

DYNAMIC MODELLING FOR OVERHEATING & COOLING ANALYSIS

CIBSE BUILDING SIMULATION GROUP
8TH FEBRUARY 2017

OVERVIEW

1. BACKGROUND ON OVERHEATING, PLANNING POLICIES AND GUIDANCE
2. OVERHEATING RISK ASSESSMENT PART L 2013
3. GLA'S GUIDANCE ON OVERHEATING & COOLING
4. OVERHEATING MODELLING
5. CASE STUDIES

BACKGROUND ON OVERHEATING POLICIES AND GUIDANCE

- Part L 2013 – Criterion 3
- Greater London Authority (GLA)
 - London Plan Policy 5.9
 - Sustainable Design and Construction SPG (section 3.2.4)
 - Guidance on preparing energy assessments (2016)
- CIBSE Guide A (2015)
- CIBSE TM 52
 - Naturally-ventilated buildings

Temperature distribution in London, August 2003

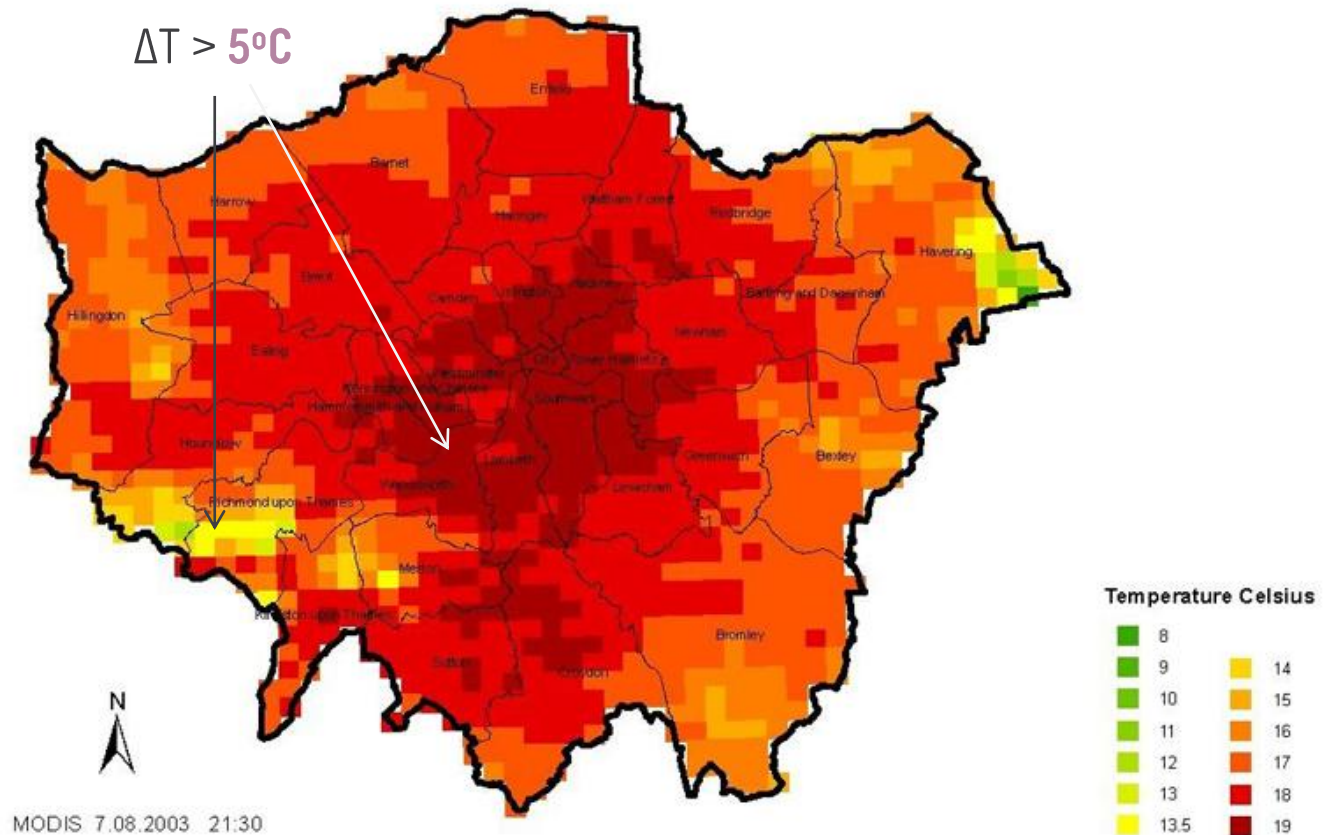


Image source: <http://climatelondon.org.uk/climate-change/heatwaves/>

BUILDING REGULATIONS PART L OVERHEATING ASSESSMENT



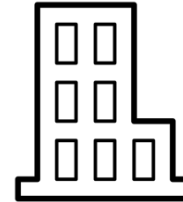
SAP2012 PART L COMPLIANCE REPORT

L1A 2013 - Regulations Compliance Report
Design - Draft



Check	Evidence	Produced by	OK?
Criterion 3: the dwelling has appropriate passive control measures to limit solar gains			
Does the dwelling have a strong tendency to high summertime temperatures?	Overheating risk (June) = Slight Overheating risk (July) = Medium Overheating risk (August) = Medium Region = Thames Thermal mass parameter = 250.00 Ventilation rate in hot weather = 2.00 ach Blinds/curtains = Dark-coloured curtain or roller blind	Authorised SAP Assessor	Passed

