New challenges to wind energy voltage control. Survey of recent practice and literature review

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Abstract-

Implementing sophisticated voltage controls of wind farms may provide manifold benefits such as reducing losses of distribution and harvesting networks, increasing the wind hosting capacity of transmission networks and reducing wind curtailments. However, it represents and enormous challenge since wind energy is dispersed increasing the complexity of the required centralized control systems. This paper contains a comprehensive state of the art review of the huge research that is available within the literature in order to foster the participation of on-shore wind energy in voltage control. The current situation is described by the actual technological developments of control devices and the regulatory framework of a set of European countries with high wind penetration figures. A classification of key wind voltage control concepts will be proposed in order to understand and organize the available literature references. The state of the art review covers the integration of wind energy through distribution networks, smart grids and dedicated harvesting networks into the transmission network, covering research from a steady state and also dynamic perspective. TSO (transmission system operators) new requirements tend to suggest that wind farms should have a similar performance compared to conventional plants. Thus, in this paper special attention will be given to literature review of harvesting networks since it is becoming the most promising alternative of integrating wind voltage control into the existing transmission grid hierarchical control schemes. A set of relevant field experiences and international projects will be described, showing some effort to implement academic research into practice.

Index Terms- wind power plants, voltage control, centralised control, smart power grids, power generation control

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