DRAFT TARIFF GUIDELINES

FOR

ROOFTOP PV AND OTHER SMALL SOLAR POWER PLANTS

No. Dated: 09th June, 2010

NOTIFICATION (DRAFT)

In exercise of powers conferred under Sections 61 read with Section 178(2)(s) of the Electricity Act, 2003 (36 of 2003) and all other powers enabling it in this behalf, and in pursuance of Clause 6.4(3) of the Tariff Policy notified by the Central Government and after previous publication, the Central Electricity Regulatory Commission hereby makes the following Tariff Guidelines, namely;

1. Short Title and Commencement

(1) These Guidelines may be called the "Central Electricity Regulatory Commission (Determination of tariff for procurement of power from Rooftop PV and other Small Solar Power Projects) Guidelines, 2010".

(2) These Guidelines shall come into force from the date of their publication in the Official Gazette.

2. Definitions and interpretations

(1) In these Guidelines, unless the context otherwise requires,-

a) **'Act'** means the Electricity Act, 2003 and subsequent amendment thereof;

b) **'Capital cost'** means the capital cost as defined in Guidelines 13,27;

c) **'CERC or Central Commission'** means the Central Electricity Regulatory Commission referred to in sub-section (1) of Section 76 of the Act;

d) '**Central Electricity Authority or Authority**' means the Authority referred to in sub-section (1) of Section 70 of the Act;

e) **'Conduct of Business Regulations'** means the Regulations notified by concerned State Electricity Regulatory Commission for Conduct of Business or Transactions of Business, as amended from time to time.;

f) **'Control Period** or **Review Period'** means the period during which the norms for determination of tariff specified in these Guidelines shall remain valid;

g) **'Consumer Meter** or **CM'** means a meter used for accounting and billing of electricity supplied to the consumer but excluding those consumers covered under Interface Meters;

h) **'Grid Meter** or **GM'** means import and export meter on the basis of which energy bills shall be raised by Distribution licensee;

i) **'Installed capacity'** or **'IC'** means the summation of the name plate capacities of all the units of the Rooftop PV and Other Small Solar Power generating system or the capacity of the generating station (reckoned at the generator terminals), approved by the State Agency from time to time;

j) **'Inter-connection Point'** shall mean the interface point of the Rooftop PV and Other Small Solar Power generating facility with the distribution network at voltage levels below 33kV;

k) **'MNRE'** means the Ministry of New and Renewable Energy of the Government of India;

l) **'Non-firm power'** means the power generated from renewable sources, the hourly variation of which is dependent upon nature's phenomenon like sun, cloud, wind, etc., that cannot be accurately predicted;

m) **'Operation and maintenance expenses'** or **'O&M expenses'** means the expenditure incurred on operation and maintenance of the project, or part thereof, and includes the expenditure on manpower, repairs, spares, consumables, insurance, administrative and general expenses and overheads;

n) **'Project Developer'** shall mean developer of the Rooftop PV and Other Small Solar Power Project, who shall own and operate such project;

o) **'Rooftop PV and Other Small Solar Power Project'** or **'Project'** means a Rooftop PV and other Small Solar Power generating station, with a capacity limit up to and including 1MW, including the evacuation system up to inter-connection point, as the case may be;

p) **'State Agency'** means the agency in the concerned state as may be designated by the State Commission to act as the agency for accreditation and recommending the renewable energy projects for registration and to undertake such functions as may be specified under clause (e) of subsection (1) of section 86 of the Act;

q) '**State Commission**' means the State Electricity Regulatory Commission referred to under sub-section (64) of Section 2 of the Act and includes a Joint Commission referred to in sub-section (1) of Section 83 of the Act.

r) **'Solar Meter** or **SM'** means a meter for used for accounting and billing of electricity generated by the Rooftop PV and Other Small Solar Power Generating Plant;

s) **'Tariff period'** means the period for which tariff is to be determined by the State Commission on the basis of norms specified under these Guidelines;

t) **'Useful Life'** in relation to a unit of a generating station for a Rooftop PV and Other Small Solar Power Project including evacuation system shall mean the 25 years duration from the date of commercial operation (COD) of such generating facility;

u) **'Year'** means a financial year;

(2) All other expressions used herein although not specifically defined herein, but defined in the Act, shall have the meaning assigned to them in the Act. The other expressions used herein but not specifically defined in these Guidelines or in the Act but defined

under any law passed by the Parliament applicable to the electricity industry in the State shall have the meaning assigned to them in such law. Subject to the above, the expression used herein but specifically defined in this regulation or in the Act or any law passed by the Parliament shall have the meaning as is generally assigned in the electricity industry.

