

SPECIFICATIONS FOR SOLAR PHOTOVOLTAIC SYSTEMS(CFL based)

(MNRE 2009-2010 SPV PROGRAMME)

Manufacturers should get the samples tested at Solar Energy Centre or ERTL, Kolkata or CPRI, Bangalore. All test centres should quantify all the measured parameters with appropriate remarks. At the end of the report the test center should provide a note on qualification or disqualifications of the sample with adequate reasons.

Validity of test reports is twenty four (24) months from date of issue or modification of specifications which ever is earlier

SOLAR HOME LIGHTING SYSTEMS

I. DEFINITION

A solar home lighting system aims at providing solar electricity for operating lights and/or fan or energizing a DC operated portable TV set for specified hours of operation per day.

II. MODELS

MODEL – 1 (1 Light Point)

Component Specifications

PV Module 1X 18 W under STC

Lamps 1X CFL (9W /11W)

Battery 1X 12V, 20 AH Tubular plate Lead Acid or VRLA Gel Type

Other components: control electronics, module mounting hardware, battery box, inter-connecting wires/ cables, switches, etc. Operation, instruction and maintenance manual.

MODEL - 2 (2 Lights)

Component Specifications

PV Module 1X 37 W under STC

Lamps 2X CFLs (9W /11W)

Battery 1X 12V, 40 AH Tubular plate Lead Acid or VRLA Gel Type

Other components: control electronics, module mounting hardware, battery box, inter-connecting wires/ cables, switches, etc. Operation, instruction and maintenance manual.

MODEL - 3 (2 lights and 1 fan)

Component Specifications

PV Module(s) 2X 37 W or 1 X 74 W under STC
Lamps 2X CFLs (9W /11W)
Fan 1X DC Fan (with wattage less than 20 W)
Battery 1X 12V, 75 AH Tubular Plate Lead Acid or VRLA GEL Type
Other components: control electronics, module mounting hardware, battery box, inter-connecting wires/ cables, switches, etc. Operation, instruction and maintenance manual.

MODEL - 4 (4 lights)

Component Specifications
PV Module(s) 2X 37 W or 1 X 74 W under STC
Lamps 4 X CFLs (9W /11W)
Battery 1X 12V, 75 AH Tubular Plate Lead Acid or VRLA Gel Type
Other components: control electronics, module mounting hardware, battery box, inter-connecting wires/ cables, switches, etc. Operation, instruction and maintenance manual.

Notes :

- i) All models will have a socket to provide power for a 12V DC TV set which can be purchased separately.
- ii) A small white LED may be provided as an optional feature, with an independent switch.

III. DUTY CYCLE

The system should be designed under average daily insolation of 5.5 kWh/ sq.m. on a horizontal surface

MODELS AVERAGE HOURS OF OPERATION / DAY

Model 1	1 Light, (3-4 Hours)
Model 2	2 Lights, (3-4 Hours)
Model 3	2 Lights, (2-3 hours), 1 Fan(2-3 hours)
Model 4	4 Lights, (3-4 Hours)

IV. LAMPS

- (i) The lamps will be of compact fluorescent (CFL) type, 4 - Pin type, with ratings of 9W or 11W with a suitable pre-heating circuit .
- (ii) The light output from the lamps should be around 550 +/- 5 % lumens (for 9 W CFL) and 850 +/- 5 % lumens (for 11 W CFL). Also please see (iii) of VI given below.
- (iii) The lamps should be housed in an assembly suitable for indoor use, with a reflector on its back. While fixing the assembly, the lamp should be held in a base up configuration.

V. BATTERY

- (i) **The battery will be of flooded electrolyte , positive tubular plate type, low maintenance lead acid or gel type VRLA.**
- (ii) The battery will have a minimum rating of 12V, 20 or 40 or 75 Ah (at C/10) discharge rate depending on Model.
- (iii) 75 % of the rated capacity of the battery should be between fully charged & load cut off conditions.

VI. ELECTRONICS

- (i) The inverter should be of quasi sine wave/sine wave type, with frequency in the range of 20 - 30 KHz. Half-wave operation is not acceptable.
- (ii) The total electronic efficiency should be not less than 80 %.
- (iii) No blackening or reduction in the lumen output by more than 10% should be observed after 1000 ON/OFF cycles (two minutes ON followed by four minutes OFF is one cycle).
- (iv) The idle current consumption should not be more than 10 mA

