

# Science for Environment Policy

## Buildings' future heating and cooling needs are predicted with new method

**Which types of buildings** will require the least energy for heating and cooling under climate change? A study in Vienna, Austria, looked at the balance between heating and cooling demand in four different types of buildings. The research provides a method that could be useful for other European cities trying to adapt to climate change.

**Use of air conditioning systems** is expected to increase under [climate change](#). This may lead to a feedback loop in which energy needs and greenhouse gas emissions associated with running air conditioning systems contribute further to climate change and rising temperatures. As a result of the [urban](#) heat island effect – whereby manmade materials, such as concrete, absorb and store heat better than natural surroundings – buildings in urban areas are more affected by this feedback loop than those in rural areas.

A number of studies have simulated the impact of climate change on indoor conditions, but few have compared its effects on different types and ages of buildings. This study's authors simulated climate change and urban heat island effects on four example buildings in Vienna: pre-World War I; post-World War II; 2000 onwards and 'highly glazed' (buildings clad with a glass exterior); and 2000 onwards built to low-energy 'passive house'<sup>1</sup> standards. They chose each to serve as a reference for common building types in Vienna.

Using thermal simulation software, they calculated the buildings' heating and cooling demands for the recent past, the present and the future based on real and simulated hourly measurements from three weather stations in three distinctly different settings in Vienna. These ranged from the central business district to the green outskirts of the city. All of the buildings' different constructions were included in the simulation, but they were assumed to operate heating and cooling on the same schedule.

According to the results, between 1960 and 2050, the net energy demands for cooling of all four types of buildings increase fairly constantly. The highly glazed and passive house types had the highest cooling demands. Houses in city centres and those that were west facing had greater cooling demand, which highlights the importance of considering location when simulating indoor heating and cooling.

Overall, the authors predict that cooling demand in these four representative building types in Vienna will double in the next 40 years, while heating demand will gradually decrease. Taking the decreased heating demands into account, this means that the total energy demand only increases for highly glazed buildings built since 2000. By contrast, the energy demands of older buildings decrease slightly and those built to passive house standard plateau.

Perhaps unexpectedly, the buildings in city centres actually have the lowest final energy demands due to reduced winter heating costs. This is not to say that simply providing more electricity for cooling will be the sole consequence of climate change but rather to highlight how demand will increase should no adaptation measures take place.

The researchers acknowledge that their results cannot be generalised as each city has its own building characteristics and climatic conditions. However, they say that with new data from other settings, these methods may be useful in exploring the combined impacts of climate change and urban heat islands.



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1. See: [www.passiv.de/en/02\\_informations/01\\_what\\_is\\_a\\_passive\\_house/01\\_what\\_is\\_a\\_passive\\_house.htm](http://www.passiv.de/en/02_informations/01_what_is_a_passive_house/01_what_is_a_passive_house.htm)