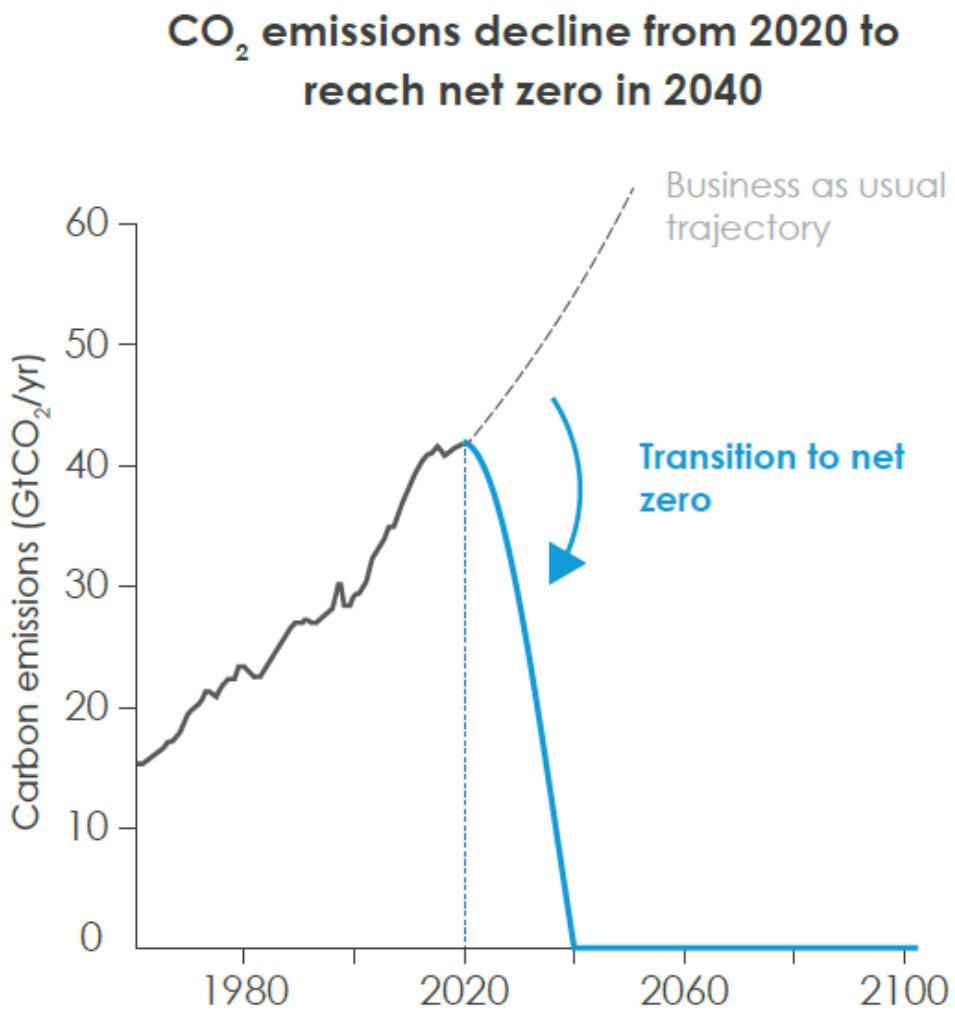
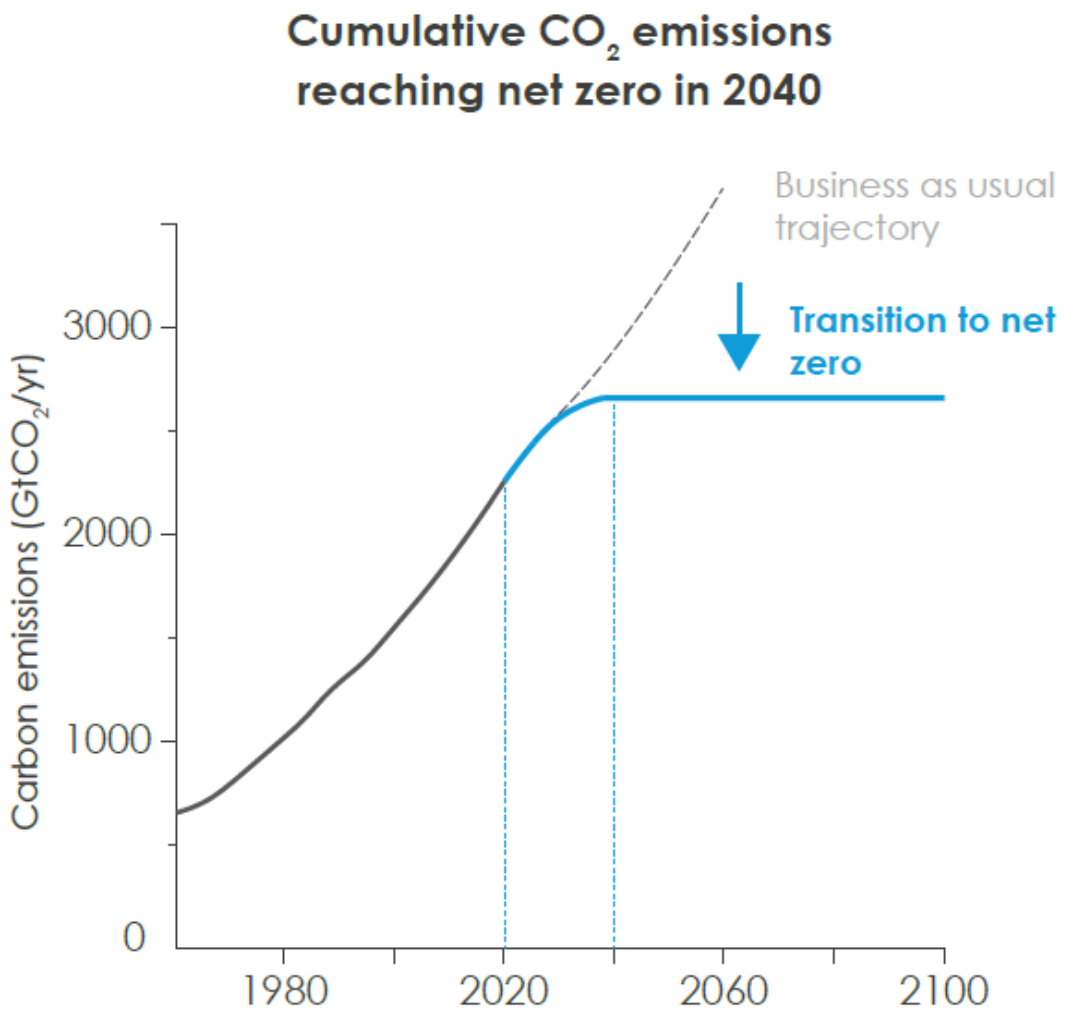
Designing for Sustainability – 5 Simple Steps

