

IMPACTS OF OVERHEATING IN HOMES LEAFLET



OVERHEATING IN HOMES



Overheating has not, historically, been something the UK housing sector has needed to grapple with, but it is a growing problem. Potentially up to 20% of the housing stock in England is already affected and the issue is likely to become more prevalent in future.

Exposure to excess heat in homes for most people would mean feeling uncomfortable and potentially being sleep deprived. However, when it is extreme, or occurs over prolonged periods, it can have serious consequences for the health of the people living there. In extreme cases, there can be a risk to life for vulnerable groups, such as the elderly or sick, who are also more likely to be occupying their homes during the day when the heat is most intense.

PURPOSE OF THIS LEAFLET

This leaflet highlights and summarises some of the key impacts of overheating in homes for Housing Providers and Building Professionals. It is based on work carried out by the Zero Carbon Hub over the past two years as part of a large-scale project on 'Overheating in Homes', and draws specifically on a detailed evidence review of the 'Impacts of Overheating' prepared by AECOM for the Zero Carbon Hub.

Topics covered include direct impacts on residents' health and wellbeing, as well as knock-on impacts for the wider economy in terms of productivity and energy supply and demand.

“As temperatures rise due to climate change there is an increased risk of overheating in buildings.”

**ENVIRONMENTAL AUDIT
COMMITTEE**

THE ZERO CARBON HUB'S OVERHEATING PROJECT

At the request of Government, the Zero Carbon Hub formed the project 'Tackling Overheating in Homes' in 2014 to gather evidence and information on the current and possible future extent and impact of overheating in homes. We also looked at the degree to which the housing sector is already gearing up to tackle the issue and what further action could be required to manage the risk of future overheating.

Our 'Overheating in Homes – the Big Picture' baseline evidence report, published in June 2015, presents our findings from:

- Over 400 research papers and reports;
- 6 thematic Evidence Reviews;
- A survey of 75 Housing Providers (representing 207,728 homes) in partnership with Sustainable Homes;
- 33 in-depth interviews with Housing Providers and other industry experts; and
- Workshops and one-to-one meetings.

All our Overheating publications are available online at www.zerocarbonhub.org

The term Housing Provider covers all organisations who build, manage, rent or retrofit domestic properties, for example developers and private and social landlords.

EVIDENCE REVIEWS

As part of the Overheating in Homes project, a series of Evidence Reviews were commissioned from experts on key themes related to overheating.

DEFINING OVERHEATING

by CIBSE, ARCC, UCL, and the LSHTM

ASSESSING OVERHEATING RISK

by Inklings LLP, CIBSE, UCL and ARCC

IMPACTS OF OVERHEATING

by AECOM

OVERHEATING RISK MAPPING

by AECOM

DRIVERS OF CHANGE – OVERHEATING IN HOMES

by the ZCH and AECOM

SOLUTIONS TO OVERHEATING IN HOMES

by BRE

LEAFLETS FOR HOUSING ASSOCIATIONS AND LOCAL AUTHORITIES

MONITORING OVERHEATING – HOUSING ASSOCIATION CASE STUDIES

LOCAL AUTHORITIES – TACKLING OVERHEATING IN HOMES

WHY DOES OVERHEATING CAUSE HEALTH PROBLEMS?

The human body needs to maintain its core body temperature between 36.1°C and 37.8°C, although it can cope with temporary increases up to 38°C or 39°C without causing damage to health.

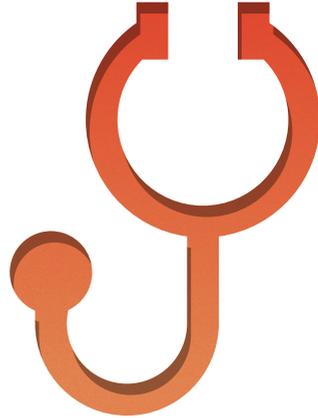
The body loses and gains heat by a number of mechanisms, for example sweating. Failure of these thermoregulation mechanisms to cope with high temperatures can lead to a range of health problems.