3. Scope and extent of application

These Guidelines shall apply in all cases where tariff, for electricity generated from Rooftop PV and Other Small Solar Power Projects is to be determined by the State Commission under Section 62 read with Section 86 of the Act.

Provided that these Guidelines shall apply subject to the fulfilment of eligibility criteria specified in regulation 4 of these Guidelines.

4. Eligibility Criteria

Rooftop PV or Other Small Solar Power technologies, as approved by MNRE, fulfilling the technical parameters as outlined under Schedule – 1 of these Guidelines.

Chapter 1: General Principles

5. Control Period or Review Period

(1) The Control Period or Review Period under these Guidelines shall be of three years, of which the first year shall be the period from the date of notification of these Guidelines to March 31, 2011.

Provided that the benchmark capital cost for Rooftop PV and Other Small Solar Power Projects may be reviewed annually by the State Commission in line with Tariff Guidelines and its amendments, if any, published by Central Commission.

Provided further that the generic tariff determined for Rooftop P and Other Small Solar projects based on the capital cost and other norms applicable for the year 2010-11 shall also

apply for such projects during the year 2011-12 subject to the conditions that the Power Purchase Agreement in respect of such solar projects are signed on or before March 31, 2011 and entire capacity covered by Power Purchase Agreements is commissioned on or before March 31, 2012;

(2) Subject to conditions stipulated under sub-clause (1) of Clause (5), the tariff determined as per these Guidelines for such projects commissioned during the Control Period, shall continue to be applicable for the entire duration of the Tariff Period as specified in Clause 6 below.

(3) The revision in Guidelines for next Control Period shall be undertaken at least six months prior to the end of the first Control Period and in case Guidelines for the next Control Period are not notified until commencement of next Control Period, the tariff norms as per these Guidelines shall continue to remain applicable until notification of the revised Guidelines subject to adjustments as per revised Guidelines.

6. Tariff Period

(1) The tariff period for Rooftop PV and Other Small Solar Power Projects shall be twenty five (25) years.

(2) Tariff period under these Guidelines shall be considered from the date of commercial operation of the solar power generating systems.

(3) Tariff determined as per these Guidelines shall be applicable for the entire duration of the Tariff Period as stipulated under Clause 6(1).

7. Project Specific Tariff

(1) Project specific tariff, on case to case basis, shall be determined by the State Commission for Rooftop PV and Other Small Solar Power Projects based on technologies such as concentrated photovoltaic, dish sterling engine or any other technology, if a project

developer opts for project specific tariff. Provided that the State Commission while determining the project specific tariff for such projects shall be guided by the provisions of Chapter-3 of these Guidelines.

(2) Determination of project specific tariff for generation of electricity from such projects shall be in accordance with such terms and conditions as stipulated under relevant orders of the State Commission.

Provided that the financial norms as specified under Chapter-2 of these Guidelines, except for the capital cost, shall be ceiling norms while determining the project specific tariff.

8. Petition and proceedings for determination of tariff

(1) The State Commission shall determine the generic tariff on suo-motu basis at least six months in advance at the beginning of each year of the Control period for solar technologies for which norms have been specified under the Guidelines.

Provided that for the first year of Control Period (i.e FY 2010-11), the generic tariff may be determined within three months from date of notification of these Guidelines.

(2) The proceedings for determination of tariff shall be in accordance with the Conduct of Business Regulations of concerned State Commission.

9. Tariff Structure

The tariff for Rooftop PV and Other Small Solar Power Projects shall be single part tariff consisting of following fixed cost components:

a) Return on Equity
b) Interest on loan capital
c) Depreciation
d) Interest on working capital
e) Operation and maintenance expenses

10. Tariff Design

(1) The generic tariff shall be determined on the levellised basis for the tariff period.

(2) For the purpose of levellised tariff computation, discount factor equivalent to weighted average cost of capital shall be considered.

(3) Levellisation shall be carried out for the 'useful life' of the project while Tariff shall be specified for period equivalent to 'Tariff Period'.

11. Dispatch principles for electricity generated from Rooftop Solar PV and Other Small Solar Systems

All grid connected Rooftop PV and Other Small Solar Power Projects shall be treated as 'MUST RUN' power plants and shall not be subjected to 'merit order dispatch' principles.

