SIMULATION AND OPTIMISATION OF A SOLAR PANEL: A CASE STUDY FOR SURESH GYAN VIHAR UNIVERSITY CAMPUS

Vivek kumar jayswal[1]Vishu Gupta[2] Hari kumar singh[3]
Suresh GyanVihar University, Jagatpura, jaipur, Rajasthan
M.tech (under dual degree) Electrical Engineering+ Energy Engineering

Abstract- In current year, endurable and entire renewable energy resources are extensively used in electrical energy generation system. Mainly, solar energy conservation systems are apply in stand -alone system. Solar panels covert solar radiation into direct electrical energy. Solar panels are one of the most potential renewable energy technologies for refreshing building. In this study, responsibility analysis of a solar system installed in my collage academic block and hostel is investigated. The system includes solar panel, battery, generator, converter and loads. In this study we calculate overall load in academic block (Electrical engineering department and round building) and only boy hostel. After knowing overall loads result for these buildings we simulate this data through HOMER tool and we obtain the best result which is presented in this paper.

The result obtained from the optimization gives the initial capital cost as 296.000$ while operating cost is 2,882$/yr. Total net present cost (NPC) is 332,846$ and the cost of energy (COE) is 0.212$/kWh.

The main purpose of this research paper is that the maximum demand of energy consumption for both academic block and hostel are simulated through solar panel, for this purpose which amount of solar panel and battery is required.

Keywords- Electrical energy, solar energy, Battery, Solar panel, Renewable energy resources.

I. INTRODUCTION

The solar energy is the one of the most important renewal energy resources. The solar energy comes from the sun. It is the most important fuel sources in the realm of the renewal energy. Solar energy is one of the most promising renewable energy sources mainly in semitropical regions. In India most of power plant work on fossil fuels. The solar photovoltaic system that converts solar energy into electrical energy through individual photovoltaic cells connected in series. [1]


Fig 1: **Solar panel**

This project focused on the simulation and optimisation of a solar panel for my collage building academic block (Electrical engineering dept. & round building) and boy's hostel. In this research paper my combination of various panel are estimated with the analytical method. The

optimisation system consists of photovoltaic (PV) panel, battery, converter, and diesel generator. The minimum value and number of system components are given in below table.[2]
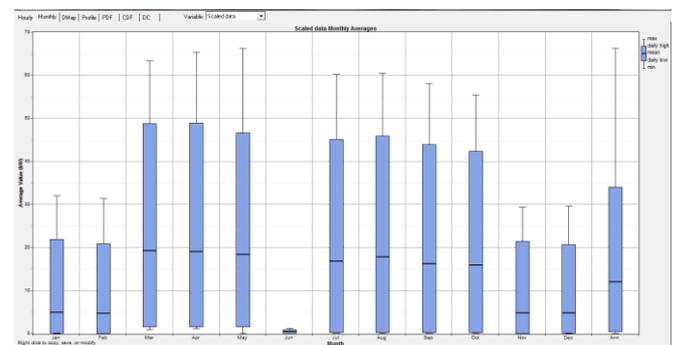
System component	Nominal value
Batter	350
Solar PV	200kw
Converter	75kw

Table 1:- Solar PV system component

The total energy consumption of hostel and academic block is given for whole year is that:
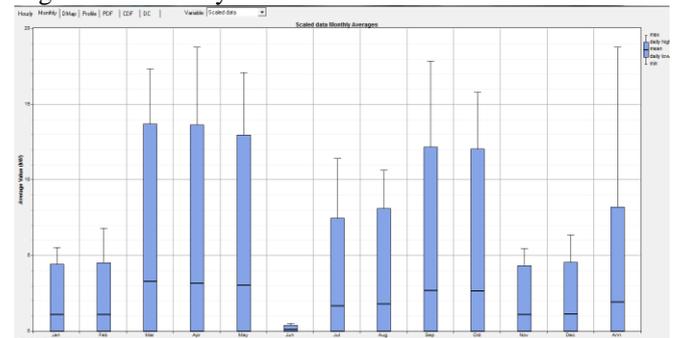
Graph 1 : Academic energy variation for whole year

Graph 2: Hostel energy variation for whole year

Both graph 1 and 2 represent the academic and hostel energy demand for every month. In both graph the energy demand is low in January and February month because this month is winter season so energy consumption is low. Again in month March to may this is summer season so energy demand is high comparatively winter season. In Jun month due to summer vacation the academic block and hostel is

closed so in this month the demand is very low.After this month July and august the college campus will open and energy demand is reaching in initial position, after these month in September and October the rain season will start and demand is low and again in November and December month the winter season is star and energy demand is comparatively less.

