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Modeling and Simulation of 2KW Grid Connected Photovoltaic System using PVsyst Software

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ABSTRACT

This paper states a complete modeling and simulation of 2KW solar PV grid connecting at the site of Chandigarh University. PVsyst software package was used to analyze the performance ratio and the different losses that occur in the system.

Keywords : Modeling, Simulation, Grid, PVsyst

I. INTRODUCTION

Electrical is an essential part of our way of life. Most of the electrical is currently provided from the conventional thermal or hydro power stations. With the growing concern about the green house gas emission and other environmental issue the renewable energy technologies such as photovoltaic cells are increasingly being recommended for electricity production. Grid – connected PV system are the most popular solar electric system on the market today . Grid connected systems are system connected to a large independent grid usually the public electricity grid and feed power directly into the grid. These system are usually employed in decentralized grid-connected PV application and centralized grid-connected.

II. GEOGRAFHICAL LOCATION OF THE SITE

Chandigarh University is in Gharaun and commune in Punjab in Northern India. It is located at latitude 30.77°N and longitude 76.58°E. The temperature ranges from 23.2°C to 27.5°C in summer and reaches to as low 10.1°C in winter. provides an ideal environment for any Photovoltaic power plant projects. Therefore it is a perfect location for implementing the PV power plant for our study.

Table 1.System characteristics

PV-field Nominal power (STC)	P_{normal}	2.0 kWP
Collector area	Acoll	13m^2
Annual energy yield	Eyear	3.85 MWh
Economical gross evaluation	Investment	83337 EUR
Specific yield		1923 KWh/KWp
Energy price		0.22 EUR/KWh

III. DISCRIPTION OF THE SOLAR PV-GRID SYSTEM

A grid-connected PV system consists of solar panels, inverters, a power conditioning unit and grid connection equipment. It has effective utilization of power that is generated from solar energy as there are no energy storage losses. When conditions are right,

the grid-connected PV system supplies the excess power, beyond consumption by the connected load to utility grid. The proposed model is illustrated in fig. 1 by PV syst software.

Fig 1. Top view of solar plant

A. Specification of PV Module Used in the system

Table 2 shows the manufacturer's specification.

Table 2. System characteristics

Nominal Power	320.0 Wp
Technology	Si-Poly
Rated Voltage	3630 V
Rated current	8.94 A
Open circuit voltage	45.0 V
Short circuit current	9.16 A
Fuse Rating	15 A
Application Class	Class A

B. Inclination and Orientation

PV panels are optimized for the best orientation according to solar path in to gain maximum solar irradiation and the yearly result is that the tilt angle is 30° and Azimuth angle is 0° in fig.2 and the summer and winter are shown in fig.3 ,fig.4 and fig 5 respectively.

