

Generation of Hybrid Power by Wind and Solar Cogeneration Techniques

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ABSTRACT

This paper presents a theoretical model and a system concept for the generation of Hybrid energy. India is one of the largest producers of electricity in the world and has acquired a global share of 4.8% in year 2013, but the demand has been increasing rapidly ahead of the supply. The present trend towards the generation of multi megawatt energy by using hybrid energy systems and the increasing interest in the combination of renewable energy resources and battery storage devices for the supply of high quality and continuous electrical power leads to development of new energy resources. This paper discusses a new hybrid power system which is a combination of both solar and wind power. For harvesting the solar energy, this hybrid model uses solar cogeneration technology for harvesting solar energy and wind turbines are used for generation of electricity using wind power the combination of both of these will increase the efficiency of this hybrid system, in addition to generation of electricity we can also supply of hot water to the various companies like dairy farms, waste recycling companies, leather industries etc. where huge amount of energy is wasted for getting hot water. This paper gives a preview of the schematic model of the hybrid power system that can be used to provide reliable energy to house hold.

Keywords –Hybrid energy, photovoltaic, Wind energy.

I. INTRODUCTION

Wind turbines and solar panels mostly depends on the climatic conditions in order to produce electricity, so when they operate individually they seems to be less efficient, so in order to develop the power generation there is a need to merge the power sources, the sun and wind are more effective in generation of electricity. So these systems are called hybrid systems. These systems can act as standalone systems (the individual electric systems which are not connected to any power grid) and grid-connected systems (the systems which are connected to power-grid) [1]. although these systems can provide back up to each other there can be situations. Where neither of the sources in hybrid systems can produce energy. Battery storage devices must be able to compensate this energy during these situations [2]. In hybrid systems the wind turbines and solar cogeneration systems. the outputs of these systems are optimized by power controllers. But when the demand is very high alternative backup sources like battery storage systems

or capacitor banks should provide energy until both the energy sources will regain to their standard power levels. So the extracted energy is used to charge these batteries bank or to supply energy to an inverter. These inverters are then attached to consumer loads and then to the power grid. Hybrid systems generally constitutes of two or more power sources to a common single load as result there are several advantages which are delivered from Hybrid wind-solar cogeneration. The advantages are like:

1. Hybrid wind-solar cogeneration can efficiently reduce the pollution.
2. Solar cogeneration reduces more greenhouse gases emission when compared to PV or SHW alone.
3. Highly efficient and continuous power supply to the consumers.
4. The power required for generating hot water for various industries can be reduced.
5. The maintenance cost of Hybrid Wind-solar cogeneration system is very less compared to the other generation techniques.

II. WIND TURBINES

Wind turbines are a classical source for tapping wind energy from the nature. The generation of power from this has been increased rapidly in the recent past at a rate of 30% annually [5]. The countries like Germany alone has installed capacity of over 20GW of the wind generators with an annual output of around 40TWh in 2007[5]. One of the largest wind turbines were installed in Emolen. The layout of a typical wind turbine generator found across the world the exact design do vary but almost all the wind turbines in used today are horizontal axis machines which has three bladed rotors spinning in vertical plane attached to front of the box called the shell in this shell we have a generator often a gear box and a high voltage transformer and the whole sits on a the top of a tower which keep the blades from touching the ground we tend the class of the turbines by their power output many turbines produces 400k to 600k and sum multi megawatt turbines, which produce up to 3 MW per unit apart physical scale they are arranged bit differently. There are mainly two types of wind turbines they are [2]: 1. Horizontal axis wind turbines (HAWT), 2. Vertical axis wind turbines (VAWT) all these turbines generate electricity by using the principle of electromagnetic induction. Apart from the two main categories HAWT and VAWT there commercially

available wind turbines are also available which are again classified in to two groups: fixed speed and variable speed wind turbines[2].The fixed speed wind turbines operate at a constant speed and frequency and they are directly connected to the power grid whereas the variable speed wind turbines are designed to absorb 10-15% more energy than that of the fixed speed wind turbines. The general equation used for the calculating power from the wind turbines is given by $P = \frac{1}{2} \rho A V^3$ [2] Where: ρ : Air density (1.225 kg/m³ at level) A : Rotor swept area (m²) V : Speed of air (m/s) P : power . By making some changes to the these wind turbines we produce more electricity they are : faster winds changing the blade angle using longer blades and having a larger generator these have several advantages they are :

1. Wind turbines used winds natural renewable source of energy to generate electricity
2. Fossil fuels are used to produce and construct wind turbines but they no longer matter once the wind turbines starts running
3. Most wind power costs associate with turbine installation wind turbines can be constructed any location with suitable winds.
4. Their maintenance is easy and cheap.



fig .1 wind turbine

III. SOLAR COGENERATION

Solar cogeneration combines photo voltaic and thermal module providing electricity and hot water. We can yield five times more energy than tradition PV systems a parabola of mirrors concentrate sun light on to narrow strip of solar panels aluminum channels are installed behind the PV cell to prevent them from overheating traditional PV system converts 15% of solar energy in to electricity with remaining energy going in to waste solar cogeneration captures up to 75% converting waste heat in to hot water. The thermal module uses reflected light to heat the coolant that produces hot water by a heat exchange loop solar module generates energy directly in can be feedback to the grid each module can pivot to

follow the sun and can harvest maximum available sunlight .The hot water produce from this system are useful for many industries like food and wine ,healthcare, multifamily housing and hospitality which spends hundreds of megawatts of energy to produce it and uses thousands of gallons of hot water of for things like showers ,cleaning and washing laundry and food processing solar cogeneration can help offset energy usage for these purposes and helps in saving energy .The below fig2 shows the body and design of the solar cogeneration system where the solar array falls on the mirrors and which are then reflected in to the solar PV cells which are place on the water pipes for the supply of the water which is later converted in to the hot water.

