DETAILED PROJECT REPORT FOR GRID INTERACTIVE ROOF TOP SOLAR PHOTOVOLTAIC POWER PLANT AT OM SAKTHI HOSPITAL ERODE

Executive summary

The proposed Roof Top Solar Photovoltaic Power Plant at Om Sakthi Hospital would utilize vacant area available of about 350 sq. m. we use 210 sq.m spaces on the terrace of the South side of the building. The SPV power plant with proposed capacity of 20 kWp would be connected to grid. No battery storage has been provided. It would meet partial load of the building during day time. The grid connected SPV project would be a demonstration plant to harness renewable energy and the data on generation would be utilized for analysis of the various aspects of operation as also that of availability of power.

The 20 kWp SPV power plant is estimated to afford annual energy feed of 36.5 MWh considering efficiency of the solar module as 15.1%, Inverter as 98 % and losses as 3% in the DC and AC system.

The SPV Power Plant is estimated to cost Rs. 22 lakhs.

Salient features

1. **Location**
   - 1.1. Place : Erode, Tamil Nadu
   - 1.2. Name of Building : Om Sakthi Hospital
   - 1.3. Latitude : **11.3422350**
   - 1.4. Longitude : **77.7274769**
2. **Area for SPV Plant**
   - 2.1. Length : 20 m
   - 2.2. Width : 15 m
   - 2.3. Location : Terrace South Side of hospital building
3. **SPV Power Plant**
   - 3.1. Total Output :20880 Wp
   - 3.2. Each Module Output : 290Wp
   - 3.3. No of Modules : 72
   - 3.4. No of Modules in series: 4
4. **Technical details of a SPV Module**
   - 4.1. PV module Type : Mono crystalline
   - 4.2. Physical Dimensions
     - 4.2.1. Length with frame : 2007mm
     - 4.2.2. Width with frame : 950mm
     - 4.2.3.Thickness : 50mm
   - 4.3. Electrical Parameter
     - 4.3.1. Maximum Power Rating : 290Wp
     - 4.3.2.Rated Current : 8 A
     - 4.3.3. Rated Voltage : 36.25 V
     - 4.3.4. Short Circuit Current : 8.32 A
     - 4.3.5.Open Circuit Voltage : 44.59 V

5. **Mounting Arrangement**
   - 5.1. Mounting : Fixed Type
   - 5.2. Tilt Angle (slope) of PV : 13 Degree
6. **Inverter**
   - 6.1. Number of units : 1
   - 6.2. Rated Capacity : 20Kw
   - 6.3. Input Voltage range : 1000V DC
   - 6.4. Output voltage : 360 – 440 V AC
   - 6.5. Frequency :50 – 60Hz
   - 6.6. Efficiency : 98.20 %
7. **Grid Connection Details**
   - 7.1. Electrical parameters for interconnection : 440 V, 3Ph ,50 Hz
8. **Annual Energy Generation**
   - 8.1. Annual Energy : 36.5 Mwh
9. **Cost Estimate**
   - 9.1. Estimated Cost (Rs. Lakh) : 26
   - 9.2. Cost per kW (Rs.Lakh) : 1.3
10. **Construction Time** : 2 Months

Inverter

1. The DC power produced is fed to inverter for conversion into AC.
2. The output of the inverter must synchronize automatically its AC output to the exact AC voltage and frequency of the grid.
3. Inverter Efficiency of 98.3% is considered in the PV system.

Protection and Controls:

1. Inverter shall be provided with islanding protection to isolate it from the grid in case of no supply, under voltage and over voltage conditions so that in no case there is any chance of accident.
2. In addition to above, PV systems shall be provided with adequate rating fuses, fuses on inverter input side (DC) as well as output side (AC) side for overload and short circuit protection and disconnecting switches to isolate the DC and AC system for maintenances are needed.
3. Fuses of adequate rating shall also be provided in each solar array module to protect them against short circuit.

INTEGRATION OF PV POWER WITH GRID:

The output power from SPV would be fed to the inverter which converts DC produced by SPV array to AC and feeds it into the main electricity grid after synchronization. In case of grid failure, or low or high voltage, solar PV system shall be out of synchronization and shall be disconnected from the grid. Once the DG set comes into service PV system shall again be synchronized with DG supply and load requirement would be met to the extent of availability of power.

