

Abstract

Rooftop solar PV capacity is continuously increasing and especially in sunny countries. It is considered as major worldwide potential. But challenges have to be faced for high penetration levels of PVs in the distribution network. The challenges are for the network operator as the low voltage distribution networks (LV DN) are aging and neither they nor the protection devices and transformers have been designed for PV integration with two-way energy flow. Challenges are also for end-users that require high quality high availability of energy with lower energy bill and for installers which should design new systems using new devices and meet standards and grid code requirements. Indeed, high penetration levels of PVs in LV DN affect voltage quality, power losses, and the operation of other voltage-regulating devices in the system. New energy technologies are currently emerging rapidly to cope with these challenges. They need to be investigated, tested within an experimental platform and in situ to convince new consumers, buyers or installers. Experimental and numerical platforms according to the PHIL principle (Power Hardware-In-the-Loop) with real and emulated systems including demonstrators have been developed. Their design, modeling, simulation and analysis are presented as well as the ability of this developed environment to investigate new energy technologies and their integration in LV DN.