COLLABORATIONS FOR CHANGE

Global Goals for Tomorrow's Education, Today

19TH ~ 21ST JUNE 2018 KEELE UNIVERSITY

Creating Better Buildings

Looking beyond the badge

Headline Sponsor

CarbonCredentials

Contributors to today's workshop

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Leicester

George Davies Centre

(Centre for Medicine)

UNIVERSITY OF LEICESTER

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engineering change

future we want
your journey to sustainability

Oxford

Kellogg Hub

ENVIRONMENTAL SUSTAINABILITY at OXFORD

UNIVERSITY OF OXFORD

CBG CONSULTANTS

What are we doing this morning?

- Your views on creating more sustainable buildings (10 mins)
- Leicester Passiv Haus and Soft Landings
- The Oxford Passiv Haus Journey (35 mins)
- Creating Better Buildings – your questions answered - takeaways from the session (15 mins)

How many of you have 50 year old buildings?

1968

Creating Better Buildings – your views

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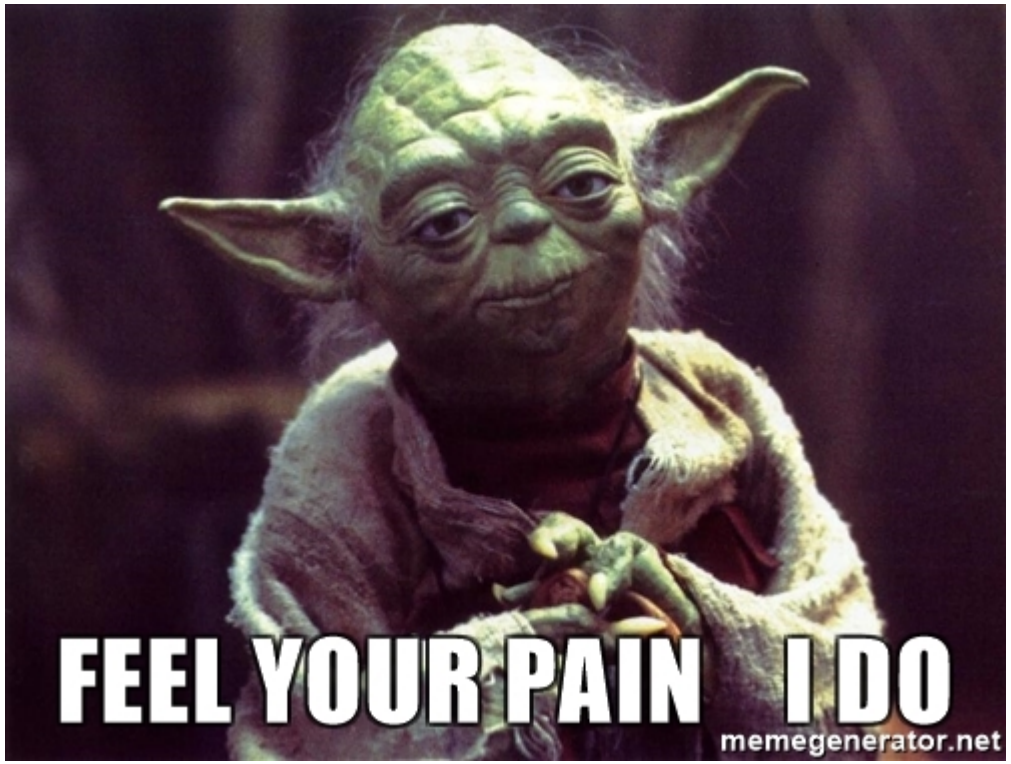
- What are the barriers?
- What can go wrong?
- What would creating better buildings mean for your estate?

future we want
your journey to sustainability

Our Motivation



George Davies Centre Passivhaus

Energy Consumption Comparison

Old Building Stock **Vs** **New Building Stock (Year 1 Data)**

Maurice Shock Building **Vs** **Centre for Medicine – DEC 'A' (25)**

320kWhr/m^2 per annum space heating	Vs	18kWhr/m^2 per annum space heating
500kWhr/m^2 per annum total	Vs	59kWhr/m^2 per annum total
£360,000 per annum energy bill	Vs	£37,917 per annum energy bill (£2.95/m^2)

