

PROSUMAGER IMPACT ON ELECTRICITY LOAD PROFILES: A MODEL COMPARISON

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Overview

With the increasing uptake of heat pumps (HP) and photovoltaic (PV) within the European building stock, demand side management becomes an increasingly attractive option to balance the volatile share of renewable electricity generation. "Prosumagers," or households that consume, produce, and manage their own electricity, could play a critical role in the energy transition. To increase the knowledge of their impact on the power system, it is essential to model such prosumaging households properly. This paper contributes to this topic by comparing two different modeling approaches for individual prosumaging households with a focus on the following indicators: peak-to-peak demand, shifting electricity consumption and PV self-consumption.

Methods

The models, Invert-FLEX and PRIMES-Prosumaging, both focus on prosumagers within the building stock for the years 2020, 2030, and 2050 in a common scenario framework and use an economic optimization approach to minimize homeowners' energy costs. FLEX minimizes operational costs over a single year, building on the long-term development being modelled by the building stock model Invert. On the other hand, PRIMES-Prosumaging minimizes the total costs for individuals over the modelling horizon from 2020 until 2050. Therefore, the PRIMES-Prosumager model is sensitive to the total electricity price as well as hourly changes in price whereas the FLEX model is solely sensitive to hourly price changes, whereas the sensitivity to absolute electricity price levels comes into play in the underlying Invert model. To reduce computational intensity the PRIMES-Prosumager model uses representative days for each year as compared to the FLEX model, which calculates 8760 hours per year. By comparing these two approaches this study contributes to a deeper understanding of modelling prosumagers and their interaction with the electricity system as well as the impacts of chosen modelling approaches.

Results

Variations in results between the models will be explained by the differences in modelling approaches. Because of the different way how both models react to prices, we will see different predicted building stock characteristics for the future. Because of the different approaches to represent the temporal resolution (yearly compared to representative days), it is expected that the models will show differences in shifted electricity and PV self-consumption especially for buildings with high shares of storage technologies. Both model results show that the peak to peak demand of individual prosumagers will rise.

Conclusion

Prosumagers will have a large potential to shift electricity demand on a national level in the future. Future research will deal with the question on how to ensure that a rising share of prosumagers contributes to grid stability instead of increasing grid stress. A time and location-based incentives might have to be provided to individuals and potential aggregators.