HEAT-RELATED ILLNESS (MORBIDITY)

Mild effects of exposure to high temperatures include dehydration, prickly heat, heat cramps, heat oedema (fluid retention often in ankles and feet), heat syncope (dizziness and fainting) and heat rash.

People's productivity and concentration may also be reduced.

More severe health effects range from mental health consequences including increased suicide risk, to heat exhaustion due to excessive sweating and heat stroke.



PEOPLE AT HIGHER RISK OF HEALTH PROBLEMS

Older people, over 65, are less able to regulate their body temperature, may be less able to detect temperature changes and have a diminished sensation of thirst. Social isolation and pre-existing medical conditions are additional risk factors for this age group.

Other people at higher risk of heat-related health impacts are those with serious chronic health conditions (particularly heart or breathing problems), mobility issues, and serious mental health problems. Individuals who are obese generate more heat when active and need less heat to be produced before their core temperature rises.

Young children and babies are also less able to regulate their own body temperature and are at greater risk of dehydration than adults, as well as being more dependent on others.

MORBIDITY

There is limited evidence about how many people are affected by heat-related illness. But, it has been estimated that for each heat-related death, there are around 100 additional hospital in-patient days.

An epidemiological study undertaken in 2004 into the effects of high ambient temperatures on emergency hospital admissions in Greater London over the period April 1994 to March 2000, found that hospital admissions did not rise to the same extent as mortality. Together with a US study of the 1995 Chicago heatwave, this has raised concerns that some heat-related deaths may be occurring before issues can come to the attention of the medical profession.

Critically, any heat-related hospital admissions could be concentrated within a relatively small number of days per year, potentially putting healthcare facilities under strain at these times.

HEAT-RELATED MORTALITY

There were 15,000 excess deaths, mostly among older people, in Northern France during the August 2003 heatwave. Compared to the previous five years, there were a total of 2,091 excess deaths across England and Wales during the heatwave and mortality rates increased by 42% in the London region.

Excess deaths are calculated by comparing the actual number of deaths to what would be statistically expected at that time of year.

There are now estimated to be approximately 2,000 heat-related deaths per year in England and Wales, not only during heatwaves. In the absence of adaptation of the population researchers estimate that this figure could rise to over 7,000 heat-related deaths per year by the 2050s as a result of climate change and a growing and ageing population.

HEALTH COSTS

In 2012 analysis for the Climate Change Risk Assessment (CCRA) suggested that by 2050, annual heat-related mortality and morbidity costs in the UK could increase from 2012 levels by a further £84m and £183m (respectively). These figures represent a four-fold increase in mortality-related costs and a doubling of morbidity-related costs.

OTHER ISSUES

High temperatures have long been related to an increase in aggressive behaviour and violence. The effectiveness of drugs can also be affected at temperatures over 25°C, and the risk of food borne illnesses also increases as the temperature rises.

THE HEATWAVE PLAN FOR ENGLAND

The Heatwave Plan for England (Public Health England 2015) defines regional day and night external temperature thresholds based on statistical analysis of summer temperature records and mortality between 1993 and 2006. In connection with this, England has a 'Heat-Health Watch' system. It comprises five main levels as shown below.

Alert levels 1 to 4 operate from 1st June to 15th September each year. Alert Level 2 is triggered when the Met Office forecasts a 60% chance of thresholds being exceeded on at least two consecutive days. Alert Level 3 is triggered as soon as the Met Office confirms that threshold temperatures have been reached in any region.

Table 1. Heatwave Plan Heat-Health Watch Alert Levels

Level	Actions
0	Long-term planning
1	Summer preparedness
2	Alert and readiness
3	Heatwave action
4	Major incident – emergency response

RELEVANCE TO BUILDING PROFESSIONALS AND HOUSING PROVIDERS

The Heatwave Plan stresses the importance of Level 0, long-term planning, in conjunction with the housing and built environment sectors.

Recommended actions include combating the Urban Heat Island, greening outdoor spaces, improving the resilience of housing to overheating and identifying cool areas or rooms to use in the event of a heatwave.

