

Scope and Potential of a Hybrid Solar & Wind Energy System for Jodhpur Region, Case study

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Abstract: Electricity is an essential part of the developing of culture and Industrial growth and it is very relevant for the future growth of the economy. There is tremendous use of the Electricity in overall development of Industrial and domestic section and it must be supplied on a continuous basis in order to cover the daily requirements of all aspects. This paper aims to investigate various methods to operate a Hybrid power plant by using all the available renewable energy sources like (wind, Solar, Water) into the consideration and to convert it for the power plants fuel consumption. The energy generated specially by solar-wind hybrid renewable is calculated by the help of MATLAB and various mathematics concepts. In my thesis take a various cases of Northern part of India especially for Jodhpur by studding various meteorological data. That is helpful for sizing PV-Wind system. The result will obtain for both economic and various environmental condition.

Keywords: PV cell, solar energy, Wind Energy, Hybrid Generation Plant, Simulation#

1. Introduction

As we know energy is the basic requirement for any development. Since 17th century requirement of energy is increases due to the rapid increase in world population, technology and other political and economic condition. Due to the rapid increase in cost and environmental concern it is important to discuss the various method and process of generation of power by Hybrid renewable energy sources. In India there are many states whose develop the hybrid energy to increase their economy and best environment condition. Presently Most of the electricity generated across the central part of India which utilizes coal, gas, oil, water or nuclear as a primary fuel. There are various dangerous impact occur on the environment by using coal and nuclear as primary fuel. And these primary fuel are present abundant in nature so it make important to generate power by hybrid designing of solar and wind power plant to achieve the better environment condition and also to reduce the use of existing fossil fuels resources , it is important for future renewable sources. No any renewable resources neither the wind nor the solar can available all the time. So it would important to generate power by the combination of these renewable resources. Hybrid energy power generation also offer of generating power in the remote areas in India among fifteen states Rajasthan is one of the most potential of renewal resources. In Rajasthan many places like Bikaner, Jodhpur, and Jaisalmer have large scope of renewable energy. Energy resources are mainly divided into two ways.

- **Un-renewable Energy assets:** The resources which are present not much in amount and can be vanished after few years.
Example: Natural gas, Wood, Coal etc.
- **Renewable Energy assets:** The resources which are always available and renew itself in the nature.
Example: Solar power, Wind Power, Biomass etc.

1.1 Solar power

Solar panel is a device that converts solar energy directly into electrical energy. Solar panel is made up off photo-

voltaic cells which are made by semiconductor. When sun beam is fall on the PV cell they absorb the heat and electron are emitted from the atom. Due to the movement of the electron current is generated. With this process solar panel convert solar energy directly into the electric energy. For Power calculation we have to study the data mainly the solar radiation at that place. For Jodhpur region the annual solar radiation is 5.79 Kwh/square/meter. It is very good for power generation.

The energy generated by the sun radiation is calculated by the formulae:

$$P = MY^2 + NY + O$$

Where,

Y = Solar radiation

P = Power Formation

And M, N, O are constant

By the above formula we can calculate the amount of power generated by the Sun.

1.2 Wind Power

Wind powers are used to convert wind energy by using wind turbine into meaningful energy. Wind turbine change mechanical energy into electrical energy by the help of generator. In the wind energy generation the speed and direction of the wind is an important factor. If there is a small change in the direction then it may be exerts the large force on the turbine and make the turbine damaged. According to the Betz limit we use only 59 % of the total wind to change into to electrical energy. Wind power is calculated by

$$P = 1/2 \rho A V^3 \text{ (in watts)}$$

Where,

A = Area perpendicular to the direction of flow in square-meter.

ρ = Density of air Kg/ Cube- meter.

V = Wind Velocity in Meter/ Sec.

1.3. Hybrid energy system

The Word hybrid means something which is made by the combination of more than one element. In energy system the electricity can be generated by more than one source at a time like Wind, solar, biomass etc. There are various module to generate hybrid energy like wind-solar hybrid, Solar-diesel, Wind- hydro and Wind –diesel. Among the above hybrid energy generation module the wind- Solar hybrid module are more important because it is abundant in nature and it is very much environment friendly.

