Abstract

The increasing feed-in of distributed generation (DG) units at the electrical distribution grid level requires grid operators to adapt previous grid operation concepts. The grid-compatible use of prosumer flexibility represents one of these novel concepts. Congestion management in distribution grids is done either by re-dispatch or manual feed-in management of renewable energy resources. But that leads to a lot of wasted energy and results in compensation being paid to the prosumer based on a feed-in tariff. A more economical solution would be utilising Distributed Energy Resources (DER) for congestion management.

The flexibility potential of a distribution grid is the amount of supply and demand that can be increased or decreased, driven by a function aggregating the flexibility of individual energy assets in the network. An asset is considered flexible if it is able to change its energy production/consumption behaviour in reaction to an external variable. Within a localized flex market, various sources of flexibility could be installed such as flexible (demand) loads, storage, and controllable DG.

To investigate this novel concept of congestion management using local flexibility options, new simulator models for smart home and congestion management system (CMS) are developed. The environment uses a co-simulation framework, which enables connection(s) and combined execution of multiple simulators. To test this simulation environment and validate simulator models, each simulator is initialized with test parameters and its performance verified by calculations. Several simulators are implemented to realize the individual grid and its various flexibility control components.

The scenario results show that the environment works as expected and can handle a variety of simulation scenarios. Concerning the congestion management simulation, the results show how smart flexibility control instead of uncoordinated consumption optimization can decrease the danger of grid congestion.