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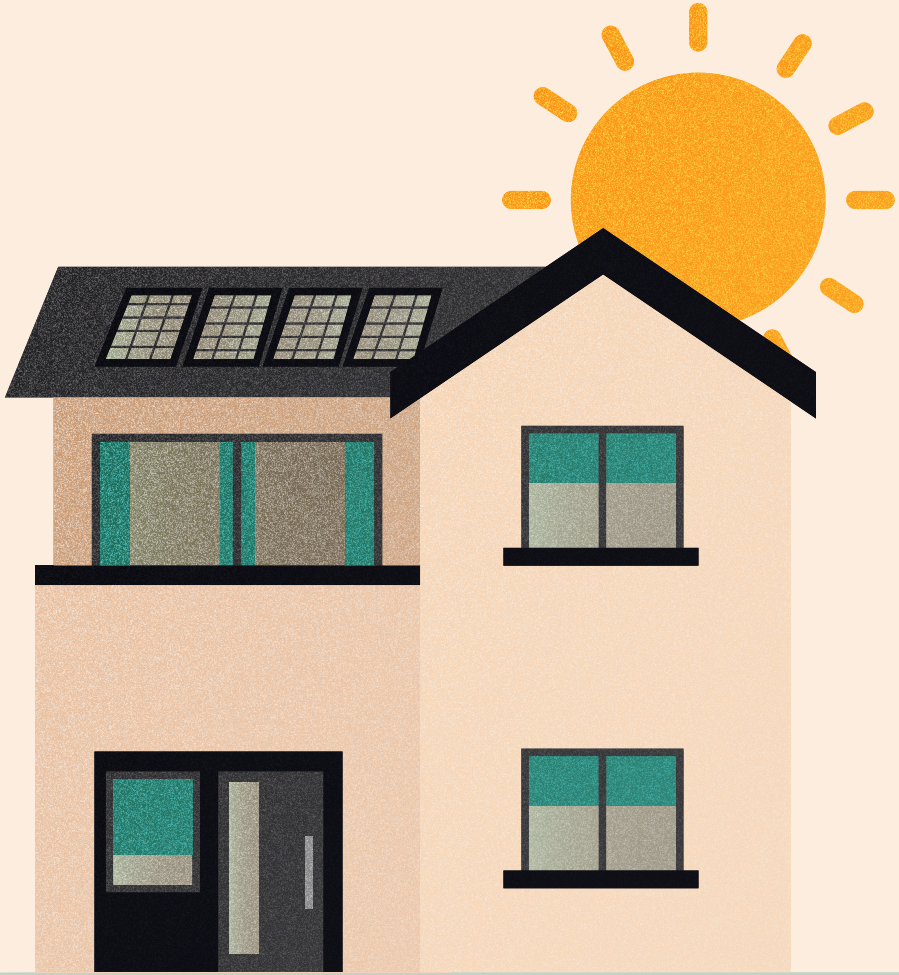
Considering summertime overheating in post 1985 properties (including older buildings converted into flats)

Factsheet for asset managers and retrofit coordinators.



Introduction

This factsheet aims to provide you with a better understanding of the impacts that summertime overheating will have on houses built after 1985 and provides some suggestions on approaches to tackling them[1].

This factsheet is also intended to provide valuable information for building owners and occupants of older, traditional buildings that have been converted into flats. Overheating refers to the occurrence of high internal temperatures which cause thermal discomfort, affecting occupants' health and wellbeing including a lack of sleep that may impact cognitive function and productivity. Please note, these impacts are already being reported in some properties.

