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Assessment of Hybrid Energy Sources by using sensitivity analysis: A Case study analysis with isolated loads

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***Abstract*:**

Usage of renewable energy resources (RES) has becoming popular since, fossil fuel consumption and environmental impact has become a substantial universal concern. Presently, the concept of Zero Energy Building (ZEB) is getting kind concern. ZEB are defined as buildings whose annual energy requirement is supplied purely by renewable energy sources (RES). Therefore ZEB has been stated as the major planning for increasing the renewable energy ratio (RER). It is defined as the ratio of the total energy generated by the total energy used primarily .A simulation based approach is developed to regulate the optimal extent of a hybrid renewable energy system for residential buildings in which it is being calculated and stimulated which helps to maximize the renewable energy ratio of buildings and minimizes total net present cost and CO_2 emission for required system changes.

***Key words*— Hybrid Renewable Energy System (HRES) , Combined PV , ZEB , Clearness index , Phase Change Materials(PCM) ,**

I. INTRODUCTION

Though much consideration has been salaried to the utilization of cross renewable energy arrangements for either commercial buildings or Residential ones, rare scholarships dealt with the submission of off-grid hybrid renewable energy systems for saleable buildings [1][2]. This paper presents a all-inclusive study on the techno-economic enactment of a stand-alone hybrid photovoltaic (PV)-wind-battery structure for an residential building of common household loads [1][5].

Wind and solar sources is dependent on impulsive aspects such as meteorological conditions and climatic conditions. Due to both sources complementary nature [3], some of these problems can be incredulous the weaknesses of one with the strengths of the other. This takes us to the hybrid solar-wind system [4][5].

The proposed hybrid system based on renewable design is design to power one room constituting of several loads [9]. The simulation results validated that the peak structure for the hybrid system for the primary load demand of 2.760 kW h per day, consists of 1.5 kW PV modules, 400 W wind turbine, 600W inverter, and five 200 A h batteries [9].

II. HYBRID SYSTEM IMPLEMENTATION

A hybrid solar-wind power arrangement only becomes a cost-competitive possibility in ranges where wind and solar patterns increase each other expressively; otherwise they will be too pricey [2]. Also the get-up-and-go efficiency comes first. In other words:
if you want to mount a hybrid system to come across your home's electricity needs, consider shielding your home to high levels and install high-performance windows, usages and lighting, in order to cut the electricity consumption to the lowest extent possible[2][13]. Only then a amalgam wind-solar system can make sense. Otherwise you will need a very large and expensive arrangement [13].

The major plus of the system is that it meets the basic power chucks of non-electrified far-flung ranges, where grid power has not yet reached. The power spawned from both wind and solar gears is stockpiled in a battery bank for use whenever required. A hybrid renewable energy system utilizes two or added energy creation methods, generally solar and wind power [13]. The core lead of solar / wind hybrid arrangement is that when solar and wind power creation are used organized, the reliability of the arrangement is enhanced. Additionally the size of battery stacking can be reduced slightly as there is less faith on one method of power production. Often the minute there is no sun, present is plenty of wind [2][13].

Wind speeds are repeatedly low in periods when the sun resources are the best. On the other arrow, the wind is all so often stronger in seasons when around are less sun resources [3][4]. Unfluctuating in the same day, in many regions worldwide or in specific periods of the year, there are different and contrary patterns in contacts of airstream and solar resources [4]. And persons altered patterns can

make the hybrid systems the unsurpassed option in electricity construction. An hybrid wind-solar electric system demands an compound initial investment than single larger system; huge wind and solar PV systems are proportionally cheaper than smaller system [13].

But the hybrid solution is the unsurpassed option whenever there is a significant advance in relations of output and routine, which materializes when the sun and the wind resources have opposite cycles and intensities during the same day or in some seasons [4].

Incorporating heat, power and highly-efficient devices can increase overall efficiency and conserve zing for a hybrid system when compared with distinct tools [5].

