197

Climate impacts and adaptation in Austria's building sector and electricity system

Franziska Schöniger[1], Gustav Resch[1], Florian Hasengst[1], Lukas Kranzl[2], Aadit Malla[2], Lukas Liebmann[1]
[1]AIT Austrian Institute of Technology, Vienna, Austria. [2]TU Wien, Vienna, Austria

Extended Abstract

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Abstract Summary

Climate change is reshaping energy demand patterns and the operating conditions of buildings and power systems in Austria. Rising temperatures reduce heating needs but significantly increase cooling requirements, driving higher electricity consumption, stronger summer peak loads, and greater flexibility needs. At the same time, changes in hydrology, solar radiation, and wind conditions alter renewable electricity generation patterns, affecting supply reliability and system stability. These dynamics interact with Austria's growing electrification of heating, cooling, transport, and industry, further intensifying system stress - especially during heatwaves.

To assess these impacts, this study combines two high resolution modelling frameworks. The building stock model Invert/EE Lab simulates heating and cooling demand, technology choices, passive and active cooling measures, and investment decisions across Austria's building archetypes. The European energy system optimisation model IESopt Europe represents electricity generation, storage, cross border exchange, and sector coupling at hourly resolution.

Two adaptation scenarios are analysed: Low adaptation, with slow uptake of passive cooling, moderate efficiency improvements, and no additional electricity system flexibility investments; and
High adaptation, with rapid deployment of efficient passive and active cooling measures and full access to flexibility options such as storage, flexible sector coupled demand, hydrogen and thermal storage, and backup generation.

Preliminary results for 2050 under RCP 4.5 show that high adaptation can stabilise cooling energy demand despite rising temperatures, while low adaptation may lead to nearly tripled cooling needs. These changes propagate into the power system: adaptation mitigates extreme price spikes and reduces the risk of costly load shedding, whereas

insufficient adaptation increases vulnerability during extreme weather events and raises system costs.

Further work will extend the scenario set to 2080 and RCP 8.5 and include a no climate change reference case to enable a comprehensive comparison of risks and adaptation strategies.

Presenting Author Biography

Franziska Schöniger has been a Research Engineer at the Center for Energy at the AIT Austrian Institute of Technology in the fields of flexibility and energy system modelling since June 2024. She studied Energy Economics and Renewable Energies and completed her PhD at TU Wien in 2023. She worked on and led (inter)national research projects in the field of energy system modelling and energy policy/economics. Her research focuses on (open-source) modelling of energy systems with high shares of RES, the investigation of the impact of climate change on the energy system, and analysis of flexibility options and needs.