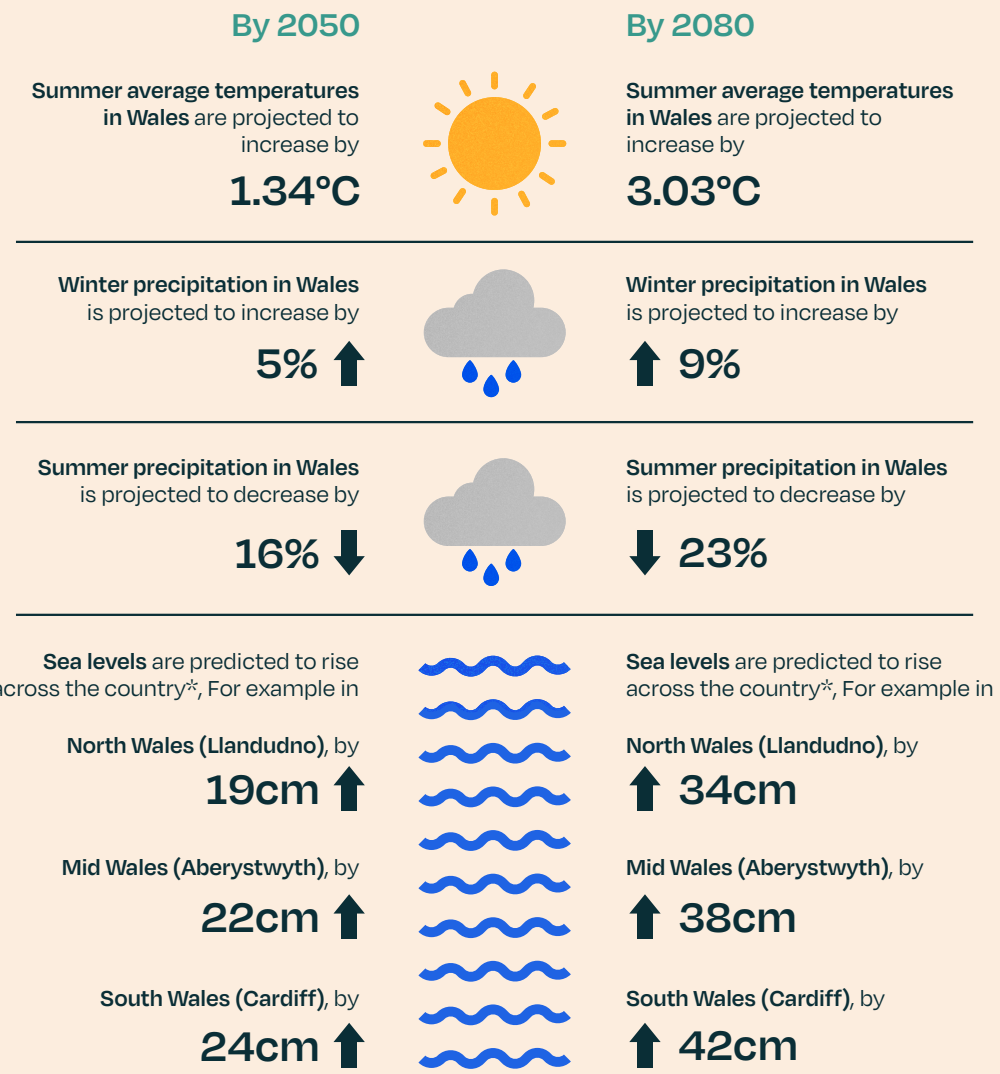
We will outline climate vulnerabilities and risks, as well as make suggestions on appropriate adaptations at behavioural, maintenance and refurbishment levels.

Climate change and Climate vulnerabilities

The urgency and likely impact of climate change has been thoroughly assessed by scientists, the results of which are now widely published and regularly reported in the mainstream media.

Current international decarbonisation efforts are unlikely to hold global warming to 1.5˚c. Consequently, we need to plan for warmer, wetter weather in Wales, and with this more extreme weather patterns including high winds, storm surges and intense precipitation. Our summers will be hotter, drier, and we are likely to experience heatwave episodes (See Figure 1b).

Figure 1: Climate Change predictions by 2050 and 2080 taken from the UK Climate Projections (UKCP18) dataset.[2]



1 – Building regulations were introduced to the UK at this time (Building Act 1984) and made homes more energy efficient. On average temperatures in homes increased by 5.5°C over two decades.

2 – UK Climate Projections (UKCP18), Met Office https://www.metoffice.gov.uk/research/approach/collaboration/ukcp/index

Overheating risks are therefore more likely to occur due to climate change, i.e., changed temperature and solar flux patterns that impact building envelope temperature dynamics. This will also impact indoor environmental quality and occupant health, particularly if they lead to persistent overheating.