*“Overheating is not fully assessed by carbon dioxide emission models, therefore developers are encouraged to **undertake dynamic thermal modelling** to ensure that their development does not overheat.” (SPG section 3.2.3)*



BRUKL PART L CRIT. 3 REPORT

BRUKL Output Document



Compliance with England Building Regulations Part L 2013

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
00AFoodBev1	NO (-39.9%)	NO
00AFoodBev2	NO (-40.9%)	NO
00DFoodBev1	NO (-65.9%)	NO
00DFoodBev2	NO (-69.6%)	NO
GBCinema	N/A	N/A
GBRetail1	NO (-59%)	NO
GBCinema	N/A	N/A
01DFoodBev	NO (-0.3%)	NO
01BOffice	NO (-34.7%)	YES
01BOffice	NO (-48.4%)	YES
00BOffice2	NO (-37.2%)	YES

GLA'S GUIDANCE ON PREPARING ENERGY ASSESSMENTS

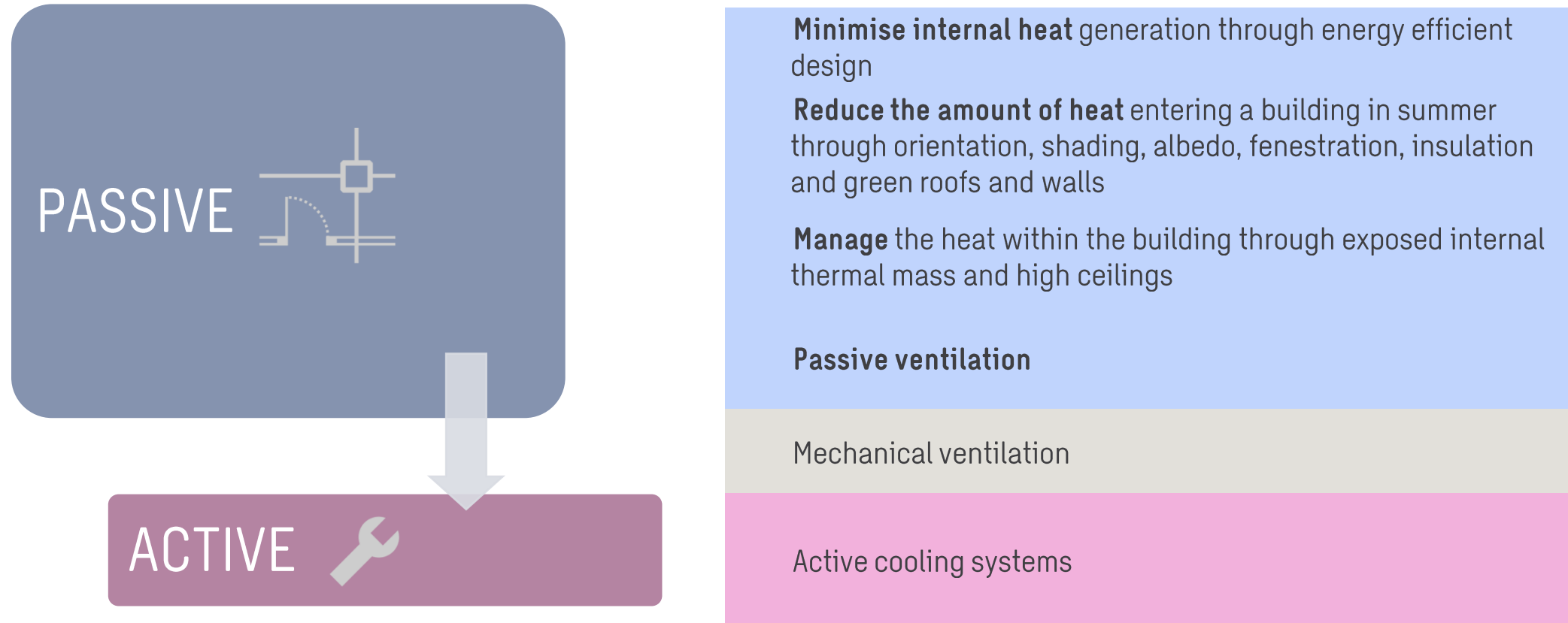
- Local Boroughs refer to it for planning applications
- From March 2016
- Section 12: Cooling and Overheating
- Appendix 5: Domestic overheating checklist
 - Site features
 - Mitigating risks
 - Window opening limitations
 - Daylighting
 - Shading
 - Heating system (communal areas)

ENERGY PLANNING

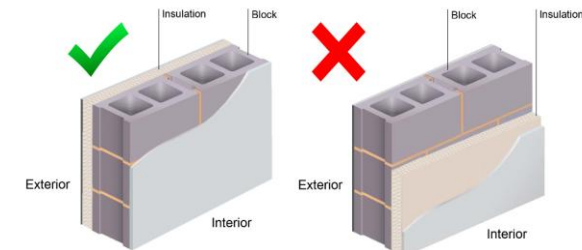
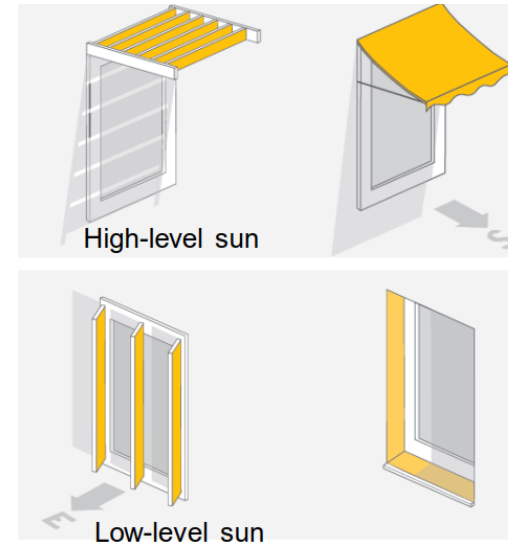
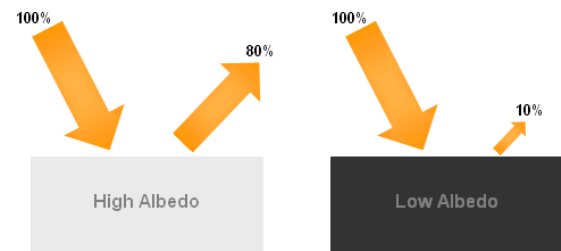
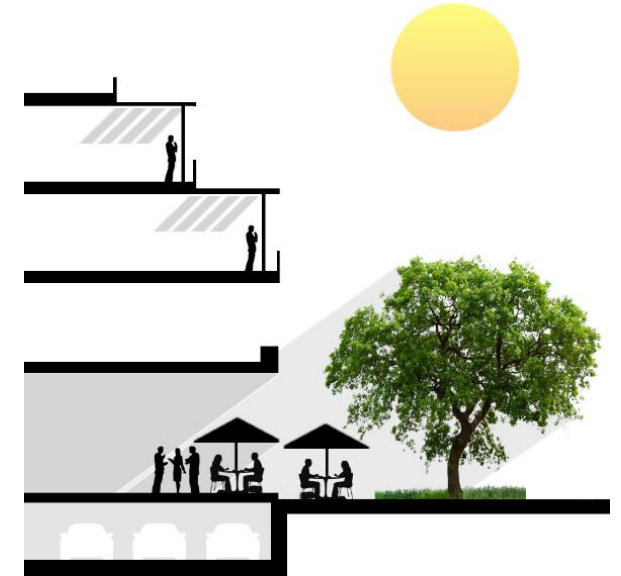
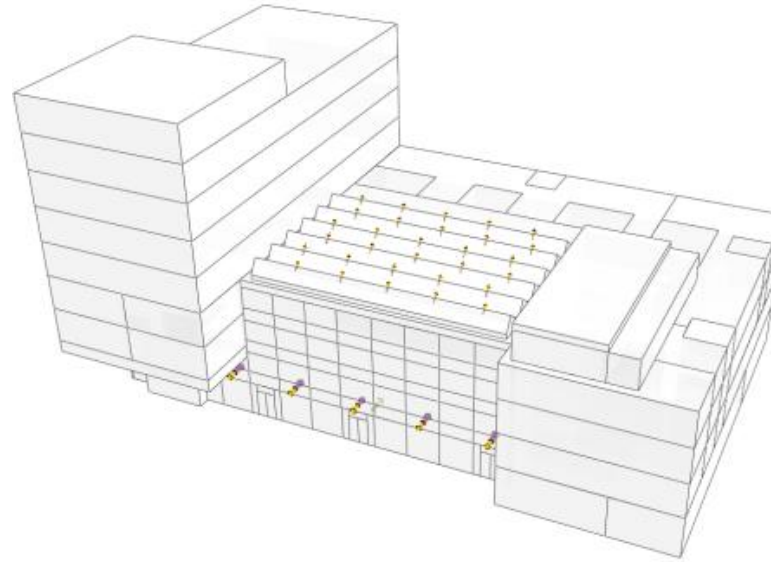
Greater London Authority guidance on preparing energy assessments (March 2016)

MAYOR OF LONDON

MAYOR'S COOLING HIERARCHY



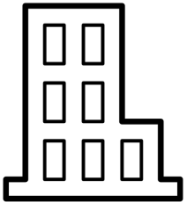
PASSIVE MEASURES EXAMPLES



OVERHEATING RISK ANALYSIS



SAP2012 PART L COMPLIANCE REPORT



BRUKL PART L



DYNAMIC THERMAL MODELLING

_ following TM49 guidance and

data sets

_ include outline of

assumptions made

OVERHEATING MODELLING

- Consultation with design team – **early!**
 - Daylighting
 - External Noise
 - Security
 - Internal Gains
 - **Occupancy Profiles**
- Methodology
 - Check local policies
- Avoiding overheating:
 - CIBSE KS 16: How to manage overheating in buildings
- Risk assessment based on:
 - CIBSE TM 52: The limits of thermal comfort: avoiding overheating in European buildings (2013)
 - CIBSE TM 49: Design Summer Years for London (2014)



