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STANDALONE HYBRID WIND SOLAR POWER GENERATION

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ABSTRACT

The global search and the rise in the cost conventional fossil fuel is making power supply demand of electricity product almost impossible especially in some remote areas .Generators which are often used as an alternative to conventional power supply systems are known to be run only during day, and the cost of fueling them is increasingly becoming difficult if they are to be used for commercial purposes. In this study we proposed a hybrid system which connects both solar panel and wind turbine system as an alternative source of electrical energy like thermal and hydro power. A simple control technique has been proposed to track the operating point at which maximum power can be extracted from the PV system and wind turbine system. The whole hybrid system is described given with simulation results.

Keywords: *Solar Energy , Hybrid System, Wind energy, Induction Generator*.

I. INTRODUCTION

With high economic growth rates and over 17 percent of the world population, India is a significant consumer of energy resources. Despite the global financial crisis, India's energy demand continues to rise. India consumes its maximum energy in Residential, commercial and agriculture purposes in comparison to China, Japan, and Russia. Solar energy from the Sun .It is renewable, inexhaustible and environmental pollution free. Solar charged battery system provides power supply for complete 24 hours a day irrespective of bad weather. By adopting the appropriate technology for concerned geographical locations, we can extract a large amount of power from solar radiations. More over solar energy is expected to be promising alternate sources of energy. The global search and the rise in the cost conventional fossil fuel is making power supply demand of electricity product almost impossible especially in some remote areas .Generators which are often used as an alternative to conventional power supply systems are known to be run only during day, and the cost of fueling them is increasingly becoming difficult if they are to be used for commercial purposes. Induction generators are increasingly being used these days because of their relative advantageous features. These features are brush-less rugged construction, low cost, less maintenance, self-protection against faults, good dynamic response and capability to generate power at variable speed. The small-scale power generating system for areas like remotely located single community or remote industry where extension of grid is not feasible may be termed as stand-alone generating system. Portable gen-sets, emergency generators and captive power plants required for critical applications like hospitals and continuous industrial process come under the category of stand-alone generating systems. Induction generator is best suitable for generating electricity from wind, especially in remote areas, because external power supply to produce the excitation magnetic field is not needed.

Generation of pollution free power has become the main aim in the field of electrical power generation. The depletion of fossil fuels, such as coal also aid to the importance of switching to renewable and non-polluting energy sources such as solar and wind energy etc., among which wind energy is the most efficient and wide spread source of energy. Wind is a free and inexhaustible energy source. From the recent scenario it is also evident that wind energy is drawing interest in the power generation sector. If the wind energy could be effectively used it could solve the problems such as environmental pollution and unavailability of fossil fuel in future. The above fact gives the interest for development of a wind power generation system which would have better performance and efficiency. Continuous research is going on taking into account different critical issues in this sector.

Wind energy is one of the most economic and easy available forms of renewable energy. Wind blows from a region of higher to lower atmospheric pressure. The difference in pressure is caused by (A) the fact that earth's surface is not uniformly heated by the sun and (B) the earth's rotation. Wind energy is the byproduct of solar energy in the form of the kinetic energy of air. Wind has been known to man as a natural source of mechanical power. Of the various renewable energy sources, wind energy has emerged as the most viable source of electrical power and is economically competitive with conventional sources. The electrical energy is rising and there is a steady rise of the demand on power generation, transmission, distribution and utilization. The extractable energy from the 0-100m layer of air has been estimated to be the order of 10 12 KWh/annum.

The terms "wind energy" or "wind power" is the process by which the wind is used to generate electricity. Wind turbines convert the kinetic energy into mechanical power. This mechanical power can be used for specific tasks or a generator can convert this mechanical power into electricity. Since earliest recorded, wind power has been used to move ships, grind grain and pump water.

Advantage of standalone hybrid system

1) The daily output will be more stable**,** since both energy sources may offset the variations in output mutually. The overall system will be productive during the day and during the night, since wind power isn't limited by sunlight. Of course, production will be higher during the day but it doesn't drop to zero at night.
2) Seasonal variations are offset. Solar PV systems are more productive during the summer, and wind turbines are more productive during the winter since the weather tends to be windier. Viewed on a yearly basis, the seasonal variations in production are offset.
3) If the installation is off the grid, smaller battery banks are required**.** It is possible for the system to operate with smaller energy storage, since one of the two sources operates day and night. Batteries are also subject to a less aggressive charge/discharge cycle, increasing their service life.
4) If a backup diesel gen-set is used, it can also be sized smaller. There is less uncertainty with respect to the combined wind and solar energy supply. If there is need to use a generator, it will be less frequently and for shorter periods of time.
5**)** Fuel Saving (up to 50%).
6) Lower Atmospheric Contamination.
7) Savings in Maintenance.
8) Silent System.