Figure 1b: Daily Average Temperature

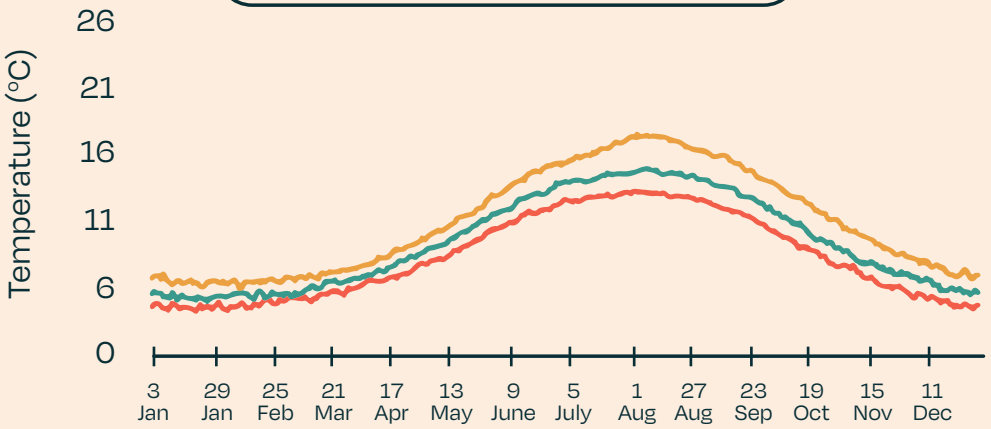
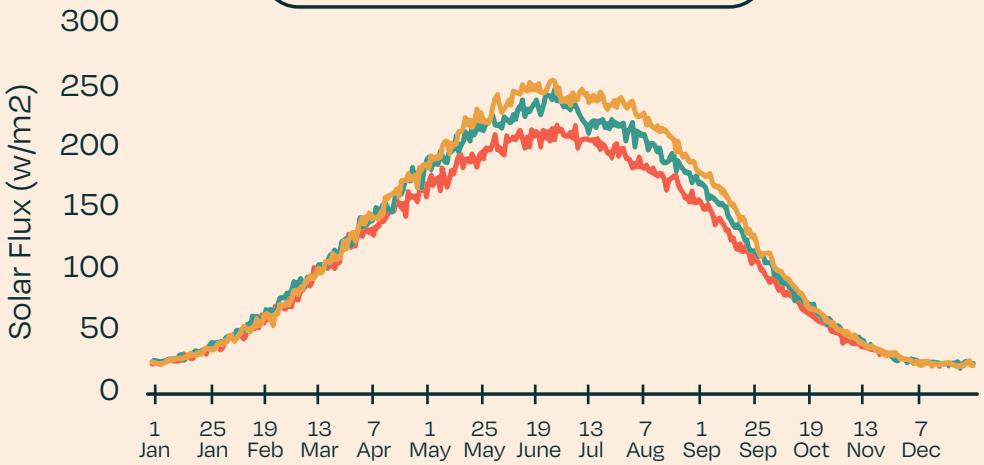


Figure 1c: Daily Average Solar Flux



Typically, dwellings built after 1985 are smaller than their earlier counterparts, with reduced room dimensions and lower ceiling heights. Insulation materials were added to both the walls and the loft spaces; and they were fitted with double glazed windows as standard. There tends to be less ventilation than in more traditional buildings and therefore fewer opportunities to reduce the build-up of heat due to external factors including increasing temperatures and solar flux (concentrated sunlight).