Table 2. Heatwave Plan Regional Threshold Temperatures for Heat-Health Watch Alert Levels 2-4

Region	Day	Night
London	32°C	18°C
South East	31°C	16°C
South West	30°C	15°C
Eastern	30°C	15°C
West Midlands	30°C	15°C
East Midlands	30°C	15°C
North West	30°C	15°C
Yorkshire and Humber	29°C	15°C
North East	28°C	15°C

SLEEP DEPRIVATION

If overheating in homes occurs during the night it can be particularly problematic as it limits the body's ability to recover from daytime heat stress. This can increase the risk of heat-related mortalities and health-related impacts, particularly for vulnerable groups.

High temperatures affect the quality and continuity of sleep. The time taken to get to sleep is longer, sleep is more interrupted and total sleep time is reduced. Sleep disturbance has been linked to reduced productivity at work, as well as poor physical and mental health.

PRODUCTIVITY IMPACTS

Home-workers are directly impacted if high temperatures are experienced at home during the day.

Overall, economic losses may result from work-days lost, accidents and reduced productivity due to heat-related sleep deprivation and other heat-related health issues causing work absences.

In order to be able to quantify the potential productivity losses to business, new research is needed to analyse the relationship between overheating in homes, interrupted sleep and health issues, and productivity. Estimating productivity losses over time as the climate changes, and in urban areas in particular where it can be more difficult to cool down dwellings at night, would also be of value.

Overheating in the workplace and the resulting economic losses to businesses was investigated in the 2012 CCRA. The team estimated that the number of staff days lost once internal temperatures exceed 26°C could lead to financial losses of £1.1bn to £5.3bn by the 2050s, compared to the current estimate of £0.77bn.

WHICH RESIDENTS ARE MOST VULNERABLE TO OVERHEATING?

Occupants, who are at home most or all of the time, will be there during the hottest part of the day. Unlike occupants who go out during the day and return in the evening, they may also be using their appliances during the day - adding to the build-up of heat in the home. This means they are more likely to experience overheating.

Many of these will be people who are already vulnerable to heat-related health problems, for example older people, those with pre-existing health or mobility problems and very young children.



WHAT CAN RESIDENTS DO IN RESPONSE TO OVERHEATING?



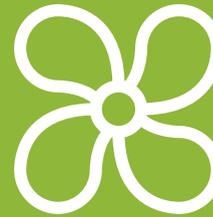
A survey of 450 older people in Islington found that fear of crime and noise concerns prevented many residents from opening their windows, particularly at night, even if they wanted to.

OPENING WINDOWS AND DOORS

One of the most obvious and in-built responses when people become too warm in their homes is to open the windows to try to get rid of the hot air. This can also create a breeze, which helps people cool down more quickly.

But opening windows when it is hotter outside than inside can make any overheating problem worse. In the Heatwave Plan, Public Health England advise keeping windows in direct sunlight shut during the day, with the curtains closed, if temperatures are high, but opening them at night if safe to do so.

However, people can only follow this advice if they are able to open the windows in their home sufficiently and safely to purge excess heat. In some homes this is not possible, either due to design issues, such as lack of sufficient openable windows or window restrictors, or due to concerns about security, noise, or outdoor pollution.



FANS

Electric fans can help people cool down, however they can also cause dehydration. They should not be used at temperatures above 35°C, i.e. close to or above body temperature. Blowing air this warm will heat people up rather than cool them down.

AIR CONDITIONING

Air conditioning for comfort cooling is not widespread within the residential sector – estimated at less than 3% of the housing stock in England. However, anecdotal evidence suggests a growing expectation that it will be included in new urban apartments at the higher end of the market.

Health concerns are often a motivation for installing air conditioning, especially where other means of adaptation are either unavailable or difficult to adopt. Studies in the US have found that the use of air conditioning significantly decreases the risk of mortality. But on the other hand, the use of air conditioning may reduce physiological acclimatisation, potentially increasing an individual's susceptibility to heat-related health risks.



