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Development of a Management System for Resource Scheduling and Controlling of the "Hybrid Urban Energy Storage"

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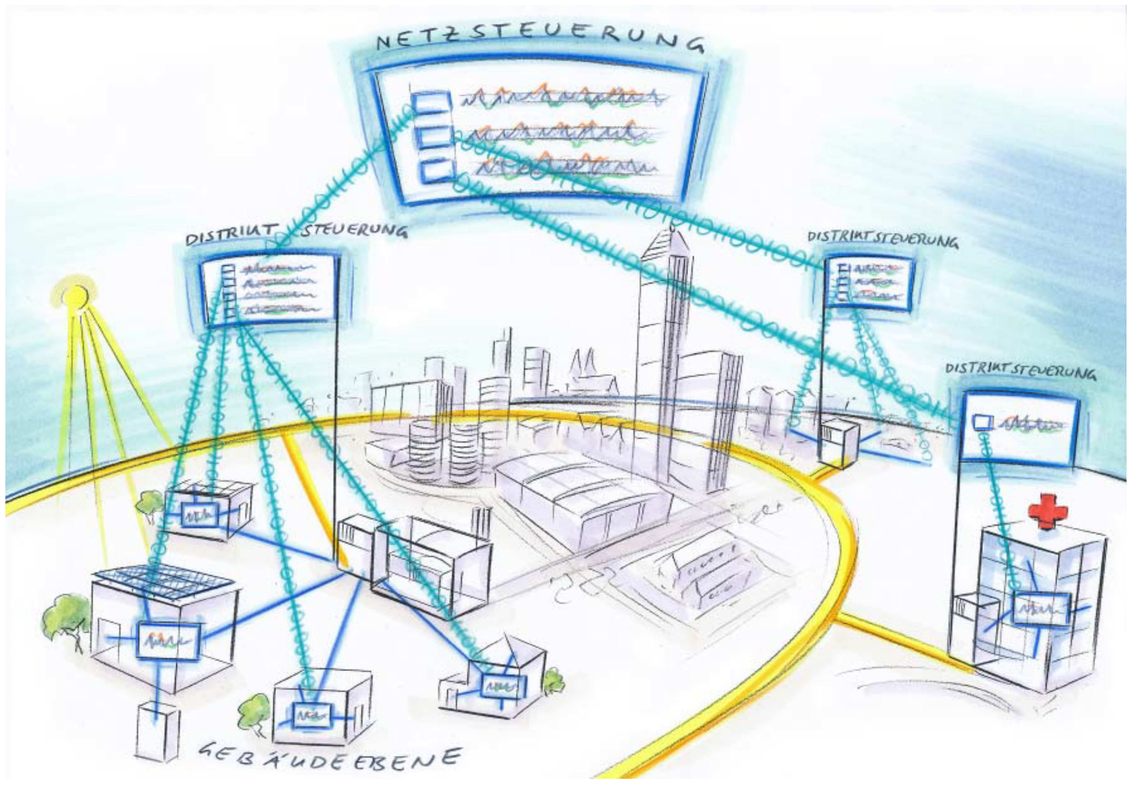
Hybrid Urban Energy Storage

The Fraunhofer Institutes (UMSICHT, IOSB-AST, ISE, ISIT) are currently working on a project called hybrid urban energy storage. In this project different distributed energy systems are logically linked to create a virtual energy storage. The basic idea of the hybrid urban energy storage is the usage of the existing potentials of energy balancing options in cities for grid ancillary service. Many of the already installed plants like heat pumps or combined heat and power systems (CHPs) could be used after only minor modifications like installing of additional heat storages. Therewith the goal is to provide an alternative energy storage technology with significantly reduced costs.

Main components of the hybrid urban energy storage:

- Central electric power storage with redox flow batteries
- Decentral electric power storage with lithium batteries
- Heat storages for CHP systems and heat pumps
- Additional load by means of electrical heating of local heating grids
- Additional generation by means of emergency power units
- Management system for resource scheduling and controlling: FLX-Ctrl