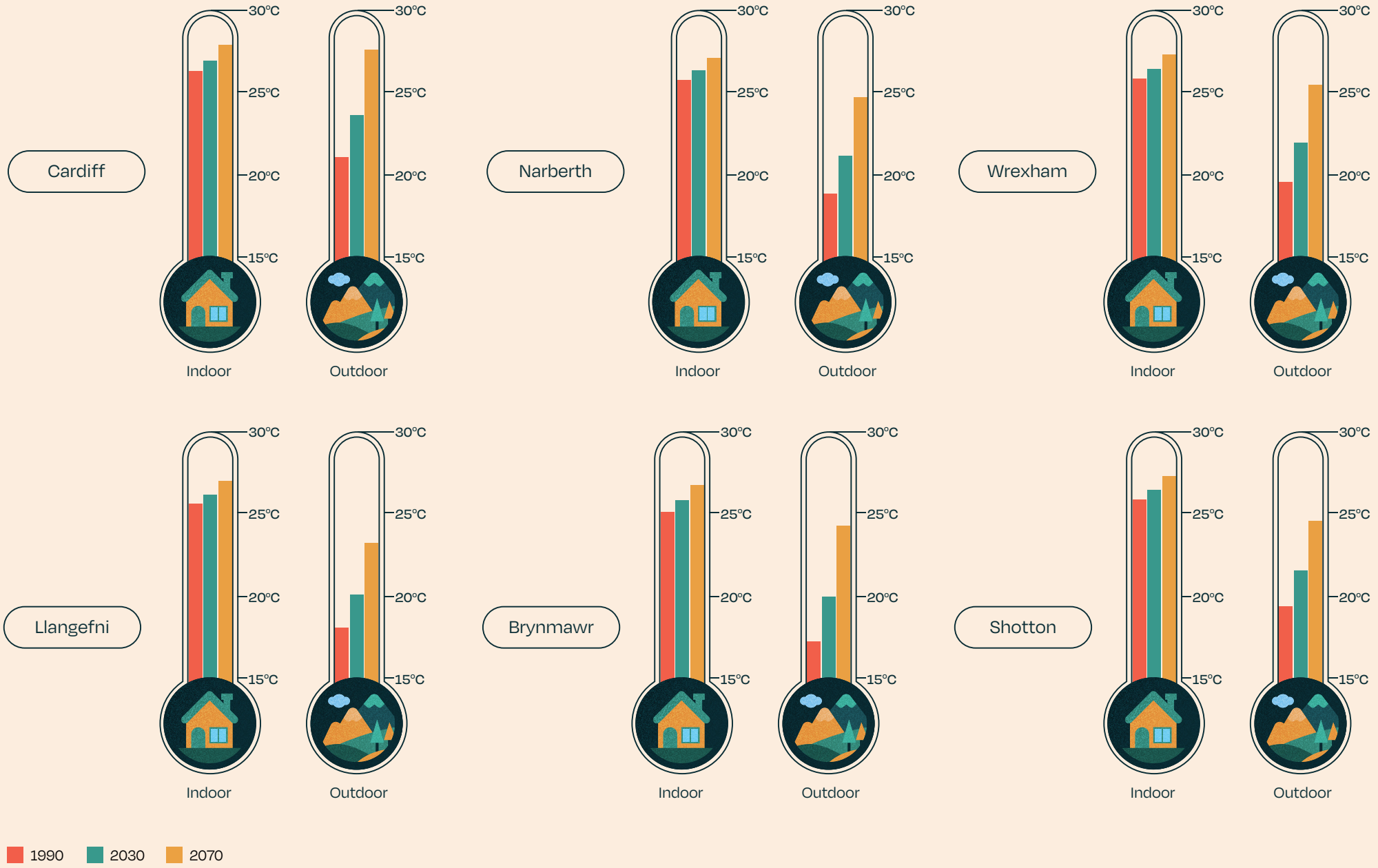
Where the airtightness of a building is elevated without adequate ventilation, overheating is likely to occur (as well as condensation and the potential for damp and mould growth). This is intensified where there are large areas of glazing and south facing facades. The effects can be exacerbated by high humidity, either internally or externally.

We need to prepare for changing weather patterns and adapt our homes accordingly. Nevertheless, overheating in buildings is caused by both external and internal gains. Therefore, we also need to understand the activities inside our dwellings that may intensify the issue.

Current and future risks

Climate vulnerability modelling (Hayles et al., 2022) has demonstrated that it is now more important than ever to consider how we adapt our buildings to address the challenges caused by a changing climate. Understanding present and future climate stressors will help inform climate mitigation and adaptation approaches and how to tackle these collectively.

