

INTEGRATION OF PHOTOVOLTAIC POWER SYSTEMS IN HIGH-PENETRATION CLUSTERS FOR DISTRIBUTION NETWORKS AND MINI-GRIDS

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Keywords: autonomous operation, grid stability, IEA PVPS, mini-grids, photovoltaics, PV clusters, PV neighbourhood, power quality, rooftop PV

ABSTRACT

This paper presents the results to date on international experience and measurement campaigns on power quality analyses and the examination of grid stability of electric networks with high penetration of photovoltaic (PV) generation. Field data from participating International Energy Agency (IEA) member countries that are part of R&D collaboration within the IEA Photovoltaic Power Systems (PVPS) implementing agreement are reviewed. Inherent characteristics and network configurations employed worldwide in several grid-connected PV clusters and autonomous PV mini-grids developments are discussed and major observations on power quality impacts are summarized. The focus of the paper is to summarize information on the current knowledge and previous experiments with these systems to identify areas for further investigation and technology enhancement that enable development of high penetration PV networks. In addition, the results from voltage analysis case studies are presented. The studies consider effects of design practices and location selection on rate of change of the voltage caused by load and generation variations in the PV cluster. This supports the work plan of the new IEA PVPS Task group 11 on PV-hybrid systems within mini-grids.