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DSO AS AN INTERMEDIARY

The responsibility for the stable, safe, and secure operation of the electrical energy system lies (often by law) with the transmission system operator (TSO). This arises from their role in the traditional design of the power system, but also makes sense since they have by far the most powerful tools to counteract disturbances as well as the most comprehensive observability area to deal with large-scale issues. It can be expected that this responsibility does not shift towards hierarchically subordinate levels of the energy system.

Today, among the most important “tools” of the TSOs are large conventional power plants that provide dispatchable active and reactive power, large reserve capacities of active power directly connected to the transmission grid, congestion management procedures, and, perhaps the most underrated one, the legal power to impose almost all actions that are deemed necessary for at least a part of the system to survive.

However, many of these tools will not be as available as they are today with the phase-out of conventional power generation. The replacement sources for ancillary services, backup generation, and congestion management will be located on lower system levels, often in the sphere of end customers and thus not directly connected to the TSO. Common examples are battery storages and electric vehicles that can be used to provide services to the system but are almost always installed in residential settings. Regardless of the question whether these technologies are technologically able to contribute to system security, the TSO simply does not know about the current or future availability of the services provided. In a way, this “blinds” the TSOs regarding their tools for secure operation. Additionally, even if this information could be inferred, the TSO would not have a connection to the actual units providing the services and therefore could not use its legal power to request changes in the operational behaviour of these units.

One solution is to use the distribution system operators (DSO) as an intermediary, tasked with aggregating all relevant information about ancillary service and flexibility provision of the units in its controllability area and forwarding the aggregated data to the TSO. The DSO may even filter out all service offers that violate local grid restrictions, passing on a set of feasible offers only. The TSO would then have all relevant information to maintain secure operation of the power system and could utilise the offered services. In the opposite direction, the DSO disaggregates the TSO’s request for specific services to the optimal units. This way, the efforts for data exchange and processing are greatly reduced, yet no information is lost. Since the aggregated service offer is affected by statistical self-balancing effects, it is more robust against changing load or generation conditions than an individual service offer. However, special attention has to be paid to the time delay introduced by the aggregation process.