The impact of warming climate conditions on buildings!

Global warming is causing the climate worldwide to change. Buildings have a long lifetime and will be in use under warmer climate conditions in the future. This has implications for all buildings, old and new, and regardless of their efficiency level. The question: Do future climate projections call for different design choices in order to reach high comfort and high energy efficiency?

Impact on the heating demand

Due to warming conditions, annual heating needs are likely to slightly decrease in the future. Efficiency measures to reduce the heating demand will remain the primary design focus in many parts of the world. Current Passive House insulation levels are therefore appropriate also under the warming conditions.

Summer comfort and risk of overheating

A closer look at summer comfort is critically important for future-proof design decisions. The risk of overheating will increase and - as soon as mid-century - active cooling will likely be needed in many locations where this is currently not yet the case. This holds true regardless of the building's efficiency level. This calls for passive cooling strategies to be taken more seriously in current design practices. It is also advisable to allow for sufficient "head room" and, depending on the project and the identified risk of overheating, to anticipate active cooling.

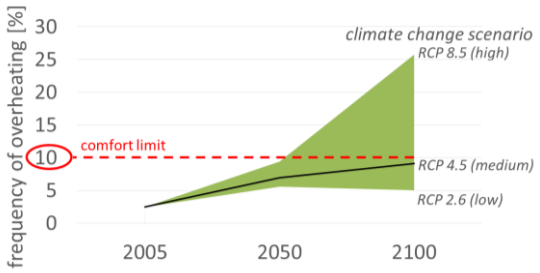

Figure 1: Example of projected summer comfort in a multifamily Passive House building in Berlin, Germany. Green represents the likely frequency of overheating in the future calculated with PHPP, depending on severity of climate warming scenario (RCP). ©Passive House Institute

Impact on active cooling needs

For buildings with active cooling, the energy needs will increase as the climate warms. By prioritising passive cooling measures and by consistently applying the Passive House concept, the cooling needs can be significantly reduced. This is already true for today's climate conditions but, importantly, these efficiency measures provide resilience to a future surge in cooling demand and in cooling peaks. The season and the times of active cooling coincide well with solar renewable energy. This makes a sustainable and low emission energy supply much easier than for heating, as is reflected in the Primary Energy Renewable (PER) assessment method.

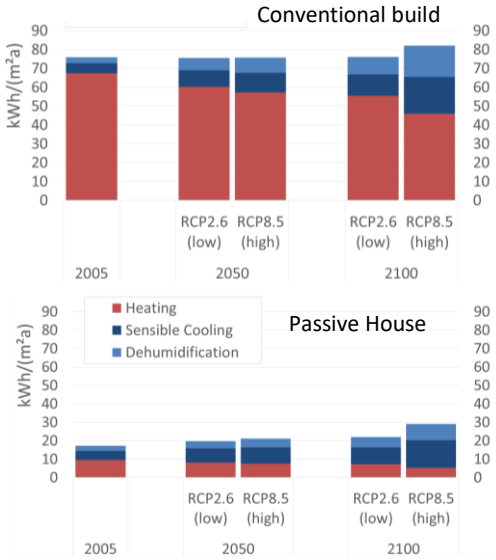

Fig.2&3: Projected energy demand based on the "Flow Chelsea" mixed-use building by ZH architects in New York. Calculated with PHPP as a conventional build (top) and as a Passive House (bottom). In general: The heating demand decreases, the demand for cooling and dehumidification increases. The magnitude of change depends on the climate warming scenario (RCP). ©Passive House Institute

Conclusion

Warmer summer conditions must be anticipated during the design of a building. This is particularly important for projects that rely only on passive means to achieve summer comfort, in order to make an informed decision on whether active cooling may be needed. Data projections of the future climate are inherently uncertain and we can only estimate the likely range. For the purpose of building design it is therefore useful to work with simplified methods, e.g. by adapting the summer temperatures in the Passive House design tool PHPP.

Source: "The impact of warming climate conditions on buildings", Jessica Grove-Smith, 24th International Passive House Conference 2020; Passive House Institute