

TECHNICAL SPECIFICATIONS FOR SOLAR PHOTOVOLTAIC LIGHTING SYSTEMS & POWER PACKS (Off-grid Solar Applications Scheme 2016-17)

1. WHITE-LED (W-LED) BASED SOLAR STREET LIGHTING SYSTEM

A standalone solar photovoltaic street lighting system (SLS) is an outdoor lighting unit used for illuminating a street or an open area. The Solar Street Lighting System consists of solar photovoltaic (SPV) module, a luminaire, storage battery, control electronics, inter-connecting wires/cables, module mounting pole including hardware and battery box. The luminaire is based on White Light Emitting Diode (W-LED), a solid state device which emits light when electric current passes through it. The luminaire is mounted on the pole at a suitable angle to maximize illumination on the ground. The PV module is placed at the top of the pole at an angle facing south so that it receives solar radiation throughout the day, without any shadow falling on it. A battery is placed in a box attached to the pole.

Electricity generated by the PV module charges the battery during the day time which powers the luminaire from dusk to dawn. The system lights at dusk and switches off at dawn automatically.

There are four models of White-LED (W-LED) Based Solar Street Lighting Systems:

Model- I:

- **With Lead Acid Battery.**
- The Street light operates from dusk to dawn at **full Brightness.**

Model- II

- **With Lead Acid Battery.**
- The Street light operates from dusk to dawn.
 - **First Four hours at full Brightness**
 - **And then, rest of the time at lower light level, with motion sensor.**
 - In case any movement is there, it senses it and glows to full level.
 - Then it comes back to lower level after sometime, automatically.

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Model- III

- **With Lithium Ferro phosphate Battery.**
- The Street light operates from dusk to dawn at **full Brightness.**

Model- IV

- **With Lithium Ferro phosphate Battery.**
- The Street light operates from dusk to dawn.
 - **First Four hours at full Brightness**
 - **And then, rest of the time at lower light level, with motion sensor.**
 - In case any movement is there, it senses it and glows to full level.
 - Then it comes back to lower level after sometime, automatically.

The configuration of each model with Specifications is described below:

MODEL- I:

- **With Lead Acid Battery.**
- **Operates from dusk to dawn at full Brightness.**

BROAD PERFORMANCE SPECIFICATIONS

PV Module	40 Wp under STC
Battery	Lead acid Tubular Flooded or Tubular GEL / VRLA , 12V- 40 AH @ C/10
Light Source	White Light Emitting Diode (W-LED) 7 Watt (Max.), W-LED luminaire, dispersed beam, soothing to eyes with the use of proper optics and diffuser
Light Out put	Minimum 16 Lux when measured at the periphery of 4 meter diameter from a height of 4 meter. The illumination should be uniform without dark bands or abrupt variations, and soothing to the eye. Higher light output will be preferred.

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Mounting of light	Pole mounted, Minimum 4 meters above the ground level
Electronics Efficiency	Minimum 85% total
Duty Cycle	Dusk to dawn at full brightness
Autonomy	3 days or Minimum 42 operating hours per permissible discharge

TECHNICAL DETAILS

PV MODULE

- i. Indigenously manufactured PV module should be used.
- ii. The PV module should have crystalline silicon solar cells and must have a certificate of testing conforming to IEC 61215 Edition II / BIS 14286 from an NABL or IECQ accredited Laboratory.
- iii. The power output of the module(s) under STC should be a minimum of 40 Wp at a load voltage* of 16.4 ± 0.2 V.
- iv. The open circuit voltage* of the PV modules under STC should be at least 21.0 Volts.
- v. **The module efficiency should not be less than 12 %.**
- vi. The terminal box on the module should have a provision for opening it for replacing the cable, if required.
- vii. There should be a Name Plate fixed inside the module which will give:
 - a. Name of the Manufacturer or Distinctive Logo.
 - b. Model Number
 - c. Serial Number
 - d. Year of manufacture
- viii. A distinctive serial number starting with NSM will be engraved on the frame of the module or screen printed on the tedlar sheet of the module.