Hybrid energy generation is more important because the wind not floe continuously and sun radiation is only present approx. 8 to 10 hours in a day. So for continuous power it is important to hybridize the solar and wind power with the storage batteries. The hybridization in India has large prospect because over 75 % of Indian household face the problem like power cut specially in summer.

2. Literature Review

Hybrid design is an important power generation method all over the world. There are various research has been done and continuously achieve new technologies and idea in this system. The paper report will discuss the different system to organize the generation of renewable sources and combining them with present energy plant into hybrid energy conversion project. This report is eventually implemented and calculated for wind solar hybrid energy system. In solar-wind system with reserve store house were construct to integrated to study action of the generation system.

This paper report standardizes a hybrid energy system associate with solar photovoltaic cell and wind turbine as a small scale another sources of electrical energy. The Simulation of hybrid generation system is done by using MATLAB software.

The paper report discussed the various types of photovoltaic module and their properties are use in the hybrid energy power plant. It also describe the Simulink by MATLAB

software of a combination of solar – Wind power generation plant with various backup store house facilities. We take the various cases like Wind speed, solar radiation, Weather condition, and the rainfall of different areas of the countries. We find out the various array properties and take the various lab view data like PV cell temperature verses daytime, Solar in lux verses daytime.

In this paper we also study and find the various properties and behavior of sensor estimations programming for example Lab view is used to examine and show the current and voltage characteristics. We did setup by using various component by source measuring unit, Data Acquisition system and MATLAB software.

This paper also gives the idea about the various properties and various conditions to construct the wind farms with their Global wind power cumulative capacity and their location. By doing research we have study about the wind turbine generators, photovoltaic panels and store house are used to construct the generation system which should be minimum in cost, high reliability, and in emission.

As we know India required a large amount of energy and it is going to become difficult to the fulfill those requirement through the fossil fuel like coal, wood etc. So the country should concentrate on generate clean and low price energy. India required motivating to take advantage of renewable energy sources like Solar, Wind, Hydropower, Fuel cells, Biomass etc. By this paper report we can easily say that the demand of energy may be fulfill by small scale through rooftop, Photovoltaic (PV), Concentrating solar power (CSP), or Wind, Geothermal and conventional Hydropower.

3. Methodology

Aim of this report to describe the method of generating power through Solar wind power system. The major problem occurs with the wind solar system is sizing because the solar radiation and wind speed varies at various level. The flow chart with algorithm shows the process of producing the power through hybrid energy plant.

