

# WIND ENERGY-GRID STABILIZATION USING A DYNAMIC FILTER COMPENSATOR

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## Abstract

The rising energy demand expected to triple by 2050 necessitates new Renewable and Green Energy Sources and Smart Grid Utilization Technologies which can play a great role in shaping the future electric energy market. Keeping in mind the environmental constraints, grid connected wind farms are viable alternatives for Off-Shore and In-Shore applications. Economic electric energy generation using wind energy production has been rapidly growing for the last three decades. However, the integration of a large wind scheme can pose inherent voltage instability and power quality problems. The paper presents the impact of a Novel Dynamic FACTS Compensator Scheme DFCS developed by the Second Author on voltage level stabilization and power quality enhancement of Wind-Grid connected green energy system. The Wind Energy Conversion System comprises four key parts. The wind farm, induction generator and DFCS scheme and the novel Multi loop dynamic error driven coordinated controller developed by the second Author to ensure voltage stabilization, power quality enhancement and minimal inrush transients and excursions under normal operation , wind velocity excursions and hybrid motorized-linear –nonlinear load disturbances.

The integrated wind-grid scheme with four subsystems has been digitally simulated using the Matlab Simulink/Sim-Power software environment. The DFCS scheme with the coordinated dynamic error driven hybrid controller developed was fully validated. The digital simulation results have indicated that the novel new DFCS Filter Architecture and Multi loop controller did maintain voltage stabilization, enhance power quality and improve energy utilization.

**Keywords:** Renewable Wind Energy, Dynamic Filter-Compensator Scheme, Reactive Power Compensation, Power Quality