Overview – Carbon Reduction Target

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Absolute emissions targets is 25% by 2020 and against its 2004/05 base year

Case Study

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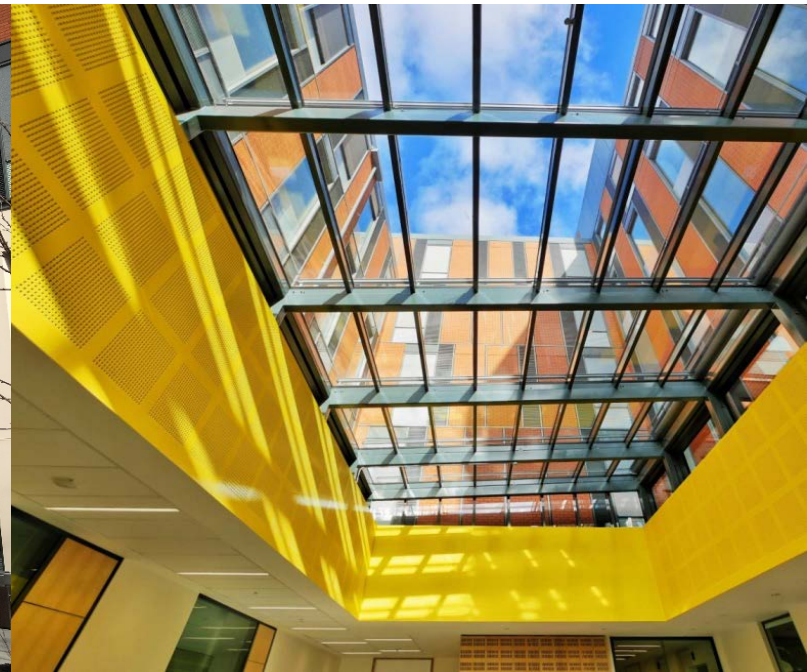
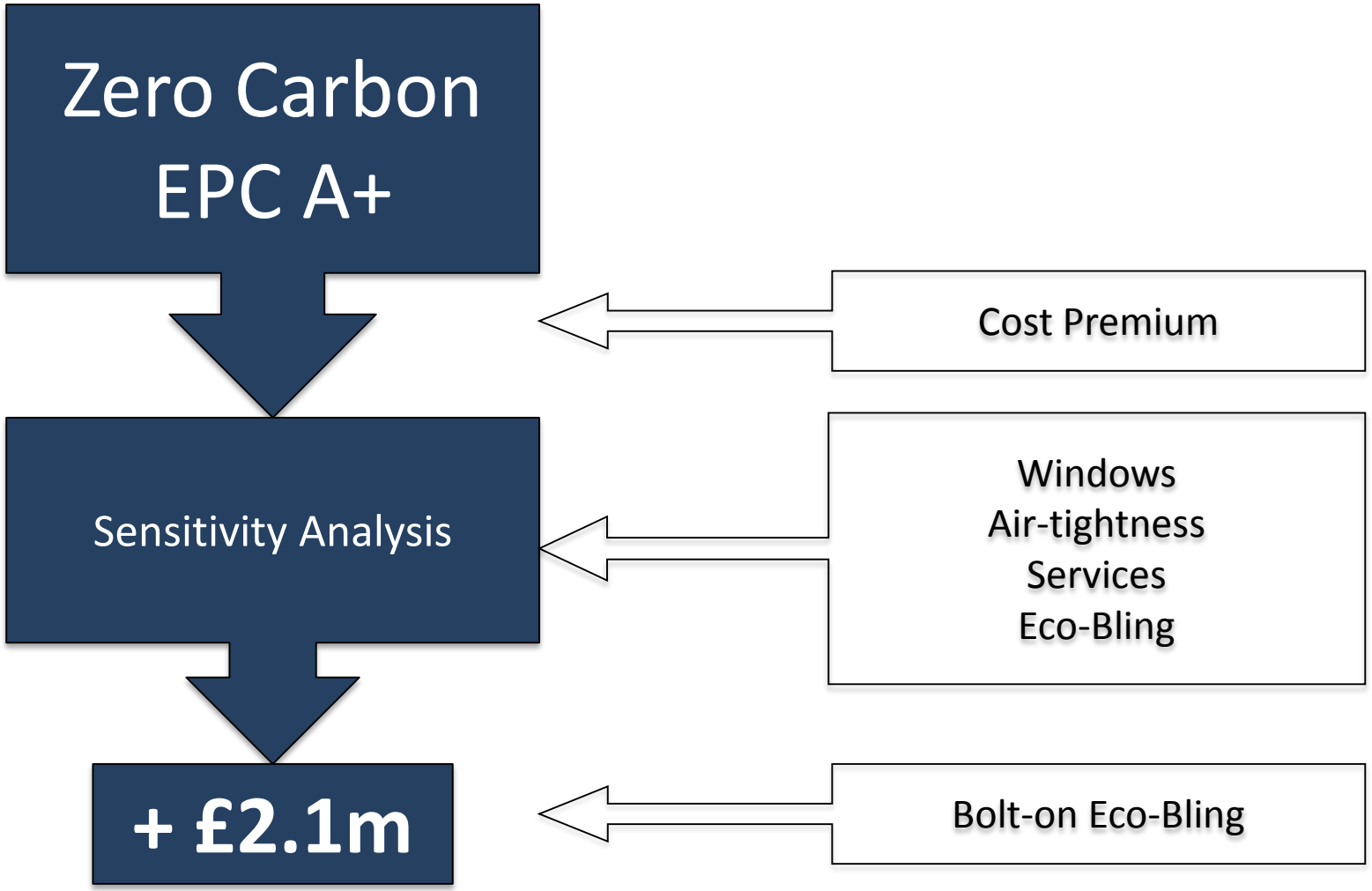
George Davies (Centre for Medicine) – 12,836m^2