Standalone Operation in Hybrid Wind and Solar Power Generation

Natural energy-based power generation systems are commonly set with storage batteries, to regulate output fluctuations resulting from natural energy variation. Therefore, it is necessary to prevent battery overcharging. As for the function related hybrid generation system consisting of a wind power, a solar power, and battery, the dump power is clever to control to avoid overcharging the battery without dump load as of

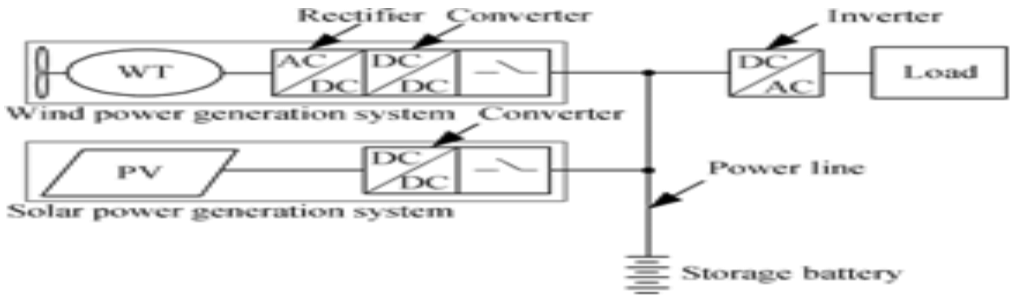


Fig. Standalone hybrid wind-solar power generation systewith storage battery

deposit power transfer into the effectiveness. As for the individual power generation system, it is considered that a PV system featuring low-cost and simple control, which incorporates maximum power point tracking control that make use of diode nature, or a PV system that skin output constancy with a multiple-input dc–dc converter able of

scheming the yield of diverse power sources in mishmash, or a cascaded dc–dc converter PV system that facial appearance good effectiveness along with low cost, or a wind turbine system that facial appearance output stability with a grouping of an electric double-layer capacitor and storage space battery, is fit for use with hybrid power generation systems to stabilize power supply. In contrast, the standalone hybrid system is mostly collected of natural energy source (i.e., wind power and solar power), and a storage battery; and in several belongings, a diesel engine generator may be included into the system as well. However, there is a leaning that the superior the system difficulty, the more fitting the power control technique are necessary to be.

A dc–dc converter is mounting in equally wind power and solar power generation systems. The two systems are interrelated at the output sides of entity converters and are also related to the storage battery. In such a arrangement, each dc–dc converter is able of monitoring the current and voltage of the storage battery, and optimally scheming battery charge, to supply power to the load. In mainly belongings where converters and storage batteries are place up at a central location, the storage batteries are normally install adjoining to the wind- and solar-power generation systems; therefore, near is in general no choice to install the batteries on plane ground or in places with superior vehicular way in for simple protection and alternate

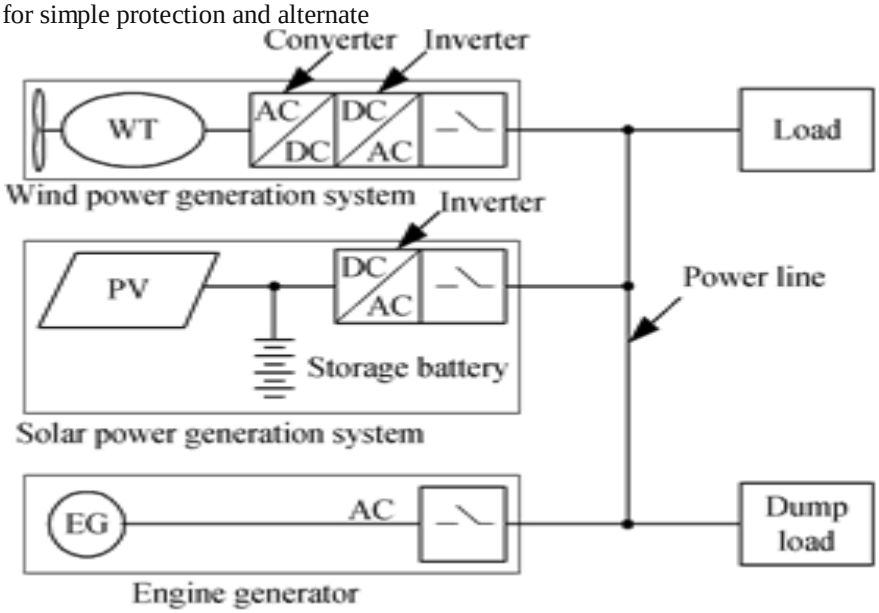


Fig. existing standalone hybrid wind-solar power generation system with dump load

