Distribution System Operator Simulation Studio

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Abstract

The electricity industry has identified the formation of Distribution System Operators (DSO) and Distributed System Platform (DSP) as critical to realize faster, tighter and better coordination of DER-based distribution systems, and to provide the necessary market mechanisms to empower consumers, prosumers, and DERs to offer and exchange services. DSO/DSP entities are mandated in the New York REV and California proceedings, and are being considered in several other states. Yet, there is no software tool that can simulate DSO physical and market operations.

We propose to develop a highly specialized and interactive software tool capable of simulating the operation of emerging Distribution System Operators (DSO) at the physical, information, and market levels. The software will offer electricity industry analysts, engineers, economists, and policy makers, a "design studio environment", in which various propositions can be studied to achieve a robust DSO design. The software will extend state-of-the-art distribution grid solvers with detailed models of distributed energy resources, decentralized decision-making, DSO pricing rules, and interactive analytics features. The software will provide a number of highly needed, but currently not available simulation capabilities including:

a) Decentralized energy scheduling of DER-rich systems of arbitrary size.
b) Explicit modeling of energy services transacted in the DSO market.
c) Locational and time-vector pricing of active/reactive power, ancillary, and security services.
d) Analytics and valuation of DER services, DSO rules, and utility business models.
e) Simulation of the DSO interactions with up-stream ISO, same level DSOs, and downstream (microgrid, building, and home) prosumer subsystems.