- Bringing together: Department of Medical Education, Department of Health Sciences and the School of Psychology
- Construction Cost: £29 million





Original Brief



Final Brief

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Client:
EPC
'A-rated'

Client:
DEC
'A-rated'

Client:
BREEAM
'Excellent'

Client:
PassivHaus

Local Plan:
15% Energy from Renewables

Leicester City Council

Low Energy Roadmap

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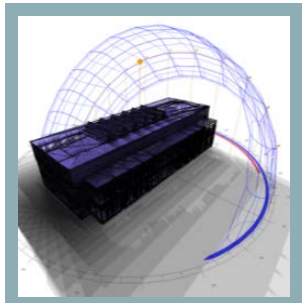
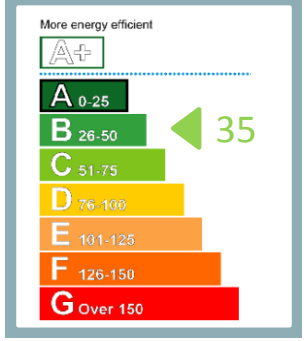
Fundamentals



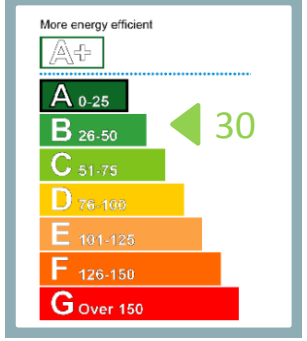
