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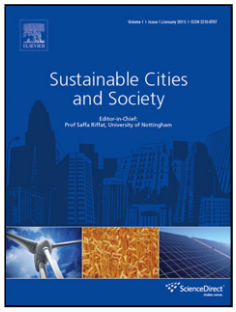

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The Impact of Harmonics Compensation Ancillary Services of Photovoltaic Microgeneration in Low Voltage Distribution Networks

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Highlights

- Microgeneration PV generators are usually placed in residential houses, composed by nonlinear loads that generate harmonics.
- We study the impact of the use of PV systems harmonics compensation features to mitigate the harmonics produced by residential nonlinear loads.
- Three case-studies are proposed: harmonic compensation disabled, harmonic compensation enabled and reactive power control.
- The PV system harmonic compensation capability is able to attenuate the harmonics, therefore improving the voltage profile.

Abstract: PhotoVoltaic (PV) microgeneration (μG) located close to the end-users is gradually increasing and is expected to increase more in the future. However, a high μG penetration level may cause overvoltage issues in the Low Voltage (LV) distribution grid. On the other hand, these μG PV generators are usually placed in residential houses, composed by nonlinear loads that generate harmonics. The use of the harmonics compensation capabilities provided by modern PV systems can be an added value, as this function improves the voltage profile and reduces losses on the LV distribution network. This paper proposes an additional contribution to the subject by studying the impact of the use of PV systems harmonics compensation features to mitigate the harmonics produced by residential nonlinear loads. The assessment tool is a suitable algorithm created to compute an unbalanced three-phase power flow in the presence of harmonics. This is based on the Common Object Model (COM) interface of two software tools, MATLAB and OpenDSS. Three case-studies are proposed: harmonic compensation disabled, harmonic compensation enabled and reactive power control. The last one is introduced for comparison purposes. The assessment is made for a typical summer day, on a highly unbalanced test radial LV distribution network with high μG penetration and harmonic pollution. The obtained results allow the conclusion that the PV system harmonic compensation capability is able to attenuate the harmonics, therefore improving the voltage profile, and reducing the power losses and voltage drop on the LV distribution network.