12. Technical Requirements

The technical requirements for Rooftop PV and Other Small Solar Power Projects would be as per Schedule - 1. The metering arrangement shall be as per schematic presented under Schedule-2.

Chapter 2: Financial Principles

13. Capital Cost

The norms for the Capital Cost as specified under Clause 27 shall be inclusive of all capital work including land and site development related expenses, plant and machinery, civil work, erection and commissioning, financing and interest during construction, preliminary and pre-operative expense and evacuation infrastructure up to inter-connection point.

Provided that for project specific tariff determination, the developer of Rooftop PV and Other Small Solar Power Project shall submit the break-up of capital cost items along with its petition in the manner specified under Clause 8.

14. Debt Equity Ratio

(1) For generic tariff to be determined on suo motu basis, the debt equity ratio shall be 70: 30

(2) For the project specific tariff, the following provisions shall apply :-

If the equity actually deployed is more than 30% of the capital cost, equity in excess of 30% shall be treated as normative loan.

Provided that where equity actually deployed is less than 30% of the capital cost, the actual equity shall be considered for determination of tariff.

Provided further that the equity invested in the foreign currency shall be designated in Indian rupees on the date of each investment.

15. Loan and Finance Charges

(1) **Loan Tenure.** For the purpose of determination of tariff, loan tenure of 10 years shall be considered.

(2) **Interest Rate**

a) The loans arrived at in the manner indicated above shall be considered as gross normative loan for calculation for interest on loan. The normative loan outstanding as on April 1st of every year shall be worked out by deducting the cumulative repayment up to March 31st of previous year from gross normative loan.

b) For the purpose of computation of tariff, the normative interest rate shall be considered as monthly average State Bank of India (SBI) Advance Rate (SBAR) prevalent during the previous year, plus 150 basis points.

c) Notwithstanding any moratorium period availed by the project developer, the repayment of loan shall be considered from the first year of commercial operation of the project and shall be equal to the annual depreciation allowed.

16. Depreciation

(1) The value base for the purpose of depreciation shall be the Capital Cost of the asset admitted by the State Commission. The salvage value of the asset shall be considered as 10% and depreciation shall be allowed up to maximum of 90% of the capital cost of the asset.

(2) Depreciation per annum shall be based on "Differential Depreciation Approach" over the loan tenure over the useful life computed on 'Straight Line Method'. The depreciation rate for first 10 years of the Tariff period shall be 7% per annum and the remaining depreciation shall be spread over the useful life of the project from 11th year onwards.

(3) Depreciation shall be chargeable from first year of commercial operation.

Provided that in case of the commercial operation of the asset for part of the year, depreciation shall be charged on *pro-rata* basis.

17. Return on equity

(1) The value base for the equity shall be 30% of the capital cost or actual equity (in case of project specific tariff determination) as determined under Clause 14.

(2) The normative return on equity shall be:

a) Pre-tax 19% per annum for first 10 years.

b) Pre-tax 24% per annum 11th year onwards.

18. Interest on working capital

(1) The Working Capital requirement in respect of Rooftop PV and Other Small Solar Power Projects shall be computed in accordance with the following:

a) Operation and Maintenance expense for one month

b) Receivables equivalent to 2 (Two) months of the energy charges for sale of electricity calculated on normative CUF.

c) Maintenance spare @ 15% of operation and maintenance expenses.

(2) Interest on Working Capital shall be at interest rate equivalent to monthly average State Bank of India Advance Rate (SBAR)during the previous year, plus 100 basis points.

19. Operation and Maintenance Expenses

(1) 'Operation and Maintenance or O&M expenses' shall comprise repair and maintenance (R&M), establishment including employee expenses, and administrative and general expenses including insurance.

(2) Operation and maintenance expenses shall be determined for the Tariff Period based on normative O&M expenses specified by the State Commission subsequently in these Guidelines for the first Year of Control Period.

(3) Normative O&M expenses allowed during first year of the Control Period (i.e. FY 2010-11) under these Guidelines shall be escalated at the rate of 5.72% per annum over the Tariff Period.

20. Rebate

(1) For payment of bills of the Rooftop PV and Other Small Solar Power Projects through letter of credit, a rebate of 2% shall be allowed.

(2) Where payments are made other than through letter of credit within a period of one month of presentation of bills by the generating company, a rebate of 1% shall be allowed.

21. Late payment surcharge

In case the payment of any bill for charges payable under these Guidelines is delayed beyond a period of 60 days from the date of billing, a late payment surcharge at the rate of 1.25% per month shall be levied by the generating company.