II. Solar energy

Today the demand of electrical energy is increasing day by day. The generation of electrical energy is fully dependable on non-renewable energy resources such as coal, uranium etc. Coal is used in the thermal power plant for the generation of electrical power. In the nuclear power plant we use uranium as a fuel for the generation of electrical power. These sources of electrical power generation are very less in amount. These non-renewable energy sources produces large amount of harmful gases such as carbon dioxide (CO_2), carbon monoxide (CO), greenhouse gases (GHG) etc**. [3]**

For this problem we use the renewable energy resources for power generation such as solar power plant. The solar power plant converts the solar radiation from the sun into electrical energy through solar panel. It is very simple process for electricity generation. The main advantage of this solar power plant is that:-

1. No any fuel is required for electricity generation.
2. It doesn't produce any harmful gases such as carbon dioxide, carbon monoxide, greenhouse gas etc.
3. It requires less maintenances and cost is low.
4. It gives better efficiency and continues producing electricity in sunny days.[4]

The main goal of my research is that to make the academic block and boy's hostel of my collage is fully renewable by using solar energy. The total average monthly power demand for academic and hostel is about 46kwh/d with 19kw peak power and 290kwh/d with 66kw peak power respectively. For make it renewable we use various component like generator, converter, battery, PV module etc.
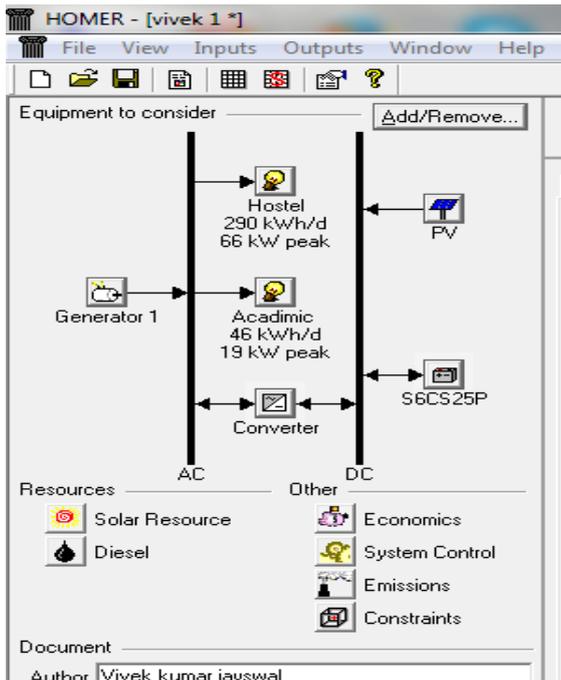

Fig1:-A typical model of solar system for college campus.

In this report the various climate data is taken by Indian metrological department and on the basis of this data simulation is done by HOMER tool.

III. Methodology

The basic steps are taken for making the campus building renewable is:-

1. Determine the solar resources through the metrological data.
2. Calculating the total electricity consumption on monthly average per hour for a hole year.
3. Calculate the total area of roof for establishment of solar panel.
4. Select the various components on the basis of requirement.
5. Simulate the result by using HOMER ENERGY software.