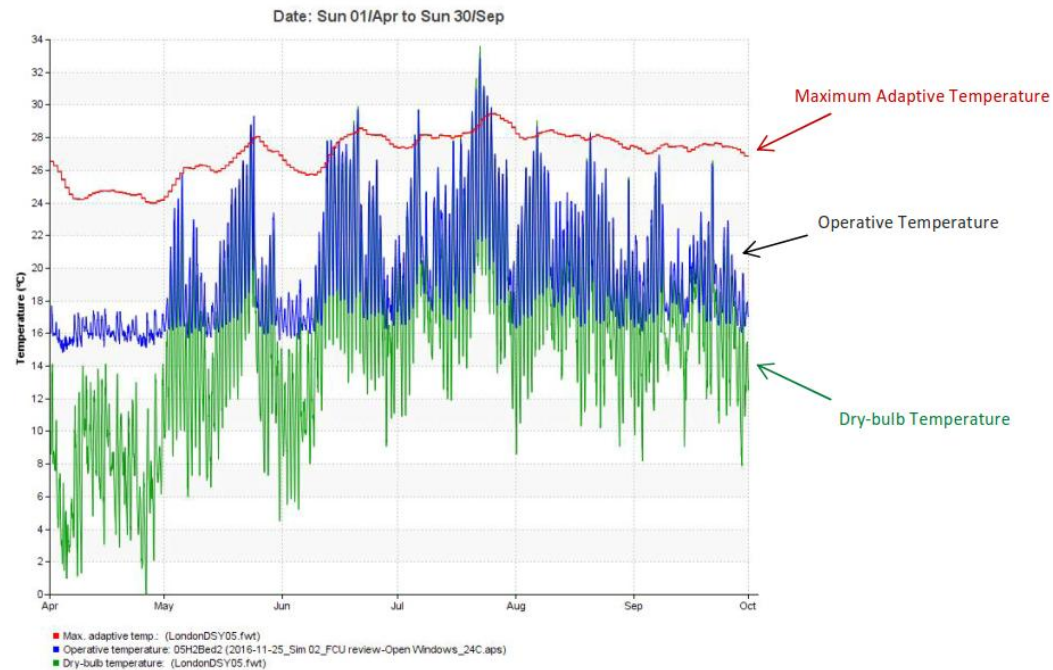
OVERHEATING MODELLING

CIBSE TM 52: The limits of thermal comfort: avoiding overheating in European buildings (2013)

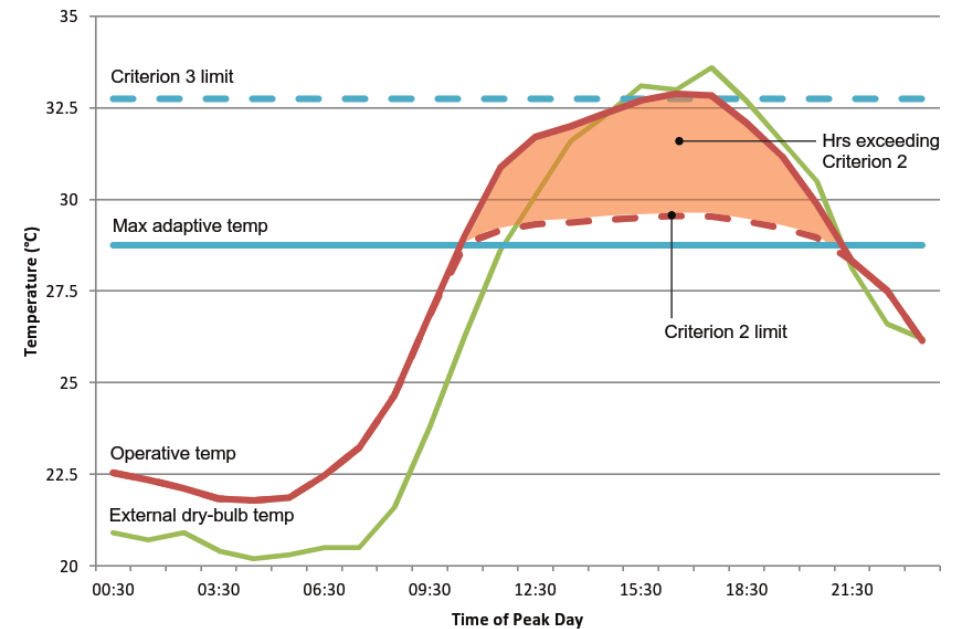
- May to September
- Naturally ventilated buildings
- Pass 2 out of 3 criteria

CIBSE TM52 Criteria (meet 2 of 3 to pass)		
Crit. 1: %Hrs $T_{op} - T_{max} \geq 1K$ (H_e)	Crit. 2: Max. Daily Deg. Hrs (W_e)	Crit. 3 (max. ΔT)
$\leq 3\%$	≤ 6	≤ 4 K

Criterion 1 - 05 H2 Bed 2:



Criterion 2 & 3 - 05 H2 Bed 2:

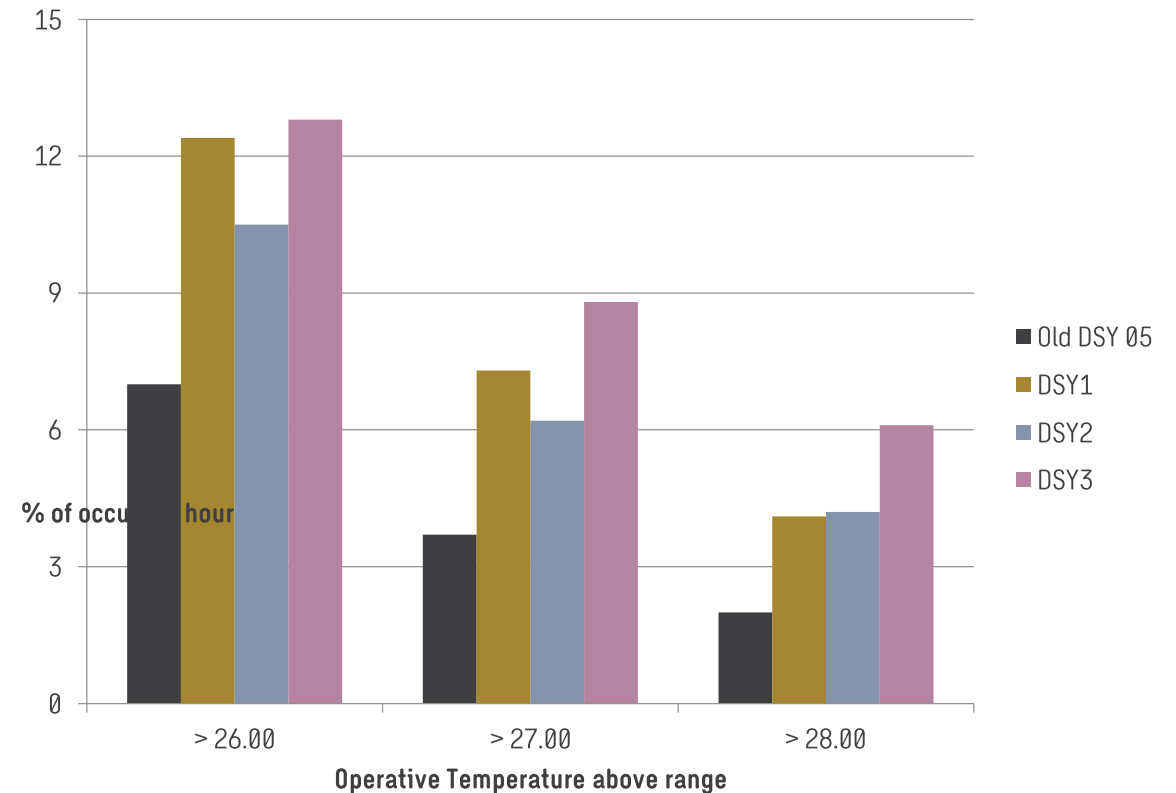


OVERHEATING MODELLING – RESIDENTIAL BUILDING

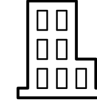
Impact of using TM49 weather files in the overheating assessment for the SW mid-floor **living room**:

- High-rise Tower
- Studio to 2 bedroom flats
- 40% glazing to wall ratio
- Work in progress in process of planning application

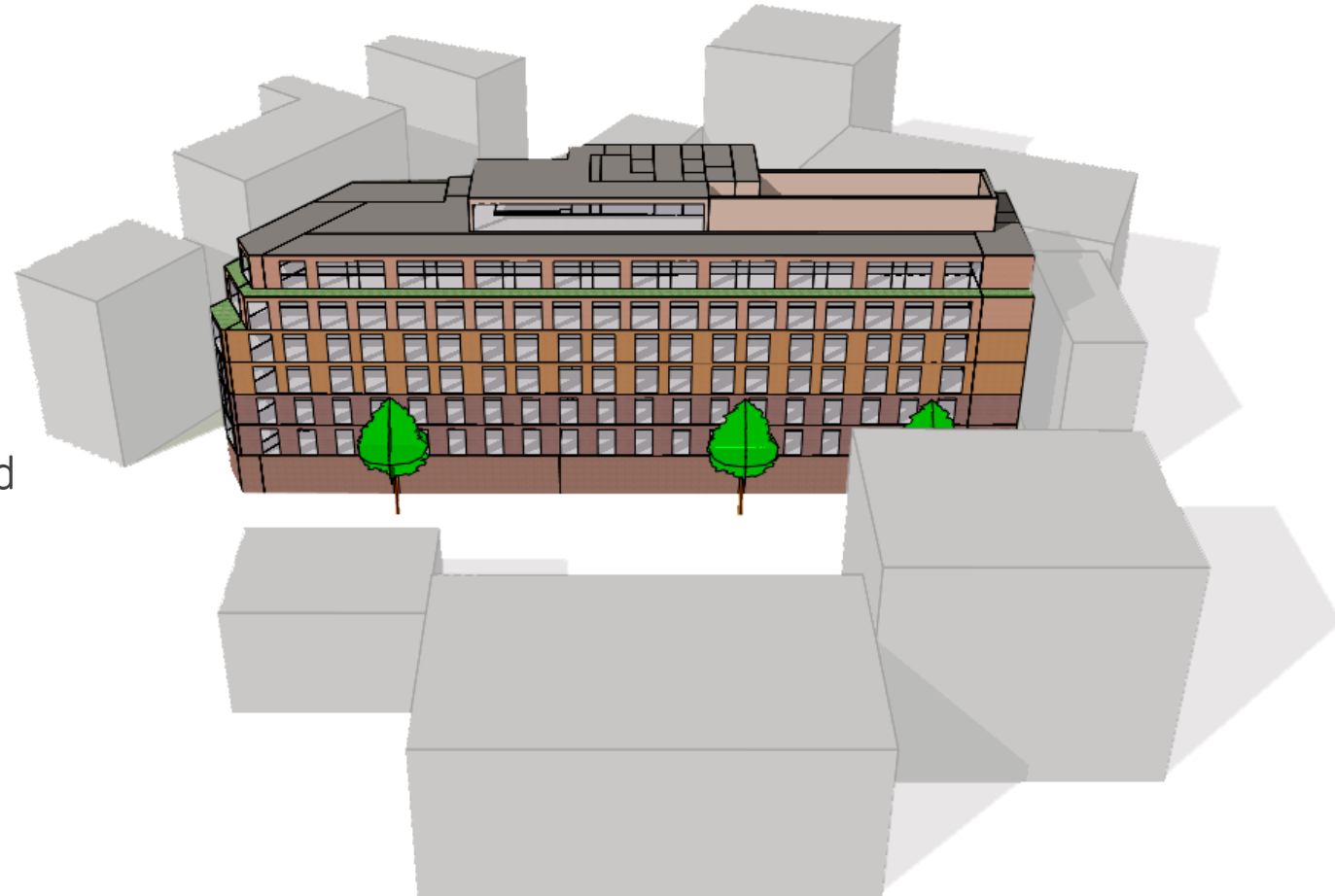
Weather File	CIBSE TM52 status
Old DSY 05	Pass
LWC DSY1	Fail
LWC DSY2	Fail
LWC DSY3	Fail



