The fluctuating and only partly predictable nature of wind challenges an effective integration of large wind power penetrations. This PhD thesis investigates to which extent heat pumps, heat storages, and electric vehicles can support the integration of wind power. Considering the gaps in existing research, main focus is put on individual heat pumps in the residential sector and the possibilities for flexible operation, using the heat storage options available.

Extensive model development is performed that significantly improves the possibilities for analysing individual heat pumps and heat storages in an energy system context. Energy systems analyses reveal that the heat pumps can even without flexible operation contribute significantly to facilitating larger wind power investments and reducing system costs, fuel consumption, and CO2 emissions. When equipping the heat pumps with heat storages, only moderate additional benefits are achieved. Hereof, the main benefit is that the need for investing in peak/reserve capacities can be reduced through peak load shaving. It is more important to ensure flexible operation of electric vehicles than of individual heat pumps, due to differences in the load profile.