# TM59 Design Methodology for the Assessment of Overheating Risk in Homes

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# Overheating in homes

- Overheating identified as an issue
- Multiple studies calling for a consistent methodology

*Zero Carbon Hub report published 2015*

HOUSING OVERHEATING

HOME IS WHERE THE HEAT IS

As global temperatures rise, overheating is becoming an urgent problem for the residential sector. With no government-enforced sanctions on maximum temperatures and little incentive for developers, **Liza Young** finds out what can be done to keep cool

The consequences of climate change are not a problem for future generations – they are an immediate threat. Already, there is growing evidence of overheating in homes. According to the Committee on Climate Change (CCC), one fifth of domestic properties could be overheating, even during a cool summer. Flats, which make up 40% of new dwellings, are especially vulnerable.[1]

By the 2040s, half of all summers are expected to be as hot, if not hotter, than in 2003, when temperatures of up to 38°C led to more than 2,000 excess deaths in the UK. A recent CCC adaptation sub-committee report predicts that annual deaths caused by high UK temperatures will triple to 7,000 on average by the 2050s.[2]

Yet at the same time, we are designing and building for winter energy efficiency,

"We've forgotten how to design for natural ventilation in dwellings – we've lost the art"
Michael Swainson


*Article by Liza Young*
*CIBSE Journal August 2014*



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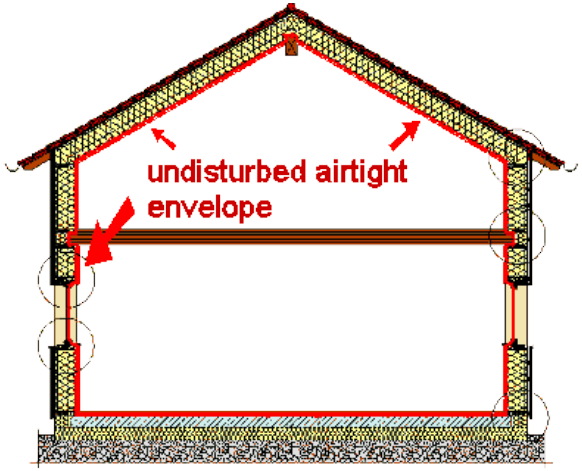
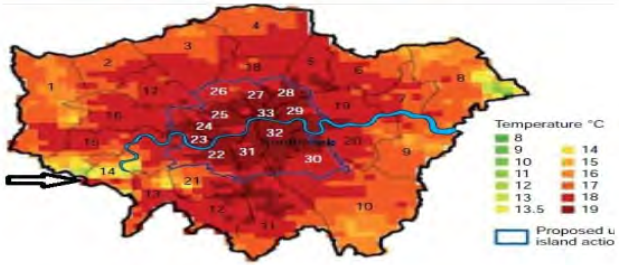
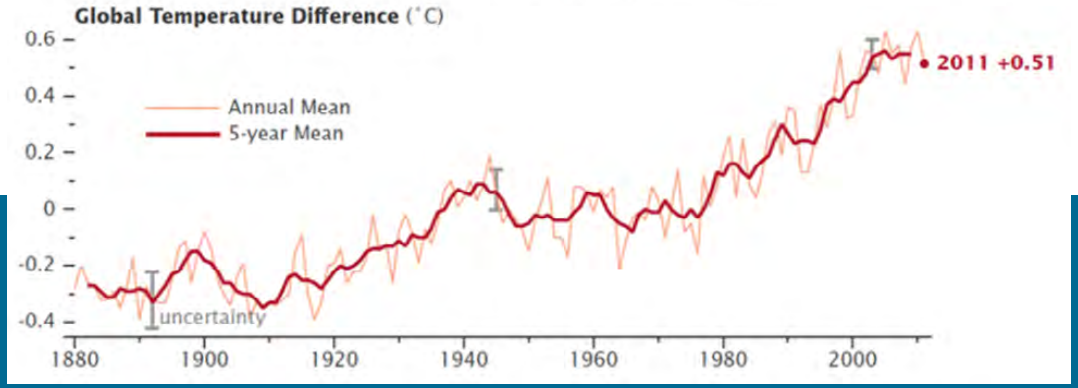
# Why is overheating a problem now?

