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Title of the study: Transient Fault Analysis of an Intelligent Distributed Generation System

# ABSTRACT

The issues related to environmental protection, quality and reliability of power, widening gap between demand and supply and very huge amount of Transmission and Distribution losses are posing a challenge to Indian power sector.

Probably, Distributed Generation System using renewable based energy conversion may be the suitable solution for all the above challenges. Renewable energy, being sustainable, is clean and does not emit toxic wastes in the process of producing electricity.

This work is intended to design and simulate an Intelligent Distributed Generation System with fault ride through capabilities. Firstly, comprehensive modeling, simulation, analysis and performance comparison of grid connected Wind Energy Conversion Systems (WECS) using DFIG and SCIG has been attempted under prevailing conditions. On the basis of this comparison, SCIG based WECS is chosen for further work.

A comprehensive modeling, simulation and analysis of grid connected PV based Solar Energy Conversion System (SECS) under prevailing conditions has also been done.

Complete coordinated control for fault ride through (FRT) of SCIG based WECS with three distinct state of the art controllers for grid converter have been simulated and compared for analysis purpose. The main features of the proposed models include pitch control, de-loading control, active power control and reactive power injection for better grid support. The control strategies also take care of power quality requirements and harnessing maximum power. Considering every aspect of the expected behavior of the WECS under grid fault and performance comparison, Dual Current Control (DCC) strategy seems to be a promising option for providing FRT capability to SCIG based WECS. Considering its performance, the DCC is implemented on SECS also where it works in coordination with the DC-DC boost controller and MPP tracker.

SECS and WECS, both with coordinated FRT control capabilities have been connected to a 415 volts radial distribution system through individual circuit breakers. This forms the desired Intelligent Distributed Generation System. This system is capable to control the converter current and real power within safe value along with providing reactive support to the grid, according to the severity of the fault.

Finally the behavior of the intelligent distributed generation system (IDGS) during different types of transient faults has been presented in this work. On the basis of the simulation results, it can be concluded that the intelligent distributed generation system, designed in this work, is capable to deal with most of the prevailing conditions automatically and is capable to fulfil the grid code requirements during grid faults while maintaining power quality.