EXTRAPOLATING HOUSEHOLD AND LINE LOAD DATA FOR LOAD PROJECTIONS

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Overview

The integration of renewable energy production and thereby the transformation of the energy sector in Germany demands an adjusted matching of production and consumption of electrical energy. Due to the supply-dependent production of renewables, the production cannot follow the demand as before, when fossil production represented the vast majority of energy production. Therefore, the demand curve as well as the production curve have to be known most accurately. Measured load data of households from intelligent metering systems can help to provide advanced information of the load situation within an electrical network. Whereas nowadays, standard load profiles are used to project user's consumption, the roll-out of intelligent metering systems in Germany enables a vast data basis, that can be used either to improve existing load profiles due to a higher rate of coverage by implementing regional load profiles, or to conduct short time adjustment of the load projections based on measured data. The presented approach aims to achieve a representative line and grid load, when not all single household load data is known, as in Figure 1 displayed.

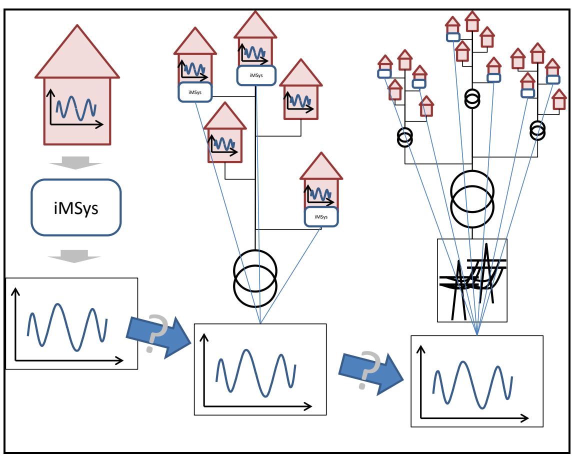

Figure 1: Extrapolation of single load data to line load data and to grid area data

Methods

However, single household data must somehow be aggregated to load data of lines and furthermore to grid areas with multiple household connection points. A first approach was presented in [1], where the error of a synthetically generated line load was discussed.This approach is pursued in order to analyze load data of grid areas, where the grid area load can also be seen to be given through standard load profiles. Measured single household data can be used as well as matching line measurements to reveal occurring deviations if not all line connection points can be used. Moreover, the load data of several lines is used to describe the load in a grid area. Today, network operators use standard load profiles to determine the load. The deviation between measured data of several lines and the standard load profiles can be analyzed as well as the deviation between load data of different lines, when not all load data of the elements contributing to the overall load is given. As network operators are responsible for the correctness of the deviation between the measured data and the projected load (mostly based on standard load profiles), differences cause costs depending on the level of disparity, which are evaluated.

Results

The difference between a synthetically generated line load of multiple household connections with the measured data is shown and different approaches of improvements are discussed. Furthermore, the devitation between multiple line load and the standard load profile is calculated and discussed and costs of the difference are calculated. The results show that further improvements are necessary. Linear combination of multiple household data does not suffice to generate representative line data as well as linear combination of line data cannot universally be put on a level with standard load profiles. However, different approaches can be outlined that minimize the deviation between synthethic load data of grid areas compared to measured data or standard load profiles.

Conclusions

As the energy transition in Germany needs a working interaction of consumption and supply dependent production, means of local, as well as regional, load prediction must be found to assure system balance and thus the reliabity of the electrical energy system. Nonetheless, synthetical generation of load curves using given data demands a larger data basis to ensure dependability.

References

[1] Eberl, Hinterstocker, von Roon - „Von Smart-Meter-Daten zum Netzlastgang“, Conference paper, IEWT Wien 2017, Wien

[2] Hinterstocker; von Roon: „Bewertung des langfristigen Einsparpotenzials durch Smart Meter und begleitende Energieberatung in Haushalten“ - Paper für das 14. Symposium Energieinnovation 2016 der TU Graz vom 10. – 12. Februar 2016

[3] Hinterstocker; Salvamoser; von Roon; Berner; Staats; Bruce-Boye: Dynamische Korrektur der Lastprognose von Haushaltskunden mittels kurzzyklischer Smart-Meter-Daten in: IEWT 2015 - 9 . Internationale Energiewirtschaftstagung Wien. Wien: TU Wien, 2015