



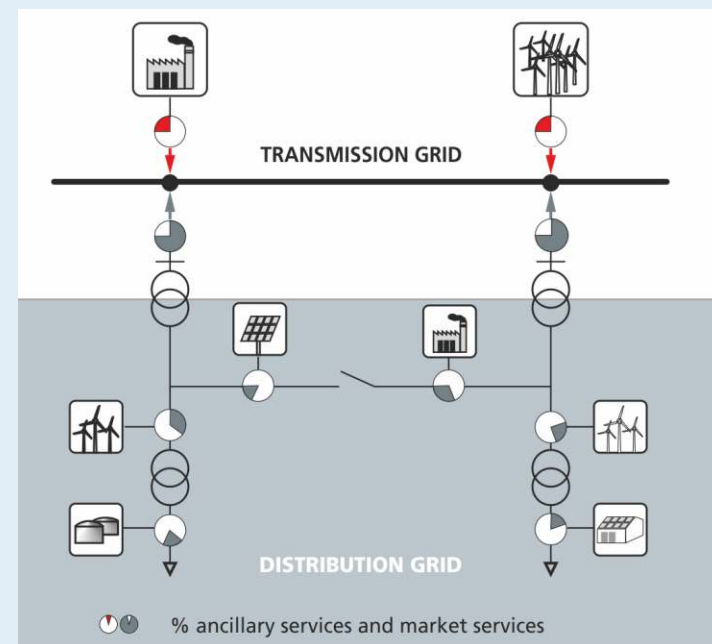
International R&D Project Collection – Advanced Cooperation between Distribution and Transmission Network Operation

Motivation

- Growing need that Distributed Energy Resources (DER), such as distributed PV, support the bulk power system operation by providing ancillary services and/ or market flexibilities
- Advanced TSO/DSO cooperation is a key enabler for high (distributed) PV penetration scenarios

Objective Report

- Collection of 19 international R&D projects from the U.S., Europe and Japan with a focus on advanced TSO/DSO cooperation
- Overview on scope, objectives, key findings and recommendations of the identified R&D projects
- Collection of experiences and discussion on the technology readiness level for the provision of ancillary services by PV



Advanced TSO/DSO cooperation: DER support the bulk system operation
(own diagram based on graph idea by the project SysDL2.0)





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Short Summary

- Identified R&D projects focus especially on the grid operation challenges: power balancing, congestion management and voltage support TSO/DSO
- Further widely addressed cooperation challenges are the development of an appropriate market design and the further development of the ICT infrastructure between TSO, DSO, DER and further relevant Stakeholders
- Provision of ancillary services by PV – technology readiness level examples:
 - **Proven in operational environment:** e.g. autonomous control characteristics of utility-scale, commercial and residential PV (e.g. Fault-ride-through, Volt/var control) and active power dispatch of utility-scale PV
 - **Demonstration in relevant or operational environment:** e.g. Reactive power dispatch of distributed (utility-scale) PV for voltage support (DSO/TSO)
 - **Proof of concept:** e.g. Dispatchable PV actively supports the grid restoration process, i.e. by balancing variations of loads and non-dispatchable DER

