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Hybrid Electricity Generation from Solar and Wind

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Abstract - The generation of electricity by conventional methods like Coal based, diesel, Hydro, Nuclear etc. is used all over the world. But as we all know that fossil fuels are very soon be depleted and there are hazardous effects of nuclear waste if not properly taken care of. So the need for use of Renewable sources for generation of electricity arises. With hybrid generation the use of batteries can also be minimized which in result cuts the operational cost. In this paper I want to propose a hybrid structure of power generation using both solar and wind, as in day time sunlight can generate electricity and in addition to day time at night wind turbines will produce electricity. So a continuous generation can be maintained. In addition, how the maximum generation from both the sources can be achieved is also considered.

Keywords - ***Hybrid generation, renewable energy sources, EV application***

1. Introduction

The wind and solar radiation peaks differs for most of the time of the day, like sunlight is brighter in day time and wind is stronger in night time. So such hybrid systems can be used to produce power efficiently when and where one needs it. In most of the part of world, wind speeds are low in the summer when the sun shines brightest and longest. The wind is strong in the winter when less sunlight is available. Also same feature can be seen every day. Because the peak operating times for wind and solar systems occur at different times of the day and year, hybrid systems are more useful instead of stand-alone generation systems. Such systems can help in reducing dependency on conventional sources. Also it will help using battery systems which are used if standalone solar systems are to be used.

2. Renewable Energy Sources

Renewable energy is clean, easily and infinitely available in nature. It has no emission problem and hence results in clean air and water. Renewable power creates jobs and generates revenue for local communities. Revenue from solar and wind farms helps stimulate local economies that need new roads, schools, libraries, and hospitals.

2.1 Solar Energy

This form of renewable energy is available in abundance in nature. This energy is never ending energy. Trapping of its radiation efficiently is the biggest problem faced by researchers today. The solar panels which are used to trap sunlight are not yet well designed so as to make maximum use of trapped sunlight. Also the cost of these panels is still high so is not reachable to everyone in the society.

Solar energy is produced when the sun is shining during the day and is complementary to wind energy, which tends to reach its highest production at night.

The electricity can be generated from solar energy by one of the following methods.

1. Concentrated solar power uses mirrors to reflect and concentrate sunlight onto receivers that collect the solar energy and convert it to heat. This thermal energy can then be used to produce electricity via a steam turbine or heat engine driving a generator.
2. Photovoltaic solar technology uses photovoltaic cells (PV) to convert sunlight directly into electricity. PV cells are made of semiconductors and can provide large amounts of power for the electric grid.

2.2 Wind Energy

Wind energy is largely available during night time and during winter season. It is actually air in motion caused by natural factors like the uneven heating of the earth's surface by the sun, the rotation of the earth and the irregularities of the earth's surface. Wind energy has been used for centuries to move ships, pump water and grind grain. Today, windmills are commonly used across the Great Plains to pump water and to generate electricity. Wind turbines that are typically 200 feet or more above ground are used to harness the wind and turn it into energy. When the wind blows, it turns the turbines blades. The blades are connected to a drive shaft that moves with the blades. The shaft is attached to a generator, which creates electricity. The electricity created is in the form alternating current.

So, the use of both solar and wind energy simultaneously for the generation of electricity will deliver maximum output with minimum cost. Although today installation cost is on higher side but with the advancement of technology this barrier can also be removed. Also, building turbines and photovoltaic's at the same location can reduce grid and battery costs and level out power supply.

This type of hybrid structure can be on-load or off-load in type of connection depending upon the requirement.

3. Block Diagram

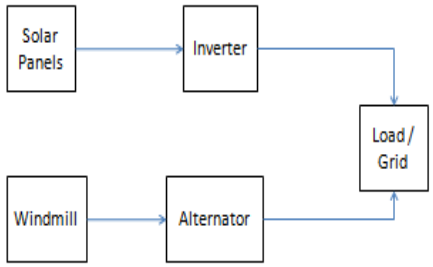

Figure 1 – Block Diagram

4. Working Principle

The hybrid structure of solar and wind does not work together. It works mostly one after another. As we know during day time sunlight is available in abundance and during night wind is available. During day time for over the period of a year sunlight is available around 5-6hrs daily. In monsoon this can be reduced to 3-4hrs a day. But average time can be considered 5-6hrs a day. With the help of solar panels we can trap these rays and convert it into electricity.

During night when sunlight is not present, wind is available in large amount. So with the help of windmills, this energy can be trapped, provide it to connected generators which in turn will generate electricity. As shown in above block diagram. Solar system and windmill must be connected in parallel to one another so that when one fails another source can generate electricity if possible [1]. In addition to it at domestic level such a system should be connected in parallel with grid supply, so that when both the sources fails to deliver the supply of electricity must not get cut out.

The output of solar panels is first fed to inverter circuit [2] before connecting to any load. On the other hand output of windmill can be directly connected to a load as it will generate AC power directly with connected alternators. If large windmills are considered then it can be connected with the grid to supply power back to it.

Such type of system can be used anywhere. Small unit of such system can be installed at domestic places or small offices where light is load connected. Also bigger version of such system can be used as an alternative to conventional methods of power generation.

5. Conclusion

Hybrid solar and wind power system for generation of electricity can be a solution instead of traditionally used conventional sources like coal, diesel etc. with the benefit that both the sources are free, easily available and clean source of energy. So generation with the help of these sources would not harm the environment in any sense. Also it can be used for numerous applications listed in future scope.

Future Scope

Biggest advantage of such system is that it is freely and easily available in very large quantity almost all the months of a year. So it can be used for numerous applications such as for power generation of an isolated houses, offices, warehouses etc.

But one important application I want to mention is that such system can be efficiently used as a power source for Electric Vehicles both two and four wheeler. In future I want to apply such a system to an EV so that performance of an EV in terms of battery life, kilometers it can go in one charging and also the requirement of frequent charging due to which the concept of charging stations has been taken care of by many researchers[3]. With such an application we can minimize the possibilities of grid failure or introduction of spikes into the grid due to frequent charging of multiple EV's, the need for establishment of charging stations at very short distances, etc.

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