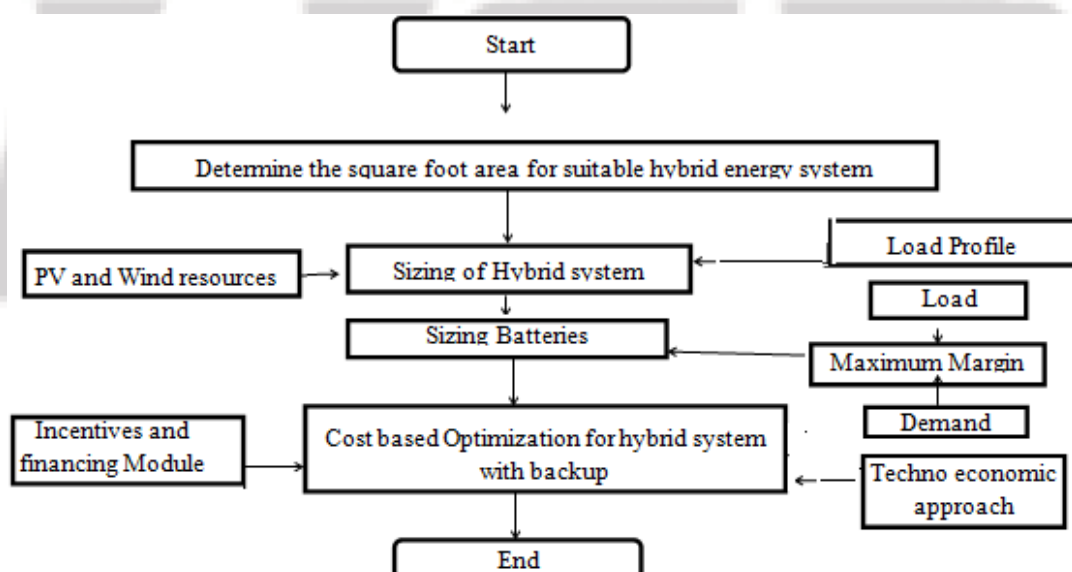
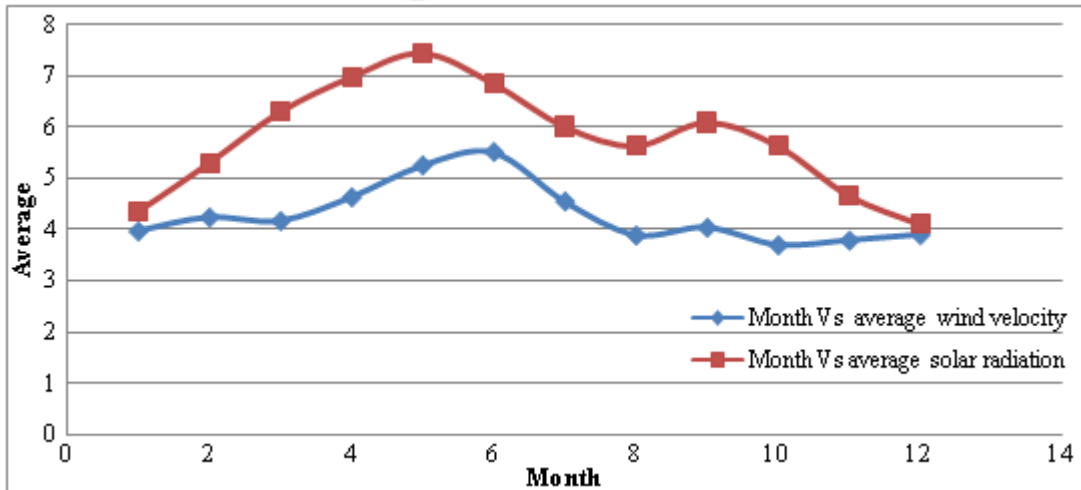


Figure 1: Flowchart and procedure of generating solar wind hybrid energy

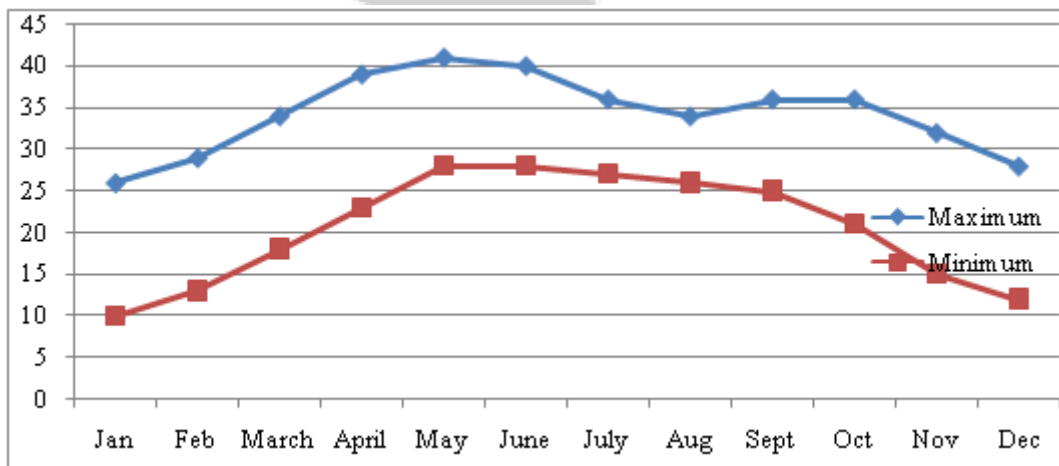
4. Result

There are many location where the electricity supply from grid is not reachable but these hybrid system can be installed everywhere. In India there are large possibilities to generate solar wind hybrid energy manly in Jodhpur in Rajasthan state. In developing country like India many of oil firms companies are work on installing hybrid power plant like

