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100KW Rooftop Solar Photovoltaic Power Plant: Block "B" of Ahsanullah University of Science and Technology

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Abstract: *In Bangladesh, conventional forms of energy are used to generate electricity but at contrast renewable sources of energy should be used because industrialization has caused degradation of environment which affects the consumption of energy sources at great extent. In this paper, a renewable source is proposed named "Photovoltaic power" which will be used to design a system of electricity generation at the rooftop of ahsanullah University of science and technology (Block-b). Design procedures, cost estimation of grid connected to power plant, calculations are described here.*

Keyword: *Renewable energy, photovoltaic energy, solar power, location analysis, capacity calculation, autocad, sunny design web.*

I. Introduction

When power quality problems arise because of the existed local generation of energy, adoption of new renewable energy becomes necessary. This paper deals with the use and design of photovoltaic system which will be used for an area of 6,000 ft square.[3]Photovoltaic process means production of electricity directly from sunlight where photovoltaic cells are used to interact with the sunlight with internal semiconductor materials.[4]For design layout and calculations for getting practical data and location analyzing "AutoCAD" and "Sunny Design" software are used[5][6] and estimated cost calcula is attached.[2]

II. Methods

For system installation at the certain area of the rooftop, cells have to be connected with south facing tilt angle of 30 degrees considering 23.8035 latitude.[7]

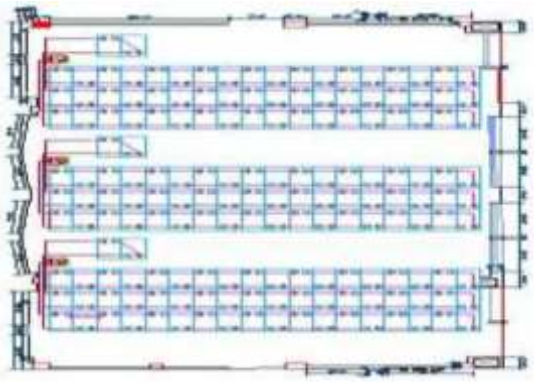

Fig. 1 Design Layout of Ahsanullah university Block rooftop by AutoCAD.

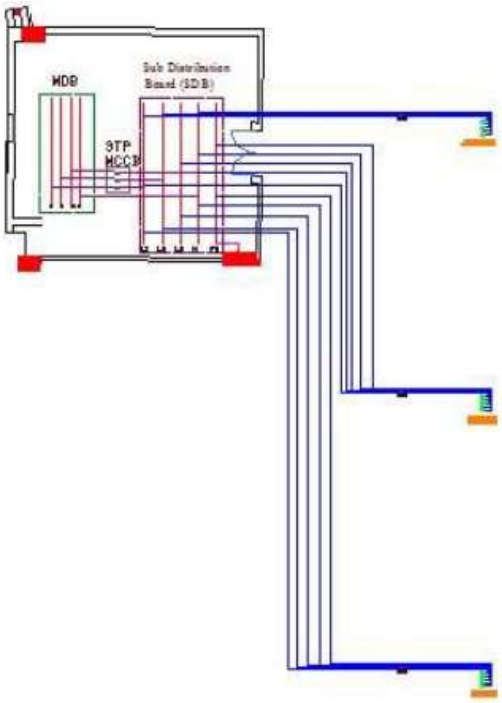

Fig. 2 Design Layout of Ahsanullah university Block rooftop(inverter to MDB) by AutoCAD .

For servicing purpose, distance between panels and parapet wall has to be 5 ft. Building loads are connected to photovoltaic grid and inverter is placed outside.[1]Surplus energy is fed back to grid for night or bad weather condition. Bidirectional type service connection meter is needed.[8]

III. Findings And Argument

By using „sunny design" software we have achieved the following data:
Azimuth Angle 0 Tilt Angle 23 mounting type: Roof
PV design data (Headings)
Total number of PV modules- 168
Peak power- 48.12kwp
Number of PV inverter -3
Nominal AC power of the PV inverter -45.00 KW
AC Active power – 45.00 KW
Active power ratio -92.4%
Annual energy yield* – 81,950.50 KWh
Energy usability factor -100%
Performance ratio -87.2%
Specific energy yield -1682 kwh/kwp
Line losses(in % of PV energy): ……
Unbalanced load: 0.00 VA
The required no of PV modules =168 which has to be accommodate within the free space of the rooftop of about 6,000 ft2
The entire design can sectionalize in one part.
The specifications of section 1 are given below 3×STP15000TL-30
Peak power: 48.72KWp
Total number of PV modules: 168
No of PV inverter: 3
Maximum DC power: 15.33 KW
Maximum AC active power: 15.00 KW
Grid voltage: 230V (230/400V)
Nominal power ratio: 94%
Dimensioning factor: 106%
Displacement power factorcosØ: 1

Table 1: Financial overview

No	Equipment's	Quantity	Unit price	Price
1	Solar panel	168	65 tk/watt	31,66800
2	Inverter	3	4,75000	14,25000
3	Cable	426m		56,564
4	MCCB	4 piece	16000	64,000
5	MDB			60,000
6	Potential Earthing			1,00000
Total cost=48,72364/BDT				

Peak power watts, Pmax= 290 Wp
No of solar panels =X
Y= X× Space factor
Here , Space factor is 0.9
So, The Plant Capacity = Y× Pmax

$$\text{The Energy}=\frac{Plant\ \ Capacity\ \times Plant\ \ efficiency}{Operating\ \ Time}\ \ \text{(unit : Kwh/day)}$$

Here Operating Time =4.5hours per day
Plant Efficiency = 85 %
In our Design ,
No of solar panels ,X=168
Y= X× Space factor
= 168×0.9
=151.2
Plant Capacity = Y× Pmax

$$= (151.2\times 290\ Wp)$$
$$= 43.848\ kWp \approx 44\ kWp$$

$$\text{The Energy}=\frac{Plant\ \ Capacity\ \times Plant\ \ efficiency}{Operating\ \ Time}\ \ \text{(unit : Kwh/day)}$$
$$=\frac{44\times 0.85}{4.5}\ \text{Kwh/day}$$
$$= 8.31\ \text{Kwh/day}$$

Per Watt Cost

$$= Total\ Cost \div Plant\ Capacity$$
$$=48{,}72364\text{BDT} \div 44000\ Wp$$
$$=110.73\text{BDT per}\ Wp \approx 111\ \text{BDT per}\ Wp.$$

IV. Conclusion

Proposed design costs 48,72, 364 BDT and daily energy generation fed into grid is approximately 8.31kwh/day.The outputs are calculated on the basis of 6,000ft square area and the methodology of this can be adopted for similar system design and analysis.

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