Robert Hopkins – 31st March 2022

Why Design for Climate Change?





Figures: Intergovernmental Panel on Climate Change

Key Design Considerations

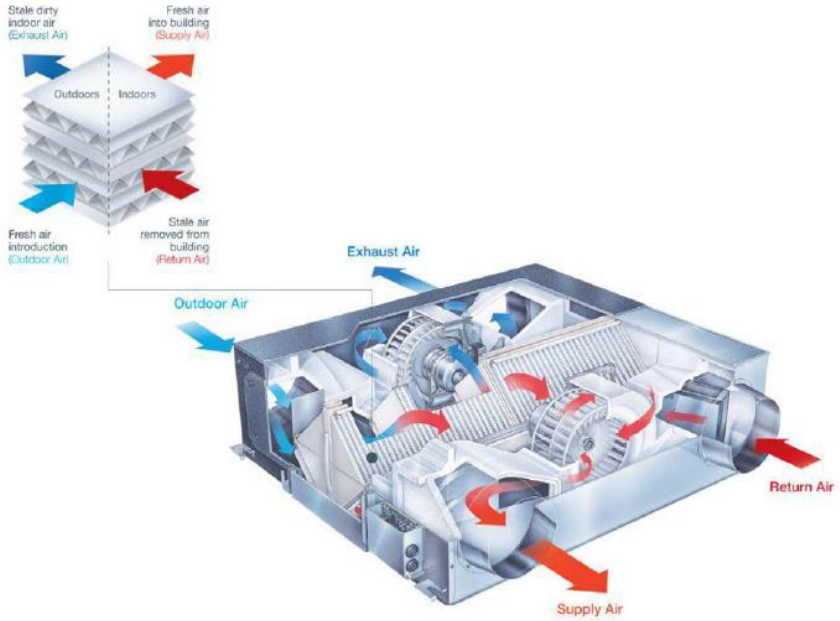
Fabric First – 60:40 Solid to Glazing
Openable Windows
Passivhaus U-Value Standards
Improved Air Tightness
Enhanced Ventilation
Relaxed Cooling Set Point from 24 to 26 degrees
Low Energy Lighting Design
Non-Fossil Fuel Heating
Optimised Structural Solutions
Thermal Mass
Exposed Ceilings
Recycled Raised Access Floors
Relationship to Biophilia