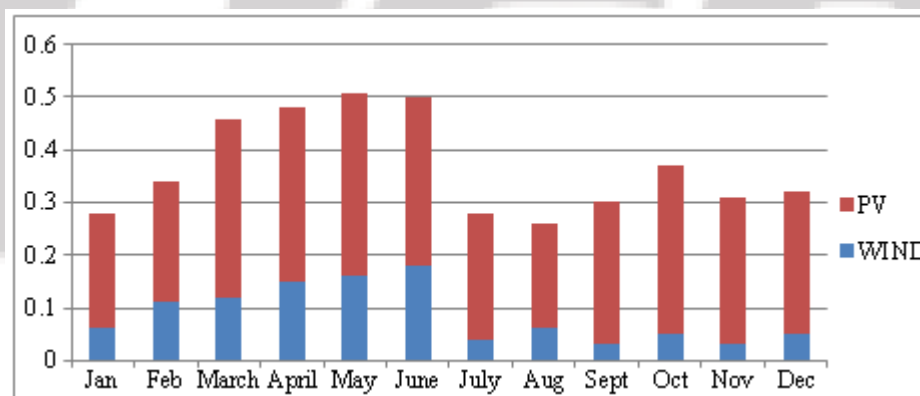
ONGC, Engineers India limited etc. The project results generated with Lab VIEW simulation tool and Microsoft Excel data in Technical Data Management Sheet format in order to extract the results in a Daily basis format. By Lab VIEW simulation tools we can easily simulates the result and optimize the wind solar hybrid energy system.



Graph (3.1): Monthly average Wind and solar radiation for Jodhpur region



Graph (3.2): Monthly Average maximum and minimum temperature for Jodhpur region



Graph (3.3): Monthly average Electric Production by 2 KWP solar PV array and 5 Kw Wind turbine in Jodhpur

5. Conclusion

Due to the present of fossil fuel in limit amount in nature the application of renewable energy mostly wind and solar energy are increasing with high rate. Energy sector is the baste way to improve the economy for any country. The hybrid energy can be installed for both small scale and for large scale. The main conclusion occurs after this research is:

1. The scope of hybrid system mainly solar and wind in Jodhpur are very high and it is very reliable for both ruler and urban areas.
2. Installation cost of 100 % Hybrid system is very costly.
3. For continuous power supply a diesel generator should also we install with these hybrid system.
4. The Minimum power generated by 2 Kwp solar with 5 Kw wind turbine is about 0.36 MW in Jodhpur region. For future research should be done on design and install a hybrid system with other renewable sources like Biomass, Water etc. for remote location.

6. Future Scope

In this paper we study the various data about the wind, solar for generating the hybrid at small level that help to the decision makers to study the various factors in construct a Hybrid generation plant with a various minimum cost with highest generating capacity. The result shows by the experimental and theoretical data that has been able to predict the energy generation through hybrid system. For future scope different time period has been use for calculating the power and efficiency. This method motivates the engineers to install small scale solar wind hybrid system in Jodhpur region. The government of India takes a major decision towards the hybrid energy sources. The **Jawaharlal Nehru solar mission (JNNSM)** target to produce 20 gig-a watts up to 2022 and should 100 % Renewable up to 2050.

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Author Profile



Jyoti Kant was born in Patna Bihar on 30 oct 1992. He did his B. Tech in electrical engineering under dual degree course and currently pursuing M. Tech with energy engineering from the Suresh Gyan Vihar University, Jagatpura, Jaipur. His interest is in Renewable energy hybrid system. And presently he work on small scale solar wind hybrid power generation system for Jodhpur region, Rajasthan. His research includes the scope and potential of small scale hybrid solar wind energy system and analyze the maximum power and efficiency for future aspect.