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STUDY OF DIFFERENT ISSUES AND CHALLENGES OF WIND ENERGY GENERATION

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ABSTRACT

With respect to energy, India is the net importer of the energy and consumes roughly 3% of the world's total energy. Total power generation installed capacity of 149,391.91 MW in the country. Electricity is most convenient form of energy, which is utilized for lighting, heating and industrial production. Also generation and consumption of electricity through wind energy does not pollute the environment and therefore can play an important role for protection of the environment and in maintenance of ecological balance. Renewable energy sources like wind energy are identified by International Energy Agency as key element to reduce fossil fuels dependency and helpful tool to combat global warming. Wind energy is indeed a form of solar energy produced by differential heating on the earth surface. Wind energy is one of the popular forms of energy at present and its use for electricity generation will continue to grow worldwide, as many countries are planning for its future deployment. There are many challenges associated with harnessing this type of energy for grid application mostly due to its intermittent nature. The kinetic energy of wind can be captured and converted into electricity. This paper will examine the key regulatory challenges and issues that are faced for promoting wind energy power plants. The major issues are located in rural areas and the power grid in these areas is often weak and prone to voltage sags, faults and unbalances.

Keywords: Gird connection, Renewable energy, wind energy, wind turbines.

I. INTRODUCTION

The world is facing twin energy-related threats: that of not having adequate and secure supplies of energy at affordable prices and that of environmental harm caused by consuming too much of it. Soaring energy prices and recent geopolitical events have reminded us of the essential role affordable energy plays in economic growth and human development, and of the vulnerability of the global energy system to supply disruptions. Safeguarding energy supplies is once again at the top of the international policy agenda. Yet the current pattern of energy supply carries the threat of severe and irreversible environmental damage including changes in global climate. Global primary energy demand in the reference scenario is projected to increase by just over one-half between now and 2030-an average annual rate of 1.6%. Demand grows by more than one-quarter in the period to 2015 alone [1]. Wind energy is one of the popular forms of energy at present and its use for electricity generation will continue to grow worldwide, as many countries are planning for its future deployment. There are many challenges associated with harnessing this type of energy for grid application mostly due to its intermittent nature.

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II. TYPES OF WIND TURBINES

Depending upon the axis of rotation the wind turbines can be classified into two types as given below [2].

2.1 Horizontal Axis Wind Turbines: Horizontal axis wind turbines (HAWT), the axis of rotation is horizontal. HAWTs are similar to wind mills in design as shown in Fig. 1.1. It has only one main rotor shaft and electrical generator at the top of a tower, with suitable mechanism for orientation along wind direction [2]. Small turbines are oriented by simple wind vanes placed, while large turbines generally use wind sensors coupled with servo motors. Horizontal Axis large wind turbines have gearboxes, which converts the slow rotation of the rotor into faster rotation suitable to drive the electrical generator.

2.2 Vertical Axis Wind Turbines: Vertical axis wind turbines, (VAWTs), have the main rotor shaft arranged vertically as shown in Fig. 1.2. The main advantage of this arrangement is that the wind turbine does not need to be pointed into the wind. This is an advantage on sites where the wind direction is highly variable or has turbulent winds. With a vertical axis, the generator and other primary components can be placed near the ground, so the tower does not need to support it, also makes maintenance easier [2].

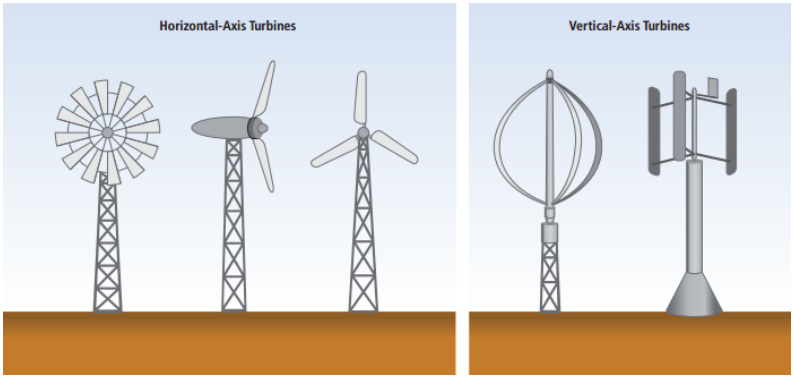

Fig.1 Horizontal Axis and Vertical axis wind turbine

III. OPERATING REGION OF WIND TURBINE

The operating region of a variable speed & variable pitch can be describe by power curve, which gives the estimated power output as function of wind speed as shown in Fig.2.

