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Estimation of Cost Analysis for 4 Kw Grids Connected Solar Photovoltiac Plant

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ABSTRACT: *The depletion of fossil fuel resources on a worldwide basis has necessitated an urgent search for alternative energy sources to meet up the present day demands. Solar energy being a clean, inexhaustible and environment-friendly potential resource among all renewable energy options. But in the present scenario, there is a need of continuous supply of energy, which cannot be full filled by alone wind energy system or solar photovoltaic system due to seasonal and periodic variations. Therefore, in order to satisfy the load demand the combination of solar and conventional conversion units are now being implemented as a Grid connected energy systems. The objective of this work is to estimate the cost analysis for 4 KW grid connected solar photovoltaic plant and developed a system based on the potential estimations made for a chosen area of 50m². The specifications of equipment are provided based on the availability of the component in India. Annual energy generation by proposed Grid connected SPV power plant is calculated.*

KEYWORDS: *Solar energy, Grid connected SPV system.*

I. INTRODUCTION

Photovoltaic's offer consumers the ability to generate electricity in a clean, quiet and reliable way. Photovoltaic systems are comprised of photovoltaic cells, devices that converted light energy directly into electricity. It is anticipated that photovoltaic systems will experience an enormous increase in the decades to come. However, a successful integration of solar energy technologies into the existing energy structure depends also on a detailed knowledge of the solar resource. But to note it is essential to state the amount of literature on solar energy, the solar energy system and PV grid connected system is enormous. Grid interconnection of photovoltaic (PV) power generation system has the advantage of more effective utilization of generated power. However, the technical requirements from both the utility power system grid side and the PV system side need to be satisfied to ensure the safety of the PV installer and the reliability of the utility grid. For this survey we have gone through different books, journals and papers to get its keen knowledge.

II. LITERATURE REVIEW

Souvik Ganguli et.al (2009) [1] presented a Estimation of Grid Quality Solar Photovoltaic Power Generation Potential and its Cost Analysis in Some Districts of West Bengal. The objective of their work was to estimate the potential of grid quality solar photovoltaic power in some districts of West Bengal (Birbhum, Burdwan, Hooghly, Howrah and Kolkata), study the solar radiation level and potential of the above mentioned districts and finally develop a system corresponding to the potential. Equipment specifications were provided based on the system developed and finally cost analysis was also carried out.

A.S. Elhodeiby et.al (2011) [2] presented a performance analysis of 3.6 kW Rooftop grid connected solar photovoltaic system in Egypt. The system was monitored for one year and all the electricity generated was fed into the 220 V, 50 Hz low voltage grid to the consumer. D.Picault et.al (2009) [3] presented an over view of current architectures used in grid connected systems, five key points for comparison based on topology upgradeability, performance under shaded conditions, degraded mode operation, investment costs and ancillary service participation. The proposed method can be adapted to the user's particular needs and expectations of the photovoltaic plant. These evaluation guidelines may assist grid-tied PV system users to choose the most convenient topology for their application by weighting the evaluation criteria Phil Bolduc et.al [4] presented a paper about performance of a grid –connected PV system with energy storage. One kilowatt amorphous photovoltaic system has been operated in a grid-connected mode with energy storage. The purpose of the system development and performance experiment is to investigate the additional value a gridconnected system garners with dispatchable battery energy storage. These values are then weighed against the added cost of the system and inefficiencies incurred in the charging and discharging of the battery.

R. Ramkumar et.al (1993) [5] presented a paper of photovoltaic systems including a discussion of major U.S. and international activities. After a brief review of system types and output characteristics, various system configurations were discussed and a classification based on photovoltaic (PV) system rating was provided. Modeling, design, and economic Considerations were briefly discussed. The worldwide status of PV system technology was discussed with a view to making an assessment of the future. The assessment presented includes some specific areas for further research and development.

Eduardo Románet.al (2006) [6] presented a performance of a grid connected PV system with energy storage. three kilo watt amorphous photovoltaic system has been operated in a grid-connected mode with energy storage. The purpose of the system development and performance experiment is to investigate the additional value a grid connected system garners with dispatch able battery energy storage. These values are then weighed against the added cost of the system and inefficiencies incurred in the charging and discharging of the battery.
Evert Nieuwlaar (1997) [7] presented an over view of current power generation used in grid connected systems, the points for comparison based on, performance under shaded conditions, degraded mode operation, investment costs and ancillary service participation. The

proposed method can be adapted to the user's particular needs and expectations of the photovoltaic plant. These evaluation guidelines may assist grid-tied PV system users to choose the most convenient topology for their application by weighting the evaluation criteria.