*The load voltage and Voc conditions of the PV modules are not applicable for the system having MPPT based charge controller

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BATTERY

- i. Lead Acid, tubular positive plate flooded electrolyte or Gel / VRLA Type.
- ii. The battery will have a minimum rating of 12V, 40 Ah at C/10 discharge rate.
- iii. 75 % of the rated capacity of the battery should be between fully charged and load cut off conditions.
- iv. Battery should conform to the latest BIS/ International standards.

LIGHT SOURCE

- i. The light source will be a white LED type.
- ii. The colour temperature of white LED used in the system should be in the range of 5500°K–6500°K.
- iii. W-LEDs should not emit ultraviolet light.
- iv. The light output from the white LED light source should be constant throughout the duty cycle.
- v. The lamps should be housed in an assembly suitable for outdoor use.
- vi. The temperature of heat sink should not increase more than 20°C above ambient temperature during the dusk to dawn operation.

ELECTRONICS

- i. The total electronic efficiency should be at least 85%.
- ii. Electronics should operate at 12 V and should have temperature compensation for proper charging of the battery throughout the year.
- iii. No Load current consumption should be less than 20 mA.
- iv. The PV module itself should be used to sense the ambient light level for switching ON and OFF the lamp.
- v. The PCB containing the electronics should be capable of solder free installation and replacement.
- vi. Necessary lengths of wires/cables, switches suitable for DC use and fuses should be provided.

ELECTRONIC PROTECTIONS

TECHNICAL SPECIFICATIONS FOR SOLAR PHOTOVOLTAIC LIGHTING SYSTEMS & POWER PACKS (Off-grid Solar Applications Scheme 2016-17)

- 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. Fuse should be provided to protect against short circuit conditions.
- iv. Protection for reverse flow of current through the PV module(s) should be provided.
- v. Electronics should have temperature compensation for proper charging of the battery throughout the year.
- vi. Adequate protection should be provided against battery reverse polarity.
- vii. Load reconnect should be provided at 80% of the battery capacity status.

MECHANICAL COMPONENTS

- i. A corrosion resistant metallic frame structure should be fixed on the pole to hold the SPV module.
- ii. The frame structure should have provision to adjust its angle of inclination to the horizontal, so that it can be installed at the specified tilt angle.
- iii. The pole should be made of Galvanised Iron (GI) pipe.
- iv. The height of the pole should be 4 metres above the ground level, after grouting and final installation.
- v. The pole should have the provision to hold the luminaire.
- vi. The lamp housing should be water proof and should be painted with a corrosion resistant paint.
- vii. A vented, acid proof and corrosion resistant metallic box or plastic box [made of Polypropylene Copolymer (PP-CP)] with a locking arrangement for outdoor use should be provided for housing the battery.

INDICATORS

- The system should have two indicators, green and red.
- The green indicator should indicate the charging under progress and should glow only when the charging is taking place. It should stop glowing when the battery is fully charged.
- Red indicator should indicate the battery “Load Cut Off” condition.

TECHNICAL SPECIFICATIONS FOR SOLAR PHOTOVOLTAIC LIGHTING SYSTEMS & POWER PACKS (Off-grid Solar Applications Scheme 2016-17)

QUALITY AND WARRANTY

- i. **The street lighting system (including the battery) will be warranted for a period of five years from the date of supply.**
- ii. **The PV module(s) will be warranted for a minimum period of 25 years from the date of supply.** The PV modules must be warranted for their output peak watt capacity, which should not be less than 90% at the end of Ten (10) years and 80% at the end of Twenty five (25) years.
- iii. The Warranty Card to be supplied with the system must contain the details of the system.

