Annexure II

Technical Specification for Solar LED Street Lighting Systems

1. WHITE LED BASED SOLAR STREET LIGHTING SYSTEM

A stand alone solar photovoltaic street lighting system is an outdoor lighting unit used for illuminating a street or an open area. A solar street lighting system consists of a PV Module, control electronics, storage battery, W-LED based Luminaire, inter connecting cables and 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 facing South direction at an inclination of 10 degree from horizontal. The system should be installed at a place where direct sunlight falls on the PV modules without any hindrance. There should not be any shadows falling on the PV modules during day time. The battery placed inside the battery box is charged by electricity generated by the PV module during day time and the luminaire provides light from dusk to dawn. The system lights at dusk and switches off at dawn automatically.

There are four models of LED based solar street lighting systems.

Solar Street Lighting System Model 1

Solar Module	60 Wp
Battery (Lithium Ferro Phosphate)	300 Wh (+20% permissible)
LED Luminaire	10 W (+20% permissible)

Pole (GI pole coated with rubber paint) Height -4m above ground level, Dia -3”

Solar Street Lighting System Model 2

Solar Module	120 Wp
Battery (Lithium Ferro Phosphate)	700 Wh (+20% permissible)
LED Luminaire	20 W (+20% permissible)

Pole (GI pole coated with rubber paint) Height -4m above ground level, Dia -4”

Solar Street Lighting System Model 3

Solar Module	200Wp
Battery (Lithium Ferro Phosphate) permissible)	1100 Wh (+20%
LED Luminaire	36W (+20% permissible)

Pole (GI pole coated with rubber paint) Height -5m above ground level, Dia -4”

Solar Street Lighting System Model 4

Solar Module	500Wp
Battery (Lithium Ferro Phosphate) permissible)	3000Wh (+20%
LED Luminaire permissible)	24W ,4 Nos (+20%

Pole (GI pole coated with rubber paint) Height -6m above ground level, Octagonal

2. . BROAD PERFORMANCE PARAMETERS

LED	White Light Emitting Diode (W-LED) with minimum luminous efficacy of 150 lumen/watt
Luminaire	Minimum luminaire efficacy should be 100 lumen/watt
Colour Temperature	White colour (colour temperature 5000°-6500°K), the illumination should be uniform without dark bands or abrupt variations, and soothing to the eye. Higher light output will be preferred.
Lux level for model 1	Minimum 10 lux within a rectangle area when measured at a distance of 4 m from the pole along the road (on either side of the road) and 4m from the pole across the road.
Lux level for model 2	Minimum 14 lux within a rectangle when measured at a distance of 5 m from the pole along the road (on either side of the road) and 4m from the pole across the road.
Lux level for model 3	Minimum 18 lux within a rectangle when measured at a distance of 6 m from the pole along the road (on either side of the road) and 4m from the pole across the road.
Lux level for model 4	Minimum 16 lux within a rectangle when measured at a distance of 6 m from the pole along the road (on either side of the road) and 4m from the pole across the road.
Electronics Efficiency	Min 85% total.

Duty cycle	Dusk to dawn.
Make of LED	**NICHIA/ CREE/ OSRAM/ PHILIPS or equivalent**
Charge Controller	**MPPT** /PWM

DUTY CYCLE

The W-LED solar street lighting system should be designed to operate from dusk to dawn, under average daily insolation of 5.5 kWh /sq.m. on a horizontal surface.

LUMINAIRE

The light source will be a white LED type. Single lamp or multiple lamps can be used. The colour temperature of white LED used in the system should be in the range of 5000°K–6500°K. Use of LEDs which emits ultraviolet light is not permitted.

The light output from the white LED light source should be constant throughout the duty cycle.

The lamps should be housed in an assembly suitable for outdoor use. The temperature of heat sink should not increase more than 20°C above ambient temperature during the dusk to dawn operation.

The make, model number, country of origin and technical characteristics (including LM-80, LM-79 report) of white LEDs/LED Luminaire used in the lighting system must be furnished The enclosure of luminary should be with IP65 protection.

BATTERY

Lithium Ferro Phosphate Battery.

Battery should conform to the latest BIS/International standards (IEC 62133).

- Battery should have minimum 5 year warranty.
- The battery should be fixed at a height of 3 metre from ground level on the pole in a battery box with IP65 protection.

PV MODULE

- The PV module(s) should be indigenously manufactured and contain crystalline silicon cells. It required to have certificate for the supplied PV module as per IEC 61215,IEC 61730 and IEC 61701 specifications or equivalent BIS specifications.
- The power output of the PV module must be reported under standard test conditions (STC) at 16.4 volt load voltage. I-V curve of the sample module

should be submitted.

- The open circuit voltage of the PV modules under STC should be at least 21.0 volt.
- The PV module efficiency should be above 12 %.
- The terminal box on the module should have a provision for opening for replacing the cable, if required.
- Each PV module should be provided with RF identification tag. The following information must be mentioned in the RFID used on each module (This can be inside or outside the laminate, but must be able to withstand harsh environmental conditions.)

  a) Name of the Manufacturer or distinctive Logo

  b) Model or Type No.

  c) Serial No.

  d) Year of make

ELECTRONICS, INCLUDING PROTECTIONS

- The total electronic efficiency should be at least 85%.
- Electronics should operate at 12 V/24V/36V/48V and should have temperature compensation for proper charging of the battery throughout the year.
- The light output should remain constant with variations in the battery voltages.
- The system should have protection against battery overcharge and deep discharge conditions.
- Fuse should be provided to protect against short circuit conditions.
- 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, full protection against open circuit, accidental short circuit and reverse polarity should be provided.
- The charge controller should be in corporate with MPPT/PWM.
- Adequate protection to be provided against battery reverse polarity
- Adequate protection is to be incorporated under No Load conditions.
- Load reconnect should be provided at 80% of the battery capacity status.
- Necessary lengths of wires / cables and appropriate fuses should be provided.

MECHANICAL COMPONENTS AND INSTALLATION

Aluminum frame structure, with anodizing to be fixed on the pole to hold the SPV module. The frame structure should be inclined at an angle of 10 degree from the horizontal to mount the PV module. The luminaire should be fixed to the pole on aluminium arm. The Aluminum arm for holding the luminaire should have suitable length and should be set at a suitable angle to maximize lux of desired level over the specified area.

A vented FRP/ABS/Alluminium box (IP65 protection) with suitable structure to be fixed on the pole for housing the storage battery with locking arrangement facility .

All mechanical metallic parts shall be of aluminium/ stainless steel of suitable thickness to withstand loads including wind loads and should have good aesthetic appearance. All external parts should be Aluminium/Stainless Steel and should be replaced during the warranty period in case of any defects. All nuts and bolts used should be of stainless steel.

The foundation of the pole should be of PCC of required size . The pole with foundation plate of suitable size should be fixed on the PCC foundation using foundation bolts.

The pole should be of GI with coated with rubber paint.

The foundation plate should be fixed 150 mm above ground level.

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

OTHER FEATURES

There will be a Name Plate (12" X 6") on the pole(2 m above ground level), which should be displayed with the following details

a. Name of the supplier.
b. Phone number of service centres.
c. Date of installation.
d. Name of Implementing agency.

Quality stickers with post number will have to be provided on the pole .

QUALITY AND WARRANTY

Components and parts used in White LED solar street lighting systems should conform to the latest BIS/ International specifications, wherever such specifications are available and applicable. A copy of the test report/ certificate stating conformity of BIS/ International standards must be submitted.

White LED solar street lighting system including the battery will be warranted for a period of 5 years from the date of commissioning .

The PV module used should be warranted for its output peak watt capacity, which should not be less than 90% at the end of 10 (ten) years and 80% at the end of 25 (twenty five) years.

DOCUMENTATION

An Operation, Instruction and Maintenance Manual, in English and Malayalam, should be provided with the solar street lighting system. Besides other information the Manual should contain the following minimum details:

a. About Photo Voltaics. A small write up (with a block diagram) on PV Module, electronics, lamps and battery.
b. About White LED solar street lighting system - its components and expected performance The make, model number, country of origin and technical characteristics of W-LEDs should be stated in the product data sheet
c. Clear instructions about mounting of pole, grouting details, fixing of PV module, battery and luminaire., clear wiring instructions with line diagram
d. About significance of indicators
e. DO's and DONT's
f. Clear instructions on regular maintenance and trouble shooting of the system
g. Name and address of the person or service centre to be contacted in case of failure or complaint.

