

Are Zero Heating Buildings doable in Swiss Climate?

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1. Introduction, Goals and Research Questions

Space heating and cooling represent a major share of building energy use in Switzerland and globally. Passive design can help reduce this demand by improving the building envelope and using climate-responsive measures such as glazing, shading, window area and night-time ventilation.

Main Research Question

Can a single passive office-building design maintain acceptable indoor thermal comfort with no active heating or cooling, across three Swiss climates of Zurich, Davos and Locarno?

Goal & Objectives:

- Develop a reference office-building model and evaluate its free-running thermal comfort against the SIA 180:2014 comfort band.
- Quantify the influence of the chosen passive design parameters on comfort in each of the three climates.
- Compare which parameters are most effective in each climate and identify the limitations and risks of the approach.

2. Methodology

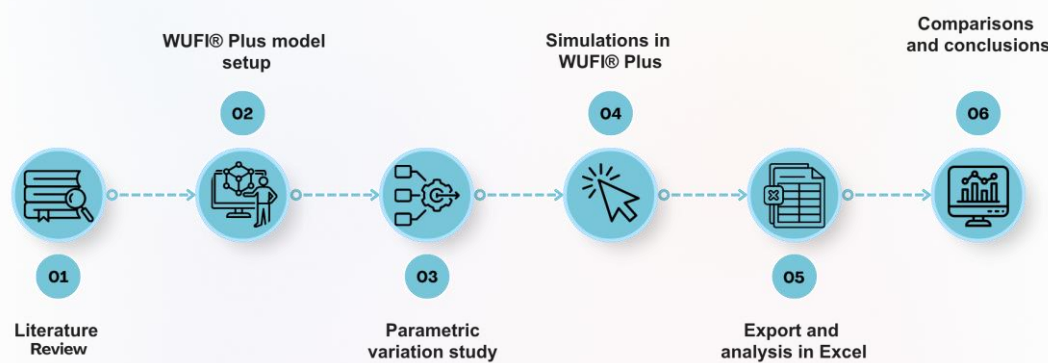


Figure 1: Project workflow

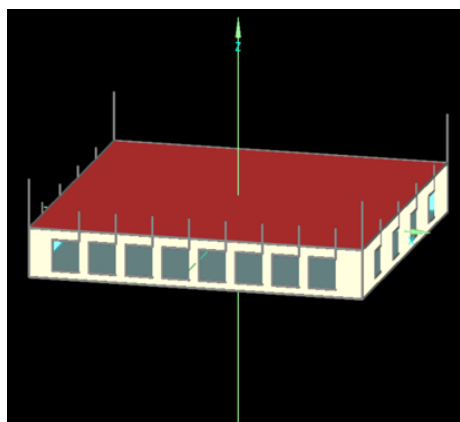


Figure 2: WUFI® Plus model

A representative middle floor of a generic office building is modelled as a single free-running thermal zone in WUFI® Plus. Using the one-factor-at-a-time (OFAT) method, each passive parameter is varied in turn, and thermal comfort is assessed from the operative temperature against the SIA 180:2014 adaptive comfort band, counting occupied hours outside the band.

Materials / Data / Tools



Figure 3: Materials and tools used

Parametric Variation

- Building orientation
- Glazing quality
- Window-to-wall (WWR) ratio
- Nighttime Ventilation
- Shading device factor

3. Results and Discussion

The same reference building performed differently in each climate, Zurich showed a mixed cold and warm discomfort, Davos was dominated by underheating, and Locarno by overheating. In the parametric study, glazing quality was the most influential parameter overall, weaker glazing sharply increased cold-side discomfort in all three climates, showing that poor glazing is not a suitable overheating-control strategy.

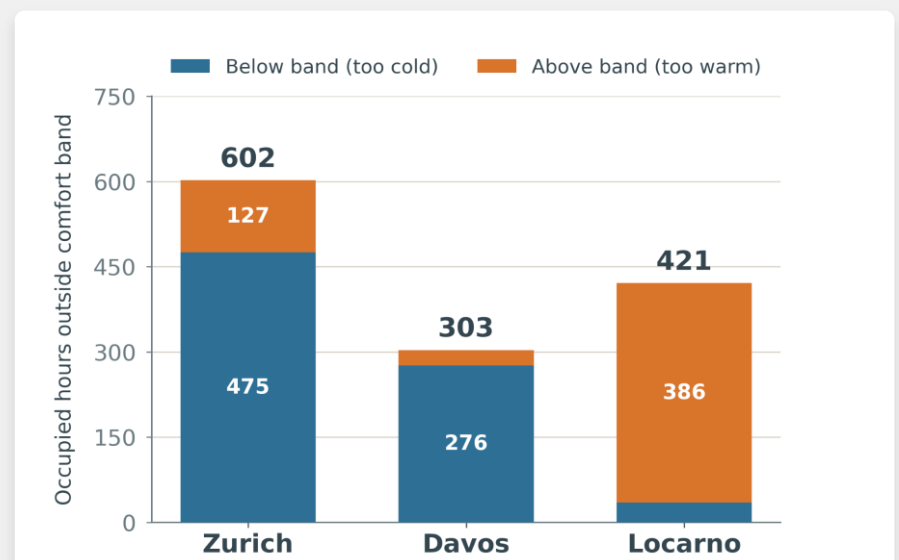


Figure 4: Reference cases occupied hours outside the comfort band

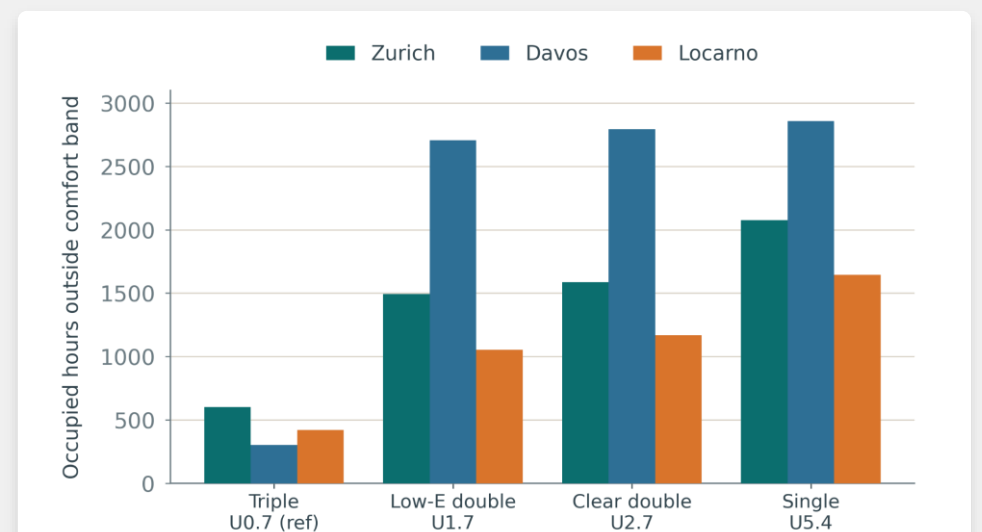


Figure 5: Occupied hours outside comfort band when glazing quality is reduced

4. Conclusion and Recommendations

Zero-heating office operation is technically plausible in Switzerland, but not as one universal design. Zurich requires a balance between heat retention and overheating control, Davos requires excellent glazing and useful solar gains, and Locarno requires strong shading and controlled passive cooling. Since no reference case remained comfortable during all occupied hours, a small backup system may still be needed. Future work should quantify this residual demand and test performance under future warming climates.

References

Manz, H., Micallef, D., Borg, S. P., & Buhagiar, V. (2018). A parametric building energy simulation case study on the potential and limitations of passive design in the Mediterranean climate of Malta. Sustainable Buildings, 3, 4.

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Semester: Spring Semester, 2026