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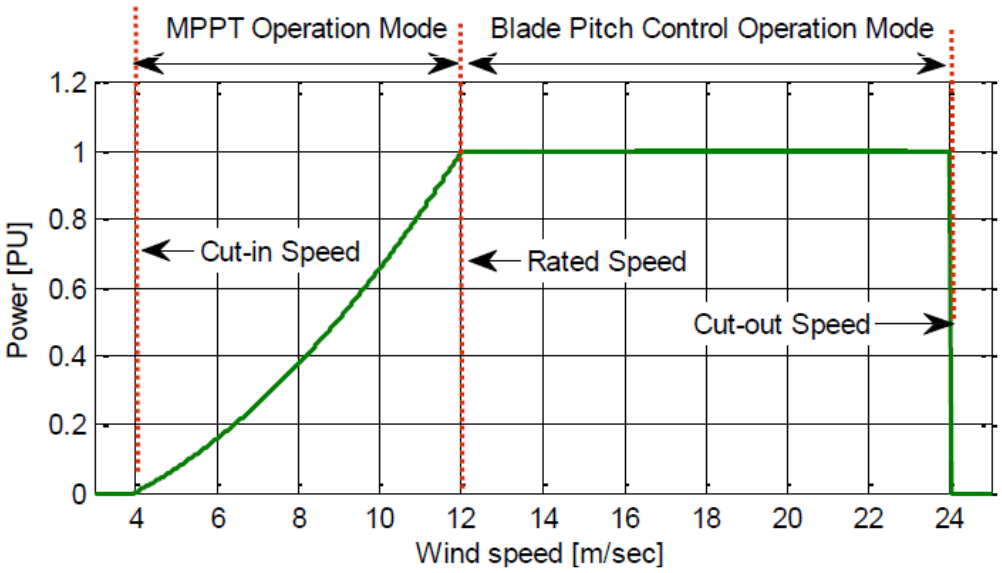

Fig.2 Power curve of DFIG based wind turbine [2]

Three distinct wind speed points can be noticed in this power curve:

1. Cut in wind speed: The lowest wind speed at which wind turbine starts to generate power.
2. Rated wind speed: Wind speed at which the wind turbine generate the rated power which is usually the maximum power wind turbine can produce.
3. Cut out wind speed: Wind speed at which the turbine ceases power generate and is shut down (with automatic brakes and/or blade pitching) to protect the turbine from mechanical damage.

IV. ISSUES AND CHALLENGES

4.1 Technical and Location Issues

Wind power started years back and has been popular in coastal areas and south. The main limitation is location – there are vast areas where wind turbines cannot work. The main issue of wind power is lower Plant Load Factor (PLF) in comparison to fossil fuel, nuclear and hydropower plants and it is also low if we compare it with international standards. The core reason of this issue is because most of wind power farms in India have been reached up to its commissioned period and requires repowering. Repowering will not only helps them to remain productive but also could create a possibility of power generation capacity enhancement to their best performing sites. As per studies repowering of old wind farms could increase the wind energy PLF percentage significantly from 15 percent to 30 percent. It has been observed that in the absence of proper governmentpolicies framework and subsidies, many wind power companies are not willing to repower their plants which is essential to overcome this obstacle. MNRE must need to motivate such old wind farms for repowering their capacity by supporting with good and log terms policies. [3]

4.2 Grid Connection

Variations in voltage and grid frequency create difficulties in wind farm operations and reduce the chances for successful wind energy grid penetration. Due to the limitation of grid infrastructure, it has been found that the amount of energy produced from wind farms could not be effectively transmitted throughout to consumers cause wastage of energy. High borrowing costs in India creates obstacle forwind energy sector growth. The project

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financing methodologyapplied for majority of wind power projects are conceived with70: 30 debt equity ratio, that also with high interest rates whichcreates an expensive debt under difficult macroeconomicsconditions of India. [3] The wind is variable resources, meaning that their availability as an energy source fluctuates due to weather patterns, clouds, and cycles of day and night. The electricity output from power plants dependent on these variable resources varies accordingly. The demand for electricity, however, does not follow the same pattern. In the case of wind electricity, electricity generation is sometimes greatest at night when electricity demand is lowest.