VII. PV MODULE (S)

- (a) **The PV module (s) shall contain mono/ multi crystalline silicon solar cells. It is preferable to have certificate for the supplied PV module as per IEC 61215(revised) specifications or equivalent National or International Standards . In case if the supplied PV module is not a regular PV module of the manufacturer and does not have certificate as per IEC 61215(revised) specifications ,then the manufacturer should have the required certification for at least one of their regular modules. Further, the manufacturer should certify that the supplied module is also manufactured using same material design and process similar to that of certified PV module.**
- (b) The power output of the module(s) under STC should be a minimum of 18 W or 37 W or 74 W. In case of Model 4 & 5 either two modules of 37 W each or one module of 74 W should be used.
- (c) The operating voltage corresponding to the power output mentioned above should be 16.4 V.
- (d) The open circuit voltage of the PV modules under STC should be at least 21.0 Volts.
- (e) The terminal box on the module should have a provision for opening for replacing the cable, if required.
- (f) A strip containing the following details should be **laminated inside** the module so as to be clearly visible from the front side:
 - g) **Name of the Manufacturer or distinctive Logo**
 - h) **Model or Type No.**
 - i) **Serial No.**
 - j) **year of make**

VIII. DC FAN

The wattage of the fan should not be more than 20 Watts and it should operate at 12V DC.

IX. ELECTRONIC PROTECTIONS

- (i) Adequate protection is to be incorporated under no load conditions, e.g. when the lamps are removed and the system is switched ON.
- (ii) The system should have protection against battery overcharge and deep discharge conditions.
- (iii) Fuses should be provided to protect against short circuit conditions.
- (iv) A blocking diode, should be provided as part of the electronics, to prevent reverse flow of current through the PV module(s), in case such a diode is not provided with the PV module(s).
- (v) Full protection against open circuit, accidental short circuit and reverse polarity should be provided.
- (vi) Electronics should operate at 12 V and **should have temperature compensation** for proper charging of the battery through out the year

X. MECHANICAL COMPONENTS

- (i) Metallic frame structure (with corrosion resistance paint) to be fixed on the roof of the house to hold the SPV module(s). The frame structure should have provision to adjust its angle of inclination to the horizontal between 0 and 45, so that it can be installed at the specified tilt angle.
- (ii) A vented metallic / plastic box with acid proof corrosion resistance paint for housing the storage battery indoors should be provided.

XI OTHER FEATURES

- (i) The system should be provided with 2 LED indicators: a green light to indicate charging in progress and a red LED to indicate deep discharge condition of the battery. The green LED should glow only when the battery is actually being charged.
- (ii) There will be a Name Plate on the system which will give:
 - (a) Name of the Manufacturer or Distinctive Logo.
 - (b) Serial Number.
- (iii) Components and parts used in solar home systems should conform to the latest BIS specifications, wherever such specifications are available and applicable.
- (iv) **PV module(s) will be warranted for a minimum period of 15 years from the date of supply and the solar home system (including the battery) will be warranted for a period of two years from the date of supply.** The Warranty Card to be supplied with the system must contain the details of the system supplied, as given in the Annexure-12. The manufacturers can also provide additional information about the system and conditions of warranty as necessary.

- (v) Necessary lengths of wires / cables, switches suitable for DC use and fuses should be provided
- (vi) An Operation, Instruction and Maintenance Manual, in English and the local language, should be provided with the solar home system.

The following minimum details must be provided in the Manual:

- (a) About Photovoltaics
- (b) About solar home system - its components and expected performance
- (c) About PV module.
- (d) About CFL.
- (e) About battery.
- (f) Clear instructions about mounting of PV module(s).
- (g) About electronics.
- (h) About charging and significance of indicators.
- (i) DO's and DONT's,
- (j) Clear instructions on regular maintenance and trouble shooting of solar home system.
- (h) Name and address of the person or service center to be contacted in case of failure or complaint.

SOLAR STREET LIGHTING SYSTEM

I. DEFINITION

A stand alone solar photovoltaic street lighting system comprises a compact fluorescent lamp, lead acid battery, PV module(s), control electronics, inter-connecting wires/cables, module mounting hardware, battery box, Operation, instruction and maintenance manual.

II. DUTY CYCLE

The system should be designed to automatically switch ON at dusk, operate throughout the night and automatically switch OFF at the dawn, under average daily insolation of 5.5 kWh/ sq.m. on a horizontal surface.

III. LAMP

- (i) The lamp will be of compact fluorescent (CFL) of 11W, 4 - Pin type. With adequate pre-heating circuit.
- (ii) The light output from the lamp should be around 850 +/- 5 % lumens. Also please see (iii) of V given below.
- (iii) The lamp should be housed in a weather proof assembly suitable for outdoor use, with a reflector on its back. While fixing the assembly, the lamp should be held in a base up configuration.

IV. BATTERY

- (i) **Flooded electrolyte type, positive tubular plate, low maintenance lead acid or gel type VRLA**
- (ii) The battery will have a minimum rating of 12V, 75 Ah (at C/10) discharge rate.
- (iii) 75 % of the rated capacity of the battery should be between fully charged & load cut off conditions.