- Climate Change
- Urban Heat Island Effect
- Smaller homes
- Larger windows for maximum daylight
- Air tightness for winter energy efficiency



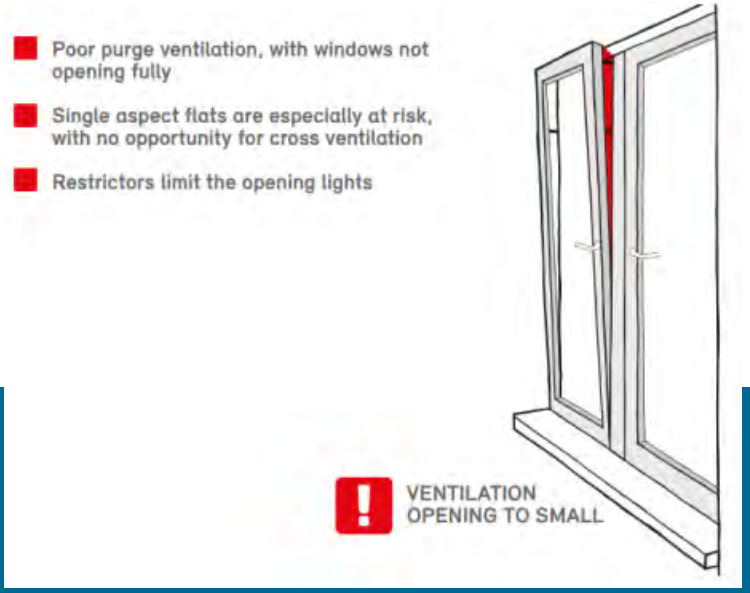




Average outdoor air temperature in London during August 2013




# Design aspects that contribute to overheating risk

- Single aspect flats
- Large areas of glazing
- Limited ventilation
  - Restricted openings
- Urban homes - noise and/or air pollution limiting natural ventilation
- Community heating



# What is overheating?

- No one definition fits all
- Comfort is subjective
- Depends on both environmental and human factors
- Duration/ timing of high temperatures is important
- Very high temperatures > 35°C lead to **Heat stress**
- High bedrooms temperatures (>26°C) can impair sleep

Image from ZCH *Overheating in homes - Where to Start - An introduction for planners, designers and property owners,* 2013

# CIBSE TM59

- Provides a consistent design methodology for the assessment of overheating risk in homes
- Based on the use of dynamic thermal modelling
- Based on current knowledge and resources but simplified
- Key aim is to highlight designs that are of high risk of overheating

Available for free:
http://cibse.org/knowledge/knowledge-items/detail?id=a0q0O00000CQ83EQAT

# Definition of overheating - Based on Guide A and TM52

**Criterion 1**: For living rooms, kitchens and bedrooms: the number of hours during which ΔT is greater than or equal to one degree (K) during the period May to September inclusive shall not be more than 3% of occupied hours. **(CIBSE TM52 Hours of exceedance)**

**Criterion 2**: For bedrooms only: the operative temperature from 10pm to 7am shall not exceed 26°C for more than 1% of annual hours (33 hours)

Bedrooms must pass both requirements

# Standardised internal gains and occupancy profiles

- 24/7 occupancy of bedrooms (worst case)
- Daytime (10am-10pm) occupancy of living rooms and kitchens

