

Electric Power Generation Using Triple Helix Designed Wind Turbine for Urban Houses with Distribution System

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Abstract

In the era of electrical system, electrical energy generation is the most important part of nation. Electricity is the essential part of indoor as well as outdoor usage, because electricity is one of the purest forms of energy that can be easily generated and can be transferred to the long distance. Today fossil fuels decreases day by day and because of that, the cost of fuel for energy generation is increases. Moreover, pollution is major problem in today scenario. Therefore, we must find out the most economical and clean way of electricity generation. Currently we are using electricity from utility for electrify to our home, utility generate this electricity from coal fired thermal power plant or gas fired. We can save this electricity if we find an alternate way of power supply for our homes. There are many alternate sources such as solar systems, wind energy systems and many more but out of all, wind energy most suitable for the purpose because it can be available freely in the atmosphere mostly as compared to the solar light which is present only at the day time and only at the hours when sunlight is maximum. Therefore, wind energy can be converted into the electrical energy and this electrical energy can be utilized for street lighting. Wind turbines are the main convertor of wind energy into electrical energy. Wind turbine takes flow of wind and converts it into rotational mechanical energy and this mechanical energy is converted into the electrical energy by ac or dc generator. There are so

many types of designs of wind turbines depend on the application and area where it is used we can use any type. For urban houses, we use triple helix design

Keywords: Triple helix, distributed system, wind turbine, CMS (central monitoring system).

Introduction

Electricity is most essential part of any city. At this time, this biggest part electricity is generated by coal fired or gas fired thermal power plant. It causes a very large cost in budget and it increases pollution. Because the coal, gas nuclear power plant produces flue gases after burnt, these gases are very harmful for our environment and cause the pollution. In this situation, we can use any other sources of electricity and they are not affecting to our environment. Generally, in urban cities, the airflow is low at near to the ground but on the rooftop of the house, the airflow is sufficient for the generation of electricity. This energy can be utilized for our homes by using wind turbine for electricity generation. Wind turbine is very clean and effective way of electricity generation. There are so many types of wind turbine designs but they are selected based on their application and place where they are used and what amount of airflow. For the urban environment, we use a very new and unique type of wind turbine design it is a triple helix designed wind turbine, which is a vertical axis wind turbine. It means that the turbine blades are rotate vertically on its axis. This design does not require any tail for keep the blades in the direction to the air flow. This system also enables the energy generation for the distribution system. When electricity is not required or the energy generation is more than the energy consume by the homes then the electricity is send to the small distribution system which supply this energy to the low load area like villages where the electricity supply is very less from the utility which enables the extra income and also provide the sufficient energy for the agriculture works. We are facing lot of problems with our environment and with energy generation but this type of use of energy can help us to decrease these problems.

Triple helix designed wind turbine

This is a vertical axis wind turbine. This designed has biggest advantage that it can catch the wind from all direction it means that these are omni directional and can be run at lower speed than horizontal wind turbine vertical axis wind turbine have been two distinct type. The darrieus type a treasonous type. The helix type wind turbine is very new design of wind turbine. These turbines are particularly used for urban Environment where it can be work safer due to their low rotational speed [3]. Moreover, they can be catching the wind from all the directions. Horizontal wind turbines are typically more efficient then vertical wind turbines. Because of that, the horizontal wind turbine make more use full in the commercial wind power market.

Nevertheless, small vertical axis wind turbines are more suitable and useful in urban area because of its silent operation and lower risk. The triple helix designed wind turbine is particularly used in urban areas because the wind flow is comparatively low and the direction of the wind change suddenly [1] [3]. Because of these property this wind turbine can be used for energizing the street lighting. One main property of this design is, it can be operate on the wind which is comes lower area to the upper area. A design of this turbine is given below. [3]



Figure 1 Triple helix designed wind turbine.

Physical

Axis	Vertical
Height	2.7m (8.85 ft)
Width	1.8 m (5.9 ft)
Weight	175 kg (386 lb)
Swept Area	4.62 m ² (50 ft ²)
Blade Materials	Fiberglass

Performance

Rated Power	1000 W
Cut-in Wind Speed	3.5 m/s (7 mph)
Rated RPM	180 RPM
Survival Wind Speed	55 m/s (123 mph)
Rated Wind Speed	12 m/s (26 mph)
Annual Energy at 5.5 m/s	1750 kWh/yr
Sound level at 12 m/s according to IEC 61400-11:	< 38 dB

Electric Generation

Grid-Compatible	110V, 120V, 208V, 220V, 230V, 240V
Rated Output	
Off-Grid	24 Vdc
Grid-Tie	600 Vdc

