Designing differently for a future climate at 100 City Road

Mel Allwood, Arup

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100 City Road

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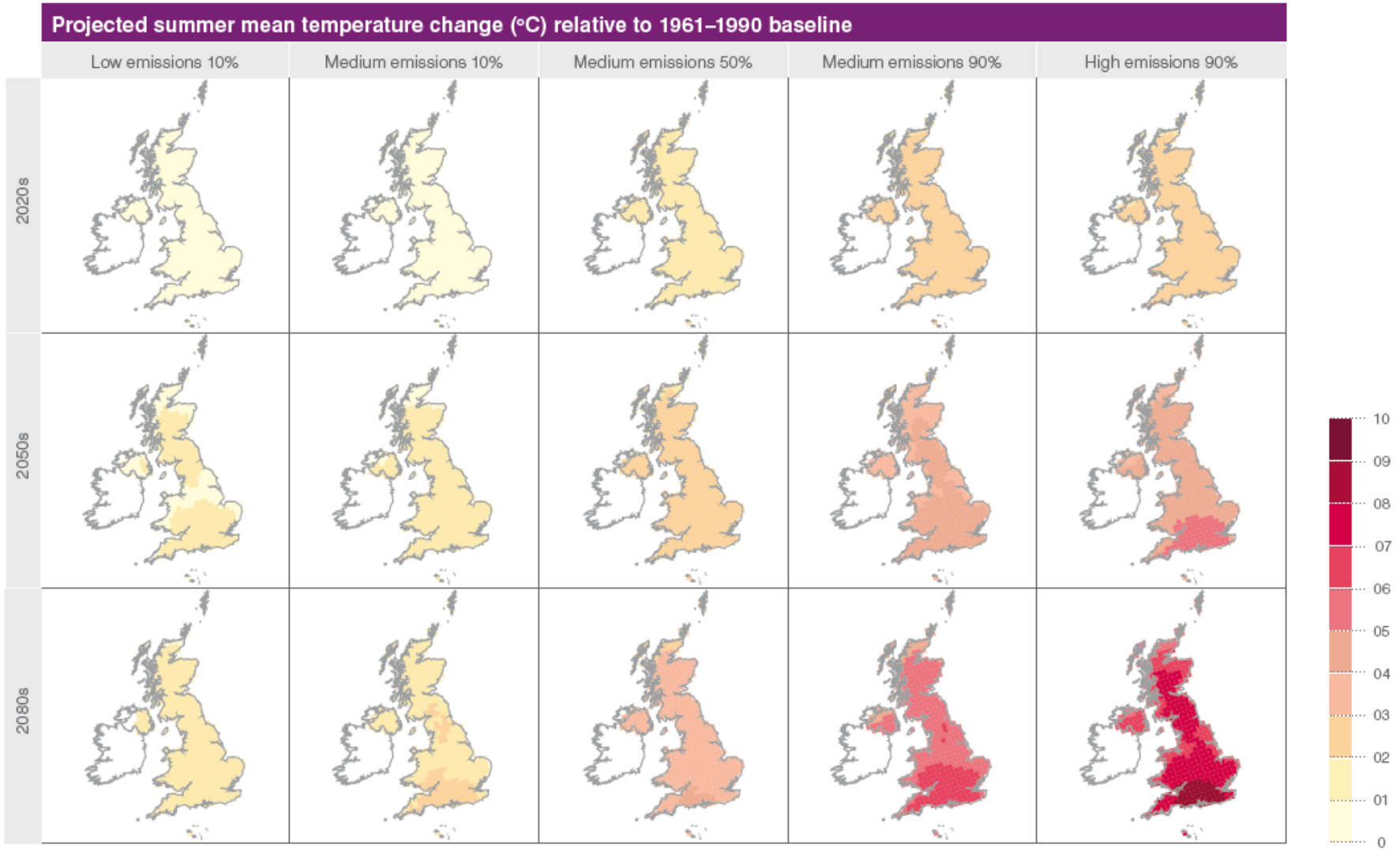
Summer mean temperature 2020s, 2050s, 2080s



Source: TSB / UKCIP

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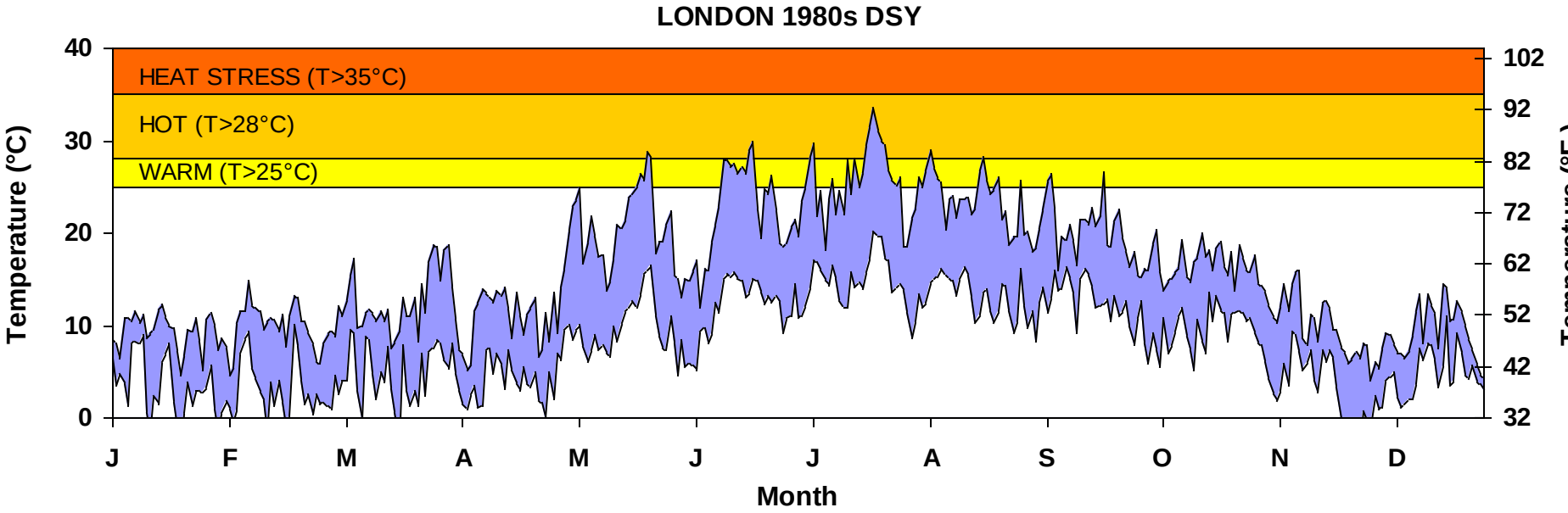
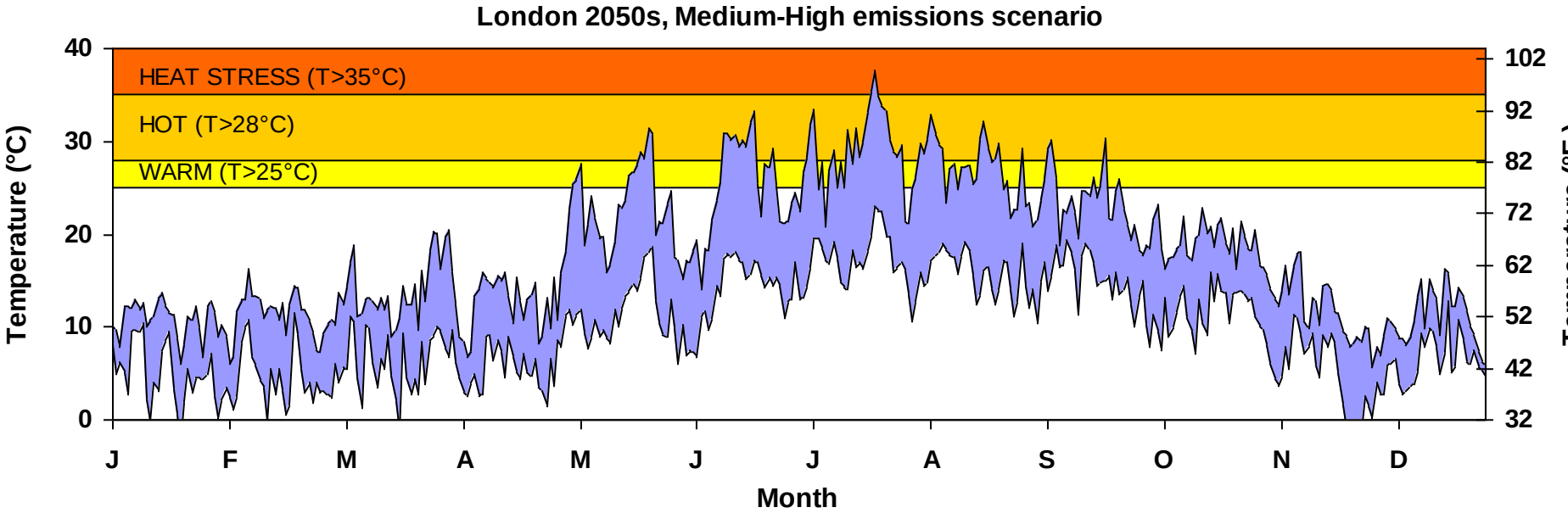
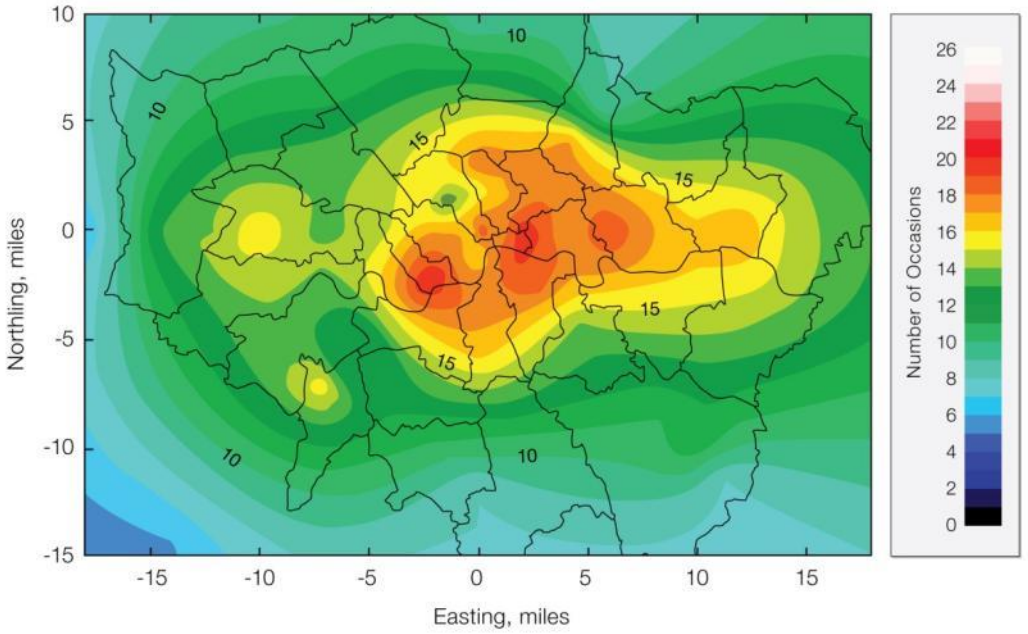
‘Morphed’ weather data (CIBSE TM48)





Summer Design Weather for London (CIBSE TM49)

- **Is the current Design Summer Year warm enough in the light of climate change?**
- **How do we take account of the Urban Heat Island?**
- **How do we incorporate future climate projections (UKCP09)?**



Weather files	Minimum temp. (°C)	Average temp. (°C)	Maximum temp. (°C)
Test Reference Year (TRY05)	-4.6	11.4	31.7
Design Summer Year (DSR05)	-4.7	12.0	33.6
UKCP09 2020 High 90%	-2.9	13.1	34.3
UKCP09 2050 High 90%	-0.9	15.0	37.9
UKCP09 2080 High 90%	0.7	17.3	41.9

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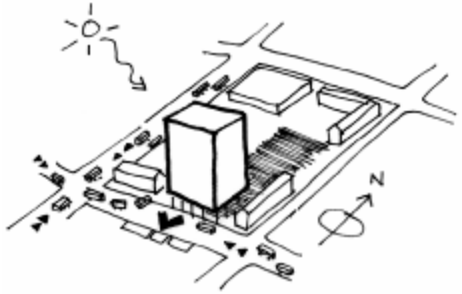
Spatial scales

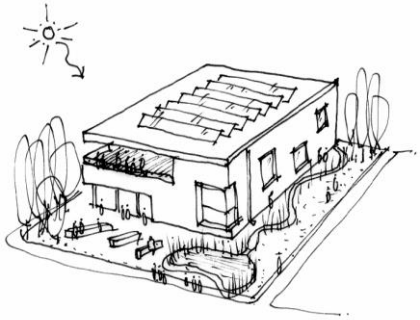
GLOBAL

NATIONAL

THE URBAN AREA



THE SITE



THE BUILDING

Source: CABE

100 City Road, London

Source: AHMM

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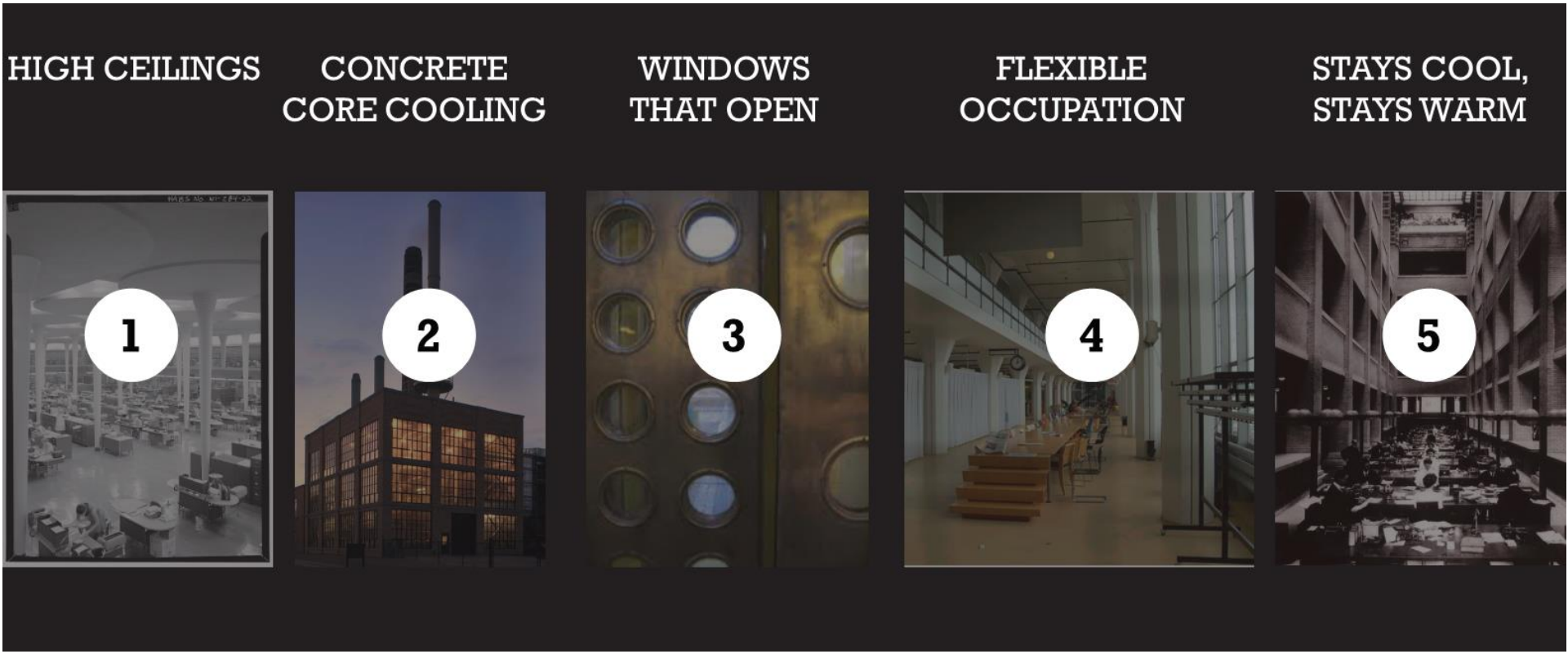
Five Principles



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Adaptation options	Proposed Adaptation
Extending Comfort Design Criteria	26°C±2°C Summer Internal Design Temperature
Limiting Solar Gains	External blinds proposed for the south and west facing façade Possibility of retrofitting blinds to other orientations if necessary
Limiting Internal Lighting Gains	2.125W/m^2/100lux 4.3W/m^2 @ 200lux Task lighting at 0.8W/m^2 Daylighting controlled
Limiting Internal Equipment Gains	5W/m^2 Equipment gain
Optimising Building Fabrics	Curtain Wall U-value = 0.15 Glazing U-value = 1.2
Optimising Thermal Mass	250mm concrete ceiling 300mm concrete ceiling 400mm concrete ceiling The thickness of the concrete ceiling will be tested against the TRY file and the CP09 90% high emission scenario
Optimising Room Height and Air Distribution System	**3m floor to ceiling height** Exposed high level ductwork Underfloor air supply **3.5m floor to ceiling height** Underfloor air supply system **5m floor to ceiling height** Exposed high level ductwork Underfloor air supply
Night Time Cooling	Openable window for night time ventilation to pre-cool building
Mixed Mode Ventilation	Mixed mode ventilation to 4.5m perimeter zone
Cross Ventilation and Low Energy Air Supply	5m tall ceiling with low velocity fan blades and openable windows for ‘boosted’ natural ventilation


RELAX THERMAL COMFORT CRITERIA
LIMIT SOLAR GAINS
LIMIT LIGHT LOAD
LIMIT EQUIPMENT GAINS
OPTIMISE BUILDING FABRIC
OPTIMISE THERMAL MASS
OPTIMISE HEIGHT & AIR DISTRIBUTION
NIGHTTIME COOLING
MIXED MODE VENTILATION
CROSS VENTILATION

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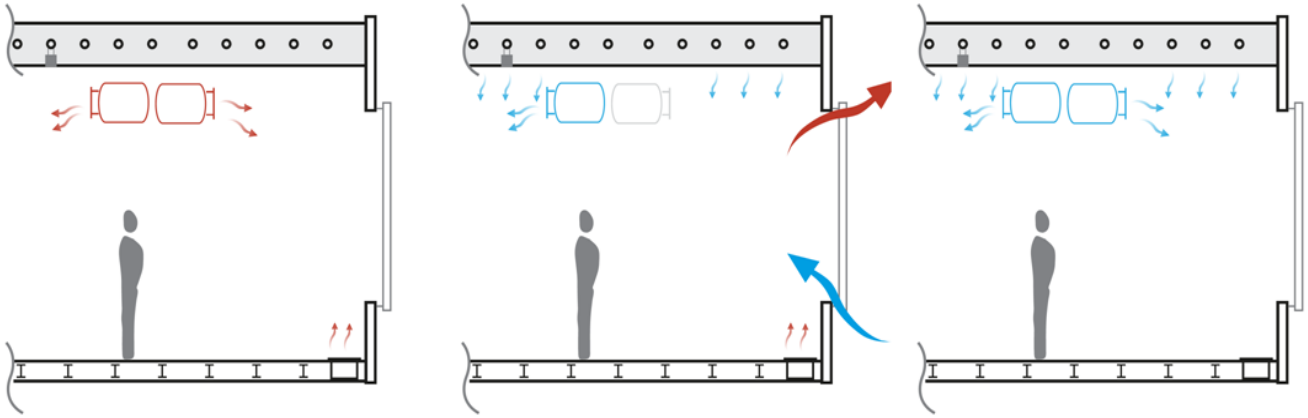
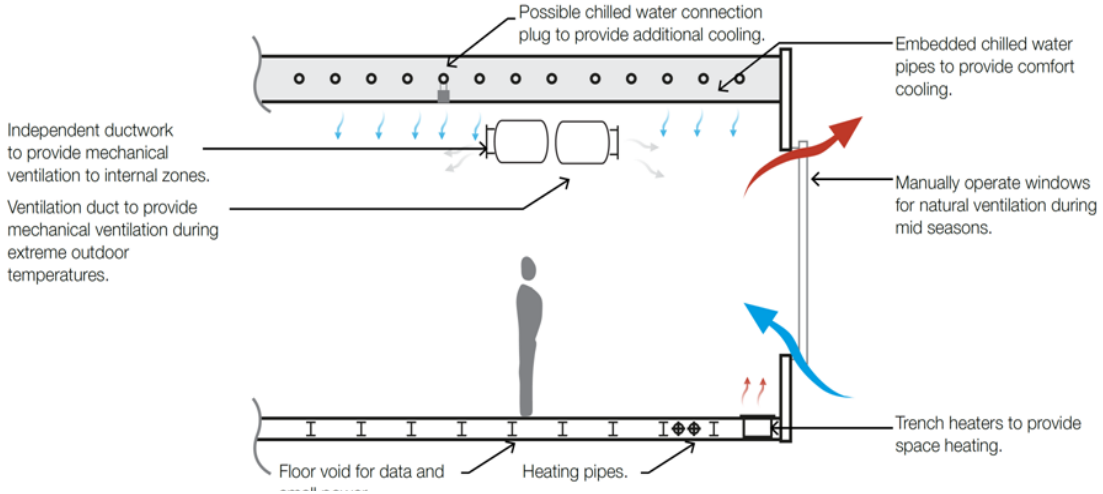
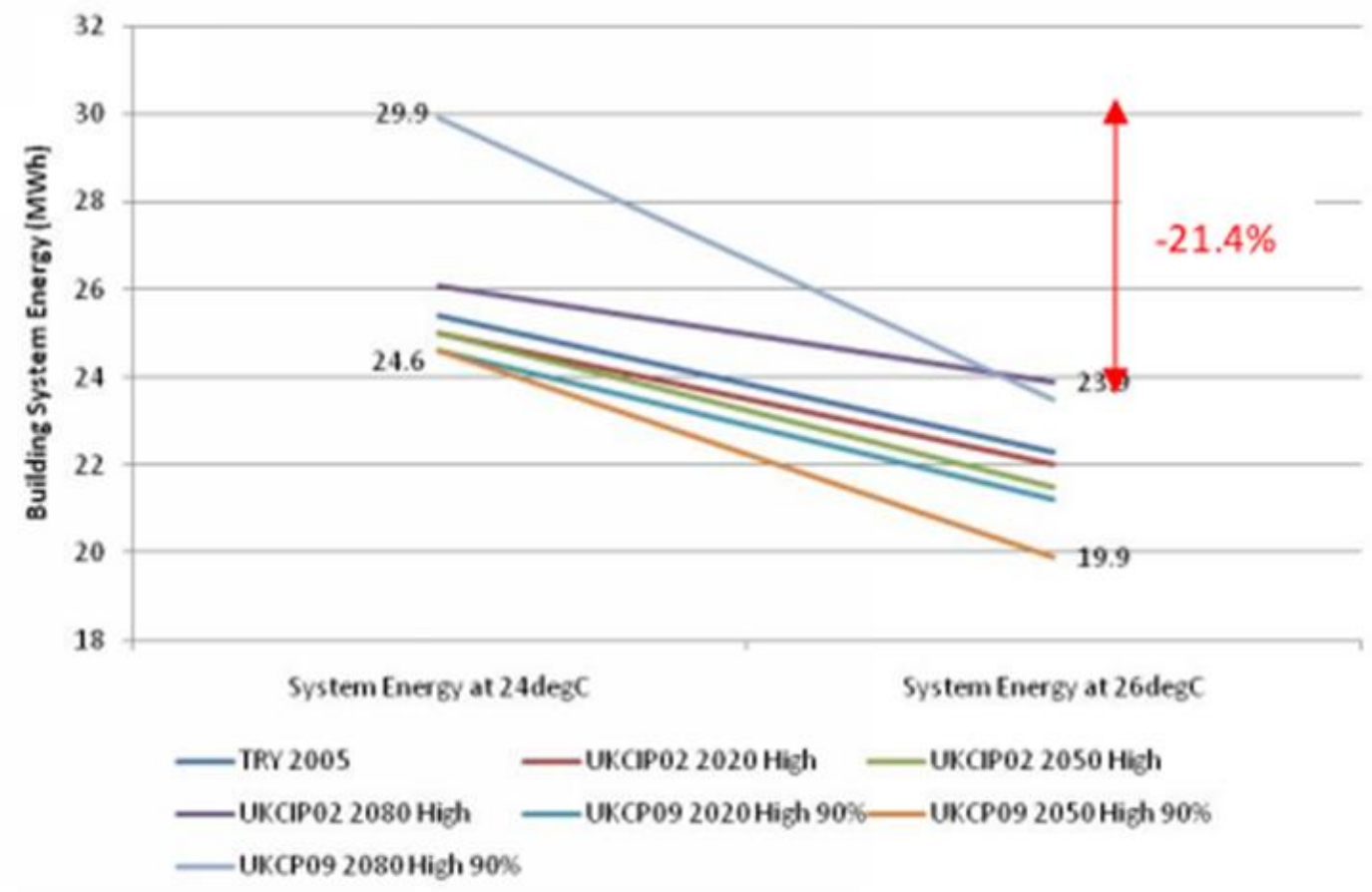
Heating, cooling and ventilation strategy





Changing "Thermostat" 24 to 26°C



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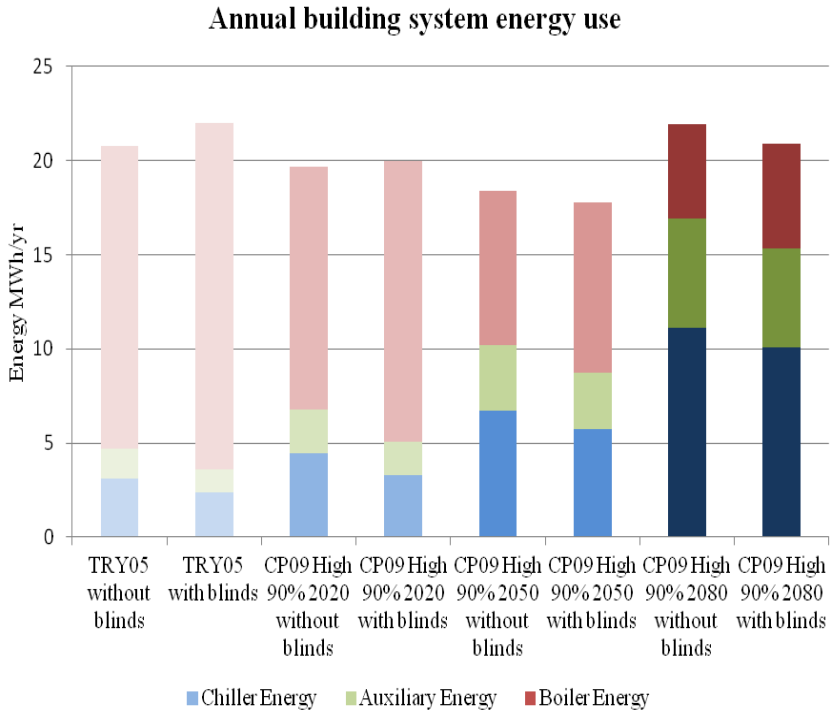
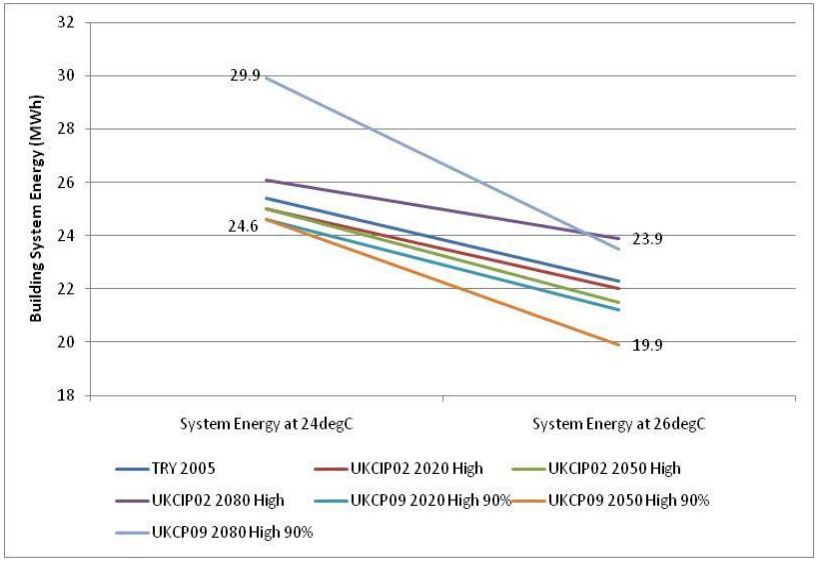
White Collar Factory	BCO typical
Operative temperature 24.5° C±1.5° C	Maximum operative temperature 26-27° C
Maximum air temperature 26° C	Air temperature 24° C +/-2 C
CIBSE PPD no more than 15%	CIBSE PPD no more than 10%

Modelled impact of adaptations



Source: Arup



Source: Arup

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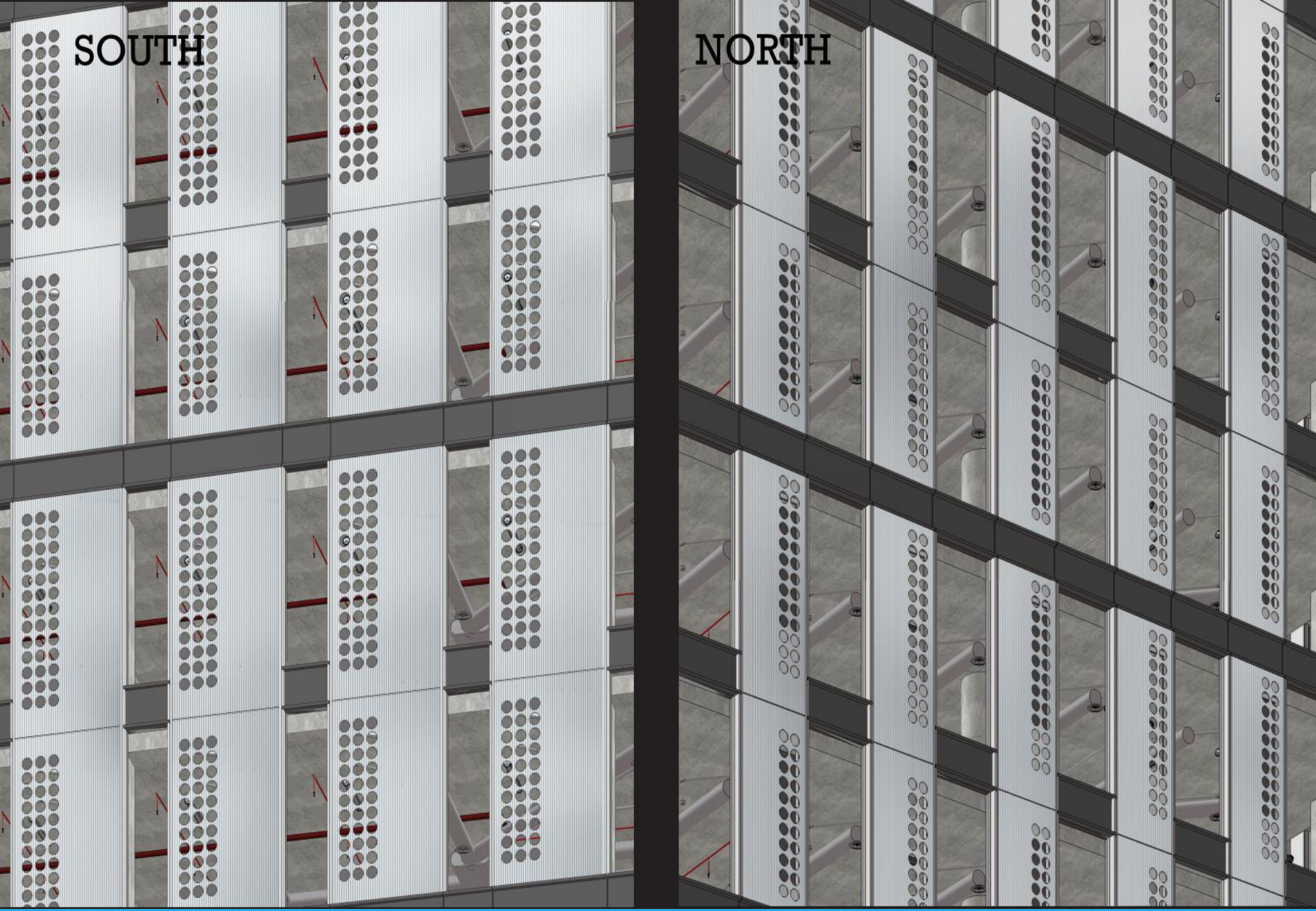

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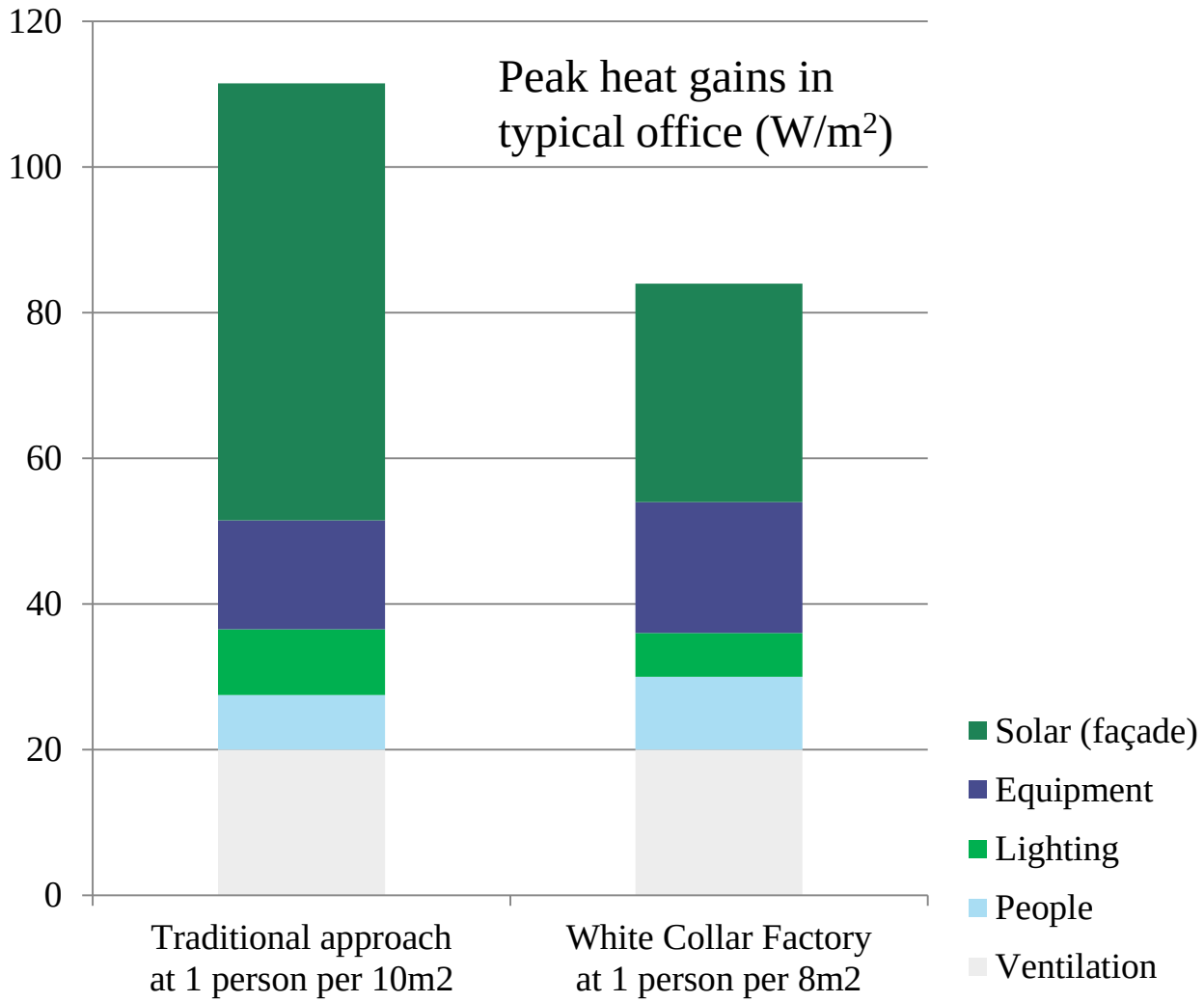
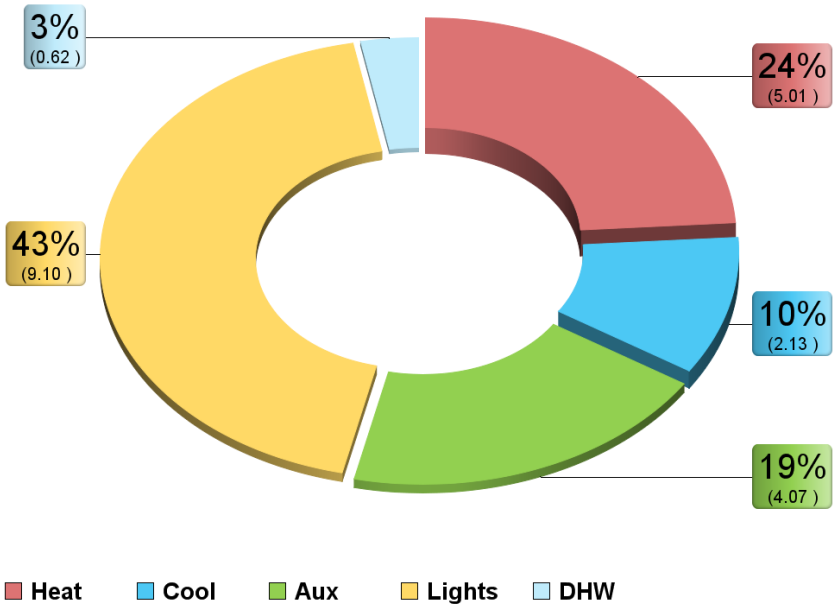
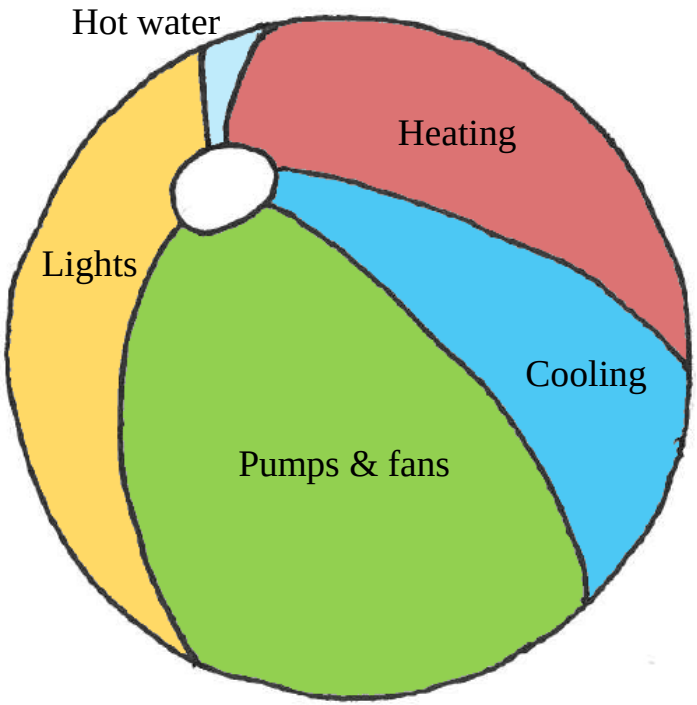
Peak heat gains



Operational Carbon Saving

Actual Carbon
(kgCO2/m².yr)





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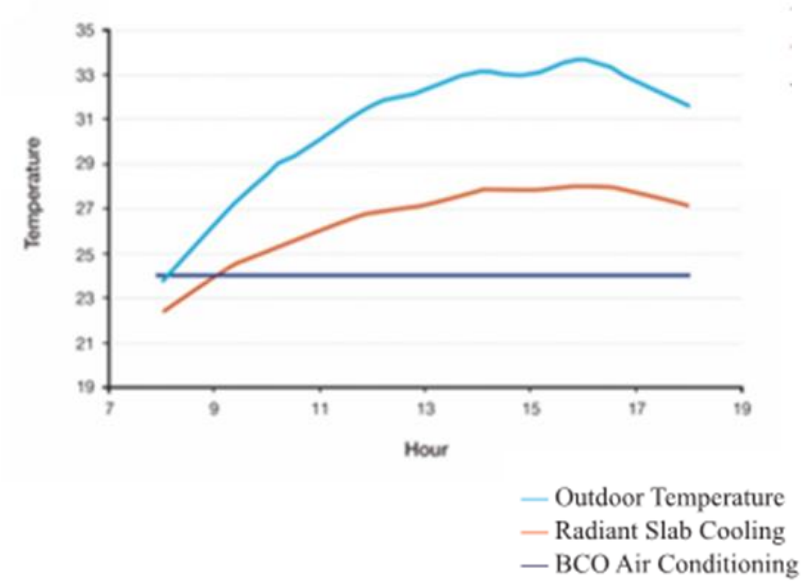
Modelling the space



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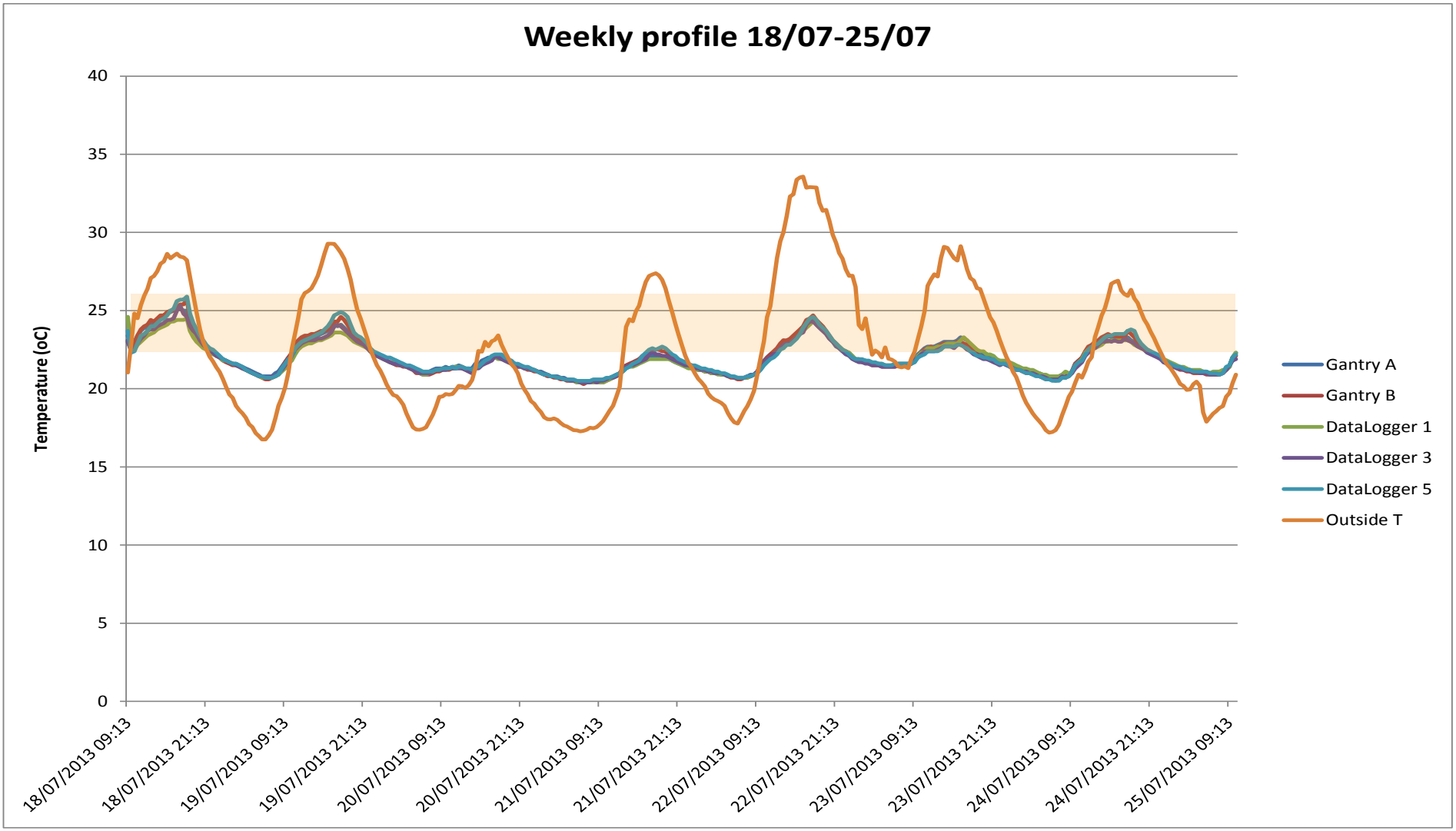
Monitoring the mock-up

What happened in the space?



Lessons learned from DfFC competition

- **Huge challenges but the UK has the knowledge and skills if resources and priorities are aligned right**
- **Impossible to ‘predict the future’ but evidence exists to make informed decisions**
- **Need to start thinking about the issues early on in a project**
- **Designs need to be fit for purpose for current climate, with adaptive capacity for future changes**
- **Need to work in partnership with other engineers, built environment professionals, clients and occupants**
- **Need to involve and communicate with people on a regular basis**
- **Need to provide project inputs and outputs in a timely fashion**

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