| | | | | Time period | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Peak Load | | 0-1 | 1-2 | 2-3 | 3-4 | 4-5 | 5-6 | 6-7 | 7-8 | 8-9 | 9-10 | 10-11 | 11-12 | 12-13 | 13-14 | 14-15 | 15-16 | 16-17 | 17-18 | 18-19 | 19-20 | 20-21 | 21-22 | 22-23 | 23-24 |
| Peak / No of People | Hour | Sensible (W) | Latent (W) | 1.00 | 2.00 | 3.00 | 4.00 | 5.00 | 6.00 | 7.00 | 8.00 | 9.00 | 10.00 | 11.00 | 12.00 | 13.00 | 14.00 | 15.00 | 16.00 | 17.00 | 18.00 | 19.00 | 20.00 | 21.00 | 22.00 | 23.00 | 24.00 |
| 1 | Single Bedroom Occupancy | 75 | 55 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0.7 |
| 2 | Double Bedroom Occupancy | 150 | 110 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 1 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 1 | 0.7 |
| 2 | Studio Occupancy | 150 | 110 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 1 | 1 Bed Living/Kitchen Occupancy | 75 | 55 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 |
| 1 | 1 Bed Living Occupancy | 75 | 55 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0 | 0 |
| 1 | 1 Bed Kitchen Occupancy | 75 | 55 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0 | 0 |
| 2 | 2 Bed Living/Kitchen Occupancy | 150 | 110 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 |
| 2 | 2 Bed Living Occupancy | 150 | 110 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0 | 0 |
| 2 | 2 Bed Kitchen Occupancy | 150 | 110 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0 | 0 |
| 3 | 3 Bed Living/Kitchen Occupancy | 225 | 165 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 |
| 3 | 3 Bed Living Occupancy | 225 | 165 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0 | 0 |
| 3 | 3 Bed Kitchen Occupancy | 225 | 165 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0 | 0 |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Single Bedroom Equipment | 80 | | 0.13 | 0.13 | 0.13 | 0.13 | 0.13 | 0.13 | 0.13 | 0.13 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0.13 |
| | Double Bedroom Equipment | 80 | | 0.13 | 0.13 | 0.13 | 0.13 | 0.13 | 0.13 | 0.13 | 0.13 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0.13 |
| | Studio Equipment | 450 | | 0.19 | 0.19 | 0.19 | 0.19 | 0.19 | 0.19 | 0.19 | 0.19 | 0.19 | 0.24 | 0.24 | 0.24 | 0.24 | 0.24 | 0.24 | 0.24 | 0.24 | 0.24 | 1 | 1 | 0.44 | 0.44 | 0.24 | 0.24 |
| | Living/Kitchen Equipment | 450 | | 0.19 | 0.19 | 0.19 | 0.19 | 0.19 | 0.19 | 0.19 | 0.19 | 0.19 | 0.24 | 0.24 | 0.24 | 0.24 | 0.24 | 0.24 | 0.24 | 0.24 | 0.24 | 1 | 1 | 0.44 | 0.44 | 0.24 | 0.24 |
| | Living Equipment | 150 | | 0.23 | 0.23 | 0.23 | 0.23 | 0.23 | 0.23 | 0.23 | 0.23 | 0.23 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 1 | 1 | 1 | 1 | 0.4 | 0.4 |
| | Kitchen Equipment | 300 | | 0.17 | 0.17 | 0.17 | 0.17 | 0.17 | 0.17 | 0.17 | 0.17 | 0.17 | 0.17 | 0.17 | 0.17 | 0.17 | 0.17 | 0.17 | 0.17 | 0.17 | 0.17 | 1 | 1 | 0.17 | 0.17 | 0.17 | 0.17 |

# Weather file to be used

Minimum requirement

- DSY1
- Nearest location
- 2020s
- High emissions,
- 50th %ile

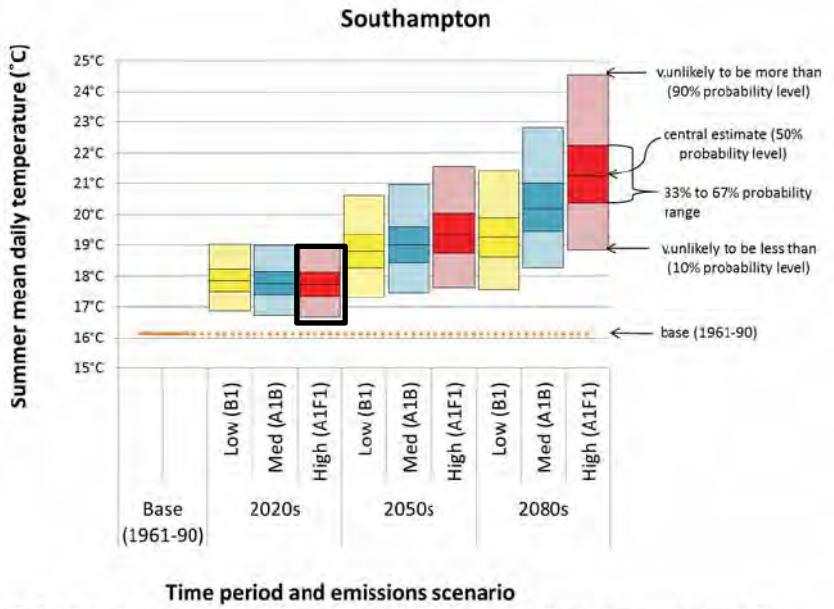



Figure: Probabilistic climate profile (ProCliP) graph from UKCP09 data - Southampton summer mean daily temperature (°C)

Recommendation to also test designs under DSY2/3 or 2050s/2080s data for risk assessment purposes but not required in order to pass

Recommendation to run for DSY2/3 or 2050/2080s data but not required to pass

# Blinds to be included only if part of the design

- If blinds form part of the mitigation strategy then these must be included in the base build
- Results without blinds must be included in the report
- Blinds should not interfere with the ventilation capacity of open windows, or if they do, this reduction in their capacity for natural ventilation should be taken into account in the design

# Other key considerations

Opening of windows for natural ventilation

- Taking into account any security, noise or air quality issue
- Windows considered open only when rooms are occupied, unless secure openings are provided

Vulnerable residents

- Care homes and accommodation for vulnerable occupants should assume Type I occupancy (see CIBSE TM52 for description)

Community heating

- Heat losses from pipework should be included

Thank you for listening

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