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Design and installation of 10kw energy by Hybrid Solar-Wind System

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Abstract –A hybrid system combines many type renewable energies like geothermal, hydro power, biomass, wind, solar, geothermal and ocean resources energies to supply a reliable and efficient power to consumer which is depend on their demand. Due to efficiency and reliability of solar-wind power system is more frequently used to meet the consumer demand. A Grid connected system of solar wind which are hybrid is more reliable and produce continuous power to consumer.
In this research we design an optimal system for 10kW load by solar wind which is hybrid system. Major role of this system is use an optimal size and selection of PV module, no and type of turbine and inverter to an optimal power system and have minimum cost.
In this system the design and implantation of hybrid solar-wind is simulation through to produce a continuous power to a load. The model is implement through MATLAB/SIMULINK. This system supply a power to 10kw load more effectively and can produce to 35KW power.

I. INTRODUCTION

Human's life style and standard of living are more dependent on electric power in this modern time. The living standard of the people increase as the population increase and energy demand will also increases to 21% in future 2030.That's why we produced electrical energy from many energies like hydro power, Geothermal power, Tidal power, Wave power, Biomass power, Geothermal power, Wind power ,solar power, Nuclear power etc.

Due to which our environment is affected by carbon dioxide and other climate changing discharges. In United States, Electricity sector produce 29% global warming emissions. Fossil fuel like coal and natural gases take a main role in these emissions.[1]

1. Hydro Energy

Aging of dams in hydro Power system now a day faced many problems. To continue in operation and safe hydro Power system require a major conditional work, due to which it have huge cost .Due to water pollution as well as air pollution it is also dangerous for environment. Hydro energy is very expensive plant because its installation cost is very high and its rate is depending upon the availability of water.it has a limited reservoir.

2. GEOTHERMAL ENERGY:

The drawback of the geothermal energy is that it can only be generate at selected sites in throughout the world. Water pollution and H2S pollution are also produced by geothermal energy. (Heat from earth i.e. Even from molten rock called magma).

3. TIDAL ENERGY:

Tidal power are generate most frequently within coastal areas. The great defect of tidal power is that it is costly and have limited availability of sites. Tidal energy or tidal power is obtained energy from tide which is a form of hydro power. Tides are the rise and fall of sea level.

4. WAVE ENERGY:

Marine ecosystem is highly affected by generating wave energy and it can also affect the source of private and commercial vessels (boats).it causes a noise pollution and also depends on wavelength. Just appropriate for a certain location and give benefit to certain plants and towns near ocean.

5. BIOMASS ENERGY:

 Biomass is renewable energy which is derived from organic material like a wood, garbage, crops etc.it harm to environment by developing methane gases which is produced by use of animal and human waste.it is appropriate to only urban areas because its plant require more space.it has low

efficient energy and also a source of air pollution and land pollution.

6- FOSSIL FUEL ENERGY:

Fossil fuel energy is produced by using coal, petrol and natural gases which contain carbon gas which is main reason in changing the climate.it is non-renewable source of energy and are very costly and harmful to environment.[2]

7-NUCLEAR POWER ENERGY:

Nuclear power energy produced very harmful radiation because uranium is unstable by nature that's why more precaution are applied for transporting, mining and storing of uranium. Its reaction is very harmful to human body and it causes a water pollution, waste, leaks and reaction failure.

1.1.1 Renewable Energy:

Renewable energy is a power which create by sources which do not consume and recharge within a human's life span.[3] Most of the natural energy obtain from a sun face to face or indirectly. When sun heat brings winds in motion its energy captured with wind turbines. 24% renewable energy is used as electricity in world. Renewable energy produces less harmful gases than fossil fuel energy system. Wind and solar energy are both are pollution free, so hybrid wind solar energy system is most use to obtain reliable and continuous energy. Wind is strong in winter when sun intensity is low and wind is weak in summer when sun intensity is high in this time PV system production is high. So the peak operating time for wind and solar system is different in day and night or month and years. The wind power industries are expanding fastly because of a more installation of wind power system. In future the energy by fossil fuel will be decline due to requirement of clean sources of energy like a sources of energy of wind and energy of solar.

II.   PROBLEM STATEMENT

The main reason and purpose of this research is design a system which is more reliable and pollution free. Solar and wind energy system is utilize which is renewable energy source are less costly and pollution free

III.   OBJECTIVES

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IV.   Research Methodology

A research work is necessary as a second option for energy sources due to the reduction in fossil fuel resources. . A more research is carried out on standalone PV system, wind system and hybrid power generating system for power generating.

A- Standalone PV system:

Photovoltaic technology is that technology which converting solar power directly into electrical power have a lot of application including distributed electricity generation throughout the world.[4] By photovoltaic a usable solar energy is used in PV system.[5] Standalone PV system consist of many arrangements like solar panel which convert sunlight into electricity, inverter which change dc into ac, batteries for store a power, for power betterment unit consisting of a charge controller, interconnecting cable and civil work etc. A Mppt is an controllable device with DC converter which is placed in mid of system of PV and consumer to maximize the output energy of array or maximize the extracting V and I.[6]
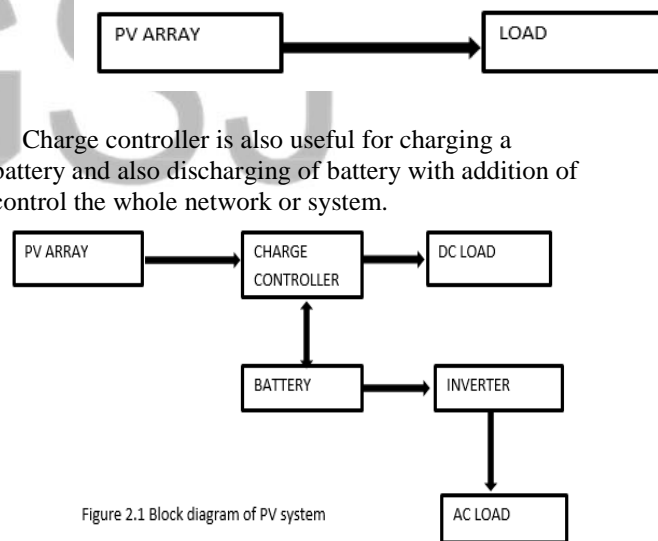

