Certain Investigation on Solar and Wind Energy Using Vertical Axis Wind Turbine & Solar Panel

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Abstract – In this work, we have carried out various readings about temperature, Watt/m^2, intensity of light in Lux and velocity of wind in m/sec. So for, the concentration has only given to solar energy conversion to thermal energy and electrical energy, but it will not be a consistent one. Moreover in some places the solar energy varied with sunny days available in the whole year as per the geographical location.[1][2]. While comparing with wind energy, it is so consistent throughout the year irrespective of the velocity varying with certain parameters related with climate change. The combination of wind and solar PV has the advantage that the two sources complement each other because the peak operating times for each system occur at different times of the day and year. The power generation of such a hybrid system is therefore more constant and fluctuates less than each of the two component subsystems [3]. Other solar hybrids include solar-wind systems. Renewable had a good year in Europe in 2015.

Wind grew by 12.8GW and solar PV by 8GW. The wind sector installed more than any other form of power generation (44% of the total) and called it a "record year" for investments (up 40% on 2014). The solar PV industry meanwhile, announced 15% growth after three consecutive years of decline [4][5]. This is the most advantageous concept taken into account and the utilization of hybrid equipments developed in the energy sector. On the other hand the energy obtains from renewable sources most suited for over environment and future.

Index Terms – UVC,DNA,UVB.

1. INTRODUCTION

Since wind is a moving air and is caused by differences in air pressure within the atmosphere. The air is under high pressure which moves towards the area of low pressure [6][7]. The greater the difference in pressure, the faster the air flows. The energy in the wind spins the turbine blades.

They in turn spin a shaft connected to a generator and this makes electricity. The amount of electricity made by a wind turbine generator depends on how hard the wind is blowing. In the United States, the original heyday of wind was between 1870 and 1930, when thousands of farmers across the country used wind to pump water. Small electric wind turbines were used in rural areas as far back as the 1920s, and prototypes of larger machines were built in the 1940s[8]. When the New Deal brought grid-connected electricity to the countryside, however, windmills lost out.

1.1 SOLAR ENERGY

On Earth, sunlight is filtered through Earth's atmosphere, and is obvious as daylight when the Sun is above the horizon. When the direct solar radiation is not blocked by clouds, it is experienced as sunshine, a combination of bright light and radiant heat. When it is blocked by the clouds or reflects off other objects, it is experienced as diffused light. Direct sunlight has a luminous efficacy of about 93 lumens per watt of radiant flux[9][10].

This is higher than the efficacy (of source) of most artificial lighting (including fluorescent), which means using sunlight for illumination heats up a room less than using most forms of artificial lighting. 1.2 **Composition and power**: The solar irradiance spectrum is above the atmosphere and at surface level. Extreme UV and X-rays are produced (at left of wavelength range shown) but comprise very small amounts of the Sun's total output power. Ultraviolet C or (UVC) range, which spans a range of 100 to 280 nm. The term ultraviolet refers to the fact that the radiation is at higher frequency than violet light (and, hence, also invisible to the human eye). Due to absorption by the atmosphere very little reaches Earth's surface[13][14].

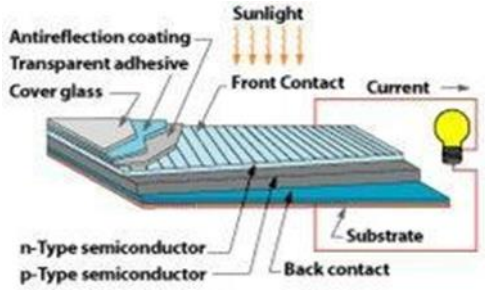


Fig 1.1: Solar Panel

This spectrum of radiation has germicidal properties, and is used in germicidal lamps. Ultraviolet B or (UVB) range spans 280 to 315 nm. It is also greatly absorbed by the atmosphere,

and along with UVC is responsible for the photochemical reaction leading to the production of the ozone layer. It directly damages DNA and causes sunburn, but is also required for vitamin D synthesis in the skin and fur of mammals.

1.2 WIND ENERGY

The wind resource — how fast it blows, how often, and when — plays a significant role in its power generation cost. The power output from a wind turbine rises as a cube of wind speed [15][16]. In other words, if wind speed doubles, the power output increases eight times. Therefore, higher-speed winds are more easily and inexpensively captured.