Design Considerations – 60:40 Glazing Ratio

40% Maximum

- Avoid fully glazed buildings
- 10-15kWh/m^2.yr improvement on energy use of the building
- Ability to add more thermal mass into the envelope
- Balance with achieving good daylight factors
- Visual reference of buildings needs to evolve

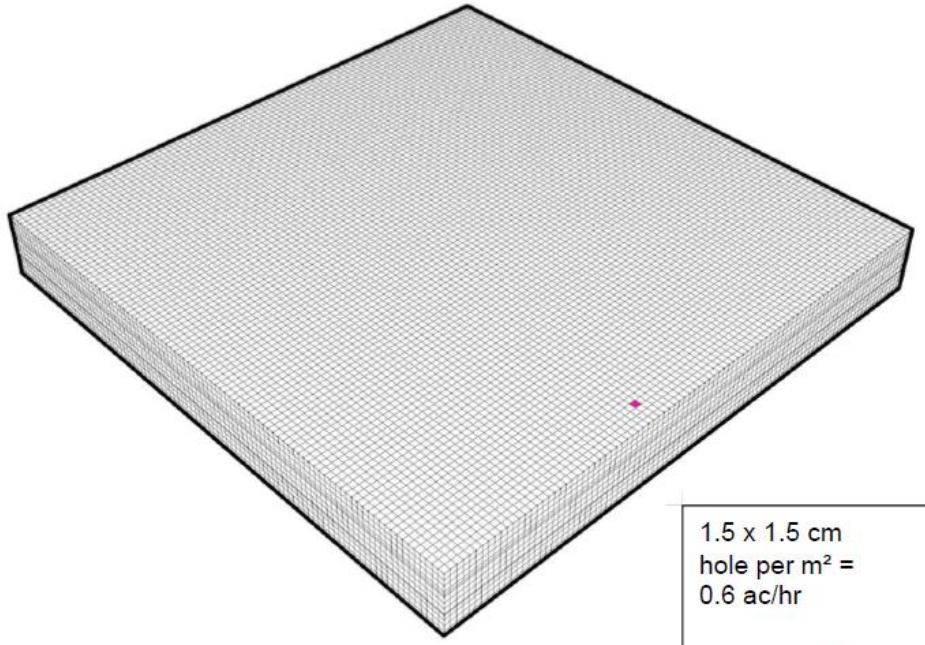
Design Considerations – Enhanced Ventilation



1000 ppm CO_2

- Ability to manually open windows gives better perception of comfort for occupants
- Air quality standards in city centres will improve
- Acoustic standards improving in city centres
- Ability to concentrate with background noise better than we thought
- Direct correlation with improved cognitive function
- Combine with better filtration
- Use air quality monitors