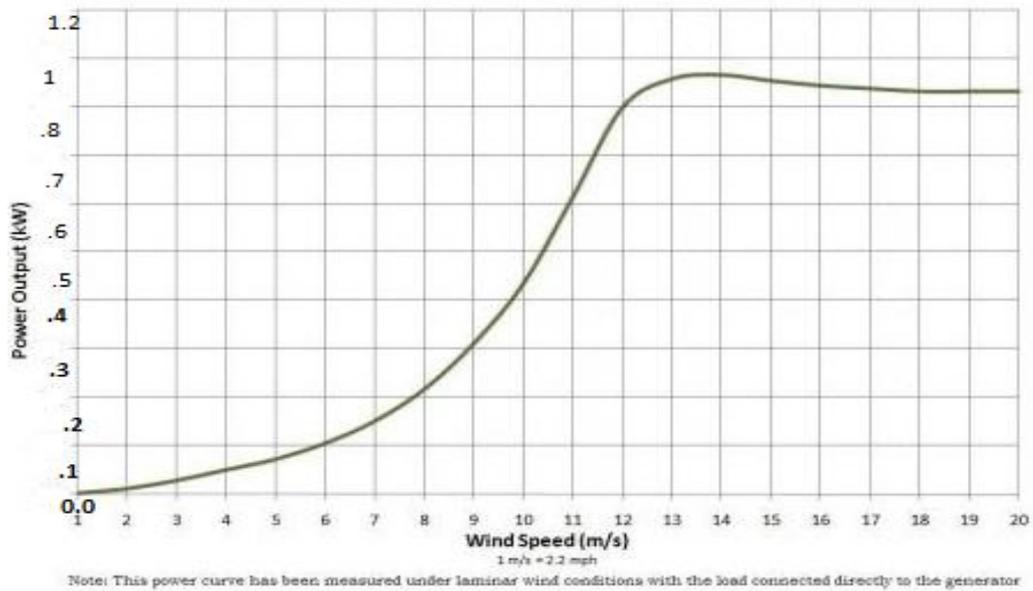


Figure 2: Plot Power output Vs wind speed.

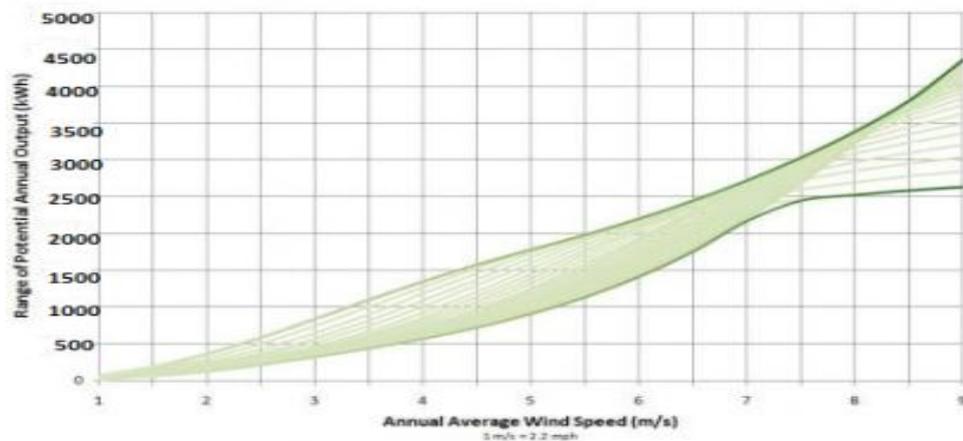


Figure 3: Plot Rang of Power output Vs Annual Average wind speed.

Proposed Work

Distribution system for wind power generation and CMS (central monitoring system) control

Basically distribution system in wind power generation is little bit different from the normal system because in this system wind turbines generate the electrical energy and this energy is consumed by urban houses but as we know that the wind flow is different on different places and the turbines are installed at very wide area so the generation is different for the different area because of that the distributing system cannot work properly in that case the CMS controls the system and gives them stable and good supply for the proper work. As we know that the energy consumption is not constant in urban houses, large electricity is required in evening and morning shift if we calculate its working hours then it will be around 10 hours from the 24 hours and remaining 14 hours the electricity requirement is less so the electricity is wasted in that hours. However, we can use this electricity for the other works and we store this electricity. So the distribution system enables proper and efficient use of generated electricity. In the distribution system the central monitoring system monitors all the generation of wind turbine and because of that it takes the preprogrammed design like when the generation is large then consumption, at that time this extra-generated electricity will be supplied through the low transmission line to the domestic loads or it can be stored. Because of that the extra if the generation in turbines are different in different areas so the central monitoring system takes the electricity from the large generation area and gives it to the lower generation area.[6]

