

Analyzing the impact of heating electrification and prosumaging on the future distribution grid costs

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Abstract-

The electrification of households' heating systems will lead to an increase in the electricity demand, which will necessitate additional investments in the grid infrastructure. The interaction with other technologies, including PV, batteries, electric vehicles (EVs), and home energy management systems (HEMSs), further complicate the situation. In this study, we analyze the following question: How will prosumaging households, who consume, produce and manage their energy consumption with HEMS, impact the future reinforcement costs of the electricity distribution grid? We conducted case studies for two urban areas, Murcia in Spain and Leeuwarden in The Netherlands. First, by developing scenarios on the uptake of electrified heating systems, PV installations, battery storage, EVs and HEMSs, the energy demand of each building is modeled for the two areas under different scenarios. Then, the buildings' electricity load profiles were provided to a second model, to calculate the necessary distribution grid infrastructure to cover this demand on a granular spatial level. Results show that low voltage lines and transformers will need significant investments, especially in the regions where a high share of conventional heating systems are replaced by heat pumps but also in regions where the aggregate electricity peak demand is reduced.

Index Terms- Distribution electricity grid; Grid reinforcements; Demand-side management; Residential buildings; Power distribution planning; Heat pumps; Electric vehicles

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