short Circuit Level

The distribution utility needs to ensure that the network's short circuit level is appropriate to the equipment rating. The network should be within 90% of the short-time make and break capacity of the maximum sub-transient three-phase symmetrical short circuit equipment. This will be ensured by the distribution utility.

4.4 Protection System

The security arrangements of the grid integration system of solar irrigation should be such that it can disconnect the defective part from the properly functional residual part of the system, if necessary. The solar irrigation entrepreneur will build the protection system in such a way that will be able to provide security as required. However, the entrepreneur must meet the conditions of protection imposed by the utility, so that even if there is a fault in the grid integrated solar system, it cannot spread outside the system.

4.4.1 Protection Verification Study

The entrepreneur will study the security coordination to determine the appropriate settings to ensure the security of the system in the event of a fault and share the results with the distribution utility. The distribution utility will review the results and suggest settings of common coupling point. Unsafe synchronization will not be accepted in any way.

4.4.2 Frequency

The distribution utility must maintain the system frequency and the PV system will be operated consistently with the distribution utility. The distribution utility will be

operated on 50 Harz system with ±1% range band. The inverter should be able to generate electricity within the frequency range as described in subsection 4.4.8.

4.4.3 Synchronization

Synchronization is the process of being consistent with a set limit. The inverter of the grid integrated solar irrigation system should have automatic synchronization facility. In the case of solar PV systems, inverters need to be synchronized.

4.4.4 Anti-Islanding Inverter

i. Without the presence of anti-islanding or non-islanding inverter grid, electricity cannot be distributed. To ensure the security of the solar PV system, operation of PV plant is not permissible in any way in the absence of a utility grid (loss of mains). Within 2 second of the grid current going out, the power supply generated from the PV system of the prosumer should be automatically disconnected, which is possible through an anti-islanding inverter. Grid-tied inverters used in grid-integration system of solar irrigation should be capable of anti-islanding in accordance with IEC 62116 (Utility-interconnected photovoltaic inverters – Test procedure of islanding prevention).

ii. The inverter used by the solar irrigation entrepreneur must have the following anti-islanding detection capabilities:

A. Under Voltage
B. Over Voltage
C. Under Frequency
D. Over Frequency

In addition, any of the following active anti-islanding techniques should be present in the inverter of the system:

A. Negative sequence current injection
B. Impedance Measurement
C. Sleep mode frequency shift
D. Frequency bias, etc.

iii. The solar irrigation entrepreneur needs to prove during the commissioning test whether the plat has anti-islanding ability.

4.4.5 Inverter fault current contribution

Inverters used for grid integration must be able to meet the conditions related to IEEE 1547 fault current. Usually, the range of short circuit current remains within 100% to 200% of the rated inverter current.

4.4.6 Protection Scheme

The basic conditions for adopting a protection scheme are as follows:

i. Distribution utility system and its others customer will not be allowed to suffer for any internal fault in the grid integrated solar irrigation system;

ii. Necessary security measures should be put in place to ensure that no damage occurs to the grid integrated solar irrigation system due to faults in the distribution network;

iii. Beside appropriate security measures, the solar irrigation entrepreneur should maintain supplementary security measures for the distribution network and grid-integrated solar irrigation systems.

4.4.7 Ineffectiveness of system protection or control equipment

In case of any of the following system failures, the solar irrigation system should be disconnected from the distribution network.

i. In case of protection equipment being disabled;
ii. In case of control equipment being disabled;
iii. In case of control power being disabled;

4.4.8 Frequency disruption

Inverter trip time at under-frequency and over-frequency levels will follow the following parameters:

Frequency at interconnection	Minimum Performance/Action
f> 52 Hz	System will decide that whether it will be connected or disconnected
51.5 Hz < f ≤ 52 Hz	5 min
48 Hz ≤ f ≤ 51.5 Hz	Continuous operation
47.5 Hz ≤ f <48 Hz	30 min
F < 47.5 Hz	5 sec

4.4.9 Voltage disruption

i. The inverter of a grid integrated solar irrigation system must have the technical ability to detect any abnormal voltage levels as per the parameters described in table -3. If the voltage in the transformer, wiring or feeder circuit is low, the inverter will adjust according to table- 3.