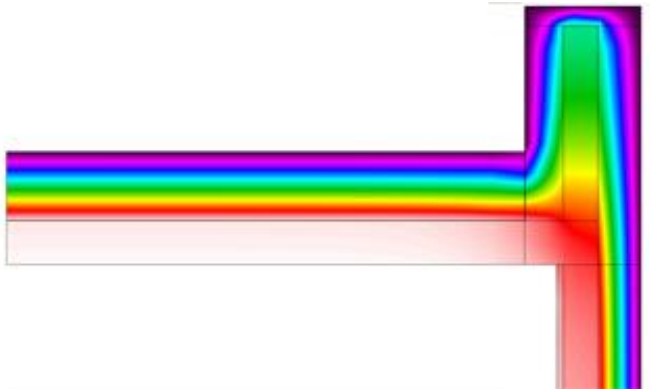
Design Considerations - Air Tightness

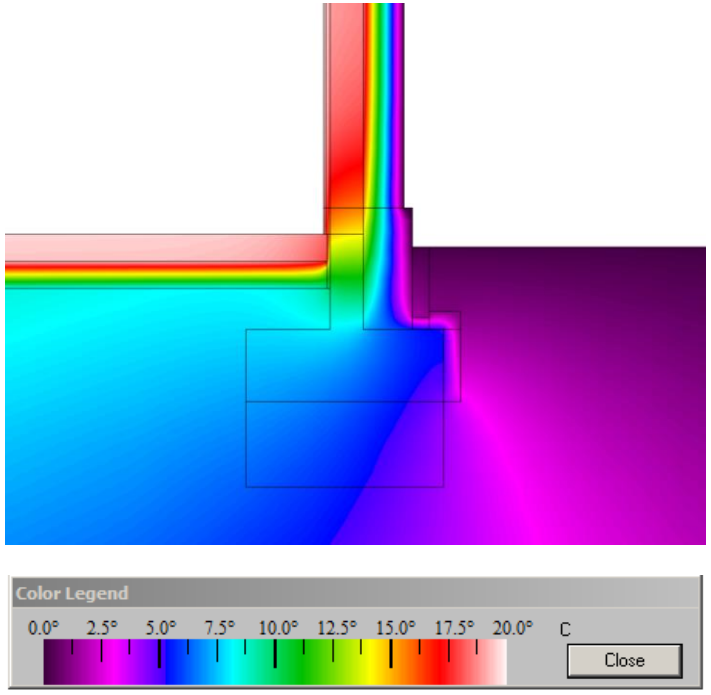


0.6 ac/hr @ 50 pa

- Around a 20 fold increase required on current standards around air tightness
- A rethink for approach to detailing is required
- The way in which air testing is carried out on site needs to evolve.
- The location of air tight line needs to be more accessible
- An area where significant attention needs to be placed
- The important emphasis is controlled air tightness in a building
- Many materials are not air tight

