Niklas Poier and Christian Rehtanz

A FAST METHOD FOR GENERATION-PARK-DEVELOPMENT ANALYSIS

N. Poier, M. Sc., Institute of energy systems, energy efficiency and energy economics, TU Dortmund University,
Emil-Figge-Street 70, 44227 Dortmund, Germany
Phone: +49 231/755-5968, fax: +49 231/755-2694, e-mail: niklas.poier@tu-dortmund.de
Prof. Dr.-Ing. C. Rehtanz, Institute of energy systems, energy efficiency and energy economics, TU Dortmund University,
Emil-Figge- Street 70, 44227 Dortmund, Germany
e-mail: christian.rehtanz@tu-dortmund.de

Overview

This paper presents a fast method to forecast the development of generation parks for long time periods in the future. In the presented approach, the driver of this development is the profitability of the different generation technologies. While the exact forecasting of the profitability of the generation units and the development of generation parks is a very complex task, for some calculations a fast approximation of this parameters is necessary. Hence this paper presents a heuristic approach for these approximations. The heuristic, presented in this paper, calculates the development of the installed capacities of the different generation technologies and the development of the wholesale price. For this calculation the shape and volume of the (residual) load, as well as the cost factors and the technical constraints of the generation units are being respected. The presented approach allows for sensitivity analysis of these parameters regarding the development of generation parks.

Methods

The proposed methods' purpose is not to calculate the actual optimum of the units' commitment for long time periods (for an optimization-based approach see *Richter*). The target is to approximate the unit commitment in an accurate way under economic and technical constraints. To be more precise, the target of the method is to calculate the cost minimal unit commitment, based on the fix costs and variable costs of the generation park, under as many technical constraints as possible. The heuristic approach is based on three calculation steps. First operation-time-sectors are calculated for the different generation technologies on the basis of a full cost accounting approach, in which these generation technologies are cost minimal in comparison to all other generation technologies. In the second step, the residual load is allocated to these operation-time-sectors with consideration of the technical constrains of the generation technologies. The allocation is carried out on the basis of hourly values for every year of the calculation period. In the last step the resulting wholesale prices for every hour of a year, based on the unit commitment deriveing from step two, are being calculated. This calculation takes into account the earning from the market-clearing-price market architecture of the wholesale market and returns the wholesale prices, nessesarry to achieve fix cost recovery and variable cost recovery for all generation units (a basic formulation of the price finding mechanism can be found in *N. Sun et al.*). With the help of this method, an analysis of the development of a generation park, based on the economy of the generation units, with incorporation of the technical constrains, is possible.

Results

The presented approach has been implement in a computation environment. Furthermore the target of the reduction of the calculation time has beed successfully achieved with the presented model. First simulations results proof, that an approximation of the development of a generation park (with ten generation technologies, in a timeframe of 50 years), can be carried out in under ten minutes of calculation time. The calculation respects hourly values for every year and the installed capacities are beeing manipulated once every year.

The first implementation of the heuristic does not consider a maximum numbers of generation units for the generation technologies. Because of this the calculated generation parks (and their development) differ from the existing generation park. Yet the results show different generation park developments for different input-data-szenarios. At this point a szenario based calculation of the generation park development is being carried out. First results of this analysis will be presented in the full paper.

Conclusions

The presented approach will further be used in order to analyze the development of the generation side, based on the profitability of the different generation units. In the paper the implementation of capacity payments in the proposed approach is characterized. With the help of the pictured use case, different generation park developments, as a function of different capacity payments, will be evaluated in the future. Findings of this research will help to judge the effects of the implementation of capacity payments for the generation unit park developments. Special interest lies in the relation between the generation park development (given different capacity payments) and the achievement of the aims of the energy turnaround in Germany. It is very desirable to deduce, whether the further generation park development (with or without a capacity market) thwarts or supports the accomplishment of the social and political targets for the future development of the electricity economy in Germany and Europe.

References

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