Table-3: Voltage disruption

Voltage at interconnection	Maximum trip time (s)
V < 50%	0.10
50% ≤ V < 85%	2.00
85% ≤ V ≤ 110%	Continuous operation
110% < V <135%	2.00
135% ≤ V	0.05

ii. The inverter should be capable of running all the time at -15% to +10% deviation of nominal voltage of the distribution network.

iii. Voltage may be affected due to voltage interruption caused by switching of transmission network and distribution to nearby feeders. Therefore, the inverter should have the capacity to surpass the voltage disruption band from 50% to 85% and 110% to 135%. This will help the utility's system stable.

iv. In case of loss of mains, the voltage drop will be less than 50%.
v. In the case of a three-phase system, there should be a system for detecting over-voltage and under-voltage for all the three phases.

4.4.10 Utility interface disconnect switch.

To ensure the safety of the system and the staff when performing any work on the distribution utility line, utility interface switch should be installed in order to disconnect the output of the grid integrated solar irrigation system from the utility. In this case, a standard switch can be used. That switch must be manual and lockable. Moreover, it should have the following features:

- The location of the switch must be specifically displayed.
- It should be easily visible and accessible to the maintenance and management personnel; and
- The two separate contact points should be visible when the switch is off.

4.5 Security Conditions

Grid integration of the existing solar irrigation systems or installation of new solar irrigation systems with grid integration should be accomplished in accordance with the national and international safety standards.

4.5.1 Operation

i. In the interest of safety of the operating staff and the public, the distribution utility and solar irrigation entrepreneurs need to coordinate with each other and make necessary arrangements for segregation of the system from the distribution grid and earthing when any work or test is conducted at interface/connection point.

Ii. To protect the safety while conducting work or testing in the distribution utility and the solar irrigation system interface, the distribution utility and solar irrigation entrepreneur are required to comply with all statutory laws, rules, sub-rules, terms and conditions of license, safety rules of the respective utility and existing grid codes and distribution codes of the country.

4.5.2 Interconnection Operation Manual

In the case of systems with a capacity of more than 500 kilowatt (AC), the applicant entrepreneur will prepare the interconnection operation manual of the solar irrigation system with the help of distribution utility.

4.5.3 Labelling

The labels on the machineries should be affixed in such a way that may be clearly visible and able to alert the operator about the operation of the same. Because, the electrified part may be associated with the renewable power generation system.

5 Amendment of the Guidelines

Department of Power, Ministry of Power, Energy and Mineral resources will undertake the task of revision, from time to time, of the Guidelines as required.

Appendix 1: Application form

i. Information

Electricity distribution Utility:

_____

Distribution Office: _____

Capacity of proposed solar irrigation system for grid integration (AC): _____ kW

Bank account where applicant wants to receive bill	Bank name: Branch name: Account number: Account name:

TIN number of the applicant:

_____

If applicant is an individual:

Name:			
Address:			
Nationality			
National Identity Number			
Passport Number (if not a Bangladeshi)			
Land phone		Cell Phone number	
Email address			

Alternative contact person:

Name:			
Address:			
Nationality			
National Identity Number			
Passport Number (if not a Bangladeshi)			
Land phone		Cell Phone number	
Email address			

If applicant is an organization

Organization/ Company name:	
Registration number:	
Trade License number:	
Address:	

---------- hereby declare that

i. I hereby delegate power to (name of the appropriate person) _____ National Identity Card No./Passport no._____ for process the application regarding grid-integration of solar irrigation system on my behalf;
Or
I hereby delegate power to (name of appropriate organization) _____ registered address: _____ to process the application regarding grid-integration of solar irrigation system on my behalf, the registration no of which is_____
and name and address of the registered authority_____
_____
Or
I, National Identity Card/passport no_____, am declaring myself competent for processing application regarding grid-integration of solar irrigation system;

ii. I hereby certify that the authorized person or organization (if exists) is able to comply with this Guideline and all directives issued by appropriate authority in this regard;

iii. I hereby certify that machineries, approved under this Guideline, will be installed in the renewable energy system under grid integration of the solar irrigation system and standards mentioned in this Guideline and National standards of the machineries will be ensured by verification;

iv. I hereby assure that I have not committed any punishable offense under Electricity Act 2018 or any other Act regarding supply and licensing of electricity

v. I hereby certify that all information provided here are true and correct to my knowledge and belief;

vi. I hereby agree that in case any information provided here proved to be wrong, the right to take any step against me including the confiscating the amount of _____ given as fee will be reserved;

vii. I hereby agree that I shall be obliged to abide all Acts, Rules and directives, given by the Government applicable to this application.

