

Reliability Analysis and Operation and Maintenance Strategies of Offshore Wind Turbine

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ABSTRACT

In recent years, the large-scale development of offshore wind power and large capacity offshore wind turbines have been grid, offshore wind turbines economical and reliable operation and maintenance has become a hot topic of new energy research. With the maintenance of the current status of offshore wind turbine operation, offshore wind turbine operation and maintenance of the status and analysis of statistics, mainly around the operation and maintenance of offshore wind power are most concerned about reliability, availability and maintenance and so for. On this basis, it organizes and summarizes the main factors affecting the cost of operation and maintenance of offshore wind turbines, offshore wind turbines on the current research focus operation and maintenance summary.

INTRODUCTION

With the rapid development of the global economy, global demand for energy is growing and energy is a key factor in social and economic development. With the accelerating consumption of traditional energy sources and failure, searching for clean energy and new energy in the ocean becomes a part of national development the strategy. Compared with other oceans energy, offshore wind

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energy is a form of clean energy and has a huge space for development. Wind power development has entered a mature stage of commercial operation. The development of technology is relatively mature, so the EU, US, China, Japan, South Korea regards the development of offshore wind energy as one way to solve future energy problems. In recent years, development of offshore wind energy market is active, the EU remains the world's center of offshore wind power, accounting for about 70% of the global market, and North America and Asia are rapidly developing.

Offshore wind resources are abundant. Compared with onshore wind power, offshore wind power has many advantages. Offshore wind power development has become a hot spot and the forefront of the global new energy development. However, the current development offshore wind power lags far behind in that of onshore wind power. According to the Global Wind Energy Association statistics, in the end of 2014, the global offshore wind power installed capacity is 8.77GW, accounting for only 2.37% of the total global wind power installed capacity. In addition to offshore wind power development difficult, high construction costs, immature technology and other factors, offshore wind turbine operation and maintenance (O & M) are difficulties and the high cost is the limit of large-scale development of offshore wind power.

The marine environment has the harsh conditions. On the one hand, a high concentration of sea salt spray, humidity, accompanied by typhoons, ice and other weather disasters[1], it is not conducive to long-running mechanical and electrical equipment;

In order to meet the capacity of global offshore wind and the “Twelfth Five-Year” plan, installing the capacity of 39.9GW of turbines by 2020, offshore wind turbine operation and maintenance(O&M) have becoming a realistic and urgent problem for the development of offshore wind power. Many companies and institutions have done a lot of works about the offshore wind turbine O&M of statistics and analysis, O&M strategy optimization etc., and discuss the best approach for offshore wind turbines O&M. This paper summarized the offshore wind turbine reliability and operation around the RAM (Reliability, Availability and Maintenance), and summarized some effective factors relevant with the cost of offshore wind turbine O&M[2] Now, based on this factors, in this paper, to review and prospect the existing issues and the developing direction of offshore wind turbine, and lay the foundation for further research work.

RELIABILITY ANALYSIS OF OFFSHORE WIND TURBINES

There are a lot of reasons leading to the outage of the wind turbine, and the literatures [3, 4] has been analyzed those reason. From it can be seen, include four major reasons that scheduled repair, fault, protection of the turbine outage and grid faults, when wind turbines cannot operate normally. The main reasons of the

outage offshore wind turbines are fault and protection outage of turbines, later has a high frequency and long downtime caused by fault of turbines. Operation of the turbine outage caused by moved the protection threshold of wind turbines and alarm from controller, it can be recovered by operator. Therefore, exclude commonly fault date, the availability of offshore wind turbine is represented by the frequency of commonly fault and the single outage time.

We compare to the public data of offshore wind turbine, and find that onshore wind turbine has accumulated a lot of operation data and experience. According to the Switzerland onshore wind turbine statistical data from Switzerland electric industry group Elforsk, the average annual failure rate of onshore wind turbine is about 0.402 times (turbine/year) and the annual outage time is 52.4 hours (turbine/year)[5].

OFFSHORE WIND TURBINE OPERATION AND MAINTENANCE

It has two main ways about preventive maintenance and repair: Regular maintenance and condition maintenance[6]. Regular maintenance is based on maintenance plan, and the main functions are condition maintenance and function testing. Regular maintenance can prolong the service life of the turbine. In order to improve the availability of wind farm wind resources, regular maintenance is carried out in the condition of small wind speed. Regular maintenance of the UK offshore wind farms is usually carried out in the summer with a smaller wind speed [7]. The s East China Sea Bridge Wind Farm usually adopts a policy that the regular maintenance 2 times a year. We usually carry out regular maintenance of turbine because of the character of climate where the sea area builds offshore wind farm. Condition maintenance is a maintenance strategy and made by combining the relevant information extract from the turbine condition monitoring system and the result of the online or offline health diagnosis or fault analysis system. In offshore wind farm O&M, not only used in prospective health condition maintenance, but also raise the best effective repair ways, which combine with weather, wind turbine condition information, fault information, cost of maintenance, resource depletion and production effective. If this technology is perfect, condition maintenance will be the ideal of way for offshore wind turbine maintenance. The offshore wind turbine usually needs to combine with the method of artificial detection for the health and fault condition of the wind turbine generator right now. At present, many related research is being carried out.

Emergency maintenance is Donghai Bridge offshore wind farm maintenance requirements combined with a new actual operation and maintenance need to be raised. It refers to the process equipment reflect in sudden emergency situations made. In the operation and maintenance of offshore wind turbines it is high-strength refers to the impact of the surge in offshore wind turbines at sea suffered hurricanes, thunderstorms and other extreme weather disasters super attacks or

grid failure caused fatal damage caused overall, the number of parts or repair the fan of the whole machine Program. Specifically as fan blades Shanwei Red Bay wind farm appears in the Typhoon "cuckoo" severely damage [8], Hainan wind farms experiencing typhoon "Wilson" after the collapse of the fan, etc. The post repair treatment.

Wind farm operation and maintenance costs, the cost of electricity with wind turbine technology, national and even the project itself are related, it is difficult to horizontal comparison. This article refers to several sets of data from the same literature on the operation and maintenance costs and the cost of electricity onshore wind and offshore wind were analyzed.

CONCLUSION

To sum up, the reliability of wind turbine generator is very important for wind farm operators. From the selection of wind turbine to the operation and maintenance of the wind turbine will directly affect the reliability of the wind turbine operation. Wind farm operation management is not only passive avoidance of risk, reduce costs, but also through a reasonable design and configuration of system, the scientific management of the goal to achieve the maximization of production capacity, and then achieve the maximum return on investment. Therefore, the operation and maintenance management of wind farm with reliability as the center is the only way to improve the reliability of the unit operation and ensure the maximum economic benefits of wind turbine users in the entire life cycle.

ACKNOWLEDGMENTS:

This work was supported by Shanghai Municipal Natural Science Foundation (No. 14ZR1417200, No.15ZR1417300), Innovation Program of Shanghai Municipal Education Commission (No. 14YZ157, No. 15ZZ106). National Natural Science Foundation of China(No. 61374136).Climbing Peak Discipline Project of Shanghai Dianji University(No.15DFXK01)

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