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FRAUNHOFER NETWORK ENERGY STORAGE SYSTEMS AND NETWORKS

HYBRID URBAN ENERGY STORAGE

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HYBRID URBAN ENERGY STORAGE

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Motivation

In the future, apart from the demand for electricity, the availability of power will also be subject to significant fluctuations over time. The high portion of fluctuating energy sources (wind, solar) fed into the electrical power supply will require large equalization capacities to compensate for extremely dynamic supply gaps in the short term in order to safeguard a reliable power supply.

Another requirement on the power supply of the future is the spatial distance between energy availability and demand. While in the past, large power plants produced electricity near urban regions, large wind parks are frequently far away from regions with a high demands for electricity.

The challenge for the energy system of the future is therefore the permanent balancing between energy availability and demand over time and distance.

Develop storage potentials

Cities possess an enormous, though indirect potential for energy storage as well as the potential to directly balance energy availability and demand in a local grid. The majority of new technologies will be distributed decentrally in the immediate future, usually in buildings.

This is where the idea of hybrid urban energy storage begins: the local, actual storage facilities as well as the local load and generation management are aggregated in the city or on the district level and made available to the upstream grid operators as a hybrid, virtual storage. The hybrid urban energy storage can thus flexibly and dynamically balance between power generation and demand, and facilitate the integration of fluctuating streams of renewable energies as a supplement to the compensation possibilities of the power plants.

Your benefit

The planning objective in using such hybrid urban energy storage must ultimately be the reduction of costs, resulting from the minimised expansion of the grid and generator capacities.

The significant advantage of hybrid urban energy storage is that many plants are already installed (e.g. heat pumps, CHP systems, potable hot water plants) which can be used after only minor modifications (e.g. additional heat storages), and therefore are of low cost for electricity storage. Since the load balancing already takes place in the local grid, the necessary expansion of the superior power plant and grid capacities can be reduced.

Technological specifications

The various storage facilities and load balancing possibilities of the hybrid urban energy storage can be combined to provide both positive as well as negative equalization energy. The following five pillars of "grid balancing" form the basis of hybrid urban energy storage:

Additional loads
Example: short-term electricity-based heating of local heating grids

Dispatchable loads
Example: utilisation of a heat pump which offers greater load displacement potential by an additional thermal storage

Actual energy storage facilities
Example: lithium accumulators or redox-flow batteries

Dispatchable generation
Example: electricity-conducting operating modes of small CHP systems for additional thermal buffer storage

Additional generation
Example: additional electricity infeed by means of an emergency diesel for data processing centres or hospitals

Project team

This objective – cost-optimized, intelligent storage of the energy in hybrid urban energy storages – is pursued by the Fraunhofer Institute with its future project "Hybrid urban energy storage". To this end, the Fraunhofer institutes (UMSICHT, IOSB-AST, ISE, ISIT) are not only developing decentralised electrical and thermal storage technologies and control engineering, but also the necessary, practice-oriented optimisation algorithms and software for operation and grid integration.

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