Appendix 2: Checklist of Grid Integration in Solar Irrigation

1. Information of the applicant

Name (Individual/organization)	
Address	
Utility Account Number	
Meter number	
Approved load	

A. Contact Person:

Name			
Title			
Address			
Nationality			
National Identity Number			
Passport Number (if foreign national)			
Land phone		Cell Phone number	
Email address			

2. Components used:

A. Solar PV Panel

Manufacturer (Company name, source)	
Brand	
Model Number	
Rated capacity	
Compliance (optional) (IEC 61215, IEC 617701, IEC 617730, PID test certificate – IEC 628804 or similar)	
Details of BSTI approved national standard compliance (mandatory) certificate (BDS IEC 61215 and others)	
Panel number	
Setup capacity (total)	

Number and date of use approval under Grid Integration in Solar Irrigation	

B. Inverter

Manufacturer (Company name, source)	
Brand	
Model Number	
Rated capacity	
Compliance (IEC 61727, IEC 62116, BDS IEC 62103-1, BDS IEC 62109-2)	
Inverter Number	
Installed capacity (total)	
Approval no. and date for use of Solar Irrigation system under Grid Integration	

C. Irrigation pump

Manufacturer (Company name, source)	
Brand	
Model Number	
Pump kind and type (1-phase/3-phase. Submersible /centrifugal/end-suction etc.)	
Rated capacity	

E. Pump Controller

Manufacturer (Company name, source)	
Brand	
Model Number	
Input & output details (voltage, frequency and others)	

Rated capacity & name of the technology	

E. Connection diagram

To be placed here. Sample is available in 4.2 section.

F. Mounting system

General Information	
Producer (Company name, source)	
Type and details (if applicable)	

G. Cable/ powerline

General information	
PV String Cable/ Powerline	
Producer	
Type	
Cross section	
PV Main Cable/ Powerline (DC)	
Manufacturer	
Type	
Cross section	
Inverter Supply Cable/ Powerline (AC)	
Manufacturer	
Type	
Cross section	

H. Feed-in Management / communication

General Information	
Features	☐ Effective power reduction ☐ 70% provision ☐ Other provision: _____ %

Implementation	☐ Permanent inverter setting ☐ Fid-in management system ☐ Other arrangement: _____
Producer (Company name, source)	
Type and details (if applicable)	
Does this system shows feed-in level effective for network operator? ☐ Yes ☐ No	

I. Others

Electrical Safety, Choice and installation of Electrical Equipment:
In case of equipment and system selection, installations have been done as per the general regulation of DIN VDE0100 and especial regulation of VDE-AR-N 4105, and inspection has been undertaken as per IEC 62446 (VDE 0126-230) regulation, and along with other specifications the following specifications are found to be existing: ☐ As per VDE 0100-520, the cables and power lines of the renewable fuel system are selected and installed in such a fashion so that there is no earthing fault and short circuit risk. ☐ The cables are fixed in frames and does not touch the wall or roof in any way and are not drawn over any sharp edge. For each connection point, arrangement of stress relief is available. Cables outside the buildings have been drawn through cable casing tray. ☐ Considering the suitability and switching capacity as per the manufacturer's manual, enough circuit breakers are there for DC current circuit.

Safeguard from lightning and high voltage		
Is there a Lightening Protection System in the grid integrated solar system?	Yes ☐	No ☐

Appendix 3: Grid-integration agreement form of Solar irrigation system

This agreement is ready on _____ year _____ month _____ day _____ (Name of contract signing place) _____ Name of the applicant for grid integration of solar irrigation system----------, address _____

Hereafter mentioned as the first party.