Orientation

Site



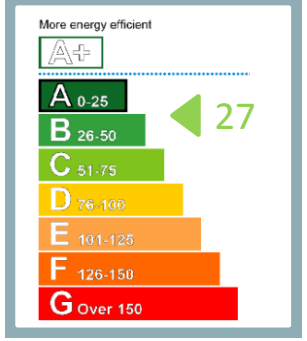
Envelope

Fabric



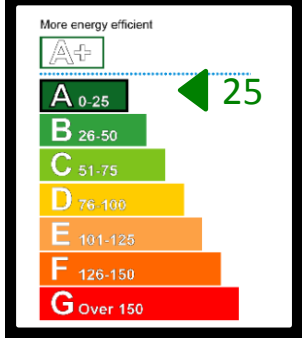
Efficiency

Services



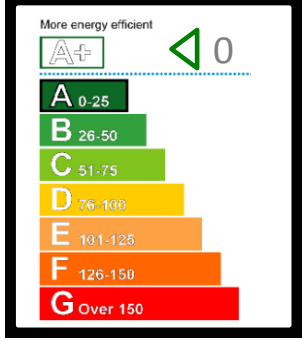
LZC Level 1

CHP



LZC Level 2

PV etc



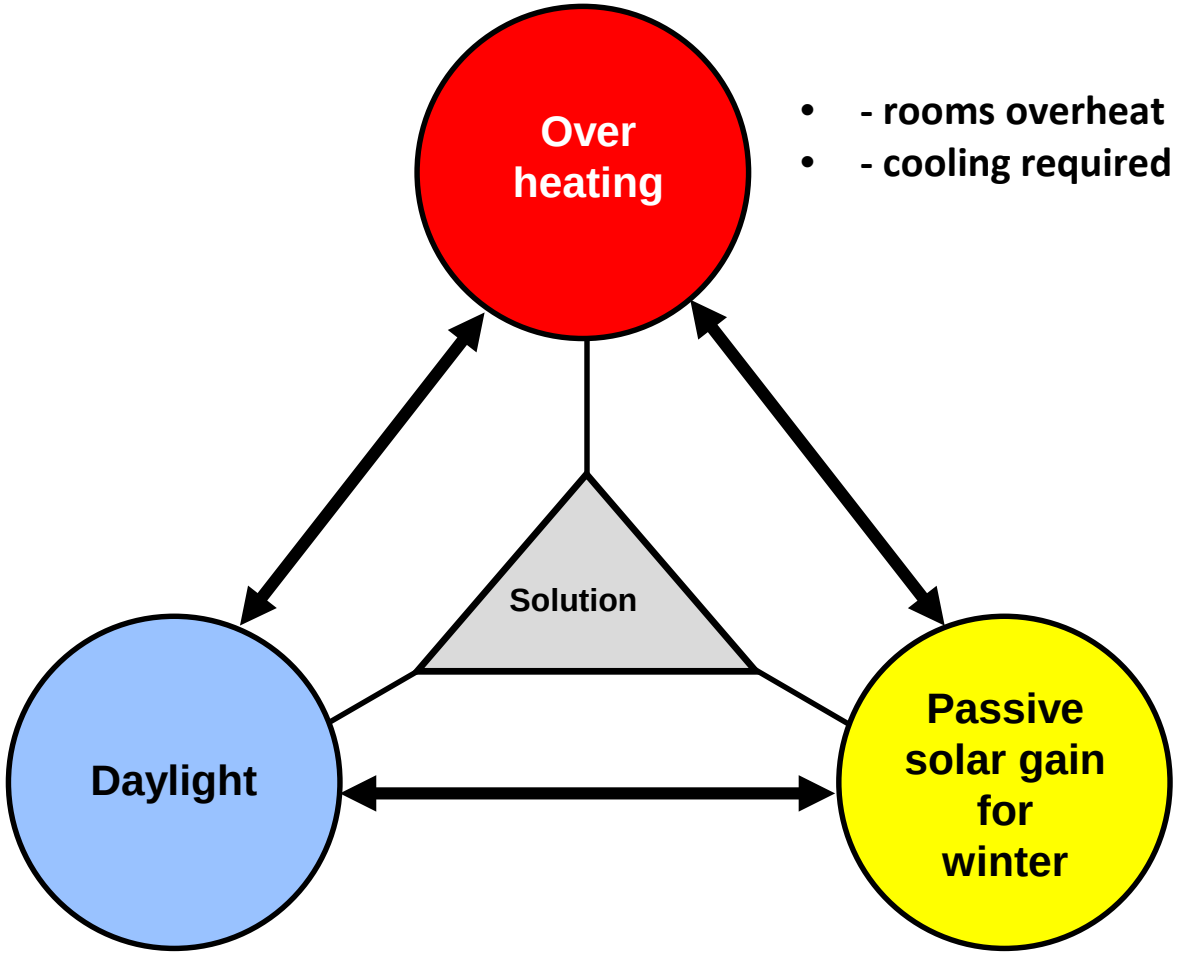
BE LEAN

BE CLEAN

BE GREEN

BE REALISTIC (£££)

Balancing Priorities



- + Larger windows
- + Less artificial lighting
- + Better colour spectrum
- - more heat loss
- - more glare ?
- - blinds down

- - rooms overheat
- - cooling required

- + Free radiant heating
- - south facing overheating
- - south façade = more glare ?

