TU Clausthal

Voltage Driven Mode for Appliances with Thermal Buffers

A Self-Acting Collision Detection for Low Voltage Lines

Objective

- Low voltage (LV) feedings are more often restricted by violation of the standard voltage range than by thermal overload of network assets.
- PV-panels have a strong regional co-incidence factor and push the mains voltage towards the tolerable limit.

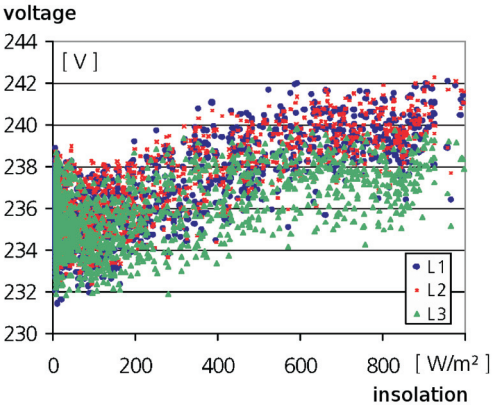


Fig. 1: Correlation of voltage and solar radiation at a residential area with 150 kW PV installed [Fraunhofer ISE, 2004]

- Further LV-feedings with no coordination may worsen the situation.
- Controllable distributed energy resources (DER) as well as consumers are able to balance the load mismatch.

Approach

- Low voltage lines are dominated by ohmic resistance. Thus, the voltage is a load indicator in LV grid segments.
- MicroCHP units or air conditioning systems, as well as fridges have a high thermal inertia. The thermal buffer coupled with the power connection serves as functional electricity storage.

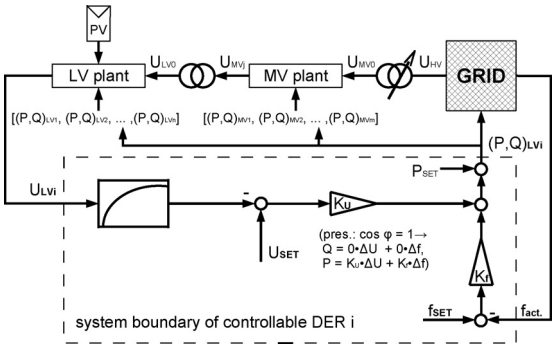
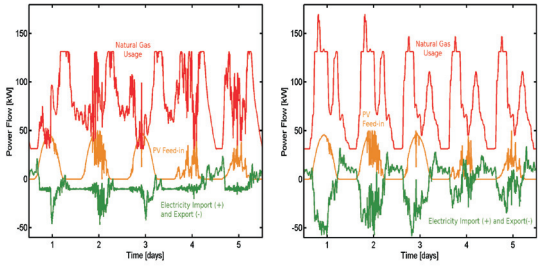


Fig. 2: Control scheme of a self-organising low voltage virtual power plant

- Peak generating hours are placed in voltage valleys and consumption during times of higher voltage.
- The use of grid parameters for the power dispatch reduces costs and operating complexity.
- The method constitutes a ”collision detection” for low voltage lines.

Results

- The voltage driven mode lets controllable microsources correlate with the net grid load.
- Thermal energy demand determines the number of operating hours.



voltage driven heat driven

Fig. 3: Energy flows of a residential area during summer days with a installed capacity of 50 kW PV and µCHP each

IEE
Institute of Electrical Power Engineering
Head: Prof. Dr.-Ing. Hans-Peter Beck

Distributed Energy Systems Working Group
Team Leader: Dr.-Ing. E.-A. Wehrmann
Gunnar Kaestle

www.iee.tu-clausthal.de