Design Considerations - Thermal Bridging

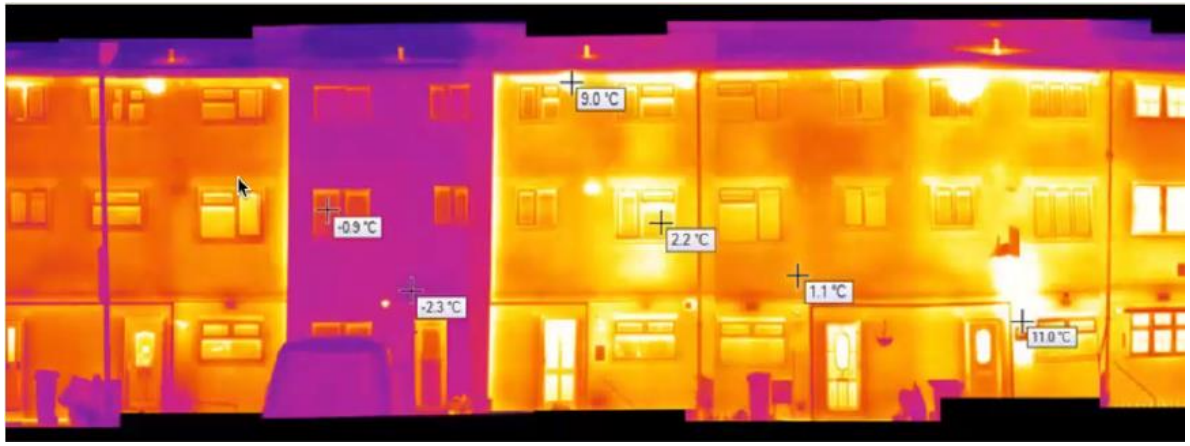


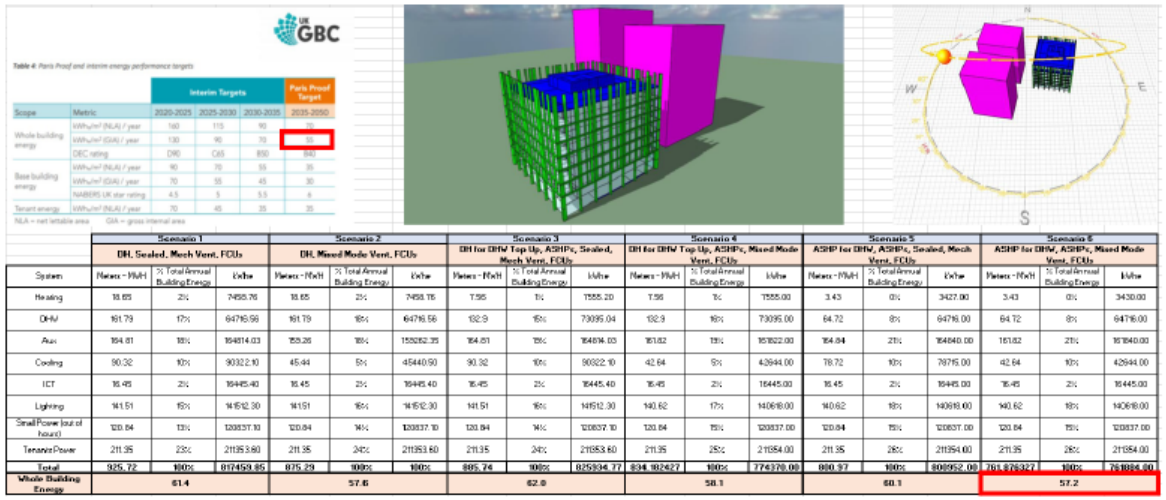


0.1 W/mK

- Largest impact is on the smallest projects
- Robust details can be become very expensive if you are not careful
- Designers need to develop the ability to be more scientific in their approach to thermal bridging
- Only take one weak point for a building to fail

Design Considerations - Insulation





Scope	Metric	Interim Targets 2020-2025	2025-2030	2030-2035	Paris Proof Target 2035-2050
Whole building energy	kWh/m² (NLA) / year	160	115	90	75
	kWh/m² (GIA) / year	130	90	70	55
	DEC rating	D90	C65	B50	B40
Base building energy	kWh/m² (NLA) / year	90	70	55	35
	kWh/m² (GIA) / year	70	55	45	30
	NABERS UK star rating	4.5	5	5.5	6
Tenant energy	kWh/m² (NLA) / year	70	45	35	35

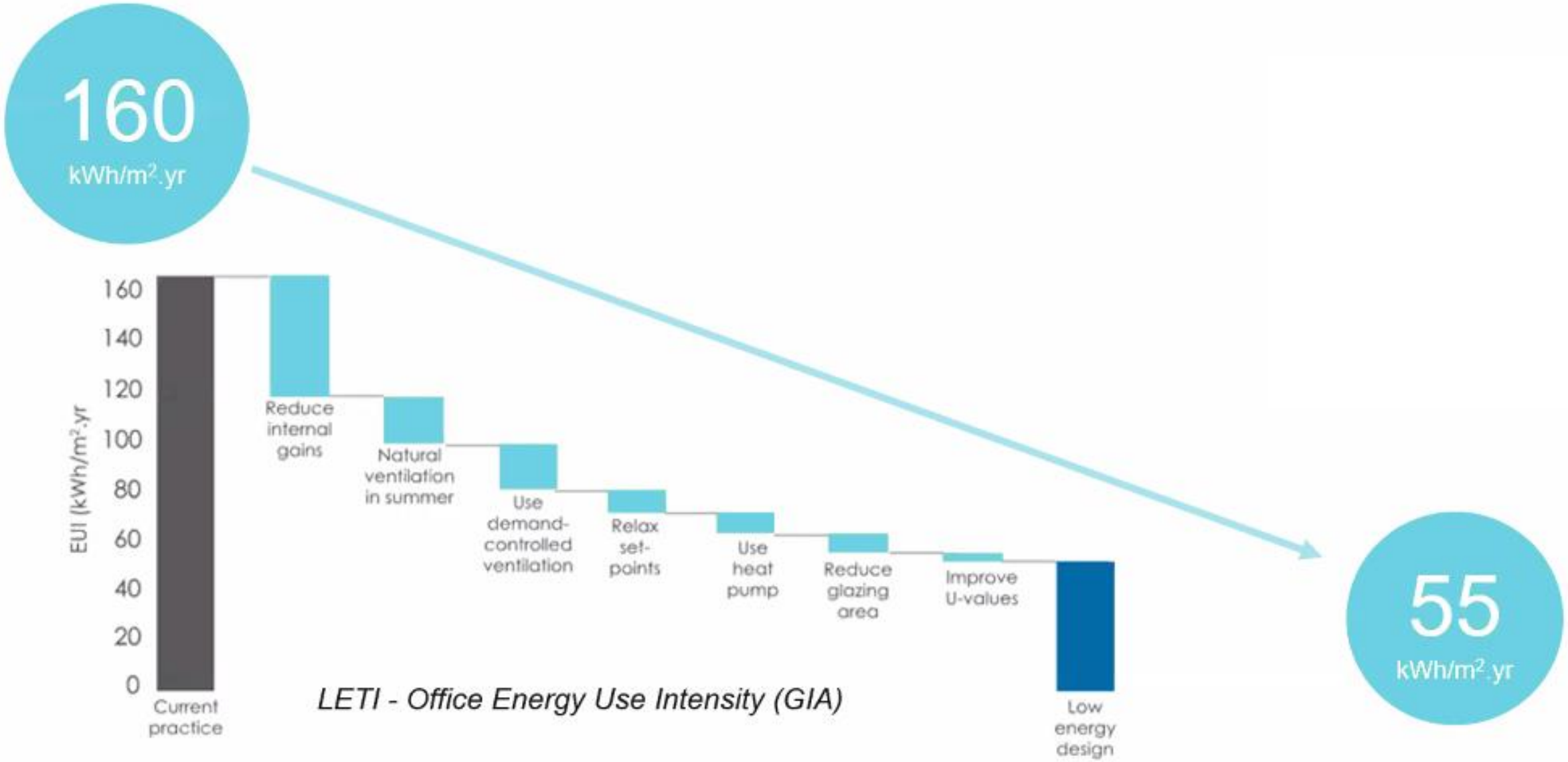
NLA = net lettable area GIA = gross internal area