In a hybrid system with a storage battery, as shown in Fig., the output of dc–dc converters is sent to an external dc–ac inverter to supply ac power to load. Therefore, a future increase in load will require an increase in inverter capacity In a system applying a dispersed inverter setup, as shown in Fig.4.4, entity wind- and solar power generation systems, each mount with a dc–ac converter consistent in parallel at the inverter yield sides and are also linked to a diesel engine generator by a power line. At the same time, a dump load is also mounted on the same power line. In this casing, a storage battery is installed in the solar power generation system, and dump power is proscribed as required to prevent battery overcharging.

Available from: "Stand Alone Renewable Energy Systems for Rural Development"

- Photovoltaic system using solar panels
- Wind turbine
- Geothermal source
- Micro combined heat and power
- Micro hydro
- Diesel or biofuel generator
- Thermoelectric generator (TEGs)

Storage is normally implement when a battery bank, although other solution be with fuel cells. Power drawn directly from the battery will be direct current extra low voltage (DC ELV), and this is used especially for lighting as well as for DC appliances. An inverter be use to cause AC low voltage, which further classic appliance can be use with.

Stand-alone photovoltaic power systems are independent of the utility grid and may use solar panels only or may be used in conjunction with a diesel generator, a wind turbine or batteries and stand-alone photovoltaic power systems, the electrical energy produced by the photovoltaic panels cannot always be used directly. When the demand as of the load does not for all time different the solar panel ability, battery banks are in general used. The primary functions of a storage battery in a stand-alone PV system are:

- Energy Storage Capacity and Autonomy: To store energy when there is an excess is available and to provide it when required.
- Voltage and Current Stabilization: To give constant current and voltage by eradicate transients.
- Supply Surge Currents: to provide surge currents to loads like motors when required.

System Monitoring

Monitoring photovoltaic systems is able to give of use in sequence on their process and what must be completed to get better performance, but if the information are not report correctly, the try is exhausted. To be helpful, a monitoring report must provide information on the relevant aspects of the operation in terms that are easily understood by a third party. Appropriate performance parameters need to be selected, and their values consistently updated with each new issue of the report. In some cases it may be beneficial to monitor the performance of individual components in order to refine and improve system performance, or be alerted to loss of performance in time for preventative action. For example, monitoring battery accuse/free profiles will indication when replacement is due before downtime from system failure is experienced.

II. WIND AND SOLAR HYBRID OPERATION ENERGY SYSTEM

Now a day's electricity is mainly desired capability for the human being. All the conservative energy resources are depleting day by day. So we include moving from conservative to non-conventional energy resources. In this the arrangements of two energy resources be take place i.e. wind and solar energy. This procedure revile the sustainable energy resources exclusive of destructive the nature. We can provide continuous power by using hybrid energy system. Essentially this system involves the incorporation of two energy system that will power give continuous power. Solar panels are use for convert solar energy and wind turbines are used for convert wind energy into electricity. This electrical power can consume for different purpose. Generation of electricity will be take place at reasonable cost.

Electricity is mainly required for our day to day life. Present at the two ways of electricity generation also by conventional energy resources or by non-conventional energy resources. Electrical energy requires increases in world so to complete demand we contain to generate electrical energy. At the present of day's electrical energy is generate by the conservative energy resources similar to coal, diesel, and nuclear etc. The major problem of these sources is that it produces waste like ash in coal power plant, nuclear waste in nuclear power plant and taking care of this wastage is very costly. And it too damage he nature. The nuclear waste is very dangerous to human being also. The conventional energy resources are deplete day by day. Quickly it will be absolutely vanish from the earth so we contain to find one more way to generate electricity. The new source must be reliable, pollution free and inexpensive. The non-conventional energy resources should be good further energy resources for the conventional energy resources. Present are various non-conventional energy resources similar to geothermal, tidal, wind, solar etc. the tidal energy has drawback like it can only implement on sea shores. While geothermal energy desires very lager step to remove heat from earth. Solar and wind are simply available in all condition. The non-conventional energy resources like solar, wind can be excellent another source. Solar energy has disadvantage that it could not produce electrical energy in rainy and cloudy period so we should to overcome this problem we can apply two energy resources so thatany one of source fail other source will continue generating the electricity. And in good weather condition we can use both sources combine.

