

Impact of solar PV self-consumption policies on distribution networks and regulatory implications

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Abstract— The sustained cost reduction of solar photovoltaics (PV) modules together with the introduction of self-consumption policies is transforming passive electricity consumers into active ones (prosumers). However, self-consumption policies may present very different designs and results mainly depending on the schemes that are put in place. Policy design implementations can have important consequences on the PV sizing and on the deployment rate, which impact the overall power sector from both a technical and an economic perspective. Previous analyses have focused on the existing relation between tariff design and self-consumption in terms of investment decisions made by prosumers or on how to ensure system fixed-cost recovery by preventing undesirable cross-subsidies among consumers. However, little attention has been paid so far to the effects of self-consumption policy design on the distribution networks, where most prosumers are connected. On this purpose, this paper performs a power flow-based quantitative assessment of such impact, using European representative distribution networks, and by discussing potential drawbacks which can be faced under different PV penetration scenarios and when different policies are put in place. Results show that the size of the installations (driven by the self-consumption policy incentives) has a great impact on the voltage and thermal limit violations, which is sometimes even higher than the impact of the PV penetration level. An in-depth discussion on the regulatory implications is also reported. The need to improve the tariff designs, so that they also reflect the extra costs in the distribution networks is discussed. Then, alternatives to avoid or defer network investments are proposed including the use of curtailment, the revision of current voltage limits, possibly too stringent in some countries, and the application of smart grid technologies. Finally, the key role of aggregator to provide flexibility services is identified.

Index Terms— Solar photovoltaics; Prosumers; Power distribution; Self-consumption; Net-metering; Regulation

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