Design Tools

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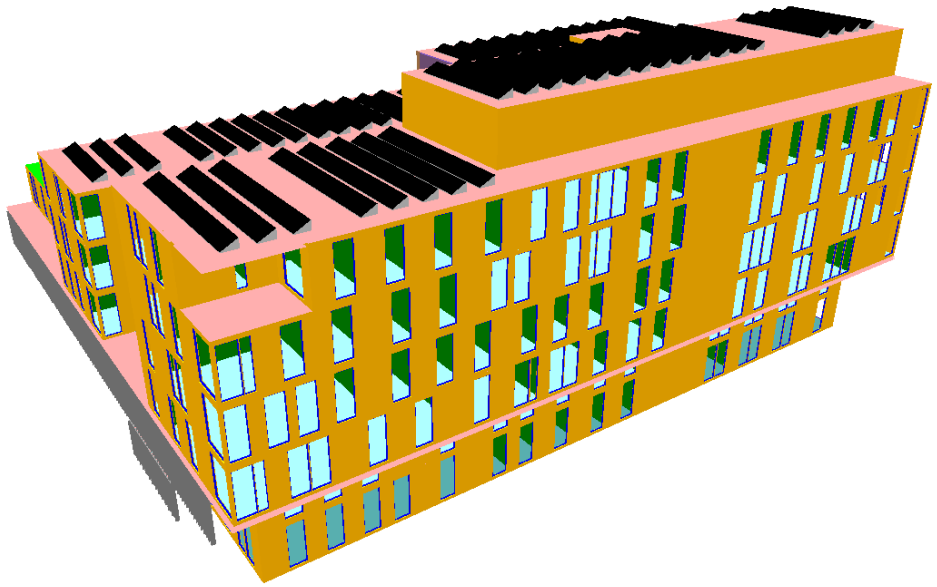
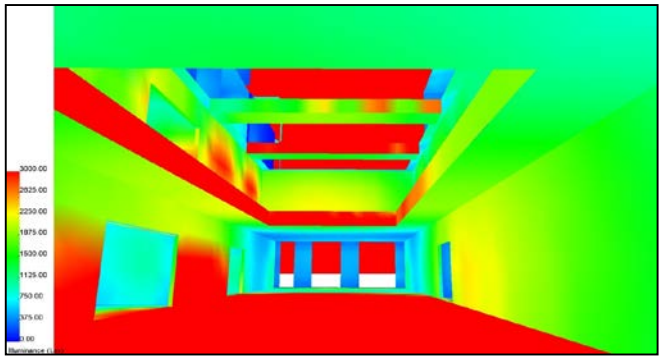
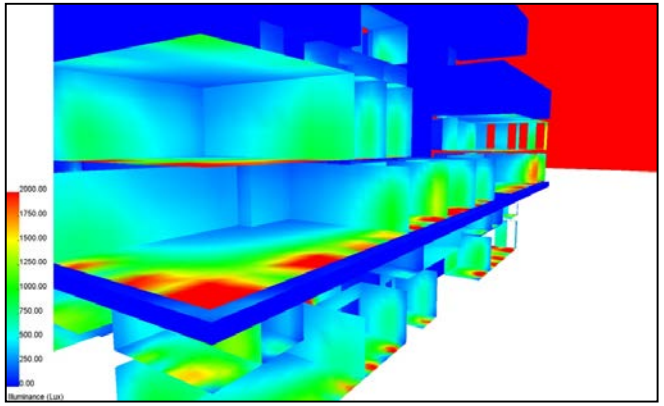
- Full Building Information Modelling (BIM) using Revit
- IES/TAS Dynamic Simulation Modelling for Part L compliance, EPC and Overheating checks
- AGI-32 for daylight modelling
- Specialist Lighting Design
- PassivHaus Planning Package (PHPP) in the background







Key Features

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