OPERATION and MAINTENANCE MANUAL

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:

- Basic principles of Photovoltaics.
- A small write-up (with a block diagram) on Solar Street Lighting System - its components, PV module, battery, electronics and luminaire and expected performance.
- Type, Model number, Voltage & capacity of the battery, used in the system.
- The make, model number, country of origin and technical characteristics (including IESNA LM-80 report) of W-LEDs used in the lighting system.
- About Charging and Significance of indicators.
- Clear instructions about erection of pole and mounting of PV module (s) and lamp housing assembly on the pole.
- Clear instructions on regular maintenance and trouble shooting of the Solar Street Lighting System.
- DO's and DONT's.
- Name and address of the contact person for repair and maintenance, in case of non-functionality of the solar street lighting system.

MODEL- II

- **With Lead Acid Battery**
- **Operates dusk to dawn, First 4 Hours at full Brightness, rest of the time at lower light level, with motion sensor.**

TECHNICAL SPECIFICATIONS FOR SOLAR PHOTOVOLTAIC LIGHTING SYSTEMS & POWER PACKS (Off-grid Solar Applications Scheme 2016-17)

BROAD PERFORMANCE SPECIFICATIONS

PV Module	30 Wp under STC
Battery	Lead acid Tubular Flooded or Tubular GEL / VRLA , 12V- 20 AH @ C/20
Light Source	White Light Emitting Diode (W-LED) 7 Watt (Max.), W-LED luminaire, dispersed beam, soothing to eyes with the use of proper optics and diffuser
Light Out put	<p>Multiple Light levels:</p> <p>The lamp should have two levels of light to take care of different lighting needs during the night.</p> <ul style="list-style-type: none"> • Minimum 16 Lux when measured at the periphery of 4 meter diameter from a height of 4 meter (at “High” illumination level). The illumination should be uniform without dark bands or abrupt variations. • Minimum 8 lux at lower illumination level <p>(Higher light output will be preferred)</p>
Mounting of light	Pole mounted, Minimum 4 meters above the ground level
Electronics Efficiency	Minimum 85% total
Duty Cycle	<p>Dusk to Dawn</p> <p>4 Hours full light, rest of the time at lower light level, with motion sensor.</p> <ul style="list-style-type: none"> • In case any movement is there, it senses it and glows to full level. • Then it comes back to lower level after sometime, automatically.
Autonomy	3 days or Minimum 42 operating hours per permissible discharge

TECHNICAL SPECIFICATIONS FOR SOLAR PHOTOVOLTAIC LIGHTING SYSTEMS & POWER PACKS (Off-grid Solar Applications Scheme 2016-17)

TECHNICAL DETAILS

PV MODULE

- i. Indigenously manufactured PV module should be used.
- ii. The PV module should have crystalline silicon solar cells and must have a certificate of testing conforming to IEC 61215 Edition II / BIS 14286 from an NABL or IECQ accredited Laboratory.
- iii. The power output of the module(s) under STC should be a minimum of 40 Wp at a load voltage* of 16.4 ± 0.2 V.
- iv. The open circuit voltage* of the PV modules under STC should be at least 21.0 Volts.
- v. **The module efficiency should not be less than 12 %.**
- vi. The terminal box on the module should have a provision for opening it for replacing the cable, if required.
- vii. There should be a Name Plate fixed inside the module which will give:
 - a. Name of the Manufacturer or Distinctive Logo.
 - b. Model Number
 - c. Serial Number
 - d. Year of manufacture
- viii. A distinctive serial number starting with NSM will be engraved on the frame of the module or screen printed on the tedlar sheet of the module.

*The load voltage and Voc conditions of the PV modules are not applicable for the system having MPPT based charge controller

BATTERY

- i. Lead Acid, tubular positive plate flooded electrolyte or Gel / VRLA Type.
- ii. The battery will have a minimum rating of 12V, 20 Ah at C/20 discharge rate.
- iii. 75 % of the rated capacity of the battery should be between fully charged and load cut off conditions.
- iv. Battery should conform to the latest BIS/ International standards.

