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WIND GENERATOR SYSTEM WITH MULTIPLE TURBINES

Wind generator with multiple turbines is completely a new idea which will change the construction of the contemporary wind turbine generator system. It will help us capture more wind energy from the nature and consequently the capacity of one unit generator will be increased. This invention will help install large wind generator system where the wind flow is even lower than that of required for the conventional wind generator system. So, this invention might be a solution to generate electricity for the places in the earth which are presently considered as non-potential sites for wind power generation.

APPLICATIONS

- A higher capacity single unit wind generator will be driven by multiple identical wind turbines whose shafts are connected to a single common shaft, in contrast to multiple wind generators driven by multiple wind turbines (single unit of turbine drives single unit of generator) currently available in the market.
- The present invention will help implement higher capacity electrical generator systems in such locations where the average or typical wind speed is below the requisite wind speed for conventional wind turbines.
- This invention will also allow for the future growth in the capacity of generators with the availability of higher-rated power electronic devices..

ADVANTAGES

- This invention will help implement higher capacity single unit wind generator system which we can't think before for a specific location.
- As the mechanical energy of multiple turbines is accumulated to a single common shaft to drive a single large generator, the number of generator and power electronic interface required for each individual wind turbine is reduced, thereby reducing overall construction, installation costs and maintenance costs.
- No electric generator and power electronic devices will be implemented over the tower. So, the total load (weight) carried by each tower will be reduced. It will save the cost of

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the tower construction for each turbine.

» Gear ratio can be maintained by proper selection of the cranks of the generator and the turbine, so no conventional gearbox is required.

» Another significant advantage is the reduction in the radius of the blades of each wind turbine, which decreases based on the number of wind turbines shown in the following table. This reduces the size and weight of each turbine, which reduces construction and installation costs as well as maintenance and repair costs of the turbines.

» In addition, with the reduction of the size of the wind turbine, the inertia of the turbines will be reduced. It will also help the pitch controller to control the aerodynamics of the turbine.

» In systems where the generator is set near to or on the ground, maintenance and repair are substantially easier.

To generate power of 6 MW (Assuming 5% mechanical power loss for multiple turbines); Air Density= 1.225 kg/m^3; Wind speed= 11 m/s; Power coefficient= 0.45		
Number of Wind Turbine	**Radius of each Turbine in meter**	**Length of the chain in between consecutive two turbines in meter (Considering the clearance between two turbines = 3m)**
1	74	Chain is not required.
3	42.7	88.4
6	30.2	63.4
8	26.1	55.2
10	23.4	49.8

THE TECHNOLOGY

In this invention each wind turbine can be smaller than a single conventional wind turbine, and is mechanically connected by a chain to each other and to a single generator, which is located elsewhere (i.e., not in the nacelle or on the turbine tower). As seen in the following figure, in one exemplary embodiment the system includes a group of wind turbines mechanically connected to each other, and to a single generator. In the figure, three turbines are shown, although the present system can work with any number of turbines. Each turbine comprises a number of turbine blades connected to a hub at the top of a pole or tower. The hub has a shaft mechanically connected to a set of cranks which may be exposed or covered (such as in a modified nacelle). A pitch control and yaw mechanism may be employed as well.

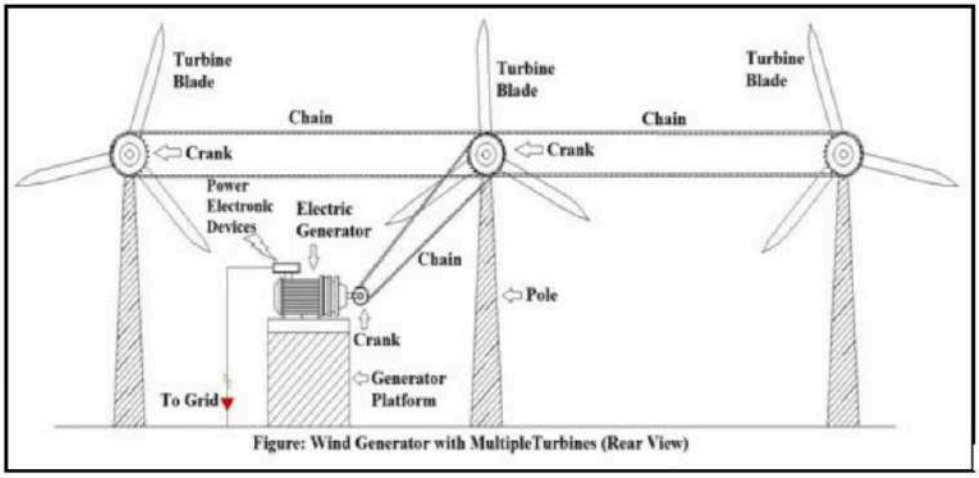

Figure: Wind Generator with MultipleTurbines (Rear View)

The cranks on adjacent turbines are connected by a chain. In the embodiment shown, at least two cranks are used, with each being mechanically connected to a corresponding crank on an adjacent turbine in the case where a turbine is located between two turbines. In the case where a turbine is on the end of a line or sequence of turbines, it will only be connected to one adjacent turbine.

An electrical generator is similarly coupled to at least one of the turbines. In the embodiment shown in the above figure, the generator is linked by a chain to a third crank on the middle turbine of a sequence of three. The electrical generator may be located on the ground, on a platform, on a pole, or other location. This allows the individual turbines to be lighter, thereby reducing the total weight on the tower or pole. Even, the generator might be located in the nacelle of one of the turbines in the sequence, and that tower or pole may be strengthened to handle the increase in total weight. Finally, extracted power from the wind by multiple turbines will help drive a large electric generator to produce more power by providing lots of advantages than multiple numbers of conventional small units of wind generators.

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Dr. Mohd. Hasan Ali received the Ph.D. degree in electrical and electronic engineering from Kitami Institute of Technology, Kitami, Japan, in 2004. He was a Lecturer with the EEE Department of RUET, Bangladesh, from 1995 to 2004, where he became an Assistant Professor in 2004. He was a Postdoctoral Research Fellow under the Japan Society for the Promotion of Science (JSPS) Program at the Kitami Institute of Technology, Japan, from November 2004 to January 2007. He was also a Research Professor in the Electrical Engineering Department, Changwon National University, South Korea, from February 2007 to December 2007. He was a Postdoctoral Research Fellow with the Electrical and Computer Engineering Department, Ryerson University, Canada, from January 2008 to June 2009. He was also a Faculty at the Electrical Engineering Department, University of South Carolina, USA, from July 2009 to August 2011. He is currently an Assistant Professor in the Electrical and Computer Engineering Department, University of Memphis, Memphis, TN, USA, where he leads the Electric Power and Energy Systems (EPES) Laboratory.

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Dr. Md Maruf Hossain is currently an Assistant Professor in the Department of Electrical Engineering Technology at the University of Wisconsin-Green Bay. Prior to this current position, he was the Herff Fellow at the University of Memphis. He received his Ph.D. in Electrical Engineering under the supervision of Dr. Mohd. Hasan Ali from the University of Memphis in 2016, and both M.Sc. and B.Sc. in Electrical and Electronic Engineering from Bangladesh University of Engineering and Technology (BUET) in 2006 and 2011 respectively. Previously he worked as an Assistant Professor in Ahsanullah University of Science & Technology and as a Lecturer in American International University-Bangladesh for over five years.

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