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A Case Study on Energy Management Using Solar Power Analysis and Simulation Approach of Student Hostel in Giet Gunupur.

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ABSTRACT
The operation of renewable energy source is becoming very compulsory due to restricted reserves of fossil fuels and across-the-board environmental concerns for the production of electric power generation and utilization. For the production of electrical energy by using solar power can be more economical. The fast draw down of conventional sources is forcing to use renewable energy sources as substitute to meet the load power demand of any building, which is completely dangling on grids which are dependent on conventional sources for electricity generation and utilization. So, there is a need to degrade this dependency of loads on grids. For this we need to incorporate the grid technologies to reduce the energy cost of building and thereby reduce consumption of conventional sources. In this paper, analysis is done on combining the PV technology with grid technology for MM-2 LADIES HOSTEL BUILDING of GIET Gunupur, We have taken HOMER simulation software to find how much reduction of cost of energy consumption is possible by this combination. This study can help us to find ways for enhancing the life of conventional fuels in existence and know the reduction of greenhouse emissions**.** Renewable energy is energy that is induced from natural processes that are continuously replenished. Such examples are sunlight, geothermal heat, wind, tides and various forms of biomass. This energy is constantly renewed and cannot be exhausted.When we think of fuel what comes to our mind ? we might think of firewood, gasoline for our car, or maybe food, which is fuel for our body which may provide heat for our home. The bull's eye is that fuel is an absolutely essential part of everyone's daily life. Deep within our Earth, there are ready-made of fuel that our world has become totally dependent on. They are called fossil fuels.Fossil fuels are the hot-button subject, they simultaneusly power and diminish our planet. As the global population continues to rise and as our efforts to "go-green" continue to fall short of expectation,the disadvantages fossil fuels are becoming even more stark and serious. Alternative energy is a term used for an energy source that is an alternative to using fossil fuels. Generally, it indicates energies that are non-traditional and have low environmental impact. The term alternative is used to contrast with fossil fuels according to some sources. By most definitions alternative energy doesn't harm the environment, a distinction which separates it from renewable energy which may or may not have significant environmental impact.

Keywords-Cost analysis, emission analysis, renewable energy, HOMER SOFTWARE simulation, weather condition, PV array.

I. INTRODUCTION

The aggregate load of a building depends upon sum number of electrical appliances which have been installed in the building. The load demand also varies throughout the day because we don't use all appliances all at once. This contrast load is given the supply from the grids which are dependent upon the conventional energy sources. So to downgrade the consumption of the fossil fuels.

We need to assimilate the existing technology to the clean renewable energy technologies for decreasing the overall electricity consumption cost and thereby the fossil fuel degradation. In this paper we have used the combination of central grid and PV technology for analysis by the use of simulation software HOMER. The choice of renewable energy is dependent on weather and climatic conditions in the area and the rate of change from time to time.

Association to the local electricity network allow any overmuch power produced to be sold to the utility. Electricity is then imported from the network outside daylight hours. When a PV system is connected to the local electrical network, Any overmuch power that is generated can be fed back into the electricity grid.

In this paper analysis the total cost associated and its impact on the environment due to reduction in green house gases emission.

II. PV SYSTEM

Sizing a photovoltaic system is an important task in the system's design. In the sizing process one has to take into account three basic factors:

i. The solar insolation of the site and generally the Metrological data
ii. The daily power consumption (Wh) and types of the electric loads, and
iii. The storage system to contribute to the system's energy independence for a certain period of time

The PV generator is oversized it will have a big impact in the final cost and the price of the power produced and in the other hand, the PV-generator is undersized, problems might occur models of components in order to get a cost effective and reliable system [3].

The amount of solar radiation at a site at any time, either it is expressed as solar intensity (W/m2) or solar insolation or radiation in MJ or Wh, is primarily required to provide answer to the amount of power produced by the PV generator. The amount of electrical energy produced by a PV-array depends primarily on the insolation at a given location and time. Data on solar insolation are usually given in the form of global radiation that is beam, direct and diffuse radiation over a horizontal surface.[1]

III. SYSTEM DESIGN

The system was designed by calculating monthly demand of electrical energy required by a small community in remote area as well as power output of the different solar PV-wind turbine generator combinations. Following points were taken into account in system design [2, 3]:

- The power generated from PV and biomass combination has to meet the total load of the system. Energy required for water heating of the community is provided by the solar water heater.
- Short term electrical power storage using lead-acid batteries is considered. The size of battery bank is worked out to substitute the PV array during cloudy and no-sun days.
- Life time of battery bank is considered to be 5 years. This point is important when estimating the capital costs.
- The storage battery bank will be able to supply power during a maximum of 5 days on no-sun days.
- The AC power from the inverter of the system is fed to the distribution network of the community.[2]

IV. POWER OUTPUT FROM AN PV ARRAY

For design of a PV system, we should know how much solar energy is received at the concern place. It is effected by sun position, could covering atmospheric affect, and the angle at which the collector is placed, called tilt angle 'β'. Normally this angle is equal to the latitude of the concern place. The related equation for estimation of the radiation is listed below:

1. Isolation
   $i = Io \{ \cos \phi \cos \delta \cos \omega + \sin \phi \sin \delta \}$ kW/m^2
2. $I_o = I_{sc} [1 + 0.033 \cos (360N/365)]$ where I_{sc} solar constant. =1.37 kW/m^2
3. H_{oA} = energy falling on t 3. $H_o = \int i \, dt$ ω_{sr} = hour angle when sun rising
   ω_{ss} = hour angle when sun setting
   $= (24/\pi) I_{sc} [1+ 0.033 \cos (360N/365)] \{\cos \phi \cos \delta \cos \omega + \sin \phi \sin \delta\}$ kWh/m^2/day he concern place considering atmospheric effect
   $= K_T H_o$ kWh/m^2/day where K_T dearness index
4. H_{oA} = energy falling on the concern place considering atmospheric effect
   $= K_T H_o$ kWh/m^2/day where K_T dearness index
5. $K_T = A1 + A_2 \sin (t) + A_3 \sin (2t) + A_4 \sin (3t) + A_5 \cos (t) + A_6 \cos (2t) + A_7 \cos (3t)$
   $t = (2\pi/365) (N-80)$ N= 1 for Jan 1st

Wpeak = {1/ hpeak } [(Wh((load) * No. of no sun days / (ηb * no of discharging . Days)) + Whload(day) + Whload(night)/ ηb)]
Where: ηb = battery efficiency
hpeak = no of hours for which peak insolation falls on pv cell.[1]

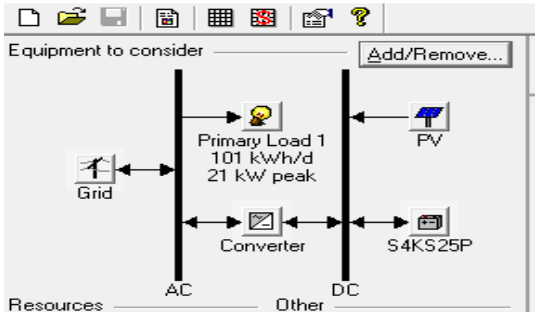
V. SIMULATION WITH HOMER SOFTWARE

Homer is condensation of "Hybrid Optimization Model For Electric Renewable". Homer can realize a sensitivity analysis by modifying some inputs in a range defined by the user in order to compare different possible scenarios. It is a micro power optimization model improved by the American National Energy Laboratory. By using this software we can find the best electricity generation system framework that is to say the applicable technologies, the size and the no of each building block, also comparing cost and environmental impacts. It can work for both conventional and renewable energy technologies in particular solar photovoltaic and wind turbines which are the options envisioned for energy efficient technologies. It can also able to estimate economics and technical feasibility of the system. First Homer simulates the

working power system by calculating the hourly energy balance for a year. It determines the electric demand of the site and local electricity supplied by the system hour by hour. Homer ranked most cost-effective in the table by Net Present Cost(NPC).[2]

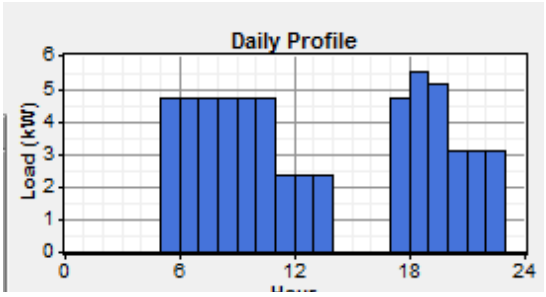
VI. ARRANGEMENT OF SOURCE AND LOAD

Selecting the suitable sizes of the sources to meet the daily load curve pattern of the system is the main attribute of Home software simulation. In the above fig.1 the load is having an average load of 4.19KW and peak load is 20.5KW. Hence the size of the PV, grid ,battery (S4KS25P) and converter is matched with the load patterns.