TECHNICAL SPECIFICATIONS FOR SOLAR PHOTOVOLTAIC LIGHTING SYSTEMS & POWER PACKS (Off-grid Solar Applications Scheme 2016-17)

LIGHT SOURCE

- i. The light source will be a white LED type.
- ii. The colour temperature of white LED used in the system should be in the range of 5500°K–6500°K.
- iii. W-LEDs should not emit ultraviolet light.
- iv. The light output from the white LED light source should be constant throughout the duty cycle.
- v. The lamps should be housed in an assembly suitable for outdoor use.
- vi. The temperature of heat sink should not increase more than 20°C above ambient temperature during the dusk to dawn operation.

ELECTRONICS

- i. The total electronic efficiency should be at least 85%.
- ii. Electronics should operate at 12 V and should have temperature compensation for proper charging of the battery throughout the year.
- iii. No Load current consumption should be less than 20 mA.
- iv. The PV module itself should be used to sense the ambient light level for switching ON and OFF the lamp.
- v. The PCB containing the electronics should be capable of solder free installation and replacement.
- vi. Necessary lengths of wires/cables, switches suitable for DC use and fuses should be provided.

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. Fuse should be provided to protect against short circuit conditions.
- iv. Protection for reverse flow of current through the PV module(s) should be provided.
- v. Electronics should have temperature compensation for proper charging of the battery throughout the year.
- vi. Adequate protection should be provided against battery reverse polarity.

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- vii. Load reconnect should be provided at 80% of the battery capacity status.

MECHANICAL COMPONENTS

- i. A corrosion resistant metallic frame structure should be fixed on the pole to hold the SPV module.
- ii. The frame structure should have provision to adjust its angle of inclination to the horizontal, so that it can be installed at the specified tilt angle.
- iii. The pole should be made of Galvanised Iron (GI) pipe.
- iv. The height of the pole should be 4 metres above the ground level, after grouting and final installation.
- v. The pole should have the provision to hold the luminaire.
- vi. The lamp housing should be water proof and should be painted with a corrosion resistant paint.
- vii. A vented, acid proof and corrosion resistant metallic box or plastic box [made of Polypropylene Copolymer (PP-CP)] with a locking arrangement for outdoor use should be provided for housing the battery.

INDICATORS

- The system should have two indicators, green and red.
- The green indicator should indicate the charging under progress and should glow only when the charging is taking place. It should stop glowing when the battery is fully charged.
- Red indicator should indicate the battery “Load Cut Off” condition.

QUALITY AND WARRANTY

- i. **The street lighting system (including the battery) will be warranted for a period of five years from the date of supply.**
- ii. **The PV module(s) will be warranted for a minimum period of 25 years from the date of supply.** The PV modules must be warranted for their output peak watt capacity, which should not be less than 90% at the end of Ten (10) years and 80% at the end of Twenty five (25) years.
- iii. The Warranty Card to be supplied with the system must contain the details of the system.

TECHNICAL SPECIFICATIONS FOR SOLAR PHOTOVOLTAIC LIGHTING SYSTEMS & POWER PACKS (Off-grid Solar Applications Scheme 2016-17)

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- Type, Model number, Voltage & capacity of the battery, used in the system.
- The make, model number, country of origin and technical characteristics (including IESNA LM-80 report) of W-LEDs used in the lighting system.
- About Charging and Significance of indicators.
- Clear instructions about erection of pole and mounting of PV module (s) and lamp housing assembly on the pole.
- Clear instructions on regular maintenance and trouble shooting of the Solar Street Lighting System.
- DO's and DONT's.
- Name and address of the contact person for repair and maintenance, in case of non-functionality of the solar street lighting system.

MODEL- III

- **With Lithium Ferro phosphate Battery;**
- **Operates from dusk to dawn at full Brightness**

BROAD PERFORMANCE SPECIFICATIONS

PV Module	40 Wp under STC
Battery	Minimum 160 Wh Lithium Ferro phosphate battery
Light Source	White Light Emitting Diode (W-LED) 7 Watt (Max.), W-LED luminaire, dispersed beam, soothing to eyes with the use of proper optics and diffuser

TECHNICAL SPECIFICATIONS FOR SOLAR PHOTOVOLTAIC LIGHTING SYSTEMS & POWER PACKS (Off-grid Solar Applications Scheme 2016-17)