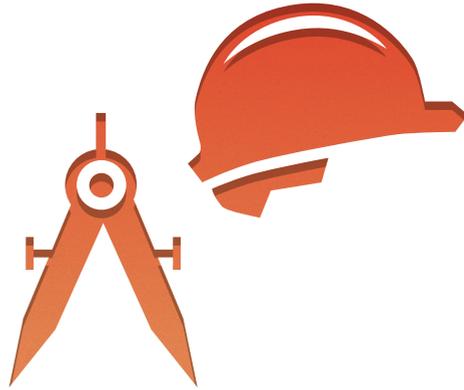
DRAWBACKS OF AIR CONDITIONING

Reliance on energy-intensive air conditioning could result in households needing to pay for energy to cool their homes in the summer, as well as to heat them in the winter. Should poorer households struggle to pay, they may decide not to use their systems at all, with a likely impact of increasing their exposure to higher temperatures.

The heat ejected from air conditioning systems has to go somewhere. It is nearly always ejected into the outside air, thus potentially intensifying any Urban Heat Island.

In addition, some experts have questioned whether increased demand for mechanical cooling could put additional strain on the electricity grid, particularly during hot spells and heatwaves. Energy demand in France rose significantly during the August 2003 European heatwave.

BUILDING DESIGN AND CONSTRUCTION



The threshold temperatures used for the Heatwave Plan Heat-Health Watch alerts are external air temperatures.

However overheating occurs when occupants experience high internal temperatures. Research carried out by UCL in the LUCID project showed that there is not a simple relationship between external and internal temperatures. Building design and construction play an equally important role in determining the risk of overheating for individual dwellings.

Industry guidance on how to minimize the risk of overheating is available, for example “Understanding Overheating – Where to Start” published by the NHBC Foundation in 2012. The Zero Carbon Hub has commissioned a detailed evidence review on “Technical And Behavioural Solutions To Overheating In UK Homes” from BRE, highlights of which are presented in another leaflet in the current series.

THE HOUSING HEALTH AND SAFETY RATING SYSTEM (HHSRS) 2006

The Housing Health and Safety Rating System was introduced under the Housing Act 2004 and applies to residential properties in England and Wales. This risk-based evaluation methodology identifies potential risks and hazards to health and safety from any deficiencies identified in dwellings. One of the 29 hazards is Excess Heat The HHSRS guidance states that temperatures above 25°C can lead to an increase in strokes and mortality.

RELEVANCE TO HOUSING PROVIDERS

Environmental Health Officers have legal powers to order housing providers to make changes to properties so that they comply with the HHSRS and are safe to live in.

BUSINESS IMPACTS ON HOUSING PROVIDERS

Housing providers report that overheating problems in their stock can damage customer relations, and lead to reputational harm and costly remedial works.

During interviews carried out by the Zero Carbon Hub, stakeholders pointed out that the range of options available to address overheating after issues have occurred are often more limited than if measures had been designed-in to begin with. Replacing windows or installing new ventilation systems, for example, can be more disruptive or expensive once people are living in the property. Lower cost choices, such as solar film on windows, may not always be acceptable to residents either.

For some dwellings, the options may be very limited. Installing comfort cooling may be the only solution, but will have energy cost implications for the occupants.

Carrying out unexpected remedial works can also be costly and challenging for Housing Providers. One housebuilder shared their experience of a recently completed apartment building where internal winter temperatures exceeded 27°C

“The cost is that I’ve had to spend time and the worry of having to deal with [overheating] after it’s happened. That’s a cost in itself.”

HOUSING ASSOCIATION

“Instead of being the homes most people want to live in, they become the homes people don’t want to live in...”

HOUSING ASSOCIATION

- without any heating. Extensive remedial works were required to gain Building Control sign off and to satisfy the local Environmental Health Officer, operating under the Housing Act, at a cost to the housebuilder of approximately £100,000.

GET IT RIGHT FIRST TIME

In the long-run it is far better to design-in measures to prevent or mitigate overheating risk as far as possible in new homes. It is also important to avoid inadvertently introducing overheating problems to existing homes when refurbishing them. For existing homes, linking adaptation projects to planned refurbishments can make projects more cost-effective.



Since our formation in 2008, the Zero Carbon Hub continues to work with Government and industry to identify risks, remove barriers to innovation and help demonstrate that energy efficient, healthy new homes can be delivered by the mainstream house building industry.

Get in touch to
find out how we
can assist you

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