Load Management Strategies for Weak Grids With High Penetration of Electric Vehicles

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Motivation

Emerging Trends
When sector coupling applications like electro mobility or distributed PV get into focus, the low voltage distribution networks can either be strengthened or the power applications can be managed in order to achieve higher utilization factors.

Load Management:
One approach is to develop intelligent lighting poles capable of managing electro mobility loads and power flows to increase the share of local renewables (Fig.1).

Energy Management:
Problem: Additional appliances at the light poles may lead to an overload at the Public Lighting Network.
Solution: The additional appliances need to be managed.

Methods

Simulations are based on actual data, without knowledge of future request for two topologies (no perfect foresight). The options of load manipulation are time shifts as a whole, splitting of loads and dispatch of already planned loads, which might be used on its own or in combination (see Fig. 2).

Discussion

Exemplary days for some management strategies at work for stab line networks are shown in Fig. 3. The strategies limit the loads as desired. The physical limits are not reached, so that additional loads could be supplied at later hours. The phases could not be used equally, so that a relocation of the loads might be reasonable to increase the usage of the network. The OS leads to many switching operations which do not lead to an increased acceptance rate or delivered energy.

Results

All time based shift strategies show a strong increase in acceptance rate and delivered energy compared to the immediate acceptance. The optimized split did not show an increase because the solution space became large to find solutions in adequate computing time.

Conclusions

- In this work, different load management strategies were analyzed.
- Time based shift of loads showed higher acceptance rates and delivered energies compared to the instantaneous acceptance of loads.
- Using the strategies, a save operation of the power network was ensured.

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