Figure 2: Projected changes in daily temperature between 22nd July and 31st August for six locations across Wales



Overheating

In a naturally ventilated home, TM59 CIBSE's design methodology for the assessment of overheating risk in homes states that bedrooms may only be warmer than 26°C for 1% of thee year's sleeping hours before they are considered to be unsuitable. That means for 32 hours in any year (between 10pm-7am) a bedroom can be oppressively hot and cause sleeplessness, but no more.

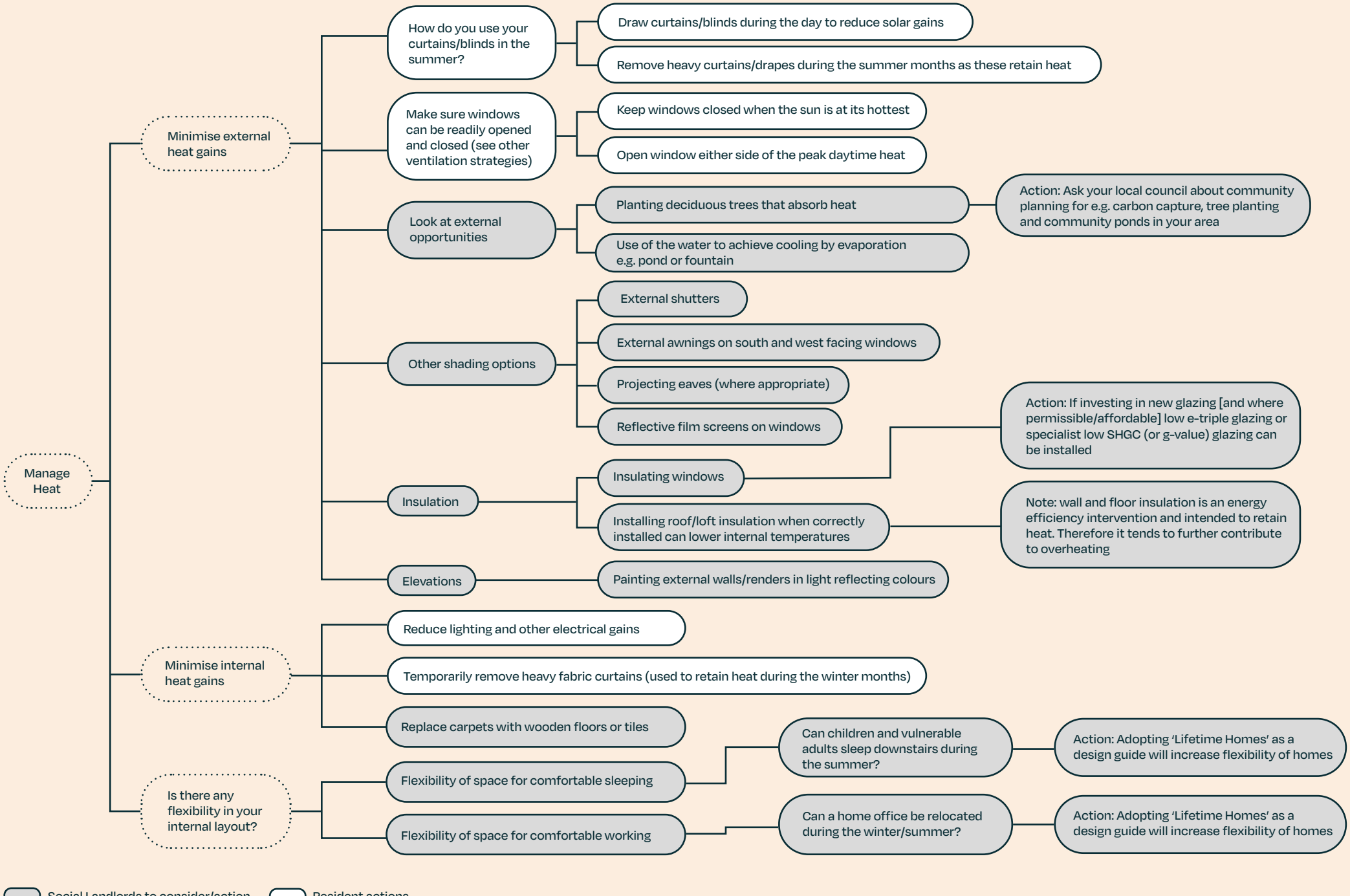
The climate modelling **research** carried out by Hayles et al. (2022) that focussed on the six-week period from 22nd July through to 31st August, projected that the percentage of hours that would exceed CIBSE guidelines for thermal comfort would be far higher and more dangerous than this. (See Figure 2)