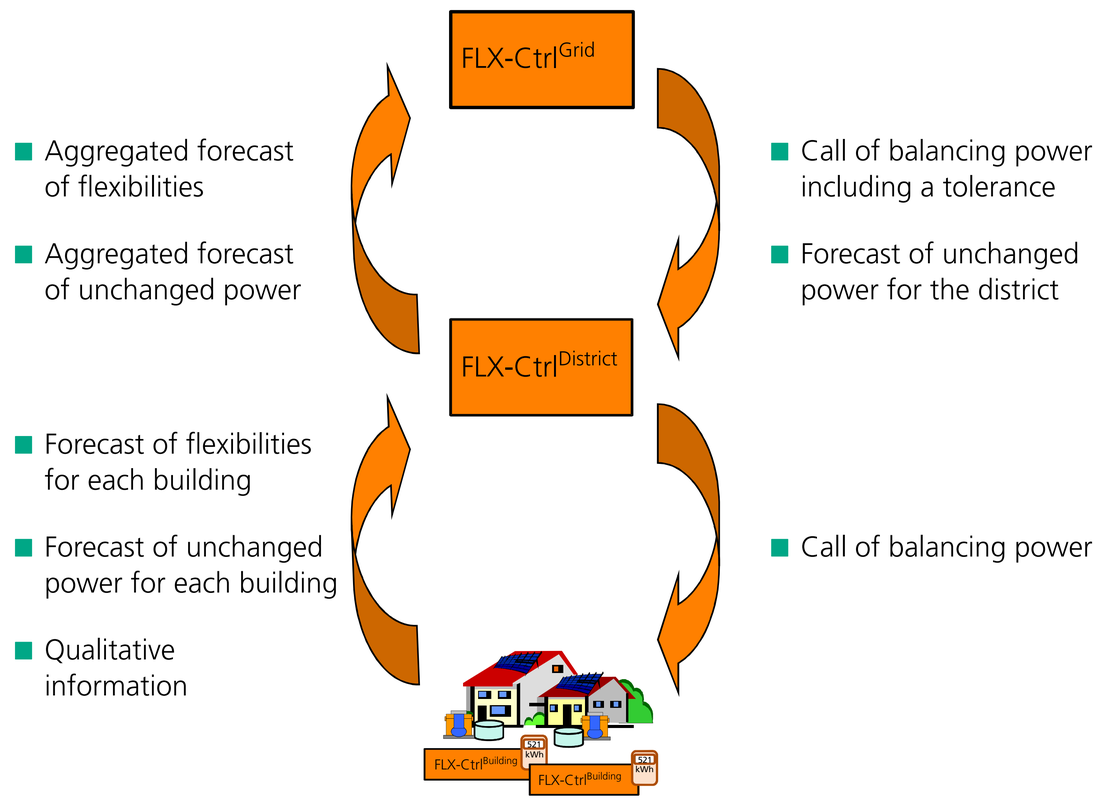
The Management System "FLX-Ctrl"



The scope of the management system of the hybrid urban energy storage is resource scheduling and controlling of the already mentioned storage facilities and energy balancing options. This is done in a distributed-hierarchical manner with three levels:

1. "FLX-Ctrl^{Building}" - On building level: responsible for building energy management and forecasting of generation, demand and flexibilities.
2. "FLX-Ctrl^{District}" - On district level: responsible for aggregation of flexibilities and optimal resource scheduling of the different "FLX-Ctrl^{Building}"-Systems as well as for real-time-controlling of the power balance in the district.
3. "FLX-Ctrl^{Grid}" - On grid level: responsible for aggregating the flexibilities of the districts in its grid area and calculating the energy balancing demand for the grid area and its districts.

Interfaces



All information is exchanged as a forecast for the next 24 hours in time steps of 15 minutes. The information is updated and shared every 15 minutes

Flexibilities	Possible change of power in a time step that is offered as balancing power
Unchanged power	Expected power without call of balancing power
Qualitative information	Technical and non-technical parameters that need to be considered by the optimization

Advantages

- In contrast to virtual power plants there is no direct and central remote control of any energy system in a building
- At any time the end user can decide if he wants to offer flexibilities for the FLX-Ctrl
- In difference to systems based on variable energy prices, the user does not have to participate actively
- There is no loss of comfort for the end user
- Decentralized data processing effects the following advantages:
  - Reduction of data traffic
  - High grade of data protection in the system
  - Good scalability of the overall system
  - Step towards a plug and play device, as plants on lower levels do not have to be modelled in higher level systems
- Separation between the FLX-Ctrl operator and the energy supplier (in difference to smart market concepts) allows easier realisation of unbundling

Acknowledgement

Further information on the hybrid urban energy storage is given in the presentation "Hybrid Urban Energy Storage - a Way to Integrate Renewable Energies" by Dr Christian Doetsch.

Fraunhofer UMSICHT

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Anwendungszentrum Systemtechnik AST