Distributed Generation and Its Power Quality Challenges: An Overview

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Abstract:
This provides an overview of power quality disturbances with the integrating of distributed generation (DG) into power grids and explores potential mitigation techniques. While DG integration offers benefits such as reduced transmission losses and improved reliability and stability, it also introduces power quality challenges like voltage fluctuations, harmonics, voltage imbalance, etc. These challenges can result in equipment damage, increased downtime, and decreased consumer efficiency. To mitigate these challenges, various mitigation techniques are employed. Custom power devices (CPD) and Flexible alternate current transmission system (FACTS) devices offer effective solutions for mitigating PQ challenges. They provide control, stability, and regulation capabilities. The paper mentioned the different types of DG technology sources which are renewable and non-renewable and explores the power quality challenges and how to mitigate them using CPD, like distributed static compensator (DSTATCOM), dynamic voltage restorer (DVR), and FACTS devices like Static Var compensator (SVR), Unified power quality conditioner (UPQC) etc. Overall, it provides an understanding of power quality challenges and potential solutions to ensure cost-effective and standard power quality for end users.

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I. Introduction

The shift toward distributed generation (DG) in power networks is driven by the desire to minimize carbon emissions and the availability of reliable, cost-effective electricity [2]. DG is the generation of electricity using small-scale facilities that are connected to the end users and can also be integrated into the grid network (IEEE). They are also refer to as decentralized generation, dispersed generation, distributed energy resources (DER), embedded generation or decentralized generation [6]. The renewable DG include wind, solar, and hydro-power technologies as well as non- renewable sources which are fossil fuel-based technologies like internal combustion engines (ICE), micro-turbine, gas turbines whichcan be integrated into the grid at a location in the network distribution system called the point of common couple which is determined through analysis and assessment of the grid system by considering the voltage level, load flow, fault protection and the stability of the network system [8], [11], [14], & [16].

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