And

_____ (name of utility), _____ (address of the head office), registered _____ under the companies act, 1994 (act no. 18) and operating as a "utility" under the "Bangladesh Energy Regulatory act, 2003", hereafter named as _____ or utility, which will also include its authorized representative and successor company as the second party.

And whereas _____ (SIP Integrator) _____ (name of the place), located in a place owned by him/her or has legal rights and _____ (name of the utility) with its distribution grid _____ at voltage level with_____ K.W. (or K.W. peak) capacity solar irrigation system expresses willingness to supply surplus power for irrigation to a second party distribution grid,

And whereas, after verification of the application of the second party as per the Guidelines for Grid Integration of Solar Irrigation Pumps, the second party has agreed by memorandum no. _____ , date_____ according to _____ in Mouza _____ in the feeder of _____ grid integration of solar irrigation system with _____kilowatt capacity.

And whereas, the surplus electricity generated from the solar irrigation system, after use in irrigation works, shall be used for the purpose of feeding electricity of the utility and subject to fulfilment of the terms and conditions of this agreement by the first party and compliance of the applicable policy/rules/regulations/codes (with amendments from time to time)-

(List of relevant documents specified by the utility)

Both parties agree on the following subject:

1. General Eligibility

I. The first party has fulfilled the terms and condition specified in paragraph 3.1 of "Guidelines for Grid Integration of Solar Irrigation 2019".
II. The first party shall properly comply with the rules governing power generation and transmission limits to the grid regulated by paragraph 3.2 of the "Guidelines for Grid Integration of Solar Irrigation 2019".
III. The first party has agreed to abide by the rules formulated and regulations issued by the Government by amendments from time to time for the transmission of electricity generated from solar irrigation to the grid.

2. Technical and Interconnection related eligibility

I. The first party has agreed that the grid-integrated solar irrigation system would be in conformity with the "Guidelines for Grid Integration of Solar Irrigation 2019", rules, existing grid codes and distribution codes in the country and specified standards and requirements brought by amendments from time to time.

II. The first party has agreed that he/she has installed a "utility interface disconnect switch" before providing solar PV system connection to the utility's distribution grid, and further committed that the concerned utility distribution system will have access to and control on the same in the interest of repairing and maintenance.

III. The first party has agreed that in the event of a power cut off in the grid, the renewable system, installed by him/her, will be automatically disconnected, and no electricity will flow from that system to the utility distribution system.

IV. All equipment connected to the distribution system shall be operated in accordance with the relevant rules specified in this guideline.

V. The first party agrees that the interface/interconnection points and metering point will be determined by the second party.

VI. Both parties agree to abide by the rules issued by the government regarding the operation and maintenance of the plant, drawings and diagrams, schedule of site duties, harmonics, synchronization, voltage, frequency, Flickr etc.

VII. In order to meet the obligations of the second party to maintain a secure and reliable distribution system, the first party agrees that if the second party make a decision to the effect that the solar system is causing harm to the assets of the utility concerned or its other customers or creating adverse reactions, then the first party will disconnect its solar system from the distribution grid instantly after receiving indications from the second party and take steps to rectify the system at his/her own cost to the satisfaction of the second party.

VIII. When the flow of electricity in the utility distribution grid is stopped, the first party shall take full responsibility if any person or animal is harmed (fatal / non-fatal / departmental/non-departmental) in any accident while back feeding of electricity generated by the first party to the utility grid.

3. Acceptance and approval of clearance

If there is a need for approval and clearance from any authority other than the utility concerned, it must be collected by the first party before connecting the photovoltaic system to the distribution system.

4. Access and disconnection

i. Both the automatic and manual means of disconnecting the metering equipment and the solar system will be accessible to the second party at all the time.

ii. In the event of an emergency or load shedding, when the automatic or manual disconnection system, such as a switch or breaker, cannot be reached in any way, the distribution utility may disconnect the customer's electricity line.

5. Responsibility

i. In case of any loss or adverse reaction caused by negligence or intentional misconduct of first party in providing connection to and managing the grid integration of the solar irrigation system, the first party will be obliged to pay compensation to the second party.

ii. The second party will not be obliged to give the first party any financial or other incentives provided by the government in addition to the incentives described in "Guidelines for Grid Integration of Solar Irrigation Pump 2019".

