Integration of Renewable Generation in Power System Defence Plans

Increasing levels of penetration of wind power and other renewable generations in European power systems pose challenges to power system security. The power system operators are continuously challenged especially when generations from renewables are high thereby reducing online capacity of conventional controllable generations to minimum. In such operation hours, the system is typically more vulnerable to disturbances in general and major disturbances in particular. This was the case in the major disturbance on 4th November 2006, where the Central European power system was split into 3 areas, one of them being the North East area with high share of wind power generation.

The aim of this study is to investigate how renewable generations like wind power can contribute to the power system defence plans. This PhD project “Integration of Renewable Generation in Power System Defence Plans” develops a new methodology to analyse the adequacy of reserves for future power systems with high penetration of windpower generation. This methodology assesses the requirements of frequency restoration reserves in order to contain the power imbalance caused by forecast errors within the designed frequency containment reserves. A set of sensitivity studies of the frequency containment process are performed where reserves are deployed from different power plant technologies including wind turbine. Recommendations for protection and control strategies from windturbines during overfrequency emergency are developed and discussed. Optimal underfrequency load shedding schemes for power systems with high penetration of distributed generation are developed and assessed through simulations. Results show the ability of such schemes to prevent additional load shedding, have minimum generation disconnection and better frequency response.

General information
State: Published
Organisations: Department of Wind Energy, Integration & Planning, Energinet.dk
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Number of pages: 163
Publication date: 2016

Publication information
Publisher: DTU Wind Energy
ISBN (Print): 978-87-93278-77-6
Original language: English
(DTU Wind Energy PhD, Vol. 0058).
Electronic versions:
PhD_Thesis_Kaushik_Das.pdf
Source: PublicationPreSubmission
Source-ID: 125376549