



Executive Summary

Task 14 Report IEA-PVPS T14-11:2018

“International R&D Project Collection – Advanced Cooperation between Distribution and Transmission Network Operation”

In a power supply system with an increasing share of distributed generation, there is a growing need for generators and demand response units at the distribution level to support the operation of the bulk power system by providing ancillary services and/or market flexibility. PV systems are mainly connected to the distribution level and hence coordinated operation and planning of the transmission and distribution level are of high relevance for electricity grids achieving high photovoltaic (PV) penetration scenarios.

This report is a collection of international R&D projects, with a focus on advanced TSO/DSO cooperation procedures. Therefore, 19 international R&D projects from the United States, Europe, and Japan have been identified and their objectives, key findings, and recommendations have been collected and summarized. The project fact sheets were provided directly by project members or through a detailed literature review.

Furthermore, for the following five projects or concepts, detailed summaries are presented in the report:

- **Possible Future DSO Models:** Kristov and De Martini (USA) describe and discuss two main concepts for the future role of DSOs; the total DSO model and the minimal DSO model.
- **SmartNet:** SmartNet analyses five different coordination schemes between TSO and DSO and different architectures for the real-time ancillary services markets with reference to three countries: Italy, Denmark, and Spain.
- **SysDL 2.0:** SysDL2.0 analyses the coordinated provision of ancillary services from DSO to TSO by means of controllable distributed generators and other controllable equipment (STATCOMs, OLTCs etc.). Case study and field test are performed for a transmission-distribution network in the eastern part of Germany.
- **Q-Study:** In the project Q-Study, new grid planning and new operational concepts for reactive power management at the TSO/DSO interface with the support of distributed generators are developed and analyzed. The case study deals with a Bavarian distribution grid section (Germany) with a very high PV penetration.
- **Next Generation SCADA:** In this TEPCO project (Japan) an integrated SCADA system for the transmission and distribution level is developed.

The challenges for an advanced TSO/DSO cooperation are multilateral and cover grid operation aspects, grid planning aspects, and the organizational and regulatory framework. In detail, the status and development of TSO/DSO cooperation depends on many impact factors, for example on the addressed grid operation challenges, the applied communication technologies and standards, the addressed voltage levels and DER types, and especially the regulatory framework and overarching policy objectives. Overall, a major part of the identified R&D projects is ongoing and still a significant research and development demand is identified for an advanced TSO/DSO cooperation.