

Power quality improvement of wind energy system using energy storage model and DSTATCOM

Kishor V. Bhadane¹, Mohan Thakre², Rakesh Shrivastava³, Deepak P. Kadam⁴,
Dnyaneshwar V. Bhadane⁵, Mahesh Harné⁶

^{1,6}Electrical Engineering, Amrutvahini College of Engineering, Sangamner Maharashtra, India

²K. K. Wagh Institute of Engineering Education and Research, Nashik, Maharashtra, India

³Matoshri College of Engineering & Research Center, Eklahare, Nashik, Maharashtra, India

⁴MET Institute of Engineering, Nashik, Maharashtra, India

⁵Jamia Institute of Engineering and Management Studies, Akkalkuwa, Nandurbar, Maharashtra, India

Article Info

Article history:

Received Jul 26, 2022

Revised Aug 15, 2022

Accepted Aug 18, 2022

Keywords:

Custom power device

DSTATCOM

Energy storage device

supercapacitor

Power quality

Wind energy

ABSTRACT

Nowadays power crises in different countries are observed and the main cause of the power crisis is the huge gap between the supply and demand of electricity, renewable energy sources are identified as an alternative to overcome the power crisis gap. Renewable wind energy is the most promising energy source. Increasing the integration of wind energy into the grid causes the exploitation of power quality. Hence there is a need to deal with this issue. In this case, supercapacitors and custom power devices are introduced as smart energy storage devices in grid-connected wind energy systems for power quality enhancement features. The indirect current control scheme has interfered with custom power devices based on DSTATCOM. The optimal MATLAB-based smart energy storage model and hardware results are compared and validated. power quality improvement feature of grid-connected wind energy system using DSTATCOM is highlighted. The main aim of this study is to determine and interface the optimistic energy storage device into grid connected wind energy system. So that the stability of the wind energy system is to be maintained and also able to enhance the overall efficiency of the wind energy system.

This is an open access article under the [CC BY-SA](https://creativecommons.org/licenses/by-sa/4.0/) license.



Corresponding Author:

Kishor V. Bhadane

Electrical Engineering, Amrutvahini College of Engineering

Near Pune Nashik Highway, Ahmadnagar, Sangamner, Maharashtra 422608, India

Email: kishor4293@yahoo.co.in

1. INTRODUCTION

Due to the fast rise in Industrialization, the Information Technology sector, and development in the retail sector, electrical power requirements have increased significantly. There is a large gap between the supply side and load side demand. In this situation, alternate energy sources (renewable sources) can play an important role to overcome this electric power gap. Out of many alternate sources for the generation of electricity, wind energy is the most promising [1]. wind power as a generation source has specific characteristics, which include variability and geographical distribution. These raise challenges for the integration of large amounts of wind power into electricity grids. To integrate large amounts of wind power successfully, several issues are needed to be considered, including the design and operation of the power system, grid infrastructure issues, grid connection of wind power, power quality, and transient stability enhancement of wind generator systems [2]. Electrical power quality is the degree of any deviation from the nominal values of the voltage magnitude and frequency. "Power quality" is a term used to describe the most