ELKRAFT 2017

Ancillary Services through Energy Management and Battery Energy Storage Systems

As a result of energy policy developments aimed to increase the share of renewable energy sources, as well as the need for more efficient use of the grids, operational support for the electricity grids is expected to increased. Ancillary services may either come from the centralized energy production side (which is still dominating), decentralized sources or the energy demand side. New providers are e.g. switchable loads in various end-use sectors, energy storage systems and distributed generators. Services that can be provided are summarized in Table 1.

Table 1. Technical possibilities for providing ancillary services, developed from a provider perspective. The matrix contain a variety of providers for comparison with demand side flexibility (energy management) and battery energy storage systems.

Provider		Fast frequency response	Frequency Containment Reserve	Frequency Restoration Reserve (aFRR & mFRR)	Replacement Reserve	Fast reactive power support	Slow voltage control	Black start	Islanding	System stability services	Congestion management	Other Power Quality Services
Conventional Generation												
HVDC Links	Classic (LCC)											
	VSC - based											
Converter based generation												
Energy storage	Large scale (Pumped hydro, CAES, thermal)											
	Power electronics based (BESS, etc.)											
	Fast response, small capacity (Flywheel, supercaps)											
Demand side flexibility												
FACTS (SVC, STATCOM)												
Tap changers/static compensation (capacitors, reactors)												

Feasible | Feasible under some circumstances | Not feasible without large modifications/constraints

Demand side conceals a significant amount of flexible loads which could be utilized for local and global ancillary services provision. As a consequence this could decrease expensive investments (new lines, equipment etc.) and stimulate an overall decrease in TSO/DSO tariffs. The relevance of practical implementations of demand response is growing. The implementation of demand response solutions can be classified into two types, see Fig. 1,:

- Price-based programs - consumption change based on price signals;
- Incentive-based programs - consumption change based on activation/deactivation signals from the outside and/or based on local measurements.

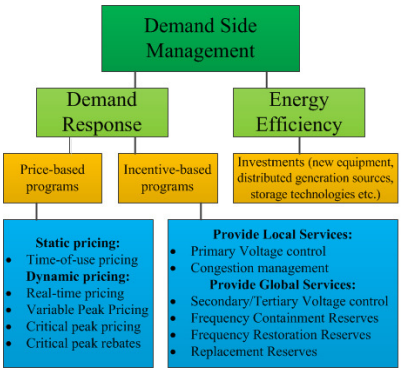

Fig.1. Demand Side Management categories

Commercial buildings are especially good candidates for implementing demand response since they usually already incorporate building management systems which are able to control electrical devices, such as lighting or heating/cooling.

The potential was studied for the Smart-Home lab of IPE in Riga, Latvia, see Fig. 2.

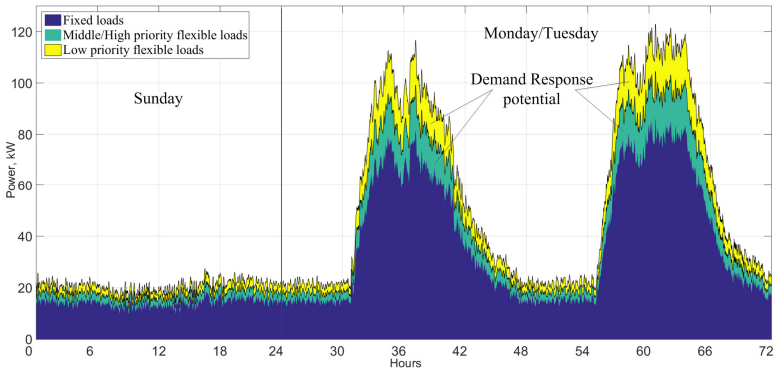

Fig. 2. Consumption profiles of a commercial building with flexible load potential

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"This project has received funding in the framework of the joint programming initiative ERA-Net Smart Grids Plus, with support from the European Union's Horizon 2020 research and innovation programme."

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