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Overcoming the barriers that hamper a large-scale integration of solar photovoltaic power generation in European distribution grids

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Abstract— Solar photovoltaic is increasingly seen as a key technology for low-carbon electricity generation. However, the deployment of growing shares of this technology is not without important challenges for their efficient integration in power systems. This paper aims to contribute to overcoming the barriers that hamper a large-scale integration of photovoltaics in the electricity distribution grids. The methodology followed is problem oriented. The paper firstly reviews the technical solutions available to integrate distributed photovoltaics, classifying them in three areas: Distribution System Operator (DSO) solutions, prosumer solutions and interactive solutions. Then, the set of barriers that hinder the implementation of the solutions in a European context are identified, assessing the relevance of each barrier in different countries. Four major barriers are discussed in detail: (1) DSO regulation does not promote smart grid investments, (2) rules limiting PV curtailment, (3) missing frameworks enabling DSOs to access advanced PV inverter capabilities, and (4) regulation hampering storage solutions. Finally, recommendations to overcome these barriers are presented, highlighting that DSO regulation should shift the focus from a short-term to a long-term cost assessment and revenue setting framework, equalizing the treatment of capital and operational expenditures, and implementing specific incentives for DSO innovation. Moreover, a fair debate on the definition of the boundary conditions for the use of renewable curtailment when the other technical solutions cannot be applied or are not economically optimal is required. Regarding the provision of services to DSOs by prosumers and the deployment of distributed storage, the roles, rights and limitations of the different stakeholders need to be clearly defined.

Index Terms— Power distribution; Regulation; Solar photovoltaic

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