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CALCULATION OF SOLAR PHOTOVOLTAIC GENRATION USING DAILY HOURS OF BRIGHT SUNSHINE FOR SIZING THE PV- SYSTEM

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Abstract- The measurement of instantaneous solar radiation and daily ambient temperature in Chandrapur, India (latitude 20.060N' and longitude 79.30E) is presented. The measurements covered one year from month of 1st July 2010 to 30th June 2011. The data were used to obtain the average monthly output, yearly average output and the average solar radiation. The polycrystalline PV module is considered for this study. Further, possible plant capacity is estimated for an arbitrary chosen area. The results supported justified the method proposed.
Keywords- Solar radiation, Photovoltaic system, solar energy potential.

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Introduction

Solar radiation is radiant energy emitted by the sun from a nuclear fusion reaction that creates electromagnetic energy. It is the dominant, direct energy input into the terrestrial ecosystem; and it affects all physical, chemical, and biological processes. The sun provides a natural influence on the earth's atmosphere and climate [1].

Solar energy is abundant, free and clean. Nowadays, there is the campaign for the popularization of solar energy for domestic and industrial uses, the need, to know how to evaluate radiation levels for any site becomes paramount. It is therefore, necessary to approximate radiation from commonly available climate parameters such as sunshine hours, relative humidity, maximum and minimum temperatures, cloud cover and geographic location. Solar energy modeling focuses upon the level of solar radiation incident at a given location on the earth's surface. This is simply a function of; (i) the level of solar intensity reaching the top of the earth's atmosphere; (ii) the transmission of radiation through the earth's atmosphere and; (iii) the location and orientation of collecting surfaces on the earth's surface with respect to the position of the sun with time. [2]

Sun emits energy at an extremely large and relatively constant rate; 24 h per day, 365 days per year. If all of this energy could be converted into usable forms on earth, it would be more than enough to supply the world's energy demand. However, this is not possible because;(i) the earth intercepts only a small fraction of the energy that leaves the sun; (ii) the earth rotates such that a collection device on the earth's surface is exposed to solar energy for only about half of each 24 hour period and;(iii) conditions of the atmosphere such as clouds and dust, sometimes significantly reduce the amount of solar energy reaching the earth's surface. Weather patterns and other atmospheric conditions which scatter incoming rays also affect the rate at which solar energy reaches the earth's surface. The summation of the amount of solar energy arriving at a unit of area (one sq. mt.) during 1 hour is called the solar radiation or insolation (U.S. polycrystalline Technology White Paper, 2006). [3]

Methodology

To find out the solar photovoltaic generation potential at Chandrapur, the solar radiation data for one year (1st July, 2010 to 30th June, 2011) is measured. For this work, polycrystalline PV

module with efficiency 11% is considered. The chosen area for the estimated plant capacity is considered as 100 sq. Meter. The monthly average output, yearly average output and possible plant capacity has been determined. [4]

Observations and Discussion

Table 1- Solar radiation data for the month May-2011 taken as sample

Date	Radiation KW/M2 Day	Start Time	Stop Time	Total Hrs
1-May-2011	5.25	6.15	18.15	12.00
2-May-2011	4.96	6.15	18.15	12.00
3- May-2011	5.85	6.10	18.15	12.05
4-May-2011	6.08	6.10	18.20	12.10
5-May-2011	5.94	6.10	18.20	12.10
6-May-2011	5.69	6.10	18.20	12.10
7-May-2011	5.53	6.05	18.20	12.15
8-May-2011	5.64	6.05	18.20	12.15
9-May-2011	5.38	6.10	18.20	12.10
10-May-2011	4.43	6.00	18.20	12.20
11-May-2011	5.01	6.10	18.15	12.05
12-May-2011	5.46	6.00	18.20	12.20
13-May-2011	5.51	6.05	18.20	12.15
14-May-2011	5.42	6.05	18.20	12.15
15-May-2011	3.55	6.00	18.20	12.20
16-May-2011	5.35	6.05	18.25	12.20
17-May-2011	4.13	6.10	18.25	12.15
18-May-2011	4.71	6.25	18.25	12.00
19-May-2011	5.06	6.10	18.15	12.05
20-May-2011	5.26	6.10	18.25	12.15
21-May-2011	5.74	6.00	18.25	12.25
22-May-2011	5.45	6.15	18.25	12.10
23-May-2011	5.40	6.10	18.25	12.15
24-May-2011	5.34	6.05	18.25	12.15
25-May-2011	5.21	6.10	18.20	12.15
26-May-2011	4.86	6.05	18.20	12.15
27-May-2011	5.44	6.05	18.25	12.15
28-May-2011	5.34	6.10	18.25	12.15
29-May-2011	5.15	6.05	18.20	12.15
30-May-2011	4.59	6.00	18.30	12.30
31-May-2011	5.05	6.00	18.30	12.30
TOTAL	5.22			

Table 2- Solar Radiation Data available from Radiation Hand-Book, NASA data and Actual data for One Year at Chandrapur (India)

Month	Data from Radiation hand-Book (KW/M2/D)	Data From NASA (KW/M2/D)	Actual Radiation (KW/M2/D)
Jul-2010	5.42	7.04	3.32
Aug-2010	5.52	6.68	3.66
Sep-2010	5.46	6.18	4.25
Oct-2010	4.6	5.5	4.68
Nov-2010	4.3	4.59	4.45
Dec-2010	3.96	4.07	3.88
Jan-2011	5.04	4.3	4.31
Feb-2011	6.12	5.39	4.84
Mar-2011	6.69	6.38	5.32
Apr-2011	6.8	7.05	5.28
May-2011	6.28	7.45	5.22
June-2011	5.59	7.17	3.98

From the result obtained, it is found that, in the month of August, produced the lowest solar radiation. And in the month of March, produced the highest solar radiation. Monthly and Yearly outputs were calculated on the basis of 100 sq. mt. area. The methodology adopted seems satisfactory for determining the possible plant capacity for an arbitrary chosen area. From the calculations, we found a solar Photovoltaic power plant capacity 45 KW can be achieved in Chandrapur, India over an available area 100 Sq. Mt.

Table 3- Monthly Radiation data, Calculations of various outputs and Possible Plant capacity. polycrystalline PV Module: Efficiency: 11.00 % [6]

Month	Radiation KW/M² / Day	Output KW/M²	Monthly Output KW/M²	Monthly Average Output KW/M²	Yearly Average Output KW/M²	Average output for 100 mtr. sq. area KW	Possible Plant Capacity KW
Jul-2010	3.32	0.3652	11.321	14.767	177.204	17720.7	45
Aug- 2010	3.66	0.4026	12.48				
Sep-2010	4.25	0.4675	14.025				
Oct-2010	4.68	0.5148	15.958				
Nov-2010	4.45	0.4895	14.685				
Dec-2010	3.88	0.4268	13.231				
Jan-2011	4.31	0.4771	14.697				
Feb-2011	4.84	0.4928	13.798				
Mar-2011	5.32	0.5852	18.141				
Apr-2011	5.28	0.5808	18.004				
May-2011	5.22	0.5742	17.8				
Jun-2011	3.98	0.4378	13.134				

Conclusion

The hourly radiation as well as the daily average radiation and daily ambient temperature data for Chandrapur, India have been presented covering 365 days for one year. The measured values of solar radiation obtained for Chandrapur in the present work has enabled a comparison to be made with the values obtained in Radiation Hand-Book and Data from NASA. Maximum Power Point Tracking (MPPT) has not been employed for the calculation which could have produced better results. It is found that in the month of March and April which offers the highest solar radiation, the result would have been for more accurate and yielded higher capacity plant. For future studies, designing, cost analysis and efficiency calculations of this solar photovoltaic power plant now need to be done once the capacity is estimated, which can be carried out in future publications. .Environmental impact of this photovoltaic plant can be taken up as one of the important issues in near future.

References

[1] Chiemeka I.U. (2008) *International Journal of Physical Science*, 3 (5), 126-130.
[2] Souvik Ganguli and Jasvir Singh (2010) *International Journal of applied engineering research Dindigul*, 1(2), 253-260.
[3] Falayi E.O., Adetitan J.O. and Rabiu A.B. (2008) *International Journal of Physical Science*, 3(9), 210-216.
[4] Ravindar Kumar and Umakand L. (2005) *journal of renewable energy*, 2221-2233.
[5] Iranna Korachagaon and Bapat V.N. (2009) *Journal of information knowledge and research in electrical engineering*, 1 (1), 05-08.
[6] Akhlaque Ahmed M., Firoz Ahmed and Wasim Akhtar M., (2009) *Journal of Basic & applied science*, 5(2).
[7] Solanki C.S. (2009) *BP Solar data sheet*.