ICT Based Performance Evaluation of Primary Frequency Control Support from Renewable Power Plants in Smart Grids

The increased penetration of Renewable Energy Generation (ReGen) plants in future power systems poses several challenges to the stability of the entire system. In future green energy rich power system, the responsibility for providing ancillary services will be shifted from conventional power plants towards ReGen plants, such as wind and photovoltaic power plants. Frequency control support from the Wind Power Plants (WPPs) is one of the crucial ancillary services in order to preserve operational stability in case of grid disturbances. Among other requirements, the ability to provide fast frequency control support from ReGen plants will highly depend on the underlying communication infrastructure that allows an exchange of information between different ReGen plants and the control centers. This paper, therefore, focuses on the impact of communication and the related aspects to provide online frequency control support from ReGen (with special focus on WPP). The study is conducted with an aggregated WPP model, integrated into a generic power system model, specifically designed to assess the ancillary services in a relatively simple yet relevant environment. Various case studies with different wind speeds at a particular wind-power penetration level and communication scenarios are considered to evaluate the performance of power system frequency response. The article provides the Transmission System Operator (TSO) and other communication engineers insights into the importance and various aspects of communication infrastructure for general service coordination between WPPs and specifically primary frequency control coordination from WPPs in future power systems.

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Contributors: Shahid, K., Altin, M., Mikkelsen, L., Løvenstein Olsen, R., Iov, F.
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