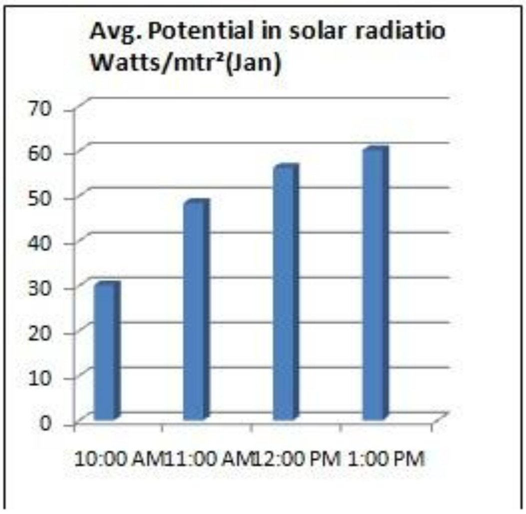
Kosuke Kurokawa et.al (2002) [8] presented paper about the cost analysis of very large scale PV system on the world desert. a 100 MW very large scale photovoltaic power generation (VLS-PV) system was estimated assuming that it is installed on the would deserts, which are Sahara, Negev, Sonora, Great Sandy and Gobi desert. PV array was dimensioned in detail in terms of array layout, support, foundation, wiring and so on.

III. METHODOLOGY

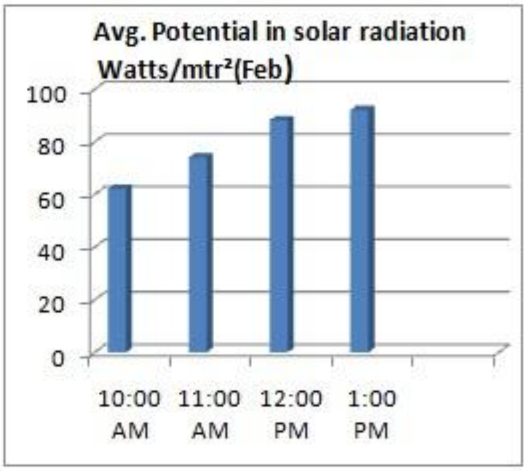
To find out the cost analysis for 4 KW grid connected solar PV plant in India, the solar radiation over different months measured. Then the diurnal variations, average monthly output are find out and related graphs are plot for showing the variation. We started our project work from January month. So we measured value of solar radiation from January to April month after that we calculated the diurnal variations, average monthly output for four months (Jan 2012 to April 2012). Thus from these data we can estimate the rating of solar PV power plant for Indore. For estimation of solar potential we need reading of solar radiation for our site. For the better understanding of the methodology, the measured radiation data sheet of Indore district for the month of April 2012 has been given as a sample. The diurnal variation for four months are plotted. From that the monthly output are calculated. Input solar radiation means how much amount of solar radiation is coming from sun and Output solar radiation means how much amount of solar radiation we can utilize to generate electricity which is depends upon the efficiency of the PV module. For calculating the output the efficiency of the PV module is taken as 13.2%. Chosen area for the estimated plant capacity is considered as 50 m².

3.1 Graphs for Diurnal Variations (Jan 2012 to April 2012)

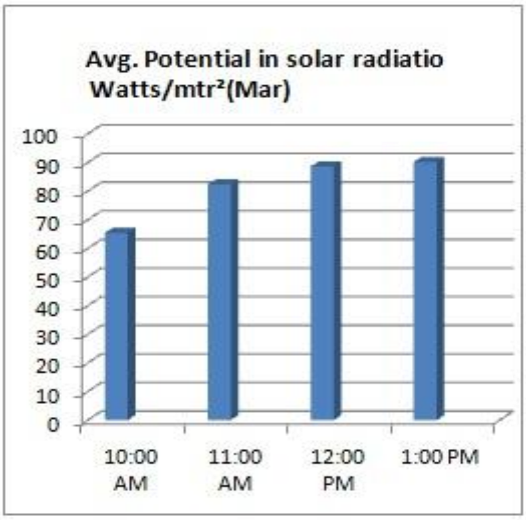
Graph is plotted between average solar radiation available in Watts/mtr² and different time interval of day for different months.



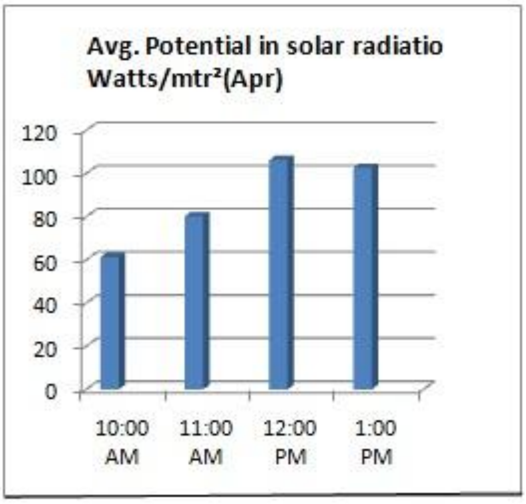
Graph 1



Graph 2



Graph 3

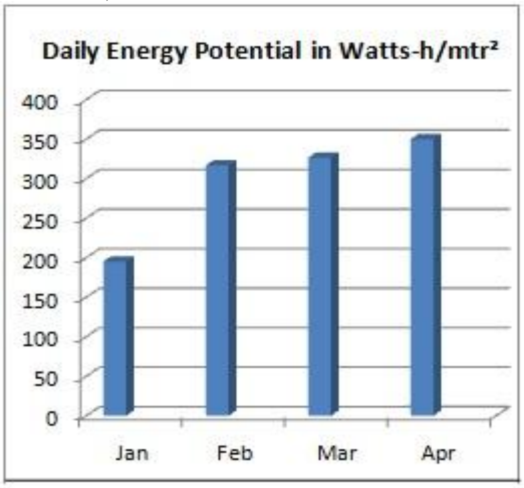


Graph 4

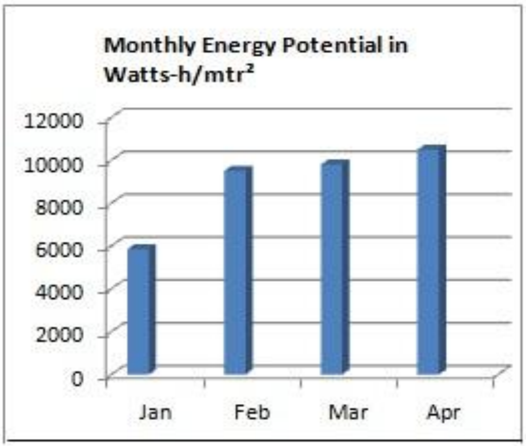
IV. TOTAL POTENTIAL

Here the average yearly energy output is calculated by multiplying average monthly energy output with total number of month12. The daily energy output also calculated for various months shown in 2nd coulomb. Monthly energy output is calculated by multiplying the number of days of month with the daily energy output shown in 3rd coulomb for various months. Kilowatt-Hour (kWh) means 1,000 thousand watts acting over a period of 1 hour. The kWh is a unit of energy. 1 kWh=3600kJ.

4.1 Graph for Daily & Monthly Energy Potentials (Watt/ mtr²-hr)



Graph 5,6



V. COST ANALYSIS FOR 4 KW GRID CONNECTED SOLAR PV

VI. PLANT

A. Cost of Solar panels: - we use the BP 5128 most powerful module manufactured by BP Solar [34], cost of solar panel is Rs.140 per watt. So cost of 150 watt panel is (150 × 140) Rs.21000.
We use 40 numbers of panels so Cost estimate for total panels used (40 × 21000)
Rs.840000.

B. Cost of 3-φ Inverter: - Only one piece of 10.5 - 12 KVA or 10 KW of an inverter
Power Conditioning Unit is used, multiply the size of the inverter by Rs. 25 per rated
watt.
Cost estimate for Inverter (25 × 10000) Rs. 250000.

C. Cost of 3-φ step up Transformer: - Only one piece of 12 KVA or 10 KW of a step up. Transformer is used, multiply the size of the Transformer by Rs. 20 per rated watt.
Cost estimate for Inverter (20 × 10000) Rs. 200000.
Subtotal: Rs.1290000.

D. Multiply the subtotal above by 0.2 (20%) to cover balance of system costs (wire,
fuses, switches, etc.).
Cost Estimate for Balance of System: (1290000 × 0.2) Rs. 258000.
Total Estimated PV System Cost is Rs.1548000.

VI. CONCLUSION

The design described is based on the potential measured. System sizing and specifications are provided based on the design made. Finally, cost analysis is carried out for the proposed design. Total Estimated PV System Cost is Rs1548000.The methodology adopted seems satisfactory for determining the possible plant capacity for an arbitrarily chosen area.

VII. ACKNOWLEDGEMENT

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