22. Sharing of CDM benefits

The proceeds of the carbon credit from approved CDM Project shall be shared between the project developers and concerned off taker in following manner.

a) 100% of the gross proceeds on account of CDM benefit to be retained by the developer in first year after the date of commercial operation.

b) In the second year, the share of the beneficiaries shall be 10% which shall be progressively increased by 10% every year till it reaches 50%, where after the proceeds shall be shared in equal proportion by generating company and the beneficiaries.

23. Subsidy or incentive by the Central / State Government

The State Commission shall take into consideration any incentive or subsidy offered by the Central or State Government, including Generation Based Incentive or accelerated depreciation benefit if availed by the project developers, for such projects while determining the tariff under these Guidelines.

Provided that the following principles shall be considered for ascertaining income tax benefit on account of accelerated depreciation, if availed, for the purpose of tariff determination:

a) Assessment of benefit shall be based on normative capital cost, accelerated depreciation rate as per relevant provisions under Income Tax Act and corporate income tax rate.

b) Capitalization of Rooftop PV and Other Small Solar Power Projects during second half of the fiscal year.

Per unit benefit shall be derived on levellised basis at discount factor equivalent to weighted average cost of capital.

24. Taxes and Duties

Tariff determined under these Guidelines shall be exclusive of taxes and duties as may be levied by the appropriate Government:

Provided that the taxes and duties levied by the appropriate Government shall be allowed as pass through on actual incurred basis.

Chapter 3: Technology Specific Parameters

25. Technology Aspects

Norms for Solar power under these Guidelines shall be applicable for grid connected Rooftop PV and Other Small Solar Power Projects , with a capacity limit upto 1MW, as may be approved by MNRE, connected with the distribution network at voltage levels below 33kV.

26. Capacity Utilization Factor

(1) The Capacity utilization factor for Rooftop PV and Other Small Solar Power Projects shall be 18.0%.

(2) Provided that the State Commission may deviate from above norm in case of project specific tariff determination in pursuance of Clause 7 and Clause 8.

27. Capital Cost

(1) The normative capital cost for setting up a Rooftop PV and Other Small Solar Power Project for FY 2010-11 shall be Rs. 1740 Lakh/MW

(2) Provided that the State Commission may deviate from above norm in case of project specific tariff determination in pursuance of Clause 7 and Clause 8.

28. Operation and Maintenance Expenses

(1) The O&M Expenses shall be Rs. 11 Lakh/MW for the 1st year of operation for Rooftop PV and Other Small Solar Power Projects.

(2) Normative O&M expenses allowed at the commencement of the Control Period (i.e. FY 2010-11) under these Guidelines shall be escalated at the rate of 5.72% per annum.

Schedule-1

Technical Requirements for Rooftop PV and Other Small Solar Power Plants

1. PV Modules and Inverter Systems

(1) The Rooftop PV and Other Small Solar Power Projects deploying PV modules and Inverter systems complying with relevant IEC/BIS standards and/or compliant with applicable standards as specified by Central Electricity Authority shall alone be considered to be technically qualified.

(2) The quality of equipment to be deployed should meet the guidelines for engineering design included in the standards and codes listed in the relevant ISI and other standards, such as :

i. IEEE 928: Recommended Criteria for Terrestrial PV power systems.
ii. IEEE 929 Recommended practice for utility interface of residential and intermediate PV systems.
iii. IEEE 519 Guide for harmonic control and reactive compensation of Static Power Controllers.
iv. National Electrical NFPA 70-1990 (USA) or equipment national standard.
v. National Electrical Safety Code ANSI C2 (USA) or equipment national standard.
vi. IEC : 61215 (2005)- Crystalline silicon terrestrial photovoltaic (PV) modules – Design qualification and type approval
vii. IEC: 61730 -1, -2 Photovoltaic (PV) module safety qualification Part 2: Requirements for testing
viii. IEC: 60904-1(2006) Photovoltaic Devices- Part-I: Measurement of Photovoltaic current-Voltage Characteristic
ix. IS 9000 Basic environmental testing procedure for Electronic and electrical items.

2. Eligible Project Capacity

Rooftop PV and other Small Solar Power Projects, with a capacity limit up to and including 1MW, subject to fulfilment of other technical requirements, shall alone be considered to be technically qualified.