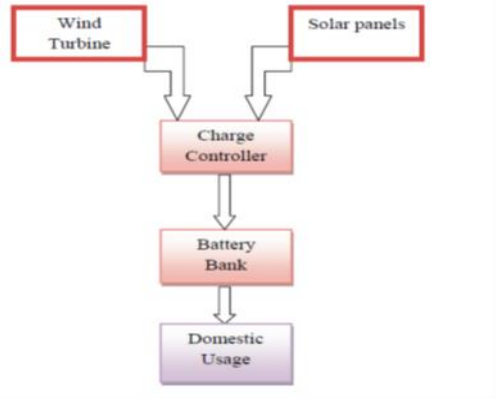
Wind speeds in classes three (6.7 – 7.4 meters per second (m/s)) and above are typically needed to economically generate power. Ideally, a wind turbine should be matched to the speed and frequency of the resource to maximize power production. Dealing with the variability of wind on a large scale is by no means insurmountable for electric utilities.

Grid operators must already adjust to constant changes in electricity demand, turning power plants on and off, and varying their output second-by-second as power use rises and falls. Operators always need to keep power plants in reserve to meet unexpected surges or drops in demand, as well as power plant and transmission line outages. As a result, operators do not need to respond to changes in wind output at each wind facility [12].

In addition, the wind is always blowing somewhere, so distributing wind turbines across a broad geographic area helps smooth out the variability of the resource.

2. DESIGN OF HYBRID ENERGY SYSTEM

For design of the hybrid energy we need to find the following data as follows. 1. Data required for solar system daily solar radiation (intensity of radiation) according to the time for particular location.2. Data required for wind system like daily wind velocity according to the time for particular location and wind power produced by a wind turbine.



2.1 Hybrid working system

The Fig 2.1 shows the block diagram of the hybrid power generation system using wind and solar power. This block diagram includes following blocks.

Main Components: 1. Solar panel 2. Wind turbine 3. Charge controller 4. Battery bank

2.1. SOLAR PANELS

Solar panel is used to convert solar radiation to the electrical energy. The physical of PV cell is very similar to that of the classical diode with a PN junction formed by semiconductor material. When the junction absorbs light, the energy of absorbed photon is transferred to the electron- proton system of the material, creating charge carriers that are separated at the junction.

The charge carriers in the junction region create a potential gradient, get accelerated under the electric field, and circulate as current through an external circuit. Solar array or panel is a group of a several modules electrically connected in series parallel combination to generate the required current and voltage. Solar panels are the medium to convert solar power into the electrical power.

2.2. WIND TURBINE

Wind turbine is that system which extracts energy from wind by rotation of the blades of the wind turbine. Basically wind turbine has two types one is vertical and another is horizontal. in this system we are using vertical axis wind turbine. It will rotate in all directions. As the wind speed increases power generation also increases. The power generated from wind is not continuous its fluctuating. To obtain the non-fluctuating power we have to store in battery and then provide it to the load.

Fig 2.2: Different Models Of Vertical Axis Wind Turbines.

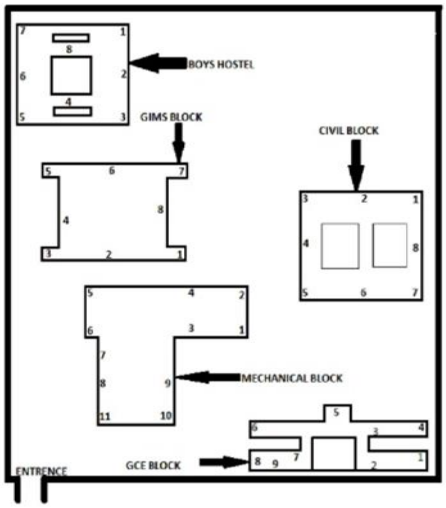
3. FOUR FACTOR ANALYSIS

In order wind speeds to be comparable from location to location, the effects of the terrain need to be considered, especially in regard to height. Other considerations are the

presence of trees, and both natural canyons and artificial canyons (urban buildings). The standard anemometer height in open rural terrain is 10 meters. In this project 4 factor analysis velocity (m/s), temperature (0 c), Intensity of radiation (Lux), Electricity (W/m^2) will be done by a Anemometer, Lox meter and pyranometer.

We know that velocity of wind could change from location to location. In order to get a maximum power generation, we have located nearly 8 to 11 locations; from the analysis of four factors the exact maximum point of location is chosen [13]. By locating at exact maximum location, maximum power could be produced with high velocity of wind, intensity of radiation and low temperature range. Since the readings are taken based on both hours and location, we are indeed of calculating average for each location with respect to the four factors [14].

All might be familiar that, temperature of the wind should be less to get maximum range of radiation. Thus for generation for power by solar panel, it just depends on the light energy, so that the heat energy is independent and does not considered for generation. The following fig shows the different locations where readings were taken.



4. TABULATIONS

To find the minimum temperature and maximum radiation & velocity among various readings, average for all readings has been taken and certain maximum value of velocity, intensity of radiation and electricity range is found. The following table is for various blocks and various days at particular time.