V. ELECTRONICS

- (i) The inverter should be of quasi sine wave/ sine wave type, with frequency in the range of 20 - 30 KHz. Half-wave operation is not acceptable.
- (ii) The total electronic efficiency should be not less than 80 %.
- (iii) No blackening or reduction in the lumen output by more than 10% should be observed after 1000 ON/OFF cycles (two minutes ON followed by four minutes OFF is one cycle).
- (iv) The idle current consumption should not be more than 10 mA.
- (v) The PV module itself will be used to sense the ambient light level for switching ON and OFF the lamp.

VI. PV MODULE (S)

- (i) **The PV module (s) shall contain mono/ multi crystalline silicon solar cells. It is preferable to have certificate for the supplied PV module as per IEC 61215(revised) specifications or equivalent National or International Standards . In case if the supplied PV module is not a regular PV module of the manufacturer and does not have certificate as per IEC 61215(revised) specifications ,then the manufacturer should have the required certification for at least one of their regular modules. Further, the manufacturer should certify that the supplied module is also manufactured using same material design and process similar to that of certified PV module**
- (ii) The power output of the module(s) under STC should be a minimum of 74 W. Either two modules of minimum 37 W output each or one module of 74 W output should be used.
- (iii) The operating voltage corresponding to the power output mentioned above should be 16.4 V.
- (iv) The open circuit voltage of the PV modules under STC should be at least 21.0 Volts.
- (v) The terminal box on the module should have a provision for opening for replacing the cable, if required.
- (vi) A strip containing the following details **should be laminated** inside the module so as to be clearly visible from the front side:
 - a) Name of the Manufacturer or distinctive Logo
 - b) Model or Type No.
 - c) Serial No.
 - d) year of make

VII. ELECTRONIC PROTECTIONS

- (i) Adequate protection is to be incorporated under no load conditions e.g. when the lamp is removed and the system is switched ON.
- (ii) The system should have protection against battery overcharge and deep discharge conditions.
- (iii) Fuses should be provided to protect against short circuit conditions.
- (iv) A blocking diode, should be provided as part of the electronics, to prevent reverse flow of current through the PV module(s), in case such a diode is not provided with the solar module(s).
- (v) Full protection against open circuit, accidental short circuit and reverse polarity should be provided.
- (vi) Electronics should operate at 12 V and **should have temperature** compensation for proper charging of the battery through out the year.

VII. MECHANICAL HARDWARE

- (i) A metallic frame structure (with corrosion resistance paint) to be fixed on the pole to hold the SPV module(s). The frame structure should have provision to adjust its angle of inclination to the horizontal between 0 and 45, so that the module(s) can be oriented at the specified tilt angle.
- (ii) The pole should be made of mild steel pipe with a height of 4 metres above the ground level, after grouting and final installation. The pole should have the provision to hold the weather proof lamp housing. It should be painted with a corrosion resistant paint.
- (iii) A vented, acid proof and corrosion resistant painted metallic box for outdoor use should be provided for housing the battery.

IX. OTHER FEATURES

- (i) The system should be provided with 2 LED indicators: a green light to indicate charging in progress and a red LED to indicate deep discharge condition of the battery. The green LED should glow only when the battery is actually being charged.
- (ii) There will be a Name Plate on the system, which will give:
 - (a) Name of the Manufacturer or Distinctive Logo.
 - (b) Serial Number.
- (iii) Components and parts used in the solar street lighting systems should conform to the latest BIS specifications, wherever such specifications are available and applicable.
- (iv) **The PV module(s) will be warranted for a minimum period of 15 years from the date of supply and the street lighting system (including the battery) will be warranted for a period of two years from the date of supply.**
The Warranty Card to be supplied with the system must contain the details of the system. The manufacturers can also provide additional information about the system and conditions of warranty as necessary.
- (v) Necessary lengths of wires/cables and fuses should be provided
- (vi) An Operation, Instruction and Maintenance Manual, in English and the local language, should be provided with the solar street lighting system.
The following minimum details must be provided in the Manual:
 - (a) About Photovoltaics
 - (b) About solar street lighting system - its components and expected performance
 - (c) About PV module.
 - (d) About CFL.
 - (e) About battery.
 - (f) Clear instructions about erection of pole and mounting of PV module and lamp housing assembly on the pole.
 - (g) About electronics.
 - (h) About charging and significance of indicators.

- (i) DO's and DONT's,
- (j) Clear instructions on regular maintenance and trouble shooting of the solar street lighting system.
- (h) Name and address of the contact person in case of non-functionality of the solar street lighting system.