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Matching renewable energy supply with building demand profiles and storage at the neighborhood scale

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Most renewable energy mismatch problems are considered at either the national scale or the building scale. In a smart integrated urban energy infrastructure, mismatch could be solved at the neighborhood scale by matching building electricity, heat and cold demand profiles, waste heat and cold supply profiles and renewable energy generation profiles. The energy profile of a building is both dependent on the occupants and usage, as well as the time of year and the time of day. Buildings provide opportunities for storing heat and electricity over periods of up to a few days (e.g. EV batteries, thermal mass). This can be added upon by seasonal heat and cold storage systems like ATES at the neighborhood level. Making smart use of this variety within a neighborhood provides opportunities for increased local consumption of renewable energy and decreased requirements of transmission infrastructure, as well as decreasing the total energy demand by using waste heat and cold at another moment and/or in another location.

In our study we aim to contribute to the knowledge on renewable urban energy supply by identifying the potentials of the neighborhood as a multi-scale energy system and unit of analysis. This is done in a model-based approach by creating heat, cold, and electricity demand and supply profiles for different types of buildings that can be found in a neighborhood. These are integrated into a spatial model, that can take into account potentials from building energy demand and supply profiles next to renewable energy production potential and seasonal storage.