Light Out put	Minimum 16 Lux when measured at the periphery of 4 meter diameter from a height of 4 meter. The illumination should be uniform without dark bands or abrupt variations, and soothing to the eye. Higher light output will be preferred.
Mounting of light	Pole mounted, Minimum 5 meters above the ground level
Electronics Efficiency	Minimum 85% total
Duty Cycle	Dusk to dawn

TECHNICAL DETAILS

PV MODULE

- i. Indigenously manufactured PV module should be used.
- ii. The PV module should have crystalline silicon solar cells and must have a certificate of testing conforming to IEC 61215 Edition II / BIS 14286 from an NABL or IECQ accredited Laboratory.
- iii. The power output of the module(s) under STC should be a minimum of 40 Wp at a load voltage* of 16.4 ± 0.2 V.
- iv. The open circuit voltage* of the PV modules under STC should be at least 21.0 Volts.
- v. The module efficiency should not be less than 12 %.**
- vi. The terminal box on the module should have a provision for opening it for replacing the cable, if required.
- vii. There should be a Name Plate fixed inside the module which will give:
 - a. Name of the Manufacturer or Distinctive Logo.
 - b. Model Number
 - c. Serial Number
 - d. Year of manufacture
- viii. A distinctive serial number starting with NSM will be engraved on the frame of the module or screen printed on the tedlar sheet of the module.

*The load voltage and Voc conditions of the PV modules are not applicable for the system having MPPT based charge controller

TECHNICAL SPECIFICATIONS FOR SOLAR PHOTOVOLTAIC LIGHTING SYSTEMS & POWER PACKS (Off-grid Solar Applications Scheme 2016-17)

BATTERY

- i. Minimum 160 Wh capacity Lithium Ferro Phosphate Battery.
- ii. Battery should conform to the latest BIS/ International standards.

LIGHT SOURCE

- i. The light source will be a white LED type.
- ii. The colour temperature of white LED used in the system should be in the range of 5500°K–6500°K.
- iii. W-LEDs should not emit ultraviolet light.
- iv. The light output from the white LED light source should be constant throughout the duty cycle.
- v. The lamps should be housed in an assembly suitable for outdoor use.
- vi. The temperature of heat sink should not increase more than 20°C above ambient temperature during the dusk to dawn operation.

ELECTRONICS

- i. The total electronic efficiency should be at least 85%.
- ii. Electronics should operate at 12 V and should have temperature compensation for proper charging of the battery throughout the year.
- iii. No Load current consumption should be less than 20 mA.
- iv. The PV module itself should be used to sense the ambient light level for switching ON and OFF the lamp.
- v. The PCB containing the electronics should be capable of solder free installation and replacement.
- vi. Necessary lengths of wires/cables, switches suitable for DC use and fuses should be provided.

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. Fuse should be provided to protect against short circuit conditions.

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- iv. Protection for reverse flow of current through the PV module(s) should be provided.
- v. Electronics should have temperature compensation for proper charging of the battery throughout the year.
- vi. Adequate protection should be provided against battery reverse polarity.
- vii. Load reconnect should be provided at 80% of the battery capacity status.

MECHANICAL COMPONENTS

- (i) A corrosion resistant metallic frame structure should be fixed on the pole to hold the SPV module.
- (ii) The frame structure should have provision so that the module can be oriented at the suitable tilt angle.
- (iii) The pole should be made of Galvanised Iron (GI) pipe.
- (iv) The height of the pole should be 5 metres above the ground level, after grouting and final installation.
- (v) The pole should have the provision to hold the luminaire.
- (vi) The Luminaire housing should be water proof (IP 65) and should be painted with a corrosion resistant paint and should be housing the battery. Alternatively, A vented, acid proof and corrosion resistant metallic box or plastic box [made of Polypropylene-Copolymer (PP-CP)] with a locking arrangement for outdoor use should be provided for housing the battery.

