DECENTRALIZED ENERGY STORAGES

50 GW
30 GW
10 GW
20 GW
40 GW
60 GW
70 GW

performance and the loss of capacity is being calculated.

For each cycle the efficiency, the generation are being evaluated. For each cycle the efficiency, the local energy generation at the self-consumption will be interpreted.

Irradiation and weather forecasts

The concept uses optimization and forecast methods to reduce the required storage capacity and to enhance the self-consumption of the local energy generation at the same time. Therefore local weather forecasts will be interpreted as well as the feed-in of the decentralized photovoltaic plants of the past few days.

Effects / Results

Different scenarios for the optimal usage of energy storage systems in low-voltage distribution networks with a high degree of decentralized generation are being evaluated. For each cycle the efficiency, the performance and the loss of capacity is being calculated.

Based on these simulations it is possible to estimate the state of health of the system (see exemplary results in the figure) and to determine the battery’s lifetime. This information is necessary for the optimization of the storage system.

Optimization

Intelligent management systems can help to reduce the aging of the battery and increase the system lifetime. Recommendations for the optimal operation method and dimensioning of the storage systems can be derived.

Usage capacity and SOH of an exemplary storage system

References:


MARTIN LÖDL
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ROLF WITZMANN
Technische Universität München, Germany

MICHAEL METZGER
Siemens AG Corporate Technology, Germany

Installed power from photovoltaics in Germany

Decentralized energy storages

Forecast of installed PV in Germany in 2020:
50 - 70 GWp

Local energy storages, which save the surplus generation, can be an alternative to grid enforcement and can be essential for a stable and efficient energy network in the future. The minimal storage capacity necessary to fully integrate the possible photovoltaic plants is being calculated for several reference network.

The power units of the storages are best chosen in the range from 60 % to 85 % of the respective plant size. Storage capacities for about 2.5 to 4 full load hours are sufficient for the best exploitation. The local demand can mostly be covered with the help of the existing storage reserves.

Aging of electrical energy storage systems

Each cycle of a battery system causes irreversible losses in the usable storage capacity. Therefore a simulation model of the relevant aging phenomena (i.e. cycle lifetime and calendar lifetime) of energy storage systems was developed. The cycle lifetime is mainly influenced by the charge and discharge cycles during operation. The calendar lifetime of a battery system is given by the processes, that occur without any operation of the system.

Optimization

Intelligent management systems can help to reduce the aging of the battery and increase the system lifetime. Recommendations for the optimal operation method and dimensioning of the storage systems can be derived.

Identification of the estimated lifetime and the changes in the battery performance during the operation period lead to more reliability and economic system operation.