

Grid-Connected Photovoltaic Power Plants: A Review of the Recent Integration Requirements in Modern Grid Codes

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ABSTRACT

The high integration of photovoltaic power plants (PVPPs) has started to affect the operation, stability, and security of utility grids. Thus, many countries have established new requirements for grid integration of solar photovoltaics to address the issues in stability and security of the power grid. In this paper, a comprehensive study of the recent international grid codes requirement concerning the penetration of PVPPs into electrical grids is provided. Firstly, the paper discusses the trends of PVPPs worldwide and the significance of improving grid codes' requirements. In addition, the comparison of common requirements covered in the majority of international grid codes considers high- and low-voltage ride-through capabilities, voltage and frequency regulation, and active and reactive power support requirements. Finally, a broad discussion on the compliance technology challenges and global harmonization of international grid codes that the PVPPs have to address is presented. The study summarizes the most recent international regulation regarding photovoltaic integration and research findings on the compliance of these regulations and proposed recommendations for future research. It also can assist power system operators to compare their existing requirements with other universal operators or establish their own regulation for the first time. Additionally, this research assists photovoltaic manufacturers and developers to get more accurate understanding from the recent global requirements enforced by the modern grid codes.

KEYWORDS

grid code regulations, grid-connected PV system, photovoltaic power plants, solar energy