INDICATORS

- The system should have two indicators, green and red.
- The green indicator should indicate the charging under progress and should glow only when the charging is taking place. It should stop glowing when the battery is fully charged.
- Red indicator should indicate the battery “Load Cut Off” condition.

QUALITY AND WARRANTY

- i. **The street lighting system (including the battery) will be warranted for a period of five years from the date of supply.**

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- ii. **The PV module(s) will be warranted for a minimum period of 25 years from the date of supply.** The PV modules must be warranted for their output peak watt capacity, which should not be less than 90% at the end of Ten (10) years and 80% at the end of Twenty five (25) years.
- iii. The Warranty Card to be supplied with the system must contain the details of the system.

OPERATION and MAINTENANCE MANUAL

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:

- Basic principles of Photovoltaics.
- A small write-up (with a block diagram) on Solar Street Lighting System - its components, PV module, battery, electronics and luminaire and expected performance.
- Type, Model number, Voltage & capacity of the battery, used in the system.
- The make, model number, country of origin and technical characteristics (including IESNA LM-80 report) of W-LEDs used in the lighting system.
- About Charging and Significance of indicators.
- Clear instructions about erection of pole and mounting of PV module (s) and lamp housing assembly on the pole.
- Clear instructions on regular maintenance and trouble shooting of the Solar Street Lighting System.
- DO's and DONT's.
- Name and address of the contact person for repair and maintenance, in case of non-functionality of the solar street lighting system.

MODEL- IV

- **With Lithium Ferro phosphate Battery**
- **Operates dusk to dawn, First 4 Hours at full Brightness, rest of the time at lower light level, with motion sensor.**

TECHNICAL SPECIFICATIONS FOR SOLAR PHOTOVOLTAIC LIGHTING SYSTEMS & POWER PACKS (Off-grid Solar Applications Scheme 2016-17)

BROAD PERFORMANCE SPECIFICATIONS

PV Module	30 Wp under STC
Battery	Minimum 120 Wh Lithium Ferro phosphate battery
Light Source	White Light Emitting Diode (W-LED) 7 Watt (Max.), W-LED luminaire, dispersed beam, soothing to eyes with the use of proper optics and diffuser
Light Out put	Multiple Light levels: The lamp should have two levels of light to take care of different lighting needs during the night. <ul style="list-style-type: none"> • Minimum 16 Lux when measured at the periphery of 4 meter diameter from a height of 4 meter (at “High” illumination level). The illumination should be uniform without dark bands or abrupt variations. • Minimum 8 lux at lower illumination level (Higher light output will be preferred)
Mounting of light	Pole mounted, Minimum 5 meters above the ground level
Electronics	Overall total Efficiency of the Electronics should be Minimum 90%
Duty Cycle	Dusk to Dawn 4 Hours full light, rest of the time at lower light level, with motion sensor. <ul style="list-style-type: none"> • In case any movement is there, it senses it and glows to full level. • Then it comes back to lower level after sometime, automatically.

TECHNICAL SPECIFICATIONS FOR SOLAR PHOTOVOLTAIC LIGHTING SYSTEMS & POWER PACKS (Off-grid Solar Applications Scheme 2016-17)

TECHNICAL DETAILS

PV MODULE

- i. Indigenously manufactured PV modules should be used.
- ii. The power output of the module under STC should be a minimum of 30 Wp.
- iii. The PV module should be made up of crystalline silicon solar cells and must have a certificate of testing conforming to IEC 61215 Edition II / BIS 14286 from an NABL or IECQ accredited Laboratory.
- iv. The Load voltage* of 16.40 V for 12 V battery or appropriate voltage for charging of battery used, under the standard test conditions (STC) of measurement.
- v. **The module efficiency should not be less than 12 %.**
- vi. The terminal box on the module should have a provision for opening, for replacing the cable, if required.
- vii. There should be a Name Plate fixed inside the module which will give:
 - a. Name of the Manufacturer or Distinctive Logo.
 - b. Model Number
 - c. Serial Number
 - d. Year of manufacture
- viii. A distinctive serial number starting with NSM will be engraved on the frame of the module or screen printed on the tedlar sheet of the module.