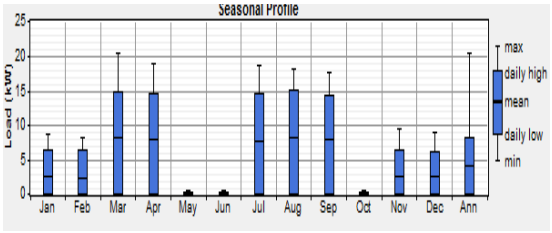


(FIG-1)

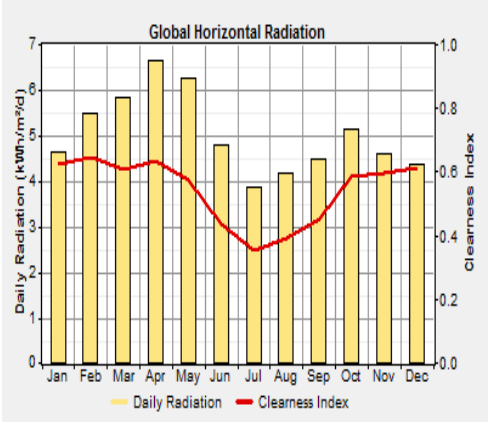
The fig.2 and fig.3 shows the daily and yearly curve of the consumer. Once the load profile has uploaded in the Homer software, the software simulates according to the availability of solar power in a given area.



(FIG-2)

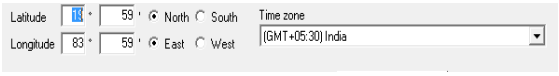


(FIG-3)



(FIG-4)

The main highlight of this software is it will give the availability of solar insolation once the gunupur area latitude and longitude has been given as shown in the fig.5. Once the solar power source is available for load pattern ; then schedule of the solar power is available. The remaining time periods the grid has to be operated.



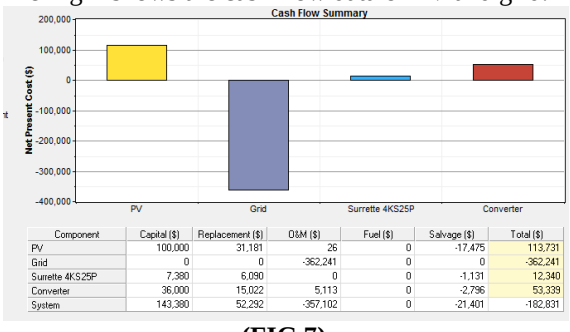
(FIG-5)

Production	kWh/yr	%
PV array	62,426	72
Grid purchases	24,032	28
Total	86,457	100

(FIG 6)

In the fig-6 we get the production data from PV array as well as grid purchase.

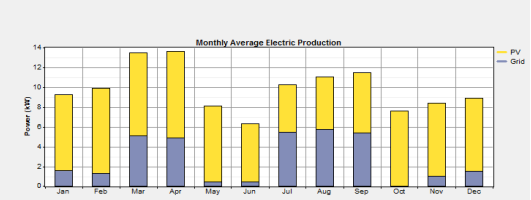
The Fig-7 shows the cash flow data of PV and grid.



Component	Capital ($)	Replacement ($)	O&M ($)	Fuel ($)	Salvage ($)	Total ($)
PV	100,000	31,181	26	0	-17,475	113,731
Grid	0	0	-362,241	0	0	-362,241
Surrette 4KS25P	7,380	6,090	0	0	-1,131	12,340
Converter	36,000	15,022	5,113	0	-2,796	53,339
System	143,380	52,292	-357,102	0	-21,401	-182,831

(FIG 7)

The fig 8 give the idea of monthly electrical power sharing between the PV array and Grid system



(FIG 8)

VII. CONCLUSION

The results obtained by using Homer software can be very realistic and gives very promising results for Hybrid systems. The main feature of this software is; it will integrate the local climatic conditions and hence planning of energy model is simpler.

In this paper the analysis has been given for systematic procedure towards to plan a PV-Biomass based hybrid system and its Economic analysis including calculation of percentage savings, payback period analysis. It will give the complete solution to remote areas which are not accessible to the grid. Initially these schemes may be costly but, the frequent usage of such schemes and wide acceptance of the technology can able to decrease the cost of such schemes.

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