Flexibility potential analysis framework for P2H sector coupling

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1 Abstract

The decentralized energy techniques like heat pumps and storages are increasingly applied to ensure the balance between supply and demand. However, rather than barely meeting the demand, the need for zero energy buildings in the EU landscape aims to respond to the fluctuations and stabilize the grid by developing sector coupling between thermal and electricity systems. Accordingly, demand side thermal energy flexibility plays a key role in enhancing the stability of the power grid. Moreover, as the district heating transition towards fifth generation, the supply temperature can be reduced to 40°C, which faces challenge when peak load occurs. Hence, the coupling also contributes to the peak shaving in district heating networks. Due to efficient coupling of the thermal and electricity sectors, power-to-heat (P2H) assets such as heat pumps as well as electric boilers play an increasingly important role in unlocking flexibility, both as boosters of the district heating network or stand-alone devices. However, there is a research gap in comprehensively analyzing the flexibility potential in such sector coupling networks. This study aims to develop a data-driven demand response strategy for such power-heat coupling systems, and the flexibility potential will be analyzed thoroughly through simulation from a district heating connected energy community in Großschönau, Austria. Furthermore, novel midterm storage solutions, such as phase change materials (PCM), will be considered to incorporate with district heating and P2H assets.