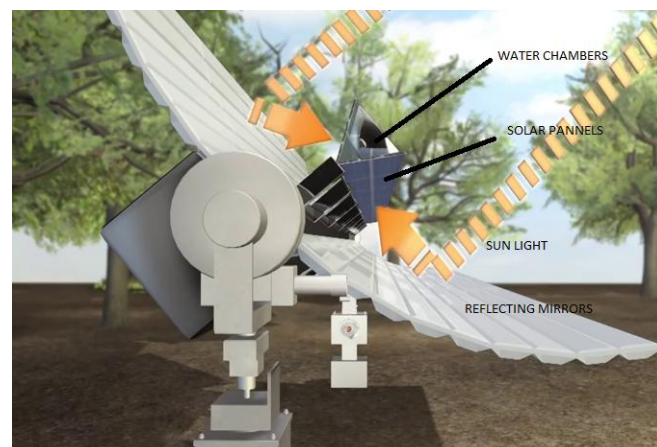


Fig.2 Solar Cogeneration system

IV. SCHEMATIC DIAGRAM

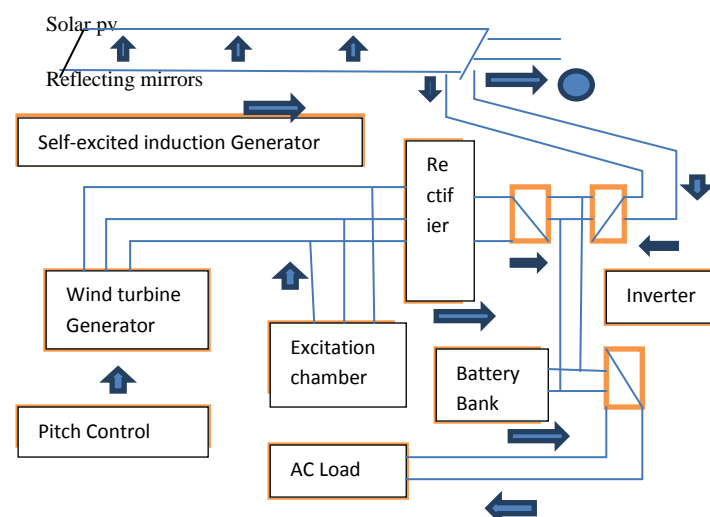


Fig.3 wind and solar cogeneration hybrid model

The above fig 3. shows the schematic diagram of the modern hybrid system .the schematic model consists of wind turbine system [2] , solar cogeneration system ,battery bank ,inverter, pitch controller, excitation capacitor ,and a rectifier .Though these hybrid system produces maximum energy and hot water by utilizing both solar and wind power to produce energy [3] .

The inverters are used to convert the DC to AC frequency and voltage, they also control the grid current at a unity power factor [5]. The latest power grid connected invert uses Pulse Width modulation as they produce the required [4] voltage and current wave forms whenever required [8]. But sometimes, when the demand is very high. These systems cannot meet the required rate so there is need for the alternate back up sources like battery banks, and capacitor banks until the systems regains its full capacity. The hybrid power systems offers many advantages over other existing technologies used for the generation of electricity in terms of reducing air pollutants other than carbon dioxide — along with volatile organic compounds, nitrogen oxides, sulfur dioxide, carbon monoxide and particulate matter — both locally and averaged across the grid [1]. The absolute and complete reductions depend on the combination of generating sources in the regional grid. Wind and solar cogeneration.

1. Hybrid power system also eliminates local emissions of pollutants compared with burning natural gas to heat water in boilers or generate electricity. Due to the complementary nature of both solar and wind energies. During the summer season the wind flow is less when compared to other seasons and during the dark winter months it is usually quite windy.
2. Because of the diversity in power supply due to the power sources the risk of power outages is considerably reduced when compared to traditional systems.
3. Because of the sample diversity in the supply the capacity of the battery is considerably reduced.
4. There will be reduction in the conversation units of both solar and wind energy because of the equal distribution of the total load.
5. The highly costly equipment like inverters and battery banks must be connected to common load in more effective way.

IV. CONCLUSION

An attempt has been made in this paper to introduce a new combination of hybrid power system. A brief explanation was given on wind turbines and solar cogeneration technique and combined hybrid system. Today as the world is unitedly working to reduce the carbon footprints [7] on the planet a more cleanly and cheaper and greener energy is much more necessary in present society [6]. As the energy produced through nuclear power plants and thermal modes are not too efficient to meet the needs and are acting as the one of the sources of carbon emissions but with the advancement in the power electronics the scientific community is paving a way for design and developing more renewable energy based power plans for the future.

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