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Annexure III

List of Components of Solar LED Street Lighting Systems Approved for Installation Work

1. Name of Empanelled Agency :Ammini Solar Pvt. Ltd., Thiruvananthapuram

Empanelment Category : Solar LED Street Lighting Systems

(Model I, Model II, Model III and Model IV)

Category	Component	Make	Model No.
Model I	SPV Module (60 W_p)	1. Navitas Green Solutions Pvt. Ltd 2. Waaree Energies Ltd. 3. Zonje Solar LLP	1. NSA 60 2. WS-60 3. ZS1260
	$LiFePO_4$ battery (300 Wh)	RONDA	300 Wh: Jiangmen RONDA Li_ion 3.2V 10.56Wh 3.3 Ah, 26650
	LED Luminaire	Ammini Energy Systems Pvt Ltd.	LEDon 10W
	LED	Osram	GW CSSRM1.PC (2.5W)
Model II	SPV Module (120 W_p)	1. Navitas Green Solutions Pvt. Ltd 2. Waaree Energies Ltd. 3. Zonje Solar LLP	1. NSA 120 2. WS-120 3. ZS12125
	$LiFePO_4$ battery (700 Wh)	RONDA	700 Wh: Jiangmen RONDA Li_ion 3.2V 10.56Wh 3.3 Ah, 26650
	LED Luminaire	Ammini Energy Systems Pvt Ltd.	Sunshine 24W
	LED	Osram	GW CSSRM1.PC (2.5W)
Model III	SPV Module (200 W_p)	1. Waaree Energies Ltd. 2. Zonje Solar LLP	1. WS-200/24V 2. ZS20072PC
	$LiFePO_4$ battery (1100 Wh)	RONDA	1100 Wh: Jiangmen RONDA Li_ion 3.2V 10.56Wh 3.3 Ah, 26650
	LED Luminaire	Ammini Energy Systems Pvt Ltd.	Sunshine 45W
	LED	Osram	GW CSSRM1.PC (2.5W)
Model IV	SPV Module (2 x	1. Waaree Energies Ltd.	1. WS-250 2. ZS25072PC

	250 W_p)	2. Zonje Solar LLP	
	$LiFePO_4$ battery (3000 Wh)	RONDA	3000 Wh: Jiangmen RONDA Li_ion 3.2V 10.56Wh 3.3 Ah, 26650
	LED Luminaire (4 Nos)	Ammini Energy Systems Pvt Ltd.	Sunshine 30W
	LED	Osram	GW CSSRM1.PC (2.5W)

2. Name of Empanelled Agency :Ecomate Energy Solutions, Perumbavoor

Empanelment Category : Solar LED Street Lighting Systems

(Model I, Model II, Model III and Model IV)

Category	**Component**	**Make**	**Model No.**
Model I	SPV Module (60 W_p)	Insolation Energy Pvt. Ltd. and Innovative Solar Solutions Ltd.	LFV12VS60W and INV060 respectively
	$LiFePO_4$ battery (300 Wh)	300 Wh: Fusion Power Systems, Shenzhen Lithium Valley Technology and Bodhi Energy Solutions	Amptek ATLP1224, IFR32650-6000mAh / IFR 32700-6000mAh and BES-LP-1224/ BES-LP-1225 resp.
	LED Luminaire	Ammini Energy Systems Pvt Ltd.	LEDon 10W
	LED	Osram	GW CSSRM1.PC (2.5W)
Model II	SPV Module (120 W_p)	Insolation Energy Pvt. Ltd. and Innovative Solar Solutions Ltd.	LFV12VS120W and INV120 respectively
	$LiFePO_4$ battery (700 Wh)	700 Wh: Fusion Power Systems, Shenzhen Lithium Valley Technology, Shenzhen FBTech Electronics Ltd and Shenzhen UBetter Technology Co	Amptek ATLP1224, IFR32650-6000mAh / LVB60 , IFR 32700-6000mAh and 32650-6000mAh resp.
	LED Luminaire	Ammini Energy Systems Pvt Ltd.	Sunshine24W
	LED	Osram	GW CSSRM1.PC (2.5W)
Model III	SPV Module (200 W_p)	Insolation Energy Pvt. Ltd. and Innovative Solar Solutions Ltd.	LFV12VS100W and INV100 respectively
	$LiFePO_4$ battery (1100 Wh)	1100 Wh: Fusion Power Systems, Shenzhen Lithium Valley Technology, Shenzhen FBTech Electronics Ltd and Shenzhen UBetter Technology Co	Amptek ATLP1224, IFR32650-6000mAh, IFR 32700-6000mAh and 32650-6000mAh resp.
	LED Luminaire	Ammini Energy Systems Pvt Ltd.	Sunshine45W
	LED	Osram	GW CSSRM1.PC (2.5W)
Model IV	SPV Module (2 x 250 W_p)	500 W: Insolation Energy Pvt. Ltd., Innovative Solar Solutions Ltd.	LFV12VS125W / LFV 12VS150W / LFV12