Fig 5.1 Block diagram of hybrid system

Solar-Wind hybrid Power system is the combined power generating system by wind mill and solar energy panel. It also includes a battery which is used to store the energy generated from both the sources. Using this system power generation by windmill when wind source is available and generation from PV module when light radiation is available can be achieved. Both units can be generated power when both sources are available. By providing the battery uninterrupted power supply is possible when both sources are idle.

Solar photovoltaic panels or small wind turbines depend on climatic conditions to operate and produce electrical energy. Thus, when operating alone, they are poor power sources. Systems that merge sources, wind and sun, are more effective in electric energy production. These systems are called “hybrid systems”. They can supply stand-alone systems (isolated electric systems that are not connected to the power grid) or grid-connected systems (systems connected to the power grid). Even with hybrid systems there are periods of time when neither of the sources produces energy. In standalone systems energy storage is required to overcome this situation and provide energy during such periods. A hybrid system combines a small wind turbine and photovoltaic solar panels. Their outputs are optimized by power controllers. The extracted energy is used to charge a batteries bank or to supply energy to an inverter. The inverter is connected to the consumer loads and, when it is present, to the electrical power grid.

III. PROPOSED WORK AND SIMULATION RESULTS

Renewable energy sources have become a popular alternative electrical energy source where power generation in conventional ways is not practical. In the last few years the photovoltaic and wind power generation have been increased significantly. In this study, we proposed a hybrid energy system which combines both solar panel and wind turbine generator as an alternative for conventional source of electrical energy like thermal and hydro power generation. A simple control technique which is also cost effective has been proposed to track the operating point at which maximum power can be coerced from the PV system and wind turbine generator system under continuously changing environmental conditions. The entire hybrid system is described given along with comprehensive simulation results that discover the feasibility of the system. A software simulation model is developed in Matlab/Simulink.

Our main motive with simulation is to find the different parameter for PV module and wind turbine generator. In this model we concentrate mainly on voltage, current, power waveforms for PV module and wind generator.

In this thesis, a wind-photovoltaic hybrid power generation system model is studied and simulated. A hybrid system is more advantageous as individual power generation system is not completely reliable. When any one of the system is shutdown the other can supply power

Simulation Model

In this model PV module and wind generator are connected parallel to genetrate the electricity .Both are connected in hybrid to fulfill the demand of utility.Converter is used to convert dc voltage into ac voltage.Both the energy system are used to charge a battery using bi-directional converter.Bidirectional converter and the battery from the

common additional load to the wind and Pv energy system.Hybrid generation systems that use more than a single power source can greatly enhance the certanity of load demands all the time.Even higher generating capacities can be achieved by hybrid system.In this model we can able to provide fluctuation free output to the load irrespective of weathers condition.To get the energy output of the PV system converted to storage energy ,and constant power delivered by the wind turbine,an efficient energy storage mechanism is requrired,which can be realized by the battery bank.

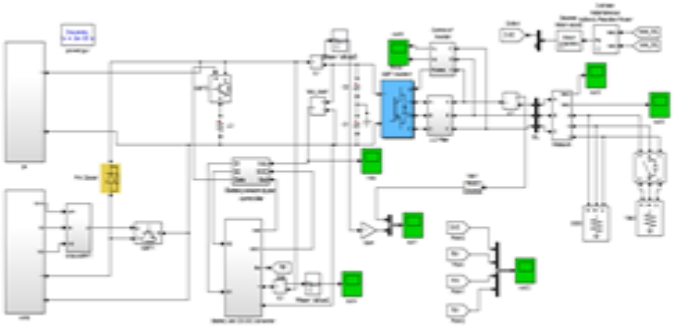
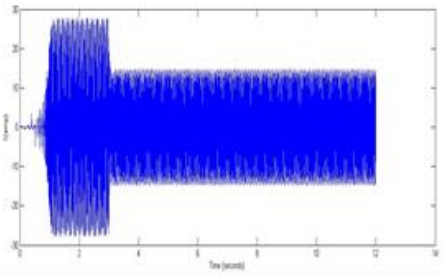
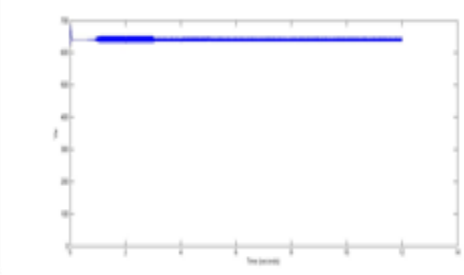