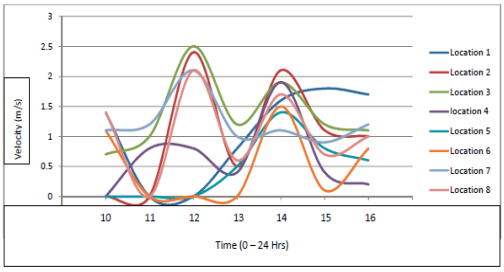
Location	velocity (m/s)	Temperature (Celsius)	Intensity of Radiation(Lux) X 100	Electricity (W/m^2)
1	1.042	36.471	807.000	637.530
2	1.014	37.085	734.000	579.860
3	1.371	37.371	732.857	579.385
4	0.642	37.500	679.571	536.861
5	0.471	38.228	707.000	558.530
6	0.500	37.714	687.000	542.730
7	1.228	37.985	836.714	627.082
8	1.071	38.328	695.142	549.162

Table 4.1: Civil Block; Day 1

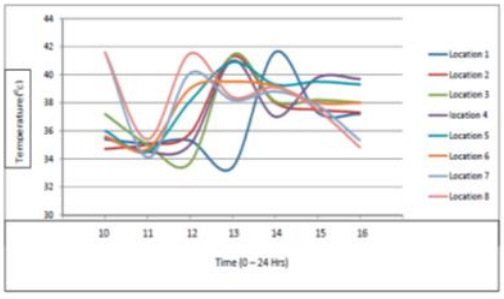
Location	velocity (m/s)	Temperature (Celsius)	Intensity of Radiation (Lux) X 100	Electricity (W/m^2)
1	3.728	36.342	717.571	566.881
2	3.914	34.871	620.857	490.484
3	4.785	34.400	610.857	482.568
4	3.314	34.828	527.857	417.007
5	3.228	35.485	570.000	450.300
6	2.971	35.714	637.142	503.342
7	3.300	34.528	624.285	493.185
8	3.828	34.342	711.714	569.514

Table 4.2: Civil Block; Day 2

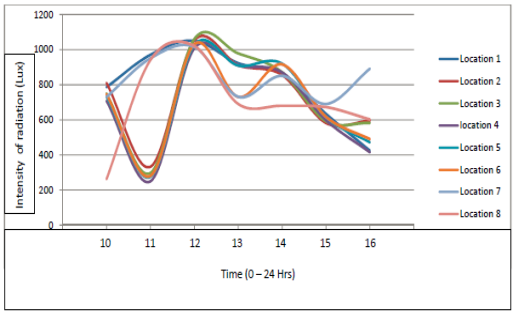
5. GRAPHS: CIVIL BLOCK



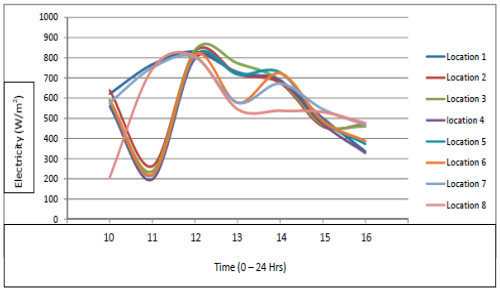
Graph 5.1: Velocity Graph for Civil Block at Day 1 Readings



Graph 5.2: Temperature Graph for Civil Block at Day 1 Readings



Graph 5.3: Intensity Graph for Civil Block At day 1 readings



Graph 5.4: Electricity Graph for Civil Block at day 1 readings

6. FIXATION OF LOCATION

While analyzing four factor analysis of (hybrid) solar & wind energy. It has been noticed that as a sample study around 1324 data were collected in a GEI (Gnanamani Educational Institutation) organization with respect to temperature (^{0}C), velocity (m/s), intensity of light in Lux and solar radiation energy in Watts/m^2.

In this graph, the velocity range starts from 2m/sec and varies upto 6m/sec and the temperature range starts at minimum for 30^0c to 32^0c as in sunny days[17]. The intensity of light is 950 to 1060 Lux on par with radiation energy ranges from 760 to 840 W/m^2[17].

Hence, as per our ranking value method computing, we have arrived 3.467m/s,35.042^{0}c,760lux and 600.4W/m^2.Based on the above facts we may locate the point where minimum range of temperature with maximum velocity of wind and solar energy radiation to be considered for set up hybrid equipment

From the above, its calculation helps us to finding out the best location for the equipment to produce high power using Hybrid system.

7. RANKING VALUE METHOD

It is a mathematical method to find out a best location among different factors on different locations .In this method first we are going to point out rank to the locations based on the maxima and minima readings.

In this four factor analysis the velocity, light intensity and solar radiation should be high where temperature to be considered as low as possible. To locate a proper point the velocity and intensity of radiation and electricity is a major factor. Note: intensity of radiation directly proportional to electricity.