		And Topsun Energy Ltd.	VS165WM, INV125 / INV 150/ INV180 and TEL12P150 respectively
	$LiFePO_4$ battery (3000 Wh)	3000 Wh: Fusion Power Systems, Shenzhen Lithium Valley Technology, Shenzhen FBTech Electronics Ltd and Shenzhen UBetter Technology Co	Amptek ATLP1224, IFR32650-6000mAh / LVB100, IFR 32700-6000mAh and 32650-6000mAh resp.
	LED Luminaire (4 Nos)	Ammini Energy Systems Pvt Ltd.	Sunshine30W
	LED	Osram	GW CSSRM1.PC (2.5W)

3. Name of Empanelled Agency :Usha Electronics Systems, Palakkad

Empanelment Category : Solar LED Street Lighting Systems

(Model I, Model II, Model III and Model IV)

Category	**Component**	**Make**	**Model No.**
Model I	SPV Module (60 W_p)	1. Navitas Green Solutions Pvt. Ltd 2. Waaree Energies Ltd.	1. NSA 60 2. WS-60
	$LiFePO_4$ battery (300 Wh)	1. Fusion Power Systems 2. RCRS Innovations Pvt. Ltd	1. ATLP1224 2. EXG12824L
	LED Luminaire	Usha Electronics Systems.	LUXION 10W
	LED	Osram	DURIS S5, GW PSLT33.PM, 1 W
Model II	SPV Module (120 W_p)	1. Navitas Green Solutions Pvt. Ltd 2. Waaree Energies Ltd.	1. NSA 120 2. WS-120
	$LiFePO_4$ battery (700 Wh)	1. Fusion Power Systems 2. RCRS Innovations Pvt. Ltd	1. ATLP1230 2. EXG12860L
	LED Luminaire	Usha Electronics Systems.	LUXION 20W
	LED	Osram	DURIS S5, GW PSLT33.PM, 1 W
Model III	SPV Module (200 W_p)	1. Navitas Green Solutions Pvt. Ltd 2. Waaree Energies Ltd.	1. NSA200 2. WS-200
	$LiFePO_4$ battery (1100 Wh)	1. Fusion Power Systems	1. ATLP1230 (3 Nos)

		2. RCRS Innovations Pvt. Ltd	2. EXG12890L
	LED Luminaire	Usha Electronics Systems.	LUXION 36W
	LED	Osram	DURIS S5, GW PSLT33.PM, 1 W
Model IV	SPV Module (2 x 250 W_p)	1. Navitas Green Solutions Pvt. Ltd 2. Waaree Energies Ltd.	1. NSA250 2. WS-250
	$LiFePO_4$ battery (3000 Wh)	1. Fusion Power Systems 2. RCRS Innovations Pvt. Ltd 3. Shenzhen FBTech Electronics Ltd	1. ATLP12125 (2 Nos) 2. EXG128120L (2 Nos) 3. IFR32700-6000mAh
	LED Luminaire (4 Nos)	Usha Electronics Systems.	LUXION 24 W
	LED	Osram	DURIS S8, GW P9LR35.PM, 5 W