Charge controller is also useful for charging a battery and also discharging of battery with addition of control the whole network or system.

Figure 2.1 Block diagram of PV system

B- Wind system:

By the sun earth surface is heated uneven due to wind is created. Kinetic energy of wind is transform in pollution free electrical power by the assist of wind turbines. Wind rotates the wind turbine which extract a K.E of wind and transforms into spinning movement to run the

generator.[7] To prevent the rotor from revolving in uncontrollable high altitude winds, turbines have automatic over speed control system.

The main components of wind energy is wind turbine and tower to produce greater approach to strong wind. Furthermore it have wind turbine, tower and also require stabilize-of-system component for small power system of wind.
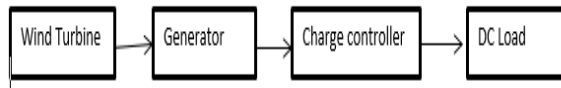

Figure 2.10 Block diagram of Wind System

C- Hybrid wind-solar system:

According to new study a hybrid electric system that is an integration of wind network and solar network (Photovoltaic) sciences are more beneficial over any individual system. The individual source cannot give a continuous electric power.[8] As we know in summers the speed of wind is very low and intensity of sun is more or sun shines for a long time as compare in winter where sun shines for less time and wind is strong. Wind and solar system are supportive to each other which produce continuous power throughout twelvemonth. The major parts of Hybrid System are:
- Turbine of wind
- Tower
- Solar photovoltaic panels
- Batteries
- Cables
- Charge controller
- Inverter

V.   Mathematical Modelling

The PV array block is a photovoltaic module which consist and made of strings which are joint side by side by side and every string consist of photovoltaic module which are all join in series.

The PV system consist of 5 parameters which are current source, series and shunt resistances and diodes the current source taken as light generated source. The identical circuit show a voltage and current graph characteristics which are conditional to temperature and irradiance as can see in figure 3.
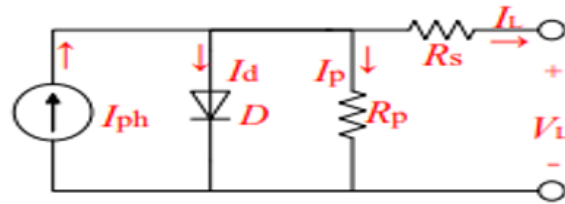

Figure 3 Analogous circuit of solar cell.

Connection among output current and voltage by PV module is shown by an equation below.

$$\mathbf{I_L} = [\ \mathbf{I_{SC}} + \alpha i\ (\ T-25)]\ \frac{G}{Gref} - \mathbf{I_{sat}}\ e^{(qvd\ /nNsKT)} {}_{-1)}(I_LRs+V_L)/R_{P\backslash}$$

At nominal PV standerd test condition with temperature 25°C and 1000W/m2 irradiance the photo currents Iph , ID , Ip and Isat set. Where Iph is very effected by a temperature and irradiation the diode current then phase current then the reverse saturation current respectively.

Mechanical network consist of wind turbine and pitch angle controller (PAC), wind turbine transform wind power from wind and convert into mechanical torque and PAC control power and speed. In this model speed of wind rotor is fifteen meter per second fixed and pitch angle set to is 8.80.
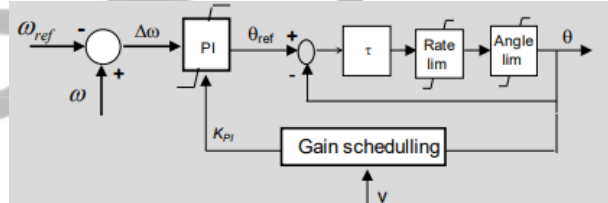
The mechanical power can be obtained by the following formula

$$P = \rho/2 \times Ar \times Vw^3 \times Cp(\lambda, \theta)$$

Mechanical power denoted by P gain the wind turbine, ρ is a symbol of air density in kgm/kg3, Ar is show the area under rotor edges in meter square, VW show the wind speed in $m$eter per second, λ express the speed ratio and power coefficient denoted by , that is characterized by λ and θ.
Under stable condition tip speed ratio is determined by

$$\lambda = \frac{Wturb\ x\ R}{Vw} = \frac{2\pi \times nturb \times R}{Vw}$$

Cp is calculate by forth order polynomial as shown below

$$Cp(\theta, \lambda) = \sum_{i=0}^{4} \sum_{j-0}^{4} (\alpha i,j \cdot \theta i \cdot \lambda j)$$

VI.   Conclusion

The hybrid solar wind system is work efficiently it produce sufficient power for AC load and by use of renewable energy instead of fuel its production cost is very low. So the price of hybrid solar-wind system is minimum per unit from grid price. It is more reliable system and produce continues power because the rating of solar wind is different depend in weather condition.

VII.   REFERENCES

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