

The Impact of Time-of-Use Electricity Distribution Network Charges on Residential Electricity Consumption

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Extended Abstract

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Abstract Summary

The decarbonization of the electricity sector increasingly depends on consumer demand flexibility, which is essential for balancing variable renewable generation. In 2023, Denmark introduced a time-of-use distribution system tariff scheme aimed at incentivizing households to shift electricity consumption away from peak hours through time-varying distribution charges. This paper evaluates the behavioural effects of this reform using a Difference-in-Differences framework that exploits the staggered rollout of time-of-use tariffs across Danish distribution system operators (DSOs).

After a complete national smart meter roll-out in 2020, time-of-use tariffs have been gradually introduced across Denmark, without opt-out options for residential consumers. In 2023, some DSOs implemented time-of-use tariffs in January and July, while others maintained constant tariffs, creating natural treatment and control groups for causal inference.

Using high-frequency smart meter data from Energinet linked with socio-economic registers from Statistics Denmark, the analysis estimates treatment effects of the tariff introduction. The empirical design builds on Enrich et al. (2024), who evaluate time-of-use pricing in Spain and Portugal using a panel fixed-effects Difference-in-Differences approach and find that predefined high-price tariff periods can lead to load reductions and habit formation. In contrast, Fabra et al. (2021) show only a limited behavioural response to real-time electricity pricing contracts in Spain in 2015, highlighting the importance of predictability in tariff structures for enabling consumer flexibility.

The analysis complements recent Danish research on electricity consumption and price responsiveness of different socio-economic groups by Gunkel et al. (2023) and Andersen et al. (2017) by incorporating tariff policy heterogeneity, offering new insights into consumer behaviour under time-of-use pricing regimes.

Presenting Author Biography

Flora von Mikulicz-Radecki is a PhD researcher at the Copenhagen School of Energy Infrastructure (CSEI), Department of Economics. Her work is part of the EU Marie Skłodowska-Curie Doctoral Network CoDeF, focusing on consumer energy demand flexibility, with her projects gives particular emphasis on Danish electricity consumption and flexibility. She holds a dual Master's degree in Innovative Sustainable Energy Engineering from KTH Royal Institute of Technology and Aalto University, and a Bachelor's degree from TU Berlin.