THE IMPACT OF NETWORK TARIFFS ON PV INVESTMENTS - REGIONAL DIFFERENTIATION AND CONSUMERS' PRICE PERCEPTION

Fabian Arnold, Institute of Energy Economics at the University of Cologne, +49 221 27729232, Fabian.arnold@ewi.uni-koeln.de
Samir Jeddi, Institute of Energy Economics at the University of Cologne, +49 221 27729205, Samir.jeddi@ewi.uni-koeln.de
Amelie Sitzmann, Institute of Energy Economics at the University of Cologne, +49 221 27729228, Amelie.sitzmann@ewi.uni-koeln.de

Overview

The transition towards a decarbonized energy system increases investments in decentralized solar PV-systems. Economic incentives, including electricity consumption prices, drive the adoption of PV-systems (e.g. Jacksohn et al., 2019). Hence, adequately designed prices are of great importance to efficiently coordinate (spatial) investments in PV-systems. In Germany, network tariffs constitute the second-biggest price component for households' electricity consumption and are the only price component that varies spatially. The regional distribution of network tariffs does not represent network congestion but follows a simplified cost allocation mechanism, potentially leading to misaligned PV investments. We empirically analyze the impact of price signals on PV investments of German households. We focus on the effect of network tariffs and examine how their effect on PV investments changed over time. Additionally, we aim at identifying the impact of fixed and volume-based network tariffs to provide further insights into consumers' perception of non-linear prices. German network tariffs effectively represent a (non-linear) two-part tariff, consisting of a fixed payment and a volume-based tariff. In theory, fixed network tariff payments should not affect a household's investment decision, as long as it does not lead to a complete energy autarky. However, it is questionable if consumers respond to average prices rather than marginal prices (Ito, 2014).

Methods

Our work's methodology is closely linked with the one of Gautier and Jacqmin (2020), who study the impact of network tariffs on PV-investments in Wallonia. We conduct a similar analysis for Germany and further investigate households' perception of non-linear prices. We analyze spatially differentiated network tariffs using municipality-level panel data. The data is a unique set of network tariffs, PV-investments as well as socio- and techno-economic variables. Our data on network tariffs specifically allows for the differentiation for fixed- and volume-based network tariff payments. We include two-ways fixed effects to capture unobserved heterogeneity across municipalities and time. Further, we lag our primary explanatory variable by one year to investigate how households evaluate their electiricity consumption when they pay their bill ex-post. As our dependent variable has a non-negative distribution, we use a Poisson quasi-maximum likelihood estimator with conditional fixed effects. We provide additional robustness checks for a least square dummy variable and a negative binomial approach.

Results

We find evidence that network tariffs influence the regional adoption of PV-systems across Germany. The impact differs concerning the network tariff component. While the fixed component of the network tariff has no or even a slightly negative effect on PV investments, a higher volume-based component results in increased PV investments. Besides, the influence of network tariffs increased over time, as economic incentives gained more importance. We provide insights into the socio-economic drivers of PV-adoption.

Conclusions

Volume-based network tariffs may distort price signals for the adoption of PV systems. The rise of network congestion and transmission expansion increases network tariffs and raises the incentives to invest in PV systems, pushing further generation into the grid. Changing the network tariff design and the allocation of network costs might improve the efficiency of price signals. However, policymakers should consider behavioral aspects like consumers' price perception when changing the regulatory setting.

References

Gautier, A., & Jacqmin, J. (2020). PV adoption: the role of distribution tariffs under net metering. Journal of Regulatory Economics, 57(1), 53-73.

Ito, K. (2014). Do consumers respond to marginal or average price? Evidence from nonlinear electricity pricing. American Economic Review, 104(2), 537-63.

Jacksohn, A., Grösche, P., Rehdanz, K., & Schröder, C. (2019). Drivers of renewable technology adoption in the household sector. Energy Economics, 81, 216-226.