4.3 Cost Issues

stimating the incremental impacts and costs of wind energy power plant is difficult due to complexity of electric systems. The most challenges in executing these studies are simulating wind power data at high time resolutions. The costs insurance, land payments and routine maintenance are relatively easy to estimate but variable costs such as repairs and spare parts are more difficult to predict. So operation and maintenance costs can vary by wind power plants. There is a high initial unit cost of equipment and maintenance, as a result of small initial order sizes, novel equipment, and the small number of units in the field to maintain. The industry could be kick started with funding for the necessary equipment, working capital, and initial overheads. Experienced management would be needed. [5]

4.3 Environmental Challenges and Sound Issues

The environmental issues which arise when a wind farm is developed on land include how the turbines appear in a (usually rural) landscape, the sound they make and their effect on birds and other wildlife. A considerable amount of misinformation and myths have been created around local impacts, including such claims as that individual turbines will kill thousands of birds or that tourism will suffer, and often based on little more than a local community's initial concern that their view of the surrounding countryside will be changed. On the issue of birds for example, the interaction between wind farms and birds is highly site specific. Sound is likely to be one of the most important sitting constraints for small wind turbines. Small wind turbines are in many cases louder than large turbines. Small wind turbines may also operate at higher tip speeds or turned partially out of the wind.

4.4 Landscape and land use

Wind turbines are tall structures which ideally need to operate in an exposed site where they can make best use of the prevailing wind. This means they are likely to be visible over a relatively wide area. Whether this has a detrimental effect is highly subjective. Being visible is not the same as being intrusive. While some people express concern about the effect wind turbines have on the beauty of our landscape, others see them as elegant and graceful, symbols of a better, less polluted future.

4.5 Variable Power

The wind energy are variable resources, meaning that their availability as energy source fluctuates due to weather patterns and cycles of day and night. The electricity output from power plants dependent on these

variable resources varies accordingly. The demand for electricity does not follow the same conditions. In the case of wind electricity, electricity generation is sometimes greatest at night when electricity demand is lowest.

V. CONCLUSION

The Indian renewable energy market is highly attractive as it helps meet not just reduction of carbon emissions, but also helps reduce power shortages. The manufacturing, transport, installation, operation and decommission of wind turbines some negative effects. This paper describes the various issues. The Operation of Wind Power Projects poses unique challenges.Wind power generation is playing a main role in the world's energy markets nowadays, due to its rapid growth rate in the last some years. The wind turbine and generator technology has reached to a matured stage. The developments and improvements of the power electronic devices added an extra pace in its overall growth; however, the high penetration of wind power to the electrical network needs further consideration of the existing grid infrastructures. Grid integration issues of wind farms are the most important challenge for the future growth of this technology, which must be handled carefully [5]. Wind energy represents an attractive source of employment in many countries in the world. There are someactivities likeoperationandmaintenance (O&M), research and development (O&M), manufacturing and construction which are able to create jobs in wind industries. [6]

REFERENCES

[1]. Annual report 2003-04, Ministry of Non-conventional energy sources, Govt. of India, 2004.http://centurionenergy.net/types-of-wind-turbines accessed on July 2011.

[2]. Singh Madhu and Singh Payal, International Research Journal of Environment Sciences Vol. 3(4), 87-92, April (2014) (ISSN 2319–1414).

[3]. P R Krithika and Siddha Mahajan, Governance of renewable energy in India: Issues and challenges, the energy and resources Institute TERI-NFA working paper series No.14, March 2014.

[4]. Al Hatmi Y, C.S. Tan"Issues and challenges with renewable energy in Oman" International Journal of Research in Engineering and Technology, ISSN: 2319-1163/ISSN: 2321-7308, vol-2, July2013.

[5]. Abdul WaheedBhutto,Aqeel Ahmed Bazmi,GholamrezaZahedi,Greener energy: Issues and challenges for Pakistan—wind power prospective, Renewable and Sustainable Energy Reviews,20(2013) 519-538.

[6]. Ali Mostafaeipour,Productivity and development issues of global wind turbine industry,Renewable and Sustainable Energy Reviews, 14 (2010) 1048-1058.