

Date: 16/05/24

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Subject: - To get research promotion scheme based
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Measurement and Analysis of Voltage Sag and Swell in Large Penetrated Grid-Connected Wind Farm

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Abstract Due to the increase in the grid-connected WE penetration and its huge integration to grid system, technical challenges are faced in the form of power quality (PQ). The injection of huge wind power in to weak grid system causes power quality issues such as voltage sag and voltage swell as per technical standard of IEC 614000-4-30 and IEEE 1668. The main objective of this review paper is to provide the causes, effect of voltage sag, swell in grid-connected wind energy system and its proper detection, protections to the unexpected voltage variations-based power quality issues such as voltage sag and swell condition during grid-connected mode of wind energy system by using custom power devices (CPD). Due to inadequate drawing of reactive power from grid system during voltage variation condition such as sag, swell condition, the voltage profile and voltage stability as PQ issues are affected the wind power operation. Hence, CPD is interfaced in to wind energy system to supplied necessary required reactive power so that to control the voltage fluctuations to within the constraint limit. During sag condition of WT, the active power of wind turbine without CPD is 29 MW and with CPD is 36.9, i.e., additional 8% active power is injected by WT in to the grid, and the reactive power is controlled up to 2.2% by CPD. During swell condition of WT, the active power of wind turbine without CPD is 38MW and with CPD is 39MW, i.e., additional 1%

active power is injected by WT in to the grid, and the reactive power is controlled up to 1% by CPD.

Keywords Wind Farm · Grid codes · Power quality · Indirect current control strategy for voltage sag and swell · Custom power devices · DSTATCOM and DVR

Introduction

Technological development is increasing globally and hence the industrialization is responsible for increasing the power demand. In India, the 60–70% of electrical power is generating by using fossil fuel-based thermal power plants. Most of power plant operating on coal as fuel and hence contributing for most of the carbon emission in the nation. Hence, there is need to transform the traditional power sector scenario to renewable-based power sector including some technical constraint. GDP is playing very important role in the development of every nation and minimizing the import like coal, oil, petrol, diesel, etc., will be encouraging toward development of renewable energy as alternatives sources. Utilization of renewable energy (RE) is saving the nature by controlling the greenhouse gases (GHE), carbon emissions and hence ecofriendly environment can be obtained. Similarly, there is need to transform the existing transportation system of gasoline to electric vehicle, so that global temperature increasing issue due to global warming can be control.

Due to increasing the effective utilization of renewable energy as a transformation from conventional to renewable-based power sector, the power quality issues are the challenges during their grid integration. As per the new grid codes policies, the good power quality is necessary to maintained during the RE injection to the grid. Renewable energy (RE) sources such as wind energy, and solar energy

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