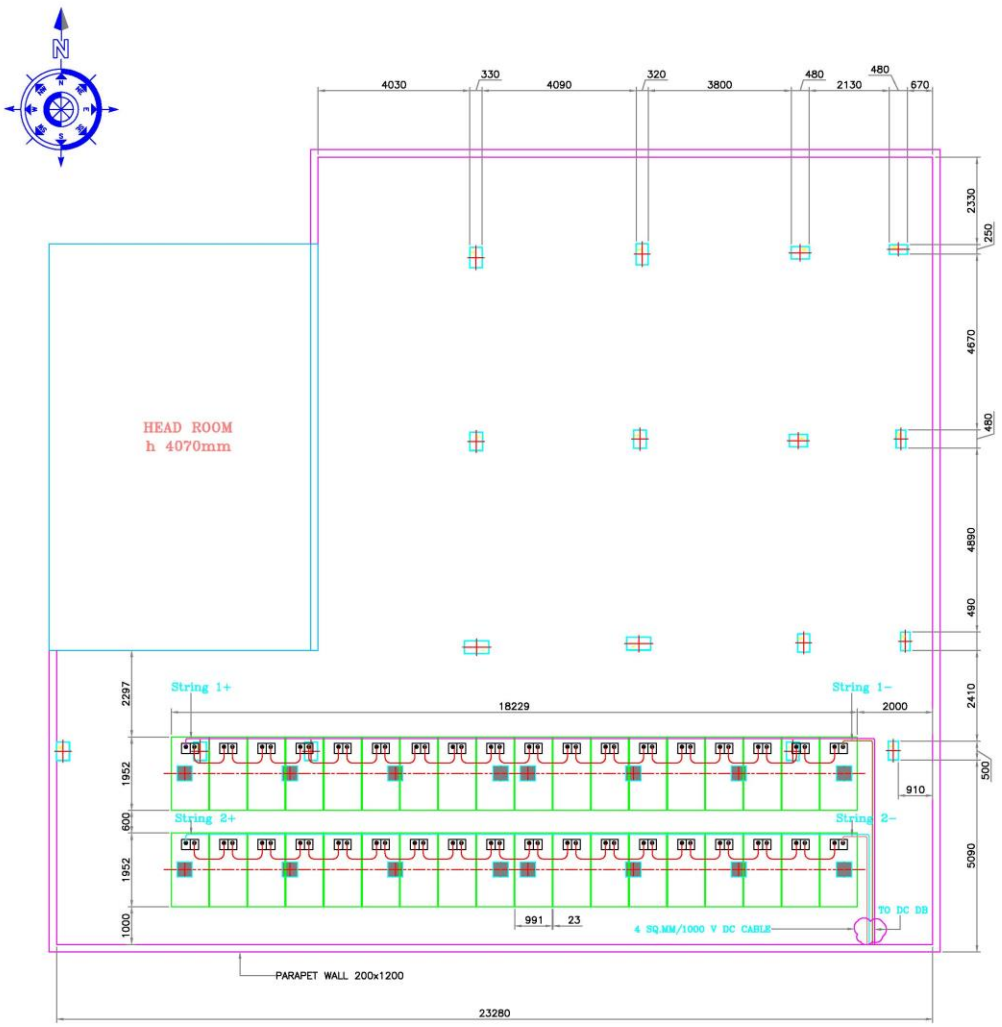
Inverter shall have the software and controls capable of operating the complete system for safe and efficient operation and includes the Islanding protection, Over voltage/ under voltage protection, Ground fault /short circuit protection system, communication equipment such as modems, web box etc, DC reverse polarity protection, Grid monitoring of all the phases & pole sensitive residual current monitoring unit, protection against voltage fluctuations in the grid & protection against internal faults in the power conditioner, operational errors and switching transients etc.

Power Generation Calculation

OM Sakthi Hospital Project -Solar Energy Generation Calculation.												
Basic	kWh/m²/day											
Space required for 1Kwp (m2)	6.629											
Isolation	The monthly average amount of the total solar radiation incident on a horizontal surface at the surface of the earth for a given month											
Chennai Isolation (Source: http://www.gaisma.com/en/location/madras.html)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	4.93	5.83	6.60	6.74	6.18	5.26	4.76	4.89	5.08	4.50	4.16	4.32
E.g-Insolation x space required x no of days	980.43	1159.41	1312.54	1340.38	1229.02	1046.06	946.62	972.47	1010.26	894.92	827.30	859.12
Solar PV panel Efficiency (15.1%)	148.04	175.07	198.19	202.40	185.58	157.95	142.94	146.84	152.55	135.13	124.92	129.73
Average Power Generation per Day (KWh or Units)	4.93	5.84	6.61	6.75	6.19	5.27	4.76	4.89	5.08	4.50	4.16	4.32
Consider the total system efficiency @ 95%	4.69	5.54	6.28	6.41	5.88	5.00	4.53	4.65	4.83	4.28	3.96	4.11
Total Units Generate per day in 1Kwp system is	4.69	5.54	6.28	6.41	5.88	5.00	4.53	4.65	4.83	4.28	3.96	4.11
No of Days in the Month	31	28	31	30	31	30	31	31	30	31	30	31
Total Units Generate per Month in 20Kwp system is	2906.61	3104.60	3891.21	3845.56	3643.58	3001.14	2806.38	2883.03	2898.43	2653.09	2373.52	2546.97
Total average Units Generate Per Year by 20Kwp system (kwh)	**36554.13**											

BOQ

Basic BOQ					
S.no	**Description**	**Specification**	**Make**	**Unit**	**Qty**
1	PV Module	20.8 Kwp	Emmvee 290Wp Module	Nos	72
2	Inverter	020K - Grid Connected	REFU	Nos	1
3	PVC Double Insulated Copper DC Cable	4Sq.mm, 1000 Volts Rated	Top Cable(Spain) -Model 1x4 ZZ-F (AS)	Mts	500
4	DC Cable Connector	4mm2 cable,MC4 Compatible,IP67	BizLink-Sunbolts PV cable Connector - Model No: S418-31B	Pair	20
5	Fuse	MC4 In line fuse - 10Amps/1000V rates OR Fuse gadrage with holder	BizLink-Sunbolts PV cable Connector /ABB	Nos	8
6	DC Breaker Switch	12 Amps/1000 V Rate	Benedict	Nos	4
7	DC Distribution board		Fabrication	Nos	1
8	AC MCB	4 Ways-3Phase - 40Amps	ABB/Schneider	Nos	1
9	3 phase Energy Meter	40Amps 3 Phase/Pulse output direct type	ABB	Nos	1
10	AC Cable	10 Sq.mm Copper cable-4 core - Armored	Polycab	Mts	5
11	AC Power Distribution Board		Fabrication	Nos	1
12	Flexible Cable	4Core Flexible cable-4Sq.mm (RYBG)	Polycab	Mts	2
13	PV Module Structure	Structure for 18 x 2 Array (15 Degree Tilt) Anodized MS carefully designed by considering wind load at site	Fabrication	Kgs	1000
14	Inverter & DB Structure	MS Painted / Anodized	Fabrication	Kgs	100
15	Concrete				As Required
16	Earthing	Dedicated Earthing)/ Copper plate /green earth cable/			As Required
17	Nut / Bolt / Screws/ Fasteners	Nut and bolt to fix Pv module & Inverter in the structure		Nos	As Required
18	Conduit Pipe	Heavy Duty PVC Conduit pipe		Mts	As Required
19	Accessories	As Required		Mts	As Required



ROOF TOP PANEL WIRING ARRANGEMENT

LEGEND

PV MODULE	SPEC	NOs
	290 Wp	36

FIN GREEN SOLUTIONS	
CLIENT: OM SHAKTHI HOSPITAL, ERODE	
PROJECT: SOLAR ROOF TOP	
TITLE: SOLAR PANEL WIRING LAYOUT	SCALE 1:75
DRG.NO: FGS/OSH-DWG-002	SIZE A2