Fig 6.1 Simulation model of standalone hybrid wind and solar power generation with dump power control

Performance of wind power generation

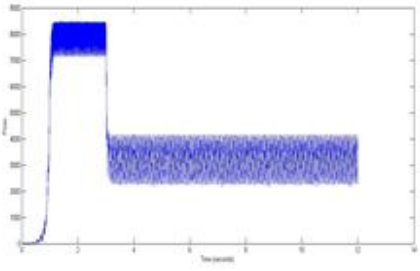
Fig repersent the i-t charactices of wind turbine. The current of PV module is start at 0.5 sec.The value of current maximum at 1 to 3 sec. After 3 sec the value of current is decrease and constant

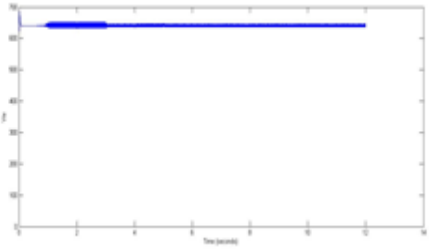




Effect of variation with I-t characterstics for wind turbine Effect of variation withV-t characterstics for wind turbine

Fig repersent the V-t charactices of wind turbine.The voltage of wind turbine is start to rise 0 to 1 sec and 1 to 3 sec voltage of wind turbine is maximum and after that 3 sec the voltage is constant.





Effect of variation with P-t characterstics for wind turbineEffect of variation with v-t characterstics for wind generator

Fig represent the P-t characterstics of wind turbine. The power of wind is start rise near 0.5 sec reaches at 1 sec at that sec the power is maximum upto 3sec .After 3 sec the power of wind turbine is constant and Fig repersent the V-t characterstics of wind generator. The voltage of wind generator is constant at all time.

Performance of solar power generation.

Fig repersent the V-t characterstics of PV module .The voltage of PV module is start rise to 0 sec then reaches at 1sec.After 1 to 3 sec the voltage is maximum. After 3 sec some voltage is decrease at constant at all time.

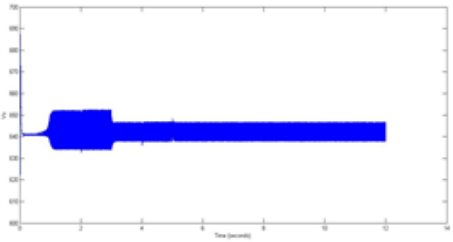


Fig Effect of variation with v-t characterstics for PV module

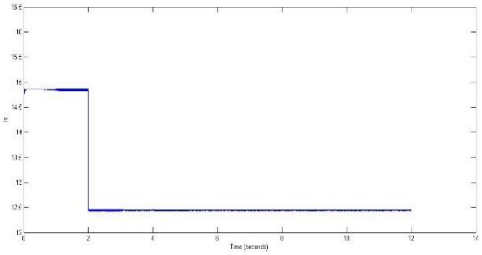


Fig Effect of variation with I-t characterstics for PV module

Fig repersent the I-t characterstics of PV module.The current of PV module is start rise at 0 sec.The value of current is 0 to 2 sec is maximum.After 2 sec the value of curent is decrease and constant. And Fig repersent the P-t characterstics of PV module.The power of PV module ia start rise at 0 sec . The power of PV module is maximum at 1 to 2 sec. After 2 sec power is decrease and constant upto 3 sec. After 3 sec the power is constant.

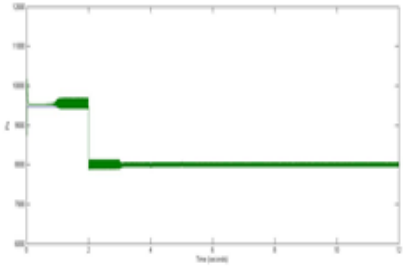


Fig Effect of variation with power w.r.t time characterstics

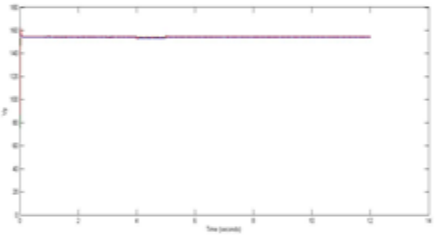


Fig Effect of variation with voltage w.r.t time characterstics

Fig repersent the the phase voltage and line voltage. The line voltage is constant w.r.t time and phase voltage is varied accroding to time.

IV. CONCLUSION

PV cell, module and array are simulated and effect of environment conditions on their characteristics is studied.

Wind energy system has been studied and simulated. Both the system is integrated and the hybrid system is used for battery charging and discharging.

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