

## **Presentation # 16**

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**Title:** Steady State Impacts and Benefits of Solar Photovoltaic Distributed Generation on Power Distribution Systems

### **Abstract**

Due to several social, economic, political and technological trends large numbers of distributed renewable energy resources, particularly solar photovoltaic distributed generation (PV-DG), are being interconnected to utility systems across North America.

PV-DG impacts several aspects of distribution systems planning and operations, some of the most noticeable effects concern voltage and current profiles, power quality, protection, electric losses, power factor, power balancing, reliability and operability of the system. These impacts vary in severity as a function of the degree of penetration and location of PV-DG. For instance, given that feeders are commonly designed and operated for supplying unidirectional power flow, some of the most significant impacts occur when large penetration levels of PV-DG lead to reverse power flows. Under this condition, the operation of voltage regulation equipment, voltage profiles, equipment loading, and overcurrent protection, among others can be affected. On the other side, PV-DG combined with distributed storage may be used to alleviate overloads, release capacity of feeders and substation transformers and increase the operational flexibility of the distribution system.

The purpose of this presentation is to discuss the impacts and potential benefits of utility-scale PV-DG on power distribution systems, including those on voltage and current profiles, technical losses, power factor, capacity planning, and operations. Utility-scale PV-DG has nominal capacities that are compatible with distribution substation MVA ratings or that are manageable by distribution feeders, e.g., between 1 MVA and 10 MVA. In order to capture a wide range of possible phenomena and impacts, the results of analysis performed for a variety of scenarios on typical distribution feeders will be presented and discussed. These scenarios cover different degrees of penetration and location of PV-DG and several feeder loading conditions.