Methods and Strategies for Overvoltage Prevention in Low Voltage Distribution Systems with PV - DTU Orbit (25/12/2018)

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The rapid development of photovoltaic (PV) systems in electrical grids brings new challenges in the control and operation of power systems. A considerable share of already installed PV units are small-scale units, usually connected to low voltage (LV) distribution systems that were not designed to handle a high share of PV power. This paper provides an in-depth review of methods and strategies proposed to prevent overvoltage in LV grids with PV, and discusses the effectiveness, advantages, and disadvantages of them in detail. Based on the mathematical framework presented in the paper, the overvoltage caused by high PV penetration is described, solutions to facilitate higher PV penetration are classified, and their effectiveness, advantages, and disadvantages are illustrated. The investigated solutions include the grid reinforcement, electrical energy storage application, reactive power absorption by PV inverters, application of active medium voltage to low voltage (MV/LV) transformers, active power curtailment, and demand response (DR). Coordination between voltage control units by localized, distributed, and centralized voltage control methods is compared using the voltage sensitivity analysis. Based on the analysis, a combination of overvoltage prevention methods and coordination between voltage control units can provide an efficient and reliable solution to increase the PV hosting capacity of LV grids.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Distributed Energy Resources
Contributors: Hashemi Togholjerd, S., Østergaard, J.
Pages: 205 – 214
Publication date: 2016
Peer-reviewed: Yes

Publication information
Journal: I E T Renewable Power Generation
Volume: 11
Issue number: 2
ISSN (Print): 1752-1416
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 4.18 SJR 0.979 SNIP 1.453
Web of Science (2017): Impact factor 3.488
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 3.55 SJR 0.878 SNIP 1.434
Web of Science (2016): Impact factor 2.635
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 3.13 SJR 0.976 SNIP 1.555
Web of Science (2015): Impact factor 1.562
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 3.56 SJR 1.229 SNIP 2.282
Web of Science (2014): Impact factor 1.904
BFI (2013): BFI-level 2
Scopus rating (2013): CiteScore 4.96 SJR 1.601 SNIP 2.799
Web of Science (2013): Impact factor 2.28
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): CiteScore 4.64 SJR 1.353 SNIP 2.787
Web of Science (2012): Impact factor 1.718
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes