DESIGN ISSUE WITH MULTIMEGAWATT WIND TURBINE AND WIND PARK

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Abstract—Multimegawatt wind-turbine systems, frequently organized in a wind park, are the backbone of the power generation based on renewable-energy systems. In this paper the most-adopted wind-turbine systems, the adopt generators, the topologies of the converters, the generator control and grid connection issues, as well as their arrangement in wind parks.

Index Terms: Control, generators, power converters, wind.

I. INTRODUCTION

Electricity production from wind turbines has been the focus of considerable attention when it comes to the fulfillment of renewable-energy targets set by governments worldwide. Multimegawatt (multi-MW) wind turbines, often organized in wind parks, are the main solution to achieve these goals. In the last years, the focus has been shifted toward offshore resources not only due to the higher wind-energy potential but also because of the limitations and the polemic issues raised around environmental impacts of land-based wind turbines. In addition to efficiency and reliability, which are generally required for all conversion systems onshore, the size and the weight of components will be of extreme importance for offshore installations, considering that expensive platforms must be placed to support the total weight of the structure and all the components of the wind-energy conversion system. In that sense, state-of-the-art conversion systems. Developed and installed worldwide in land-based wind turbines will not necessarily be the most-suitable ones offshore in terms of the weight, the size, and the reliability. The generators conventionally used in large WECSs are the doubly fed induction generator (DFIG) .the cage induction generator (IG), and the synchronous generator (SG). This paper aims at giving an update of the most-recent trends regarding generators, power converters, and their control with respect to overviews already published in the past years. On the other hand, this paper highlights the most-recent issues in terms of inertia emulation, energy storage, harmonics, faults/unbalances, and system-oriented approach for a wind park design.

II. WIND-TURBINE SYSTEM OVERVIEW

The wind-turbine systems and the control issues are reviewed here. Wind turbine systems directly connected to the grid and/or without any power converter directly or indirectly controlling the rotor speed will not be taken into consideration. The electrical generators presently used for the implementation of multi-MW WECSs are the DFIG, the cage IG, and the SG

III.WORKING

Parallel Connection System

In this scheme the turbines are connected to a low voltage grid. A high power transformer is needed to increase voltage to transmission level. High voltage DC transmission is employed with the help of converters. Advantages are more reliable and it can be used for both DC and AC offshore grids. Weight is more and thus offshore platforms needed so investment cost is high and lesser efficiency due to losses in low voltage offshore grid. With the introduction of medium voltage power conversion systems in WT can eliminate transformers and increase efficiency.

Series Connection

Output of each wind turbine is first converted to DC and then connected in series by the HVDC cables. Advantages is that it requires lesser cables and investment cost, High power transformers are not desired and Least losses in transmission lines and offshore grid since HVDC is transmitted. Drawbacks are losses in power electronic converters and Variation in wind velocity will cause variation in output and less reliable.

IV. HOW DOES IT WORK

The energy in the wind turns the propeller-like fins around a rotor. The pitch of the blades types optimum use of the wind direction. The rotor is linked to the main drive shaft, which turns a generator to create electricity. Wind turbines are straddling on a tower to capture the most energy.

At 30 meters or additional above ground, they can take benefit of faster and less turbulent wind. Wind turbines can be used to products electricity for a single home or building, or they can be connected to an electricity grid for more widespread electricity distribution.

V. EFFICIENCY OF WIND PARK (OFFSHORE)

Not all the energy of blowing wind can be harvested, since conservation of mass requires that as much mass of air exits the turbine as enters it. Betz' law gives the maximal achievable extraction of wind power by a wind turbine as 59% of the total kinetic energy of the air flowing through the turbine. Further the rotor blade friction and drag, gearbox losses, generator and converter losses reduce the power delivered by a wind turbine. Commercial utility-connected turbines carry about 75% of the Betz limit of power extractable after the wind, at rated operating speed.

ADVANTAGE

Wind energy is welcoming to the nearby environment, as we know that fossil fuels are prepared to generate electricity from wind energy. Wind turbines require less space compare to average power stations. When wind energy is combined with solar electricity then this energy source is excessively for developing countries to provide a steady, reliable supply of electricity.

GENRAL DISADVANTAGE

The main disadvantage of wind power is down the winds fickleness factor. In many areas, the wind strength is not sufficient to support a wind turbine. Wind turbines generally products allot less electricity than the middling fossil fuelled power station, which means that multiple wind turbines are desired to make an impact.

VI. CONCLUSION

This paper has summarized the most-recent research trends and industrial solutions in the field of the multi-MW wind turbine systems and wind parks. Regarding generators and converters, it seems that the most-adopted system is still the doubly fed generator equipped with a back-to-back converter, due to the lower weight and cost. However, for large wind-energy systems mainly designed for offshore applications, where the robustness, the efficiency, and the reliability are of paramount importance, the preferred solution has been the direct-drive SGs, considering PMSGs or machines of the wound-rotor type. Nevertheless, if the nominal power of the WECSs is substantially increased in the future, the large (increased) size and weight of the multiple PMSGs required for direct-drive operation is likely to be too large for commercial applications. In this case, other solutions, e.g., the HTS direct-drive generator or systems based on the “Multibrid” concept, will become more-attractive alternatives. The example of this trend, the 10-MW Britannia WECS is planned using a topology similar to that of the “Multibrid” concept, i.e., considering a smaller to that of the “Multibrid” concept, i.e., considering a smaller.

VII. REFERENCES

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