IMPLEMENTATION OF VARIABLE RETAIL ELECTRICITY RATES IN THE GERMAN SYSTEM OF TAXES, FEES AND LEVIES

Michael Hinterstocker, Forschungsgesellschaft für Energiewirtschaft mbH, +49 89 158121 53, mhinterstocker@ffe.de
Serafin von Roon, Forschungsgesellschaft für Energiewirtschaft mbH, +49 89 158121 51, sroon@ffe.de

Overview

Retail electricity rates in Germany consist of several components like costs of power generation, grid fees, EEG levy, electricity tax, VAT, concession fees etc [1]. In today's market setting, all these components are usually charged per unit of energy, therefore, a constant energy price applies to energy consumption of retail customers, which poses no incentive for adjustments of the consumption behavior to external requirements.

Since increasing generation from volatile renewable sources causes higher demand for flexibility in the energy system, flexibilization of household customers' consumption patterns can be an important contribution. Utilization of this potential can be enabled by variable electricity rates with elements like time-dependent pricing, peak pricing, real-time pricing or demand charges [2,3,4]. Recommendations for useful rate design can be deduced by simulation based on measured consumption data [5,6,7]. This raises the question: Which price components should be charged in a variable way in order to reproduce the optimal rates with necessary spreads and to assign price risks to the appropriate market players [8,9]?

Methods

Previous work yields optimized electricity rates which are calculated without consideration of the price composition [10]. Generally, the resulting price structures cannot be represented in only one price component in a sensible way. The components are analyzed regarding several criteria like current level of the component (e.g. on average 7.5 cents for grid fees), the responsible market players or authorities (e.g. grid operator and regulator for grid fees), their intentions and goals (e.g. coverage of grid costs for grid operators), the regulatory and practical potential for flexibilization etc.

Customer reactions to variable rates can be simulated based on measured time-resolved consumption data [11,12], which allows to evaluate which rate elements cause which specific reactions like load-shifting or energy saving. Based on that, it is examined whether the effects of these variable elements correspond to the goals of the considered market players and authorities and whether the related price component can pose a sufficient incentive for this change in behaviour. This leads to a recommendation for a useful design of price components.

Results

The evaluations show that the price component which covers the cost of electricity generation is too small to cause relevant changes in the behavior of household customers. Therefore, it is recommended to consider additional flexibilization of other price components. Grid fees and EEG levy are the best candidates here, since they provide the largest lever. Grid fees can be designed to incorporate demand charges, since grid costs are largely dependent on peak demand. Time-dependent EEG levies can help to integrate renewable generation into the system by incentivizing load-shifting to peak generation periods. Together with other components like electricity tax, concession fees and possibly a new flexibility levy, this enables the design of effective variable rates.

Conclusions

The analysis shows the importance of considering all price components of retail electricity rates in the design of variable retail rates. Suitable flexibilization of these components allows to assign effective variable elements to the respective market role and thus, to develop a useful future market setting.

References

[1] "BDEW-Strompreisanalyse Februar 2017". Bundesverband der Energie- und Wasserwirtschaft, Berlin, 2017.

[2] C. Joe-Wong, S. Sen, S. Ha, M. Chiang: "Optimized Day-Ahead Pricing for Smart Grids with Device-Specific Scheduling Flexibility". IEEE Journal on Selected Areas in Communications, 30(6), 1075–1085, 2012.

[3] R. L. Conkling: "Energy Pricing". Springer, 2011.

[4] K. Herter: "Residential implementation of critical-peak pricing of electricity". Energy Policy, 35(4), 2121–2130, 2007.

[5] M. Hinterstocker, P. Schott, S. von Roon: "Evaluation of the effects of time-of-use pricing for private households based on measured load data". 14th International Conference on the European Energy Market, Dresden, 2017 (submitted).

[6] S. Shao, T. Zhang, M. Pipattanasomporn ; S. Rahman: "Impact of TOU rates on distribution load shapes in a smart grid with PHEV penetration". IEEE Transmission and Distribution Conference and Exposition, New Orleans, 2010.

[7] S. Gottwalt, W. Ketter, C. Block, J. Collins, C. Weinhardt: "Demand side management – A simulation of household behavior under variable prices". Energy Policy, 39(12), 8163–8174, 2011.

[8] A. Jahn, B. Praetorius: „Der Spotmarktpreis als Index für eine dynamische EEG-Umlage". Agora Energiewende, Berlin, 2014.

[9] „Kosten und Nutzen einer Dynamisierung von Strompreiskomponenten als Mittel zur Flexibilisierung der Nachfrage". Frontier Economics/BET, 2016.

[10] M. Hinterstocker, S. von Roon: "Optimization of retail electricity pricing structures". VDE ETG Congress, Bonn, 2017 (submitted).

[11] M. Hinterstocker, P. Schott, S. von Roon: "Disaggregation of household load profiles". 10. Internationale Energiewirtschaftstagung, Vienna, 2017.

[12] M. Hinterstocker, P. Schott, S. von Roon: „Increasing residential self-consumption of PV energy by DSM". 10. Internationale Energiewirtschaftstagung, Vienna, 2017.