We need to adapt dwellings to deal with climate change now, not in the future.

Building design, construction, orientation, and household characteristics will all impact if a dwelling is likely to overheat and by how much. There is a greater overheating risk in certain types of dwelling, such as flats and mid-terraced houses, as well as rooms that face south or west. Internal heat gains influence overheating levels with impacts being more pronounced in high use areas. This may be more common in purpose-built flats where an open floor plan is more likely to be used, especially for the kitchen, dining and living areas; and single-aspect flats (new-build or conversions) that do not allow for cross ventilation.

Cooling strategies for a more comfortable indoor environment have been outlined in Figure 3. Occupant behaviour can influence overheating risks by altering the advantages of passive cooling measures and consequently their effectiveness in achieving optimal air circulation and cooling performance. A better understanding of adaptive behaviour and passive cooling efficiency will further mitigate the effects of overheating and climate change (see Murtagh et al., 2019).

Figure 3: Cooling Strategies for a more comfortable indoor environment



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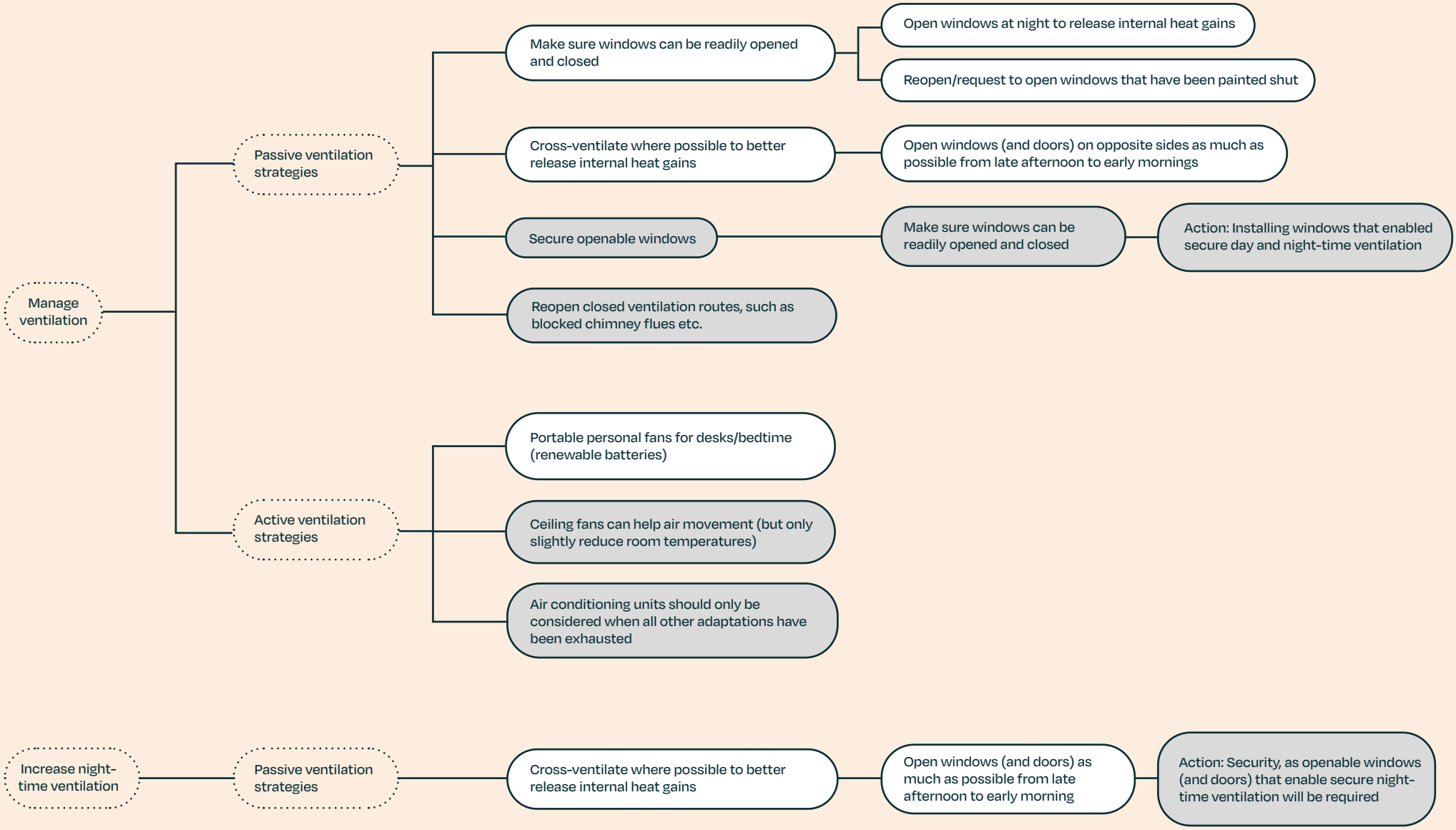

Overheating assessment methods

- BS EN 15251 (2007). Indoor and environmental input parameters for design and assessment of energy performance of buildings addressing indoor air quality, thermal environment, lighting and acoustics, 2007. London, UK: British Standards Institution
- CIBSE (2013). TM52 The limits of thermal comfort: Avoiding overheating in European buildings. London UK: The Chartered Institution of Building Services Engineers.
- CIBSE (2017). TM59 Design Methodology for the assessment of overheating risk in homes. London: The Chartered Institution of Building Services Engineers.
- CIBSE Guide A (2006). Environmental design. London, UK: Chartered Institute of Building Services Engineers.
- Passivhaus Trust (2018). Passivehaus criteria: Passivhaus UK buildings database. London, UK.

Further Reading on overheating and keeping cool in the summer

- Alrasheed, M. and Mourshed, M. (2023). Domestic overheating risks and mitigation strategies: the state-of-the-art and directions for future research. Indoor and built environment Vol 0(0) 1-21.
- BRE (n.d.) Overheating in dwellings: Guidance Document. Available online at: 116885-Overheating-Guidance-v3.pdf (bre.co.uk)
- BRE (n.d.) Overheating in dwellings: Assessment Protocol. Available online at: 117106-Assessment-Protocol-v2.pdf (bre.co.uk)
- Hayles, C. S. (2022). How resilient are buildings in the UK and Wales to the challenges associated with a changing climate? Welsh Government. Available online at https://gov.wales/resilience-buildings-challenges-associated-climate-change-report
- Hayles, C. S., Huddleston, M., Chinowsky, P., & Helman, J. (2022) 'Summertime impacts of climate change on dwellings in Wales, UK. Building and Environment', https://doi.org/10.1016/j.buildenv.2022.109185
- Murtagh N, Gatersleben B and Fife-Schaw C. (2019). Occupants' motivation to protect residential building stock from climate-related overheating: a study in southern England. J Clean Prod 2019; 226: 186–194.

Additional Guidance

- NHS (2022) Heatwave: how to cope in hot weather. Available online at: Heatwave: how to cope in hot weather - NHS (www.nhs.uk)
- The Green Age (2013) Getting to grips with U-values. Available online at: Getting to grips with U-values! - TheGreenAge
- UK Government (2019) Research into overheating in new homes. Available online at: Research into overheating in new homes - GOV.UK (www.gov.uk)
- UK Government (2022). Beat the heat: keep cool at home checklist. Available online at: Beat the heat: keep cool at home checklist - GOV.UK (www.gov.uk)

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