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Smart grid operation and control – Challenges for Danish distribution systems operators

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The modern society is focussing more and more on reducing CO₂ emissions and increasing the use of sustainable energy technologies. The official European Union objectives are captured in the "20/20/20 plans". For Denmark, the objectives are to reduce greenhouse gas emissions in 2020 by 20% compared to 2005, to expand the use of sustainable resources to produce an amount of energy equal to 30% of the total energy consumption, and finally, to reduce the energy consumption by 4% in 2020 compared to 2006. In addition, the Danish government targets 10% of the energy consumption in the transport sector, to be produced from sustainable technologies. As part of the total objective, the Danish government aims for 50% of the electricity consumption to be produced by wind power in 2020. In comparison, in 2014, 39% of the electricity consumption was produced by wind power. In 2012, this was 30.1% which indicates that Denmark will reach this goal. In order to realise these objectives, the capacity of wind and solar power should be increased and more people should have Electric Vehicles (EVs), along with installing Heat Pumps (HPs) instead of the normal district heating. Penetration of renewable generation is already high in the distribution grids and more units are expected to be installed. Thus, new challenges for daily operation of distribution grids will arise. This paper deals with operational challenges related to this high penetration of renewable generation and smart grid devices into distribution grids. Field measurements showing reverse power flow and voltage rise due to renewable generation are shown. Voltage unbalances in low voltage grids due to asymmetrical loading as well as other power quality challenges will be shown. Mitigation techniques and possible control methods are investigated and assessed through benchmark studies.

Biography

Florin Iov (IEEE S '98, M '04, SM '06) received the MSc degree in Electrical Engineering from Brasov University, Romania, in 1993 and a PhD degree from Galati University, Romania in 2003 with a special focus in the modeling, simulation and control of large wind turbines. He was staff member at Galati University, Romania from 1993 to 2001. He was with Institute of Energy Technology, Aalborg University, Denmark between 2001 and 2009 where he was mainly involved in research projects regarding grid integration of wind power. From 2010 to 2012, he held a position as Power System Research Specialist in Vestas Wind Systems working with new ancillary services for augmented wind power plants. Since 2013, he is with Institute of Energy Technology focusing on research within smart grids and intelligent energy systems. His research areas cover control and application of electrical machines and power electronic converters for grid integration of renewable energy sources and, operation and control of dispersed generation in modern power systems. He is author or co-author of more than 120 journal/conference papers.

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