6. Metering

The metering system shall be determined in accordance with section 3.4 of the "Guidelines for Grid Integration of Solar Irrigation Pump 2019" and the amendments made from time to time.

7. Commercial Settlement

Commercial settlements will be carried out in accordance with section 3.3 of the "Guidelines for Grid Integration of Solar Irrigation Pump 2019" and amendments made from time to time.

8. Expenditure for providing connection

All the costs of grid integration of solar irrigation system including metering and interconnection should be borne by the eligible first party. If necessary, the first party will also have to bear the principal cost of system changes and the cost of upgrading the system.

9. Inspection, testing, calibration and maintenance at the invitation of the first party after installation of the system

After the installation of the system, at the invitation of the first party, the second party will perform all the inspections and tests scheduled in consultation with the customer. The first party will provide all the drawings, specifications and test records of the project or generation station (whichever is applicable) to the second party.

10. Records

Both parties will maintain complete and accurate records and all other data, which will be required for proper implementation of the agreement by both parties and for operation of grid integrated solar irrigation system.

11. Dispute Settlement

i. Disputes between the two parties over this agreement or any related issue should be resolved first through mutual discussions expeditiously, fairly and in good faith.

ii. If the dispute between the two parties cannot be resolved through negotiations within 60 (sixty) days of the commencement of such dispute or the period mutually extended, then

a. disputes over sending billing or amount of electricity billing will be settled by the Electricity department /SREDA.
b. disputes arising out of rules or their interpretation will be resolved through proper procedures by the Department of Electricity; the Ministry of Power, Energy and Mineral Resources or by any organization authorized by the Department of Electricity.

12. Termination of contract

i. The first party may give 30 (thirty) days prior notice to the second party to terminate the contract at any time.
ii. The first party agrees that, if a notice is given by the second party to the first party due to breach of any condition of this agreement, the first party will take necessary remedial steps regarding the breach of condition within 30 days after receipt of the notice, otherwise the second party can terminate the agreement through written letter within 30 days.
iii. Within 1 week after the ending of the contract, the first party will disconnect the grid integrated solar irrigation system from utility distribution grid as per the satisfaction of the second party.

Notification

The undermentioned officials will carry out responsibilities in case of any communication under this contract:

On behalf of _____ (name of the utility):	On behalf of the consumer:

Both parties have executed this contract with the help of their own authorized officials and copies of the contract on the given date are sent to all the parties.

On behalf of the utility	On behalf of the proprietor of the project
Signing authority Witness 1.	Signing authority Witness 1.
2.	2.

Appendix 4: Monthly bill submission format for contracted solar irrigation Entrepreneur to the utility

Bill no:
Bill month:
TIN number:
Area code:

Utility information	Information of under contract solar irrigation entrepreneur	Account details of the back approved for bill payment
Name of utility: Name of office: To whom it will be submitted: Address:	Account number of electricity producer: Name of the manufacturer: Name of father/husband: Address:	Title of the account: Account number: Name of the bank: Name of the branch:

1	Subject	Date	Meter reading (Export)	Meter Reading (Import)	Unit
2	Final meter reading:				kWh
3	Previous meter reading:				kWh
4	Total of exported and imported electricity (2-3)				kWh
5	Net export after import adjustment (A-B)				kWh
6	Electricity tariff:				Tk./ kWh
7	Electricity bill (5*6)				Taka
8	VAT (5%)				Taka
9	Amount (7-8)				Taka
10	In words				Taka

Bill month & meter reading of previous 12 months (from bill month and previous months in order):

Serial	Meter reading date (monthly)	Export meter reading (kWh)	Import meter reading (kWh)	Electricity export in said month (kWh)	Electricity import in said month (kWh) *B	Net exported electricity (Wh)	Bill amount (taka)
X	A	B	C	D=BX-B(X+1)	E=CX-C(X+1)	F=D-E	G=F* Tariff
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
Net exported Electricity and bill (with VAT) of 12 months							

Signature, Date, & Seal