	Scenario 1			Scenario 2			Scenario 3			Scenario 4			Scenario 5			Scenario 6		
	DH, Sealed, Mech Vent, FCUs			DH, Mixed Mode Vent, FCUs			DH for DHW Top Up, ASHPs, Sealed, Mech Vent, FCUs			DH for DHW Top Up, ASHPs, Mixed Mode Vent, FCUs			ASHP for DHW, ASHPs, Sealed, Mech Vent, FCUs			ASHP for DHW, ASHPs, Mixed Mode Vent, FCUs		
System	Meters - MWH	% Total Annual Building Energy	kWhe	Meters - MWH	% Total Annual Building Energy	kWhe	Meters - MWH	% Total Annual Building Energy	kWhe	Meters - MWH	% Total Annual Building Energy	kWhe	Meters - MWH	% Total Annual Building Energy	kWhe	Meters - MWH	% Total Annual Building Energy	kWhe
Heating	18.65	2%	7455.76	18.65	2%	7455.76	7.95	1%	7555.20	7.56	1%	7555.00	3.43	0%	3427.00	3.43	0%	3430.00
DHW	191.79	17%	64716.98	191.79	18%	64716.56	192.9	19%	73095.04	192.9	19%	73095.00	64.72	8%	64716.00	64.72	8%	64716.00
Aux	164.81	15%	164814.03	155.26	15%	155262.35	164.81	16%	164814.03	161.62	15%	161622.00	164.84	21%	164840.00	161.62	21%	161640.00
Cooling	90.32	10%	90322.10	45.44	5%	45440.90	90.32	10%	90322.10	42.64	5%	42644.00	78.72	10%	78715.00	42.64	10%	42644.00
ICT	16.45	2%	16445.40	16.45	2%	16445.40	16.45	2%	16445.40	16.45	2%	16445.00	16.45	2%	16445.00	16.45	2%	16445.00
Lighting	141.51	13%	141512.30	141.51	14%	141512.30	141.51	14%	141512.30	140.62	17%	140618.00	140.62	18%	140618.00	140.62	18%	140618.00
Small Power (out of hours)	120.84	13%	120837.10	120.84	14%	120837.10	120.84	14%	120837.10	120.84	15%	120837.00	120.84	15%	120837.00	120.84	15%	120837.00
Tenants Power	211.35	23%	211353.60	211.35	24%	211353.60	211.35	24%	211353.60	211.35	25%	211354.00	211.35	26%	211354.00	211.35	26%	211354.00
Total	925.72	100%	817459.85	875.29	100%	100%	895.74	100%	825934.77	834.182427	100%	774370.00	800.97	100%	808952.00	761.826327	100%	761886.00
Whole Building Energy	61.4			57.6			62.0			58.1			60.1			57.2		

0.15 W/m²K

- Improvements on current standards do not need to be too onerous
- Changing our philosophy to insulation needs to improve significantly
- Think carefully how insulation will be installed on site
- Additional care in detailing required as levels rise
- Early stage use of thermal models

Design Considerations - Summary



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