

Our buildings make heatwaves worse – here’s how to cool them down

By [Michael Le Page, published in *New Scientist* \(weekly\), print edition of Aug 4, 2018](#)
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Many buildings in cool countries are poorly designed to cope with heat, and new homes and offices are even worse. Thousands will die if we don't fix them

Temperatures in the southern parts of the UK have been pushing 30°C for weeks, and health warnings about the heatwave have been flying. That has attracted some derision from those living in hotter places, such as the city of Darwin in Australia. “In Darwin that’s called winter”, was [one mocking response](#).

Yes, it gets much hotter elsewhere. But that is missing the point. Hot places are geared up to cope with heat. By contrast, when temperatures soar in normally cooler cities like London, people commute on crowded trains that breach the temperature limits for transporting livestock, work in buildings with limited cooling systems and struggle to sleep in stuffy houses designed for Victorian winters.

Hot summers like this used to be extremely rare in the UK. They will soon be the norm because of climate change – and in 50 years or so a summer like this year’s will be regarded as relatively cool. So unless more is done adapt buildings and transport systems to the heat, summers are going to become ever more miserable for millions – and ever more deadly to the young, the ill and the elderly.

Preventable deaths

“Without further action, the number of heat-related deaths could increase from 2000 per year today to 7000 in the 2050s,” says Kathryn Brown, head of adaptation at the UK Committee on Climate Change.

If a flood killed that many people, there’d be a massive outcry, [points out Bob Ward](#) of the Grantham Research Institute on Climate Change in the UK. “It’s a scandal that hundreds of people are dying,” he says. “Many of those are preventable deaths.”

A report by the UK’s Environmental Audit Committee published on Thursday [August 2] says the problem is so serious that the country should have a dedicated government minister to tackle the issue. But what can be done?

Countries like the UK are simply not doing enough to fix buildings that are poorly designed for staying cool in hot summers. Worse still, new buildings are being designed in such a way that they require vast amounts of energy to cool.

And cooling is more than just a matter of comfort. High temperatures reduce the productivity of workers and affect [how well children learn](#), lowering exam scores with potentially life-long impacts.

Coping strategies

So countries need to do three things to protect their citizens' lives and livelihoods. First, existing infrastructure – from homes and hospitals to schools, offices and trains – needs to be modified to cope with the extremes expected as the planet warms, including longer and hotter heatwaves. Second, new buildings and transport systems need to be designed with future heatwaves in mind. Last, but not least, cities as a whole need to minimise the “[urban heat island](#)” effect that can boost local temperatures several degrees.

We can keep buildings cool by actively removing excess heat – air conditioning, in other words. We can also prevent them getting too hot in the first place. Needless to say, prevention is better than cure.

The problem with air conditioning is that it produces yet more heat. A study in Paris, for instance, concluded that [air conditioning could warm the city by as much as an extra 2°C](#).

It is also expensive to install and run, because air conditioners use a lot of energy. In fact, 10 per cent of electricity globally is used to power air conditioners and this is expected to soar as the world gets hotter and more people become able to afford air con, [according to a recent International Energy Agency report](#).

That's a huge problem, because most electricity is still generated from fossil fuels. In other words, the more air conditioning we use, the hotter planet will become.

All-weather buildings

The focus, then, should be on creating buildings that can stay warm in winter and cool in summer. Architects and planners don't seem to have realised this, says eco-designer Sue Roaf, co-author of the book *Adapting Building and Cities for Climate Change*. “They just don't get it.”

Current architectural crazes are for light-weight glass buildings that would become unbearably hot without energy-intensive air conditioning systems. Roaf lives in an eco-house with a much more sensible approach.

The first step is think about the shape of the building, and the size and placement of windows, in relation to the path of the sun. The basic idea is to minimise the amount of sunshine entering windows in summer but maximise it in winter. Long roof eaves are a classic way of achieving this, and a modern version can be seen on [Apple's new headquarters](#).

Besides good insulation to keep the heat out, buildings should be slow to warm up. That means having a high thermal mass, such as thick walls made of a dense material, or sinking the building into the ground. It should also be possible to get a good air flow through the house at night – for instance, by having windows that can open wide and be left open at night without compromising security.

All this means we should be building relatively low-rise, cube-shaped buildings with thick walls and few windows on the sunny side. That, of course, is pretty much the opposite of what is being done. Designer homes often feature wall-to-ceiling windows, and most new office buildings are all-glass skyscrapers with no shading and no windows that open.

Glass is terribly energy inefficient – it leaks heat in the winter, and soaks it up in the summer. The bottom line, then, is that people who live in a warming world should not build glass houses. “It’s a no-brainer,” says Roaf.

So why have we fallen into this glass trap? Partly, it is a matter of culture. Glass is fashionable, and most architects still don’t understand that buildings need to be designed differently in a world facing catastrophic global warming.

Tougher regulations needed

Although that is starting to change, Roaf says, much of the focus has been on energy efficiency. So if engineers design a cooling system for a building that requires less energy, it is hailed as a “green” building. Few are trying to create buildings that don’t need cooling systems in the first place.

To tackle this, governments need to introduce tough building standards that force designers to create truly green buildings. But nothing is being done, warns the Environmental Audit Committee. “The government should recognise the importance of protecting public health by introducing building regulations to stop new buildings overheating,” said Thursday’s report.

Can badly designed buildings be fixed? With skyscrapers, there is often little that can be done, but with smaller buildings and houses, there is often scope for making them cooler without resorting to air conditioning. The first thing is obviously to insulate them – but the UK has abandoned insulation schemes and rates of insulation have plummeted. The next thing is to stop the 500 watts of heat per square metre you get when sun shines in through a window, says Roland Ennos of the University of Hull.

Drawing curtains will help a bit, but it is much better to stop the sunshine getting through in the first place. This can be done by installing external shutters, awnings or pergolas, or by planting trees or climbers to shade the exterior.

Similar principles can be applied to transport systems. For instance, [tube trains in London have grown steadily hotter and more sauna-like](#) over the past century as the clay surrounding the deep tunnels has absorbed heat – the main source of which is the braking of trains. Transport for London is introducing air-conditioned trains and regenerative braking systems that generate less heat to start with.

Authorities also need to look at the big picture. The urban heat island effect can warm cities like London by as much as an extra 7°C. “That’s why it’s such a miserable place to live in,” says Ennos. But measures like tree planting can drop urban temperatures by several degrees, reducing the need for cooling city-wide and making such places more pleasant.

For buildings that do need cooling, there are greener cooling systems available than standard air conditioners. For instance, ground-source heat pumps that warm buildings in winter can be reversed in summer to cool them. But these systems are expensive and won't be affordable for everyone.

We need to be doing all these things and more to adapt our homes and cities to a world of ever more extreme weather. Introducing better standards for new buildings is especially urgent, because these buildings could be around for centuries. If they are not fit for purpose, we will all pay the price. Or as Roaf puts it: "The government has to wake up and smell the coffins."

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Air conditioning use emerges as one of the key drivers of global electricity-demand growth, by [International Energy Agency, May 15, 2018](#)