*The Load voltage conditions of the PV modules are not applicable for the system having MPPT.

BATTERY

- i. Minimum 120 Wh Lithium Ferro Phosphate Battery.
- ii. Battery should conform to the latest BIS/ International standards.

LIGHT SOURCE

TECHNICAL SPECIFICATIONS FOR SOLAR PHOTOVOLTAIC LIGHTING SYSTEMS & POWER PACKS (Off-grid Solar Applications Scheme 2016-17)

- i. The light source will be of white LED type.
- ii. The colour temperature of W-LEDs used in the system should be in the range of 5500°K–6500°K.
- iii. LEDs should not emit ultraviolet light.
- iv. The light output from the W-LED light source should be constant throughout the duty cycle.
- v. The lamps should be housed in an assembly suitable for outdoor use.

ELECTRONICS

- i. The total electronic efficiency should be at least 85 %.
- ii. The idle current should be less than 10ma
- iii. The voltage drop from module terminals to the battery terminals should not exceed 0.8 volts including the drop across the diode and the cable when measured at maximum charging current.
- iv. The PCB containing the electronics should be capable of solder free installation and replacement.

ELECTRONIC PROTECTIONS

- i. The system should have protection against battery overcharge, deep discharge condition.
- ii. Adequate protection should be provided against battery reverse polarity.
- iii. Fuses should be provided to protect against short circuit conditions. Fuse is not mandatory, in case, over current protection is provided in the driver circuit.
- iv. Protection for reverse flow of current through the PV module(s) should be provided.

MECHANICAL COMPONENTS

- i. A corrosion resistant metallic frame structure should be fixed on the pole to hold the SPV module.

TECHNICAL SPECIFICATIONS FOR SOLAR PHOTOVOLTAIC LIGHTING SYSTEMS & POWER PACKS (Off-grid Solar Applications Scheme 2016-17)

- ii. The frame structure should have provision so that the module can be oriented at the suitable tilt angle.
- iii. The pole should be made of Galvanised Iron (GI) pipe.
- iv. The height of the pole should be 5 metres above the ground level, after grouting and final installation.
- v. The pole should have the provision to hold the luminaire.
- vi. The Luminaire housing should be water proof (IP 65) and should be painted with a corrosion resistant paint and should be housing the battery.

Alternatively:

A vented, acid proof and corrosion resistant metallic box or plastic box [made of Polypropylene-Copolymer (PP-CP)] with a locking arrangement for outdoor use should be provided for housing the battery.

INDICATORS

- The system should have two indicators, green and red.
- The green indicator should indicate the charging under progress and should glow only when the charging is taking place. It should stop glowing when the battery is fully charged.
- Red indicator should indicate the battery “Load Cut Off” condition

QUALITY AND WARRANTY

- i. **The complete Solar Street Lighting System (including battery) will be warranted for a period of Five years from the date of supply.**
- ii. **The PV module(s) will be warranted for a minimum period of 25 years from the date of supply.** PV modules must be warranted for their output peak watt capacity, which should not be less than 90% at the end of Ten (10) years and 80% at the end of Twenty five (25) years.
- iii. 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.

TECHNICAL SPECIFICATIONS FOR SOLAR PHOTOVOLTAIC LIGHTING SYSTEMS & POWER PACKS (Off-grid Solar Applications Scheme 2016-17)

OPERATION and MAINTENANCE MANUAL

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:

- Basic principles of Photovoltaics.
- A small write-up (with a block diagram) on Solar Street Lighting System - its components, PV module, battery, electronics and luminaire and expected performance.
- Significance of indicators.
- Type, Model number, voltage & capacity of the battery, used in the system.
- The make, model number, country of origin and technical characteristics (including IESNA LM-80 report) of W-LEDs used in the lighting system must be indicated in the manual.
- Clear instructions about mounting of PV module(s).
- Clear instructions on regular maintenance and trouble shooting of the Solar Street Lighting System.
- DO's and DONT's.