So we are going to consider velocity and intensity of radiation as a major factor and temperature as a minor factor to least possible value. We have taken readings in 5 blocks every day (4days) at various time starts from 10.00 am to 4.00 pm .In short, around 44 locations were taken 28 spell.

We have to find out the average value for 44 locations as major factors: The overall average shown in the table as below with rank:

7.1 AVERAGE READING FOR OVERALL ANALYSIS WITH RANKING VALUE

Locations	Velocity (m/s)	Velocity rank value (nos)	Temp (^{0}c)	Temp Rank value (nos)	Intensity of radiation (lux) X 100	Intensity of radiation rank value (nos)
Mechanical block 1 (1)	1.772	33	35.634	40	728.785	37
2	2.042	36	36.252	34	711.821	31
3	1.675	28	36.004	38	717.357	33
4	1.825	35	36.395	32	705.250	24
5	1.532	25	36.665	26	686.035	06
6	1.242	10	37.373	12	699.571	20
7	1.389	16	36.873	21	666.142	03
8	1.769	32	37.000	16	699.214	19

9	1.500	24	38.190	03	683.678	04
10	1.705	31	37.904	07	711.500	29
11	1.778	34	36.982	17	718.142	34
Civil bock 12 (1)	2.653	42	35.203	43	760.571	44
13	2.771	43	35.042	44	716.392	32

14	3.467	44	35.328	42	698.892	17
15	2.596	41	35.585	41	663.25	02
16	2.246	38	36.132	36	685.928	05
17	2.135	37	35.803	35	699.071	18
18	2.257	39	36.750	39	691.107	08
19	2.464	40	36.750	24	706.428	26
Gce block 20(1)	1.485	23	36.610	28	708.321	27
21	1.403	18	36.385	33	710.357	28
22	1.071	02	36.740	25	698.178	14
23	1.353	13	36.825	23	663.000	01
24	1.325	11	37.100	15	697.392	13
25	1.335	12	37.407	11	711.321	29
26	0.610	01	37.520	10	738.607	40
27	1.117	05	37.867	08	726.892	36
28	1.117	06	38.621	01	734.857	39
Boys hostel 29(1)	1.596	26	36.542	31	749.540	42
30	1.675	27	36.582	30	754.178	43

31	1.439	21	36.975	18	743.928	41
32	1.071	04	37.746	09	730.964	38
33	1.432	20	38.017	06	719.821	35
34	1.171	08	38.142	05	703.571	22
35	1.464	22	38.542	02	700.571	21
36	1.071	03	38.150	04	698.892	16
Gims block 37(1)	1.125	07	36.589	29	705.071	23
38	1.373	15	36.892	20	695.071	10
39	1.689	30	36.025	37	695.642	12
40	1.425	19	36.864	22	698.607	15
41	1.389	17	36.642	27	705.571	25
42	1.357	14	36.957	19	694.142	09
43	1.685	29	37.121	14	695.642	11
44	1.240	09	37.210	13	691.000	07

Table 7.1: Average reading for overall analysis with ranking value

For velocity and intensity of radiation based on our methodology (ranking value method) we have marked 44th rank for best higher value, Further we have allot 01 for minimal value. For temperature ranking value given based on descending order, i.e. maximum value location get 01 as a ranking value; minimum value location marked as 44th (Because this factor is comparatively less than the other readings)

The hybrid equipment will produce 65% of power by wind and remaining 35% by solar radiant energy (photo voltaic principle)

Calculation to find the best location:

Example:

Location 12 (civil block location 1) = (42*65) + (44*35) +43 =4312

Location 12 gets value of 4312 in ranking value method; it is the highest value among 44 locations.

By using ranking value method location 1 gives high velocity of wind and the maximal radiation, so that maximum amount of power could be produced.

So the best location is "CIVIL BLOCK LOCATION 1"

8. CONCLUSION

Hybrid power generation system is good and effective solution for power generation than conventional energy resources. It has greater efficiency .In proposed system; it will overcome the existing system and produce up to 1kw electricity. Solar panel will produce the electricity accordingly to the environmental climate. In windmill, the energy will be recovered continuously. The analysing process helped us to fix in the exact location for producing high electric power. It can provide electricity in the remote places where government is unable to reach. So that the power can be utilized where it is generated so that it will reduce the transmission losses and cost[18]. Cost reduction can be done by increasing the production of the equipment. People should motivate to use the non conventional energy resources. It is highly safe for the environment as it

doesn't produce any emission and harmful waste product like conventional energy resources. It is cost effective solution for generation. It only needs initial investment. It has also long life span. Overall it is good, reliable and affordable solution for electricity generation.

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