3. Grid Connectivity

(1) Subject to fulfilment of other technical requirements, Rooftop PV and Other Small Solar Power Projects connected to the distribution network at voltage levels below 33kV shall alone be eligible for generic tariff determined for such projects under these Guidelines.

(2) In general the requirements specified by CEA in the CEA (Technical Standards for Connectivity to the Grid) Regulations, 2007 would be observed.

4. **Metering Arrangement**

(1) The metering arrangements for all grid interactive Rooftop PV and Other Small Solar Power Plants shall essentially be in accordance with the metering scheme finalized by the appropriate State Electricity Regulatory Commission.

(2) Metering requirements shall be as per Regulations on "Installation and Operation of Meters".

(3) The Metering is required to measure the solar gross generation, consumer load consumption, export of energy to the grid and import of energy from the grid besides measurement of AC system voltages and currents, frequency etc.

(4) Necessary changes in the proposed metering scheme to accommodate for required DG sets and/or battery inverter etc., as per need of solar developer may be adopted without affecting the security and sealing of complete metering system besides all cabling and switchgear from solar panel to the solar meter(SM).

(5) The Grid Meter (GM) and Solar Meter (SM) shall be interface type as envisaged in the metering regulations. These meters may also comply the Time of Day (ToD) requirements so as to accommodate this type of metering in future course of time. Also the SM would record net solar energy export reading indicated as SE(N).

5. Communication interface and Data Acquisition system

(1) The communication must be able to support Real time data logging, Event logging, Supervisory control, Operational modes and Set point editing. The parameters to be measured and displayed continuously include Solar system temperature, Ambient temperature, Solar irradiation/isolation, DC current and Voltages, AC injection into the grid (one time measurement at the time of installation), Efficiency of the inverter, Solar system efficiency, Display of I-V curve of the solar system, any other parameter

considered necessary by supplier of the solar PV system based on prudent practice. Data logger system must record these parameters for study of effect of various environmental & grid parameters on energy generated by the solar system and various analysis would be required to be provided through bar charts, curves, tables, which shall be finalized during approval of drawings.

(2) The communication interface shall be an integral part of inverter and shall be suitable to be connected to local computer and also remotely via the Web using *either* a standard modem or a GSM / WiFi modem. The project developer must install all the required hardware to have this web based Supervisory Control and Data Acquisition (SCADA) operational such that the system can be monitored via the web from distribution company office. Also, full fledged SCADA is required to be installed by the developer.

6. Power Quality Requirements

(1) **DC Injection into the grid**: The injection of DC power into the grid shall be avoided by using an isolation transformer at the output of the inverter. It is proposed to limit DC injection within 1% of the rated current of the inverter as per IEC 61727.

(2) **Harmonics on AC side**: The limits for Harmonics on AC side would be as stipulated under CEA Grid Connectivity Regulations, as under:

a) Total Voltage Harmonic Distortion…….. 5%

b) Individual Voltage Harmonics Distortion……3%

c) Total Current Harmonic Distortion……..……..8%

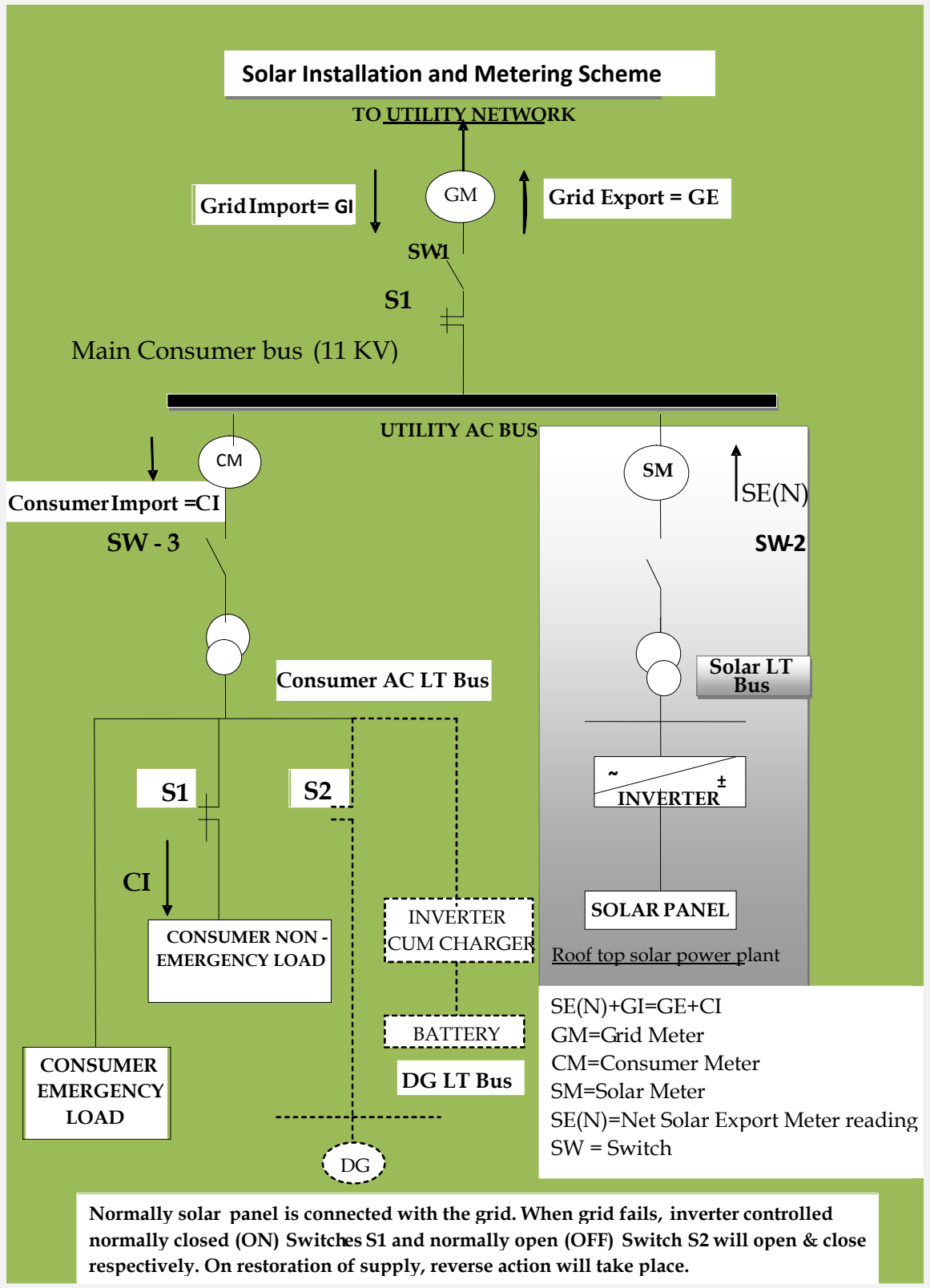
(3) **Voltage variation**: The voltage unbalance at HV side shall not exceed 3.0%. The permissible limit of voltage fluctuation for step changes which may occur repetitively is 1.5%.For occasional fluctuations other than step changes the maximum permissible limits is 3%.

(4) In addition to disconnection from the grid on no supply, under and over voltage conditions, PV systems shall be provided with adequate rating fuses, fuses on inverter input side (DC) as well as output side (AC) for overload and short circuit protection and disconnecting switches to isolate the DC and AC system for maintenance.

(5) Fuses of adequate rating shall also be provided in each solar array module to protect them against short circuit.

(6) Manual Disconnection Switch: In order to avoid possibility of malfunctioning with the automatic disconnection system of the inverter, manual disconnection switch besides automatic disconnection to grid would also be provided to isolate the grid connection by Distribution Licensee's personnel and to carry out any maintenance. This switch shall be locked by the Distribution Licensee's personnel during the planned shutdown of the Distribution Licensee's feeder. Locking of the switch may be required only under shutdown.

Schedule 2


Solar Installation and Metering Scheme
TO UTILITY NETWORK
GM
Grid Import= GI
Grid Export = GE
SW1
S1
Main Consumer bus (11 KV)
UTILITY AC BUS
CM
Consumer Import =CI
SW - 3
SM
SE(N)
SW-2
Solar LT Bus
Consumer AC LT Bus
S1
S2
INVERTER
CI
SOLAR PANEL
CONSUMER NON - EMERGENCY LOAD
INVERTER CUM CHARGER
Roof top solar power plant
BATTERY
CONSUMER EMERGENCY LOAD
DG LT Bus
DG
SE(N)+GI=GE+CI
GM=Grid Meter
CM=Consumer Meter
SM=Solar Meter
SE(N)=Net Solar Export Meter reading
SW = Switch
Normally solar panel is connected with the grid. When grid fails, inverter controlled normally closed (ON) Switches S1 and normally open (OFF) Switch S2 will open & close respectively. On restoration of supply, reverse action will take place.