“Review Based On Modular Multilevel DC/DC Power Converter for High Voltage DC-Connected Wind Energy Applications”
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Abstract- In this project, a multilevel modular DC/DC conversion system based on the capacitor-clamped module is explained. This project explores the application of modular multi-level converters (MMC) as a means for harnessing the power from wind power plants. The MMC consists of a large number of simple voltage sourced converter (VSC) sub modules that can be easily assembled into a converter for high-voltage and high power. DC/DC power conversion solutions are becoming more popular for fulfilling the growing challenges in the high voltage DC-connected wind power industry. Two types of the capacitor-clamped modules, the double-switch module and switchless module, are discussed. A soft-switching technique is adopted to achieve minimal switching losses and the maximum system efficiency. The inherent interleaving property of the proposed configurations effectively reduces the output voltage ripple without adding extra components. A cascaded hybrid topology is developed by the combination of double-switch and switchless modules. The proposed hybrid topology achieves higher efficiency and lower component count. This project is implemented by using Matlab / simulation.

Keywords- Modular Multi-level Converters (MMC), Wind Power Plants (WPP), Voltage Sourced Converters (VSC), HVDC Transmission, MATLAB/Simulink.

I. INTRODUCTION

Wind energy is an important renewable and green source of energy. A recent trend is to install large offshore wind power plants (WPP) because they offer higher energy yield due to a superior wind profile as compared with land based installations and provide a reduced level of irritation to the general public as noise, tower shadow and visual impact are not a significant problem.

The Offshore wind power must be connected to the onshore power grid for the subsequent distribution and consumption of the generated power. For distant offshore wind power plants, high voltage dc (HVDC) transmission becomes favorable compared to high voltage ac (HVAC) transmission.

In the MMC, several elementary switching sub-modules are stacked together to attain the required dc operating voltage. Unlike other high voltage VSC topologies, the MMC avoids the difficulty of connecting semiconductor switches in series.

The voltage rating can be scaled by simply adding additional sub-modules to the stack. Thus, it becomes easier to construct VSCs with very high power and voltage ratings. The MMC arrangement also has significantly lower switching losses. A soft switching technique is used to reduce switching losses and provide a high efficiency for MMC topologies.

The capacitor clamped multilevel converter is used for high power offshore wind energy applications. There are two types of the capacitor-clamped modules, the double-switch module and switchless module, are discussed.

The cascaded SL- and DS-based topologies are used to achieve the high voltage gains at high efficiency in offshore wind applications. The simulation results are executed by Matlab / Simulink.
II. BODY OF PAPER

Objectives

This paper presents several multilevel modular DC/DC conversion systems based on the capacitor-clamped module concept for high power wind energy applications.

- To Reduce the switching losses
- To Reduces the output voltage ripple without adding extra components
- To Achieve high voltage gains at high efficiency

Project Methodology

This project has proposed the modular multilevel converter based on capacitor clamped multilevel converter for wind energy systems to interface with high voltage transmission networks. This project extends the CC module concept and proposes two different CC module structures, the double-switch (DS) module and active switchless (SL) module. Each module provides a high degree of modularity by the combination of two top and bottom cells. A resonant technique is adopted to achieve a soft-switching scheme for all switches. A combination of SL- and DS-based modules is possible and total power handling is distributed among the components differently to reduce component count and cost for a cascaded hybrid topology. Then, 2n+1 level cascaded DS- and SL-based configuration with their properties are demonstrated to achieve a high voltage gain for wind energy systems. Based on these properties, the cascaded SL-DS- and SIL-DS-based configurations are proposed to reduce component count and cost in the system.

2n+1 level cascaded SL-based topology:

2n+1 level cascaded DS-based topology:

III. CONCLUSIONS

A typical application of MMC based HVDC transmission system was presented. The MMC topology can be effectively used to transmit power generated by the offshore wind turbine-generators. An accurate Thevenin equivalent model for the converter was used to simulate the MMC on an electro-magnetic transient
simulation program. Several simulations were carried out to demonstrate the behaviour of the MMC based HYDC system in WPP connections. The wind power plant was modelled as an aggregated system connected to the offshore grid. The ability to operate the converter without filters is a distinct advantage in WPP systems to accomplish the compact design requirement.

IV. ACKNOWLEDGEMENT

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V. REFERENCES