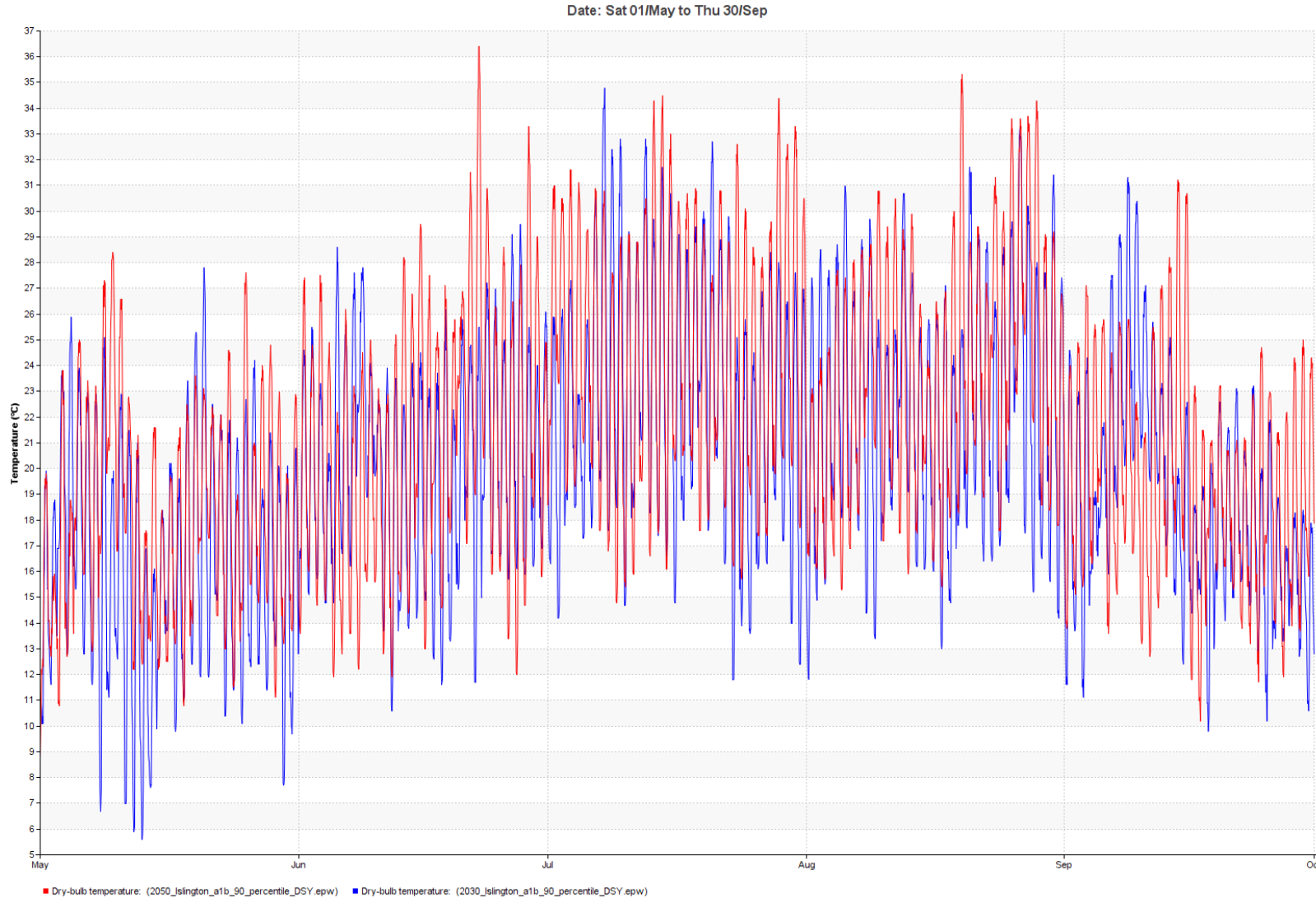
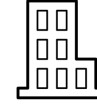
OVERHEATING MODELLING – OFFICE BUILDING



- Follows Mayor's Cooling Hierarchy
- London Borough of Islington
- Displacement ventilation
- Analysis for a projected climate scenario:
 - Use Design Summer Year (DSY) weather tape Islington 90th percentile for 2030s;
 - Additional design elements have been included to ensure that overheating is not an issue by using DSY Islington 90th percentile for 2050s.



OVERHEATING MODELLING – OFFICE BUILDING



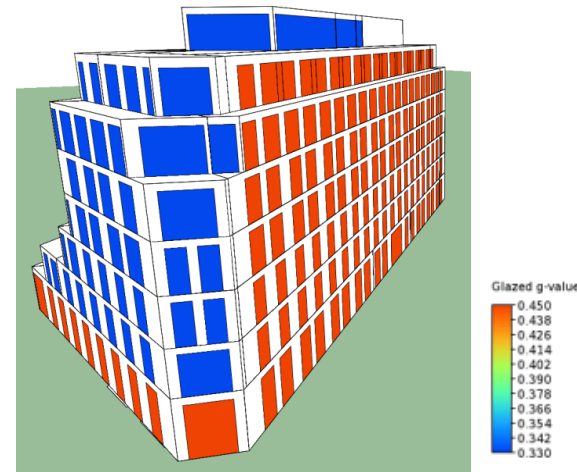
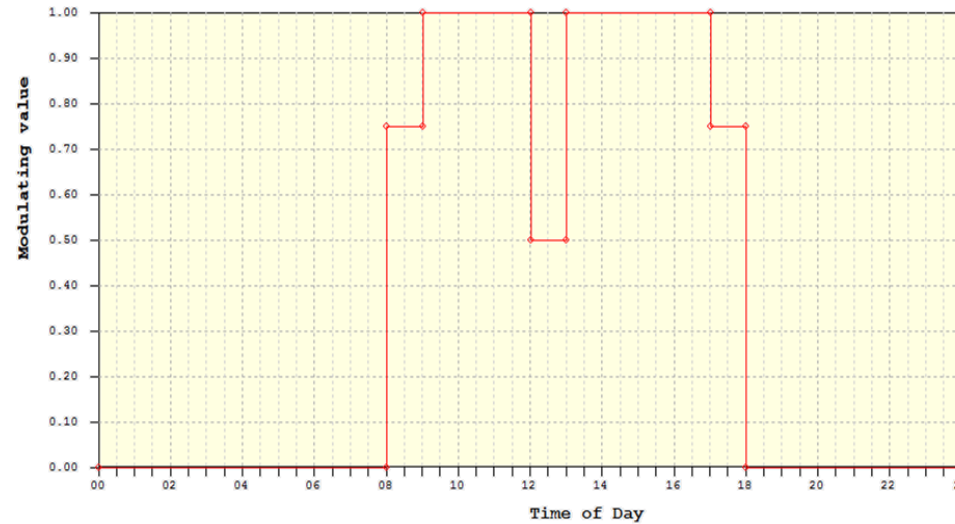
OVERHEATING MODELLING – OFFICE BUILDING



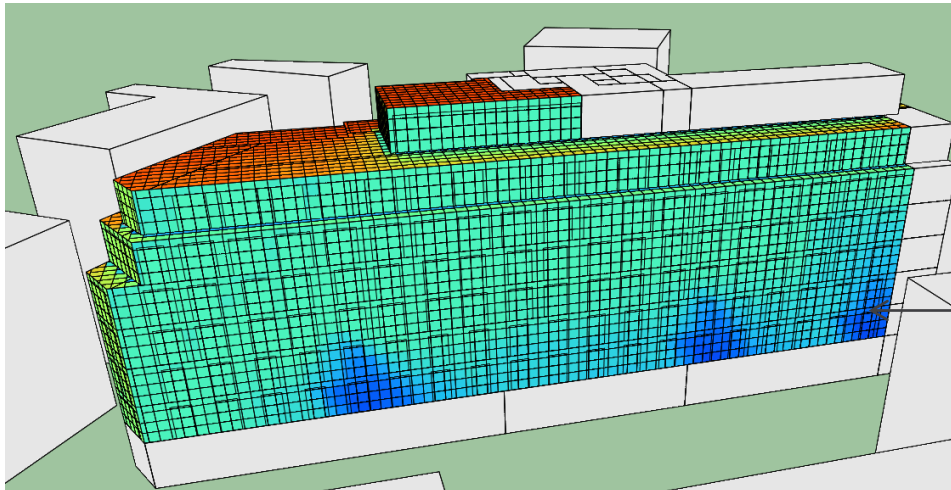
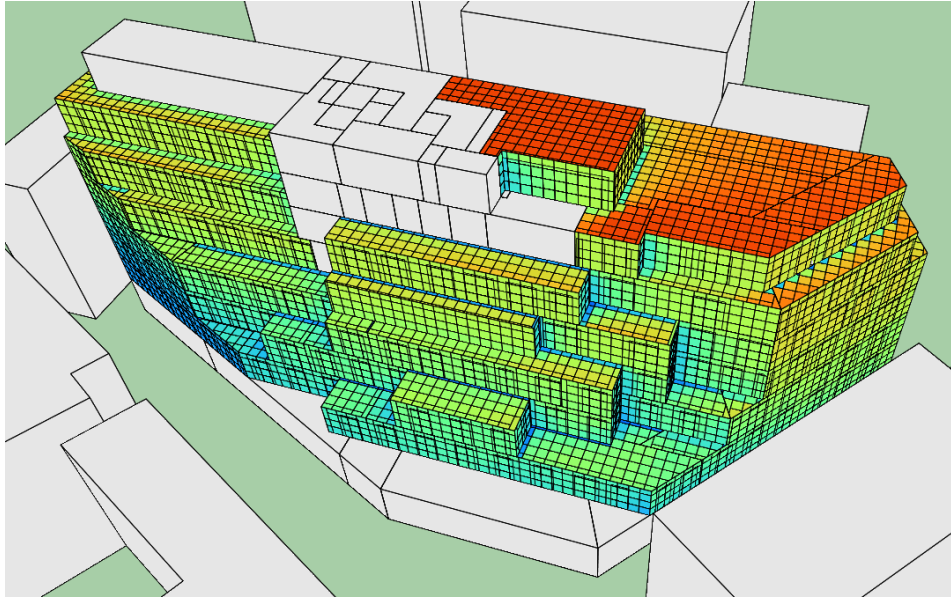
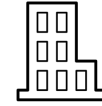
Thermal Performance of building elements		Applied Values
U-values	Wall	0.20 W/m ² K
	Curtain Wall	Glazing – 1.4W/m ² K
		Solid – 0.80W/m ² K
	Roof	0.22 W/m ² K
	Floor	0.18 W/m ² K
Thermal Mass	Walls	35 kJ/m ² K (lightweight)
	Ceiling (exposed soffit)	200 kJ/m ² K (heavyweight)
	Floor (raised floor)	8 kJ/m ² K (lightweight)
Glazing U-value		1.40 W/m ² K
Glazing g-value (BS EN 410)	South / West / East Facade	0.33
	North Facade	0.45
Glazing Lighting Transmittance	South / West / East	61 %
	North	72 %

Office internal gains		Applied Values
Occupancy		1 person / 12m ²
Sensible / Latent gain (W/person)		90 / 60
Lighting gain		6 W/m ² (with dimming control)
Small power		15 W/m ² (follow occupancy schedule)
Occupancy schedule		8am to 6pm with lunch break

Office Auxiliary Ventilation		Applied Values
Fresh Air supply (Part F)		10 l/s/person
Infiltration		0.25 ach

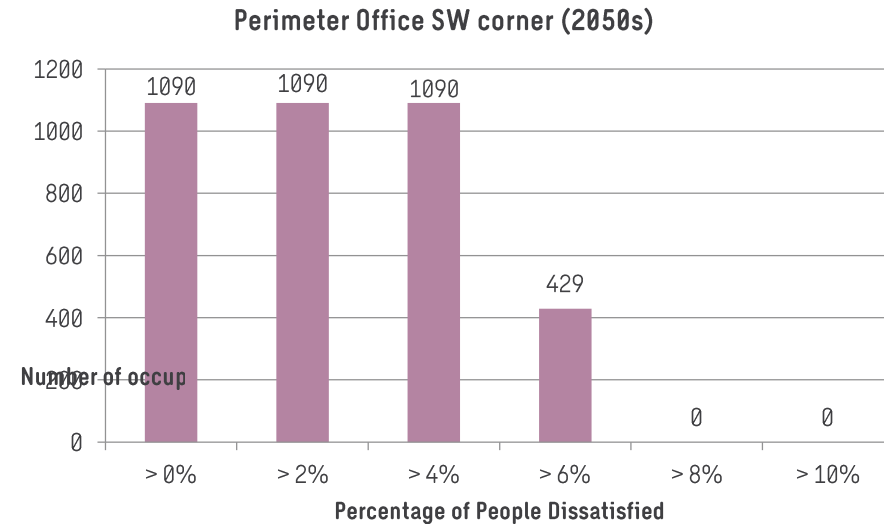
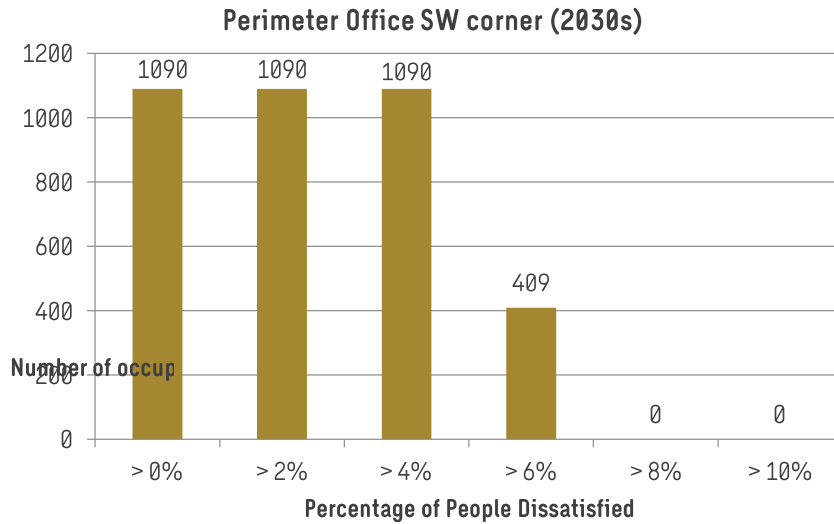
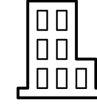


OVERHEATING MODELLING – OFFICE BUILDING



Shading from largest trees

OVERHEATING MODELLING – OFFICE BUILDING



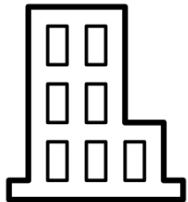
- High performance blinds with reflective backing to reduce heat gains
- Slight increase in number of dissatisfied people in the 2050s scenario

ACTIVE COOLING DEMAND



SAP2012 PART L COMPLIANCE REPORT

- Row 107 in section 8c of DER worksheets



BRUKL PART L

- ‘HVAC Systems Performance’:
Actual and Notional

Average domestic cooling demand for July (kWh/m ²)	Maximum domestic cooling demand for July (kWh/m ²)
e.g. 105.20	e.g. worst case

Area-weighted average building cooling demand (MJ/m ²)	
Actual building	e.g. 115.5
Notional building	e.g. 119.3

DYNAMIC THERMAL MODELLING RESULTS SHOULD ALSO BE REPORTED!

IN SUMMARY

- Attention to the guidance from **GLA AND OTHER LOCAL AUTHORITIES**
- The **WEATHER FILE** used impact significantly on the results
- Adaptation to **CLIMATE CHANGE**
- Design for **OCCUPANT'S WELLBEING**
- **EARLY** engagement with design team
- **COMMUNICATION** is key
- Consider design and client's aspirations
- Research of novel technologies to allow for **CREATIVE SOLUTIONS**
- Engage with manufacturers/suppliers, they are adapting to have their products applied to the virtual environment
- Overheating Working Group: Good Homes Alliance

THANKS FOR YOUR ATTENTION,
ANY QUESTIONS?



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