Achieving sophisticated reliability can be skillful with redundant technologies and get-up-and-go storage. Some hybrid system naturally include both, which can in chorus improve the quality and readiness of power

COMPONENTS/RATING	QUANTITY	RUNNING HOURS	TOTAL ENERGY CONSUMPTION
TUBELIGHT/ 40W	1	14	560W
FAN/80W	1	14	1120W
INCANDESCENT LAMP /60W	1	4	240W
TV /100W	1	6	600W
LAPTOP/60W	1	4	240W
		Total->	2760W=2.760KW

III. CASE STUDY AND IMPLEMENTATION

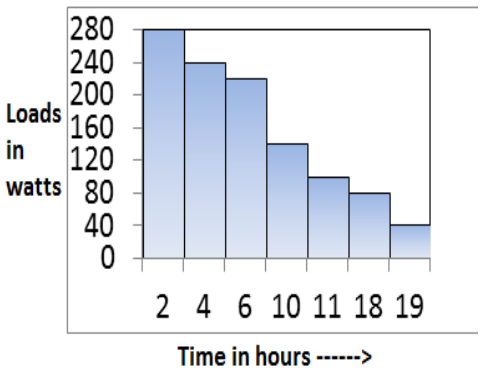

Fig.1 Load duration curve of the running load

IV. ANALYSIS

The overhead load duration curve in fig 2 and the tons considered as in fig 1 are for a housing room, so the total running hours of loads are 19hrs[14][12][9]. The peak load is 280 watt which is successively for 2 hours and the minimum load is 40 watt at a time.

So, according to the above data, the apparatus's to be used are Inverter of 600 watt output to be cast-off.

To analyze the input current to the inverter.Formula to be used

$$I_{IN} = \frac{WATT_{OUT}}{V_{IN} * EFFICIENCY}$$

$WATT_{OUT}$ = OUTPUT OF INVERTER

V_{IN} = VOLTAGE INPUT TO INVERTER i. e 12v

EFFICIENCY= 87% OF INVERTER

$$I_{IN} = 600 / (12 * 0.87) = 57.47 \text{ AMP}$$

Now to analyze the battery sizing, we need to calculate the battery MAH value

Therefore, I_{in} x total running hours

57.47 amp X 19 hours = 1091.95 AH.

If the battery is of 10 Ah battery ,we can inducement 1A incessantly for 10 hours. When ampere goes above 1A, the available Ah decreases. For eg. If we draw 2A from 10 A battery, the battery can provide 2A for 5 hours[14]

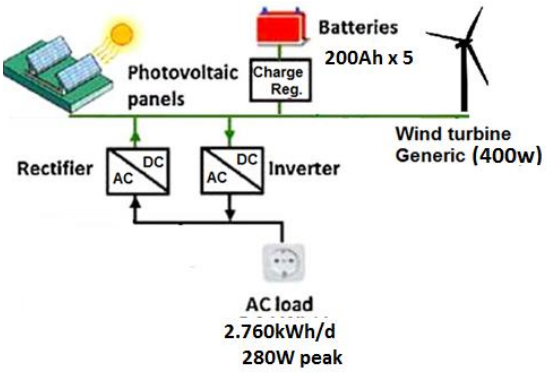

Fig.2 Pictorial representation of the used components

V. LOCATION AND GEOGRAPHICAL FACTORS

The building with the hybrid energy organization is located in the geographical coordinates defined as Coordinates: 19.08°N 83.82°E and average altitude Elevation 83 m (272 ft) [1]

Wind speed

When the energy after the PV array is not -sufficient to provide the average daily energy request, the wind turbine might be utilized to provide the outstanding power required for the office building [1]. Wind turbine transforms the

wind energy to mechanical energy, which is rehabilitated to electrical power in a generator. Founded on the wind speed data obtained from an anemometer tower, the regular monthly wind speed differences were determined at 10, 20, and 40 m above the surface of the earth[2]. The annual average wind speed is almost 4.63m/s. Fig. 4 explains the monthly mean wind speed contour with the maximum and minimum values actuality at 5.8 m/s (in July) and 3.6 m/s (in November). In June, July, and August, the considered site has good budding of wind power because the monthly mean wind speed values are higher than 5m/s[1][2]

Solar Radiation

The solar irradiation grasps up to 7.4kW h/m2 d in the summer season and drips down to 2.94kW h/m2 d in the winter season. The annual average of solar irradiation is estimated to be 4.9kW h/m2 day. The twelve-monthly average clearness index—which is a measure of clearness of the sky and is identical to the fraction of solar energy which passes through the atmosphere and influences the earth's surface—was calculated to be 0.532[1][2].

