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Active Power Filters and their Smart Grid Integration - Applications for Smart Cities

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Abstract : Most installations nowadays are exposed to many power quality problems, and they also face numerous challenges to comply with grid code and energy efficiency requirements. The reason behind this is that they are not designed to support nonlinear, non-balanced, and variable loads and generators that make up a large percentage of modern electric power systems. These problems and challenges become especially critical when designing green buildings and smart cities. These problems and challenges are caused by equipment that can be typically found in these installations like variable speed drives (VSD), transformers, lighting, battery chargers, double-conversion UPS (uninterruptible power supply) systems, highly dynamic loads, single-phase loads, fossil fuel generators and renewable generation sources, to name a few. Moreover, events like capacitor switching (from existing capacitor banks or passive harmonic filters), auto-reclose operations of transmission and distribution lines, or the starting of large motors also contribute to these problems and challenges. Active power filters (APF) are one of the fastest-growing power electronics technologies for solving power quality problems and meeting grid code and energy efficiency requirements for a wide range of segments and applications. They are a high performance, flexible, compact, modular, and cost-effective type of power electronics solutions that provide an instantaneous and effective response in low or high voltage electric power systems. They enable longer equipment lifetime, higher process reliability, improved power system capacity and stability, and reduced energy losses, complying with most demanding power quality and energy efficiency standards and grid codes. There can be found several types of active power filters, including active harmonic filters (AHF), static var generators (SVG), active load balancers (ALB), hybrid var compensators (HVC), and low harmonic drives (LHD) nowadays. All these devices can be used in applications in Smart Cities bringing several technical and economic benefits.

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