IV. Result

The main result of this research paper is that we have to require the photo voltaic (PV) panel of 200kW label and 350, S6CS25P battery , for total hostel load 290 kWh/d and total peak power is 66 kW and Academic load is 46kWh/d and total peak power is 19 kW. The initial capital cost of whole system is \$296.000 and operating cost is 2,882\$/year. The total NPC (net per cent cost) cost is 332,846\$ and the total COE power (cost of energy) is 0.212\$/kWh and the total renewable frequency is 1.00. We have total area of roof $3434.5m^2$. We use 230W panel of area $1.6m^2$ so we have to require 1000 panel of 230W and it cover area $1600m^2$. This is sufficient for us.
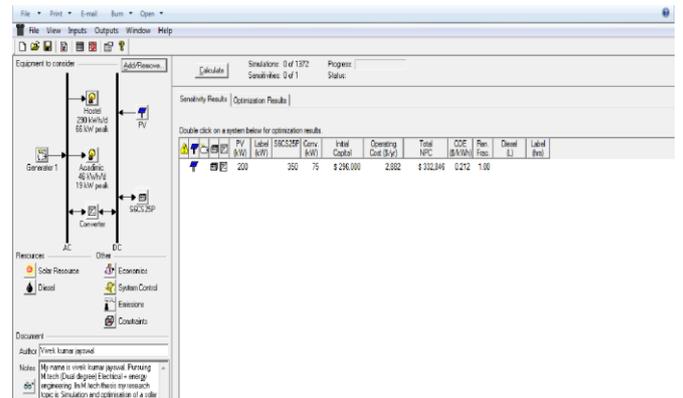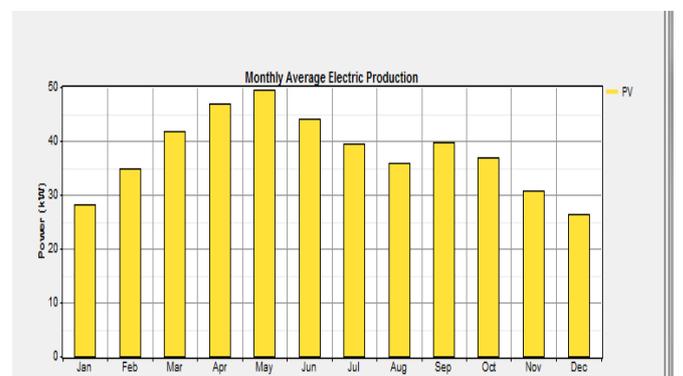

Fig 2: Overall result view

Here the result of monthly average electric production.

Graph 3 : Monthly average electric production

These above graphs represent the monthly average production of electricity through solar panel in college campus.

V.   Conclusion

The main conclusion of this research is that here is the opportunity to make renewable this collage campus. Because the cost of energy is 0.212$/kWh means that in one dollar cost we obtain 0.212kWh energy generate. It is very cost effective. If we use solar project in college campus, the campus is fully self dependable on electrical energy and it can minimise the pollution. As a result of this review, we determine that the most frequent systems are those consisting of a PV, generator with energy storage batteries.

VI.   Future scope

The future scope of renewable of college campus is very bright. We have to sufficient of area for solar panel . Today, in all most places the demand of energy is increasing very fast. So, the solar project is installed in all big buildings and places. If we stable the solar project in Suresh gyan vihar university campus then we generate large amount of electrical power. This paper motivates the other researchers who want to study in the field of solar energy. The future of solar energy is very bright.

REFERENCES

[1]   B.kekezoglu, o.Arikan, A.Erduman,"Reliability analysis of hybrid energy system:case stude of Davutpasa campus". July 2013.

[2]   Arbi Gharakhani siraki, Pragasen pillay, "Study of optimum tilt angles for solar panels in different latitudes for urban application", ELSEVIER 2012.

[3]   H.M.S. Hussein, G.E. Ahmad, H.H.EL-Ghetany,"performance evaluation of photovoltaic modules at different tilt angle and orientations" ELSEVIER 2004.

[4]   Jose l, Bernal-Agustin, Rodolfo Dufo-Lopens,"Simulation and optimization of stand-alone hybride renewable energy". ELSEVIER 2009.

Vivek Kumar jayswal was born in Patna, Bihar on 6 sept. 1992. He is currently pursing M.tech under dual degree (B.tech electrical engineering & M.tech Energy engineering). Presently he works on Simulation and optimisation of a solar panel: A case study for Suresh gyan vihar university campus. His research includes making the college campus fully renewable through solar energy.

B
i
g
h