This index varies from 0.25 for a very cloudy month to 0.75 for a very sunny month.

Month	Wind Speed (m/s)	Clearness index	Daily Radiation (kWh/m2/d)
January	3.8	0.334	
February	4.2	0.385	
March	4.7	0.527	
April	4.7	0.630	
May	5.2	0.709	
June	5.8	0.873	
July	5.6	0.734	
August	5.6	0.674	
September	4.6	0.532	
October	4.1	0.413	
November	3.6	0.310	
December	3.7	0.230	
Average	4.63	0.529	

Fig 3: Wind and Solar Resource

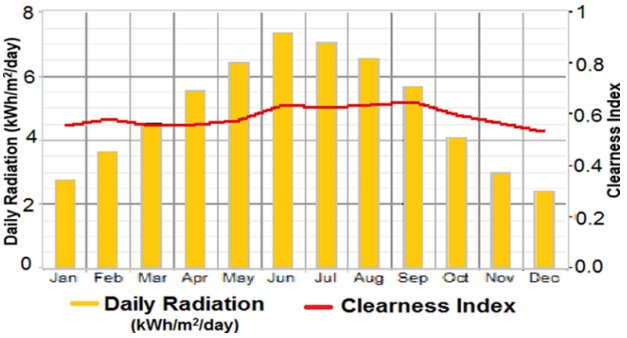

Fig 4. Annual solar radiation and the clearness index

V. ADVANCEMENTS

In the current situation, as the hybrid system is fetching popular with more number of system getting connected [6]. It is acting a master plan for fossil fuel spare in near future[6]. With advantages of any system, there comes disadvantages, so thru the commencing years these flaws is being improved and the efficiency of the hybrid system has been amplified. The more development in the present working technologies, more benefits we will get in future [6][7][8]. This project includes PV panel and wind turbine.

In the present scenario, as the hybrid system is becoming popular with more number of organization getting installed[6]. It is acting a master plan for fossil fuel replacement in near coming [6]. With recompenses of any system, there comes disadvantages, so with the commencing years these flaws is being improved and the efficiency of the hybrid system has been increased. The more progress in the present working technologies, more benefits we will get in future[6][7][8]. This plan includes PV panel and wind turbine combination for the hybrid energy group. So, some advancements which obligation be done in the PV panels and wind turbines are mentioned below.

1. As we know that solar cells at contemporary can absorb 70% - 75 % of the solar radiation coming and out of the absorbed percentage some percent are applied for electricity generation dependent on the conversion efficiency of PV cell technology and some part is dissipated as heat accumulating on the surface of the cells instigating elevated temperature[7].

This effects the presentation and life period of the cells. So many methods that can be realized to avoid that flaws in the solar cells. Among these designs, systems utilizing air, liquid ,heat pipes, phase change materials (PCM) and thermoelectric(TE) devices which help cooling[7][8].

2. Some other progress in solar cells are, like increasing efficiency with enhanced design (transparency). To do this, the first step is to optimize the making process of the cells based on different polymers (absorbing lights of different wavelengths), in command to achieve the maximum efficiency of these materials. Secondly polymers that fascinate light at different wavelength have to be used in pair like structure placing one on top of the other. The greater efficiency is realized in the cells fit in series than in one fitted in parallel [6][8].

3. In the field of wind turbines diverse areas causes alterations, such as rotor, controls, electronics and gearboxes [6]. But the progressing technology used in wind power production has always aimed for manufacture the wind power making a better high-quality for power generation.

To deliver more efficient wind turbines to the clienteles the area of the rotor should be augmented to get more energy at lower wind speed and that advancement in rotor has been increased by nearly 40 % in less than 5 years, in the near future the proportion can be elevated[8].

The advancement are being done on in areas of reliability, which means wind turbines are operational and available at different instant of time. And this can be achieved by improving the individual components used in wind turbines [6][7].

Nowadays specially calculated Off Shore wind turbines are installed in coastal areas unlike preceding days only one type of wind turbine was accessible for both onshore and offshore regions i.e On shore wind turbines[6][7][8].

VI CONCLUSION

This research paper gives an idiomatic overview of hybrid renewable energy systems (HRES). Various aspects such as methodology, unit sizing and optimization, storage and energy flow management along with load optimization duration curve are specifically reviewed. Future trends as well as challenges with implementation in GREEN BUILDING are also presented in the paper. The presented literature and assessment review facilitates interested researchers in design and power management of HRES. This project revives the techniques associated with the calculation of hybrid energy parameters that can be carried out for implementation in the trends of green energy sources along with the transformation and optimization into capability of consumption to zero energy rating.

REFERENCES

1. G.R.K.D. Satya Prasad "Integration of Renewable energy sources in zero Energy buildings with Economical and Environmental aspects by using Homer " in International journal of advanced engineering sciences and technologies, ISSN:2230-7818,vol-9,Issue No-2,2011; page no: 212-217
2. G.R.K.D. Satya Prasad "Performance optimization of a Rooftop Hybridized Solar PV-AC grid assisted power system for peak load management" published in *International Journal of Engineering Research and Applications*, ISSN:2248-9622, vol-2,Issue No-3,May-june 2012
3. G.R.K.D. Satya Prasad "Design Of Standalone hybrid Biomass & PV system of an off grid house in a remote area" in International Journal of Engineering Research and Application, vol-3,issue-6,Nov-Dec 2013 , pp-433 - 437
4. Maghraby HAM, Shwehdi MH, Al-Bassam GK. Probabilistic assessment of photovoltaic (PV) generation systems. IEEE Trans Power Syst 2002; 17(1):205– 8.
5. Al-Ashwal AM, Moghram IS. Proportion assessment of combined PV–wind generating systems. Renew Energy 1997; 10(1):43–51.
6. K. Agbossou, M. Kolhe, J. Hamelin, and T. K. Bose, "Performance of a standalone renewable energy system based on energy storage as hydrogen," IEEE Trans. Energy Convers., vol. 19, no. 3, pp. 633–640, Sep. 2004.
7. Valente LCG, Almeida SCAD. Economic analysis of a diesel/photovoltaic hybrid system for decentralized power generation in northern Brazil. Energy 1998; 23(4):317–23.
8. Khan MJ, Iqbal MT. Pre-feasibility study of stand-alone hybrid energy systems for applications in Newfoundland. Renew Energy 2005; 30(6):835–54.
9. Zoulias EI, Lymberopoulos N. Techno economic analysis of the integration of hydrogen energy technologies in renewable energy based stand-alone power systems. Renew Energy 2007; 32(4):680–96.
10. Borowy BS, Salameh ZM. Methodology for optimally sizing the combination of a battery bank and PV array in a wind/PV hybrid system. IEEE Trans Energy Converse 1996; 11(2):367–73.
11. Bucciarelli Jr LL. Estimating loss-of-power probabilities of standalone photovoltaic solar energy systems. Solar Energy 1984; 32(2):205–209.
12. G.R.K.D. Satya Prasad Energy and Comfort Management in Energy Efficient Buildings Using RETSCREEN Software-A Case Study Analysis" in International Journal of Engineering Research and Application ISSN: 2248-9622, Vol. 3, Issue 6, Nov-Dec 2013, pp.378-381
13. G.R.K.D. Satya Prasad "Hybrid Solar-Kitchen waste based plant for Green buildings: An approach to meet the standards of Zero energy buildings" International Research journal of Engineering and Technology" Vol. 2, Issue 8, Nov- 2015 pp.1335-1340