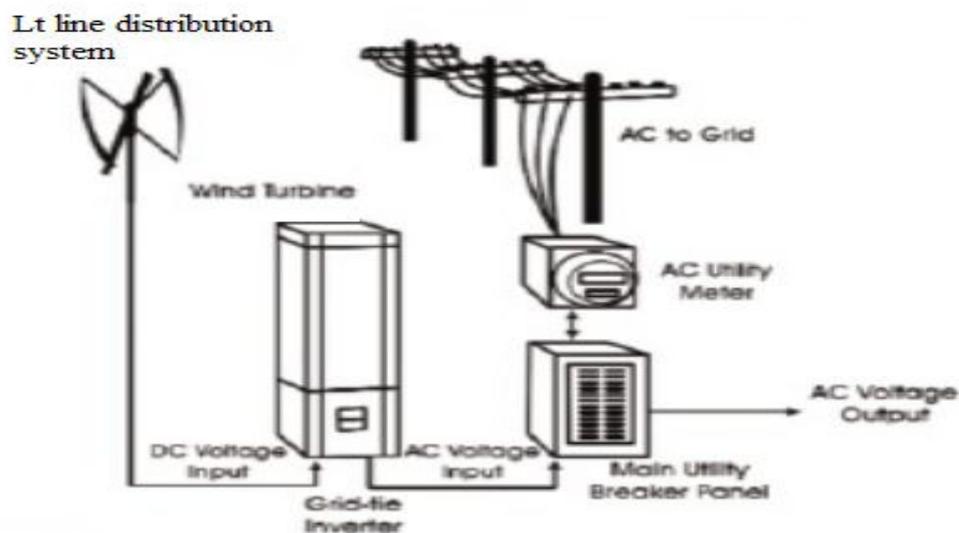


Figure 4: wind turbine system when supply is given to the low transmission line distribution system [1].

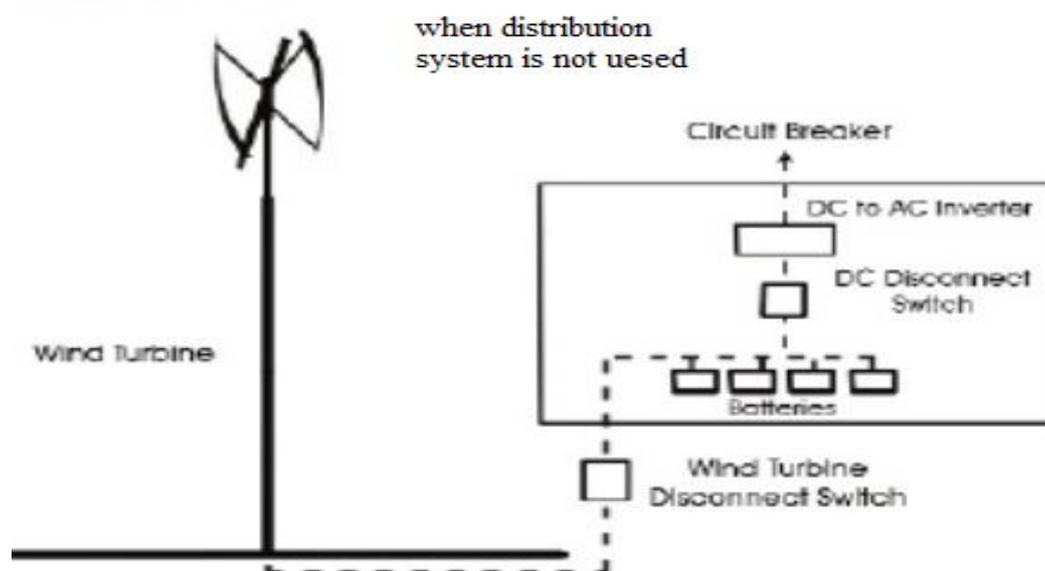


Figure 5: Wind turbine system when the supply is isolated from the low transmission line distribution system [7].

Working of Distribution System

In wind turbine based power generation for the urban environment, the CMS performs the work of distributed system in this we have to define the work of CMS, by the use of programming in CMS. There are some works of CMS on the working site, which are defined below.

Proper monitoring of the energy generation, energy consumption, and energy stored in the battery bank, wind speed etc. by the use of sensors and measuring instruments.

1. Data acquisition of all the measured data for the future analysis of the system.
2. When the electricity is not in use like day shift then this extra energy should be step up by the transformer and send to the small distribution system for the proper utilization of energy and extra income by this generation system.
3. For one-kilometer square area there are around number of houses where wind turbines are installed but as we know that the wind speeds are different for the different places at any time because of that generation of each turbine is different. Because of that, the electricity supply is deferent for the different houses. Therefore, the CMS monitors the system and give the sufficient supply to the homes.
4. When the generation is large and the consumption is less. So this remaining energy is supplied to small distribution system and this work is done by the CMS.

Result

We found that the average generation of electricity using helix design windmill is 12 kWh (12 unit) in 24 hrs and consumption of electricity in urban houses by utility is around 10 kWh (10unit) a day so the energy generated is sufficient for this system. This system batter then solar power generation because 1kw solar power system generates five kwh (5 unit) in 24 hr. also this system is more costly then wind power generation system for the same amount of energy.

Conclusion

We can utilize the wind power using helix design wind turbine for energies the urban houses. This designed has biggest advantage that it can catch the wind from all direction, it means that these are Omni directional and can be run at lower speed than horizontal wind turbine. Energy generated by this windmill for urban houses solves energy related problems as well as extra energy is used for utility. In this manner, we can utilize the energy, which is waste every day. Because of limited amount of fossil fuel and it also creates pollution, Wind energy is the cleanest and the most pure form of energy; it is also known as green energy.

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