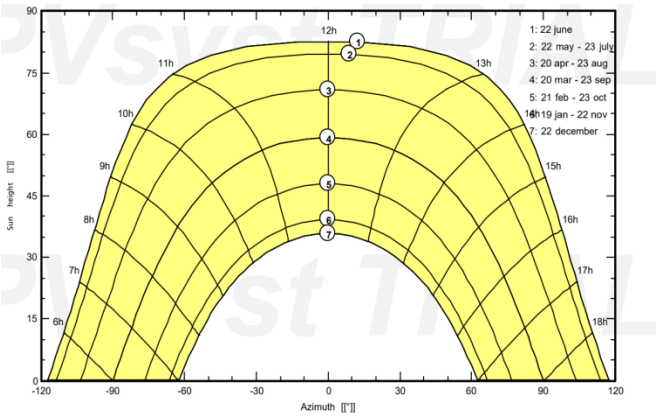

Fig 2. Solar Irradiance

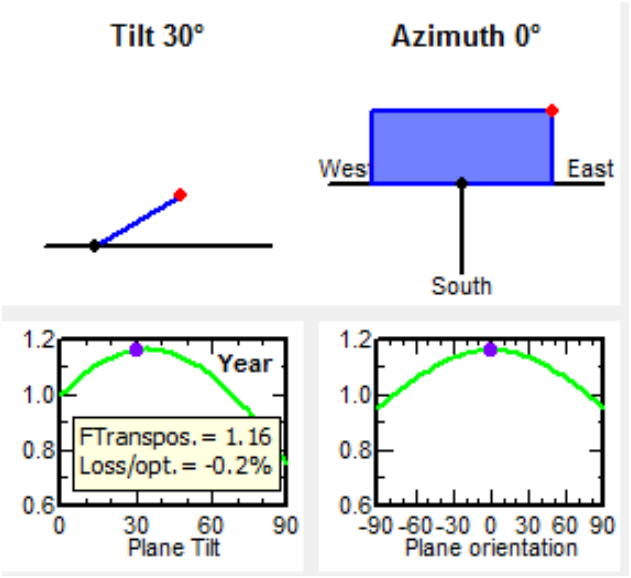

Fig 3. Yearly Solar Irradiance variation

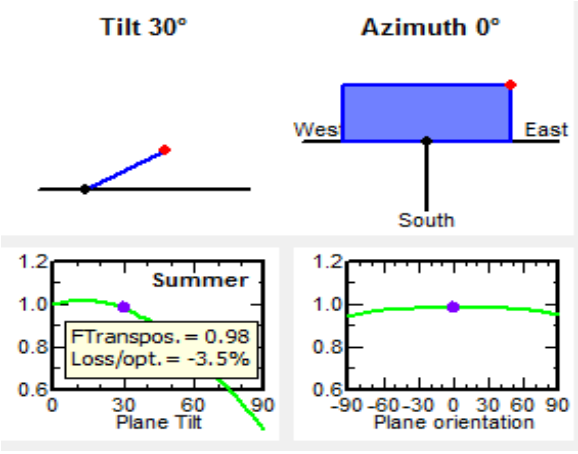

Fig 4. Solar Irradiance variation in summer

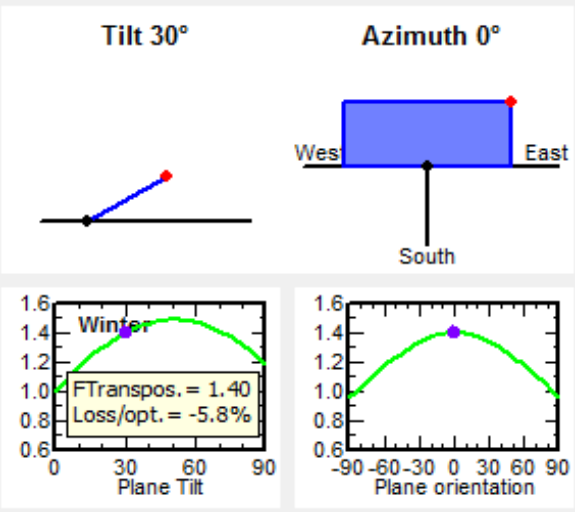

Fig. 5 Solar Irradiance variation in Winter

C. Inverter

This study uses 2units of1 KW to get a total of 2KW.The output is set to 400 V at 50HZ for compatibility in Gharaun.

IV. RESULTS AND DISSCUSSION

Fig.6 depicts the current and voltage generated from the photovoltaic array for a day which the current is 45.0 the average voltage is 254.8 and the effective energy at the output of the array is 306KWh/day. Fig.7 shows the daily system output energy generated from our system for a month which the energy injected to the grid is 9.86 Wh/day

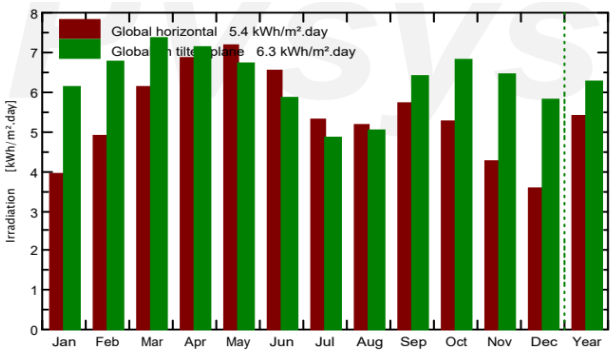

Fig. 6 Global horizontal and tilt irradiance

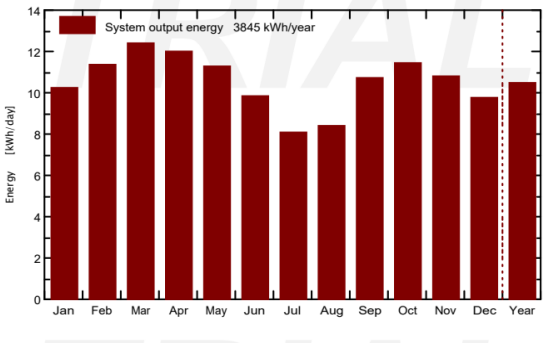

Fig. 7 System output energy

Table 3 shows the balances and the main results of grid connected PV system. Yearly global horizontal irradiation is 5.41KWh/m2. The yearly global incident energy on the collector plane is 6.27 KWh/m². Energy available at the output of the PV array is 10.53KWh. The yearly average efficiency of the system is 60 % . The yearly ambient temperature is 18.23°.Figure 8 shows the cost analysis.

Table 3 Monthly irradiance and system output

	Gl. horiz. kWh/m².day	Coll. Plane kWh/m².day	System output kWh/day	System output kWh
Jan.	3.95	6.11	10.27	319
Feb.	4.91	6.76	11.36	318
Mar.	6.13	7.37	12.38	384
Apr.	6.87	7.15	12.02	361
May	7.18	6.73	11.32	351
June	6.52	5.86	9.84	295
July	5.30	4.83	8.12	252
Aug.	5.17	5.02	8.44	262
Sep.	5.73	6.40	10.75	323
Oct.	5.25	6.82	11.46	355
Nov.	4.27	6.44	10.82	325
Dec.	3.57	5.80	9.74	302
Year	5.40	6.27	10.53	3845

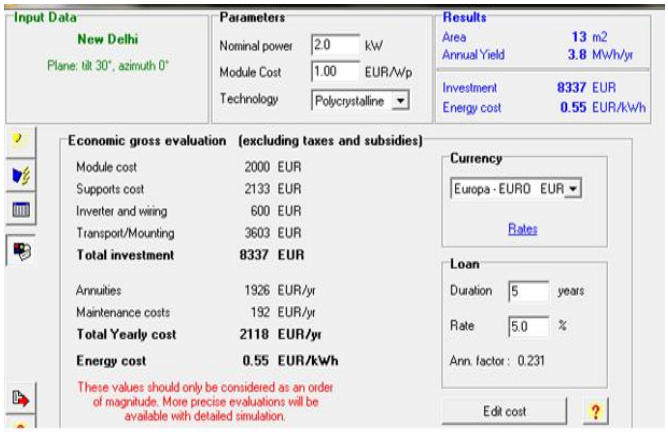

Fig. 8 System cost analysis

V. CONCLUSION

Solar power is a immense source of directly useable energy .The energy of light shifts electrons in some semiconducting materials. This photovoltaic effect is capable of large-scale electricity generator. The use of this energy is free, does not create pollution, and if used wisely can help us become less dependent on other more costly and damaging forms of power. However, the present low efficiency of solar PV cells demand very large areas to supply electricity demands. Lastly, I would say that if we use solar energy, then you can count on pollution and this energy is coming from the sun which is a natural element.

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