

ARE OUR URBAN BUILDINGS CLIMATE-READY?

Global warming will hit cities harder than the surrounding rural areas. This factsheet outlines how changing temperatures will affect building energy consumption and indoor comfort in European cities. Are older generations of buildings equipped to handle increasingly common heatwaves? Or will there be a need for further cooling? And will this cooling be offset by reduced heating costs during milder winters? Or are households and companies facing steep increases in energy costs?

Evaluating building energy needs in cities

To predict buildings energy needs, engineers use dynamic building simulations (or Building Performance Simulation BPS). These planning tools allow them to simulate the energy consumption and indoor climate using numeric models of planned or existing buildings in which climatic conditions are defined using e.g. Typical Meteorological Year (TMY) data.

Unfortunately, TMY data does not always accurately reflect the real climate conditions in planned building sites. This is especially the case in cities, where the climate data used to feed the building simulations is often gathered at weather stations outside the city centre, where temperatures tend to be lower. As a re-

sult, buildings in cities can show unexpected cooling needs in summer and might require less heating during winter than predicted by the initial modelling. Furthermore, this performance gap is likely to widen under changing climate conditions. Current building simulations don't always incorporate climate predictions that accurately reflect how energy needs are likely to evolve, especially in urban areas.

As part of the Horizon 2020 project Climate-fit.city, Pronoó created series of simulations for six European cities, integrating urban-specific climate data for three climate scenarios: current, 2050 RCP 4.5 and 2050 RCP 8.5. The simulations took into account both old and new buildings, with and without cooling, as well as the composition of local construction materials and can model buildings in rural, urban and city-centre locations.

Does the urban heat island effect have an impact on building energy consumption?

The urban heat island effect has a pronounced effect on buildings energy use, but this effect is different from city to city. Buildings in cities North of the Alps, for instance, require less heating during winter, with energy needs decreasing by as much as 20%. South of the Alps, however, cooling demands during summer increase by as much as 50% or even double in cities. These increased cooling energy needs during the summer will, however, be easier to cover as they are in phase with solar energy supply.

Will we still be able to live in buildings without air conditioning?

While indoor temperatures in buildings in Northern Europe will certainly increase, they will remain within the acceptable temperature range set by EU-norm EN 15251. For buildings in Southern European cities, however, indoor temperatures will regularly exceed the comfort limits.

This need for air conditioning is particularly pressing in older buildings, where indoor temperature will far exceed comfort limits for considerable periods of time. What's more, many of the existing condenser unit air conditioning devices are not built to withstand the projected outdoor temperatures and are likely to simply switch off. Even when they do not, their efficiency will be lowered by as much as 10%, further increasing energy demands for cooling.

Conclusion

The changing climate will have a considerable impact on livability and energy use in urban residential buildings, especially for cities in the south of Europe. Cities who want to prepare for these considerable impacts could review their building energy requirements for planned housing. To do so, they do not simply need to make sure that building energy consumption is calculated for different climate scenarios, they should also ensure that building energy simulations are made with urban climate data rather than general data, which do not take into account the urban heat island effect.

Furthermore, cities with many older residential buildings will face increasing cooling demands. Older buildings without air conditioning will become unlivable, with indoor temperatures that pose risks to human health. To prepare their citizens for the changing temperature needs, cities could inform property owners of the inherent risks in addition to profit losses and encourage them to make their buildings more energy-efficient or to invest in appropriate cooling measures.

In summary, thermal building renovation remains the main task in order to reduce heating and cooling energy consumption and to provide acceptable indoor climate comfort. In southern cities, air conditioning will become essential.



About Climate-fit.city

Climate-fit.city helps cities prepare for the effects of climate change. It provides detailed scientific urban data to predict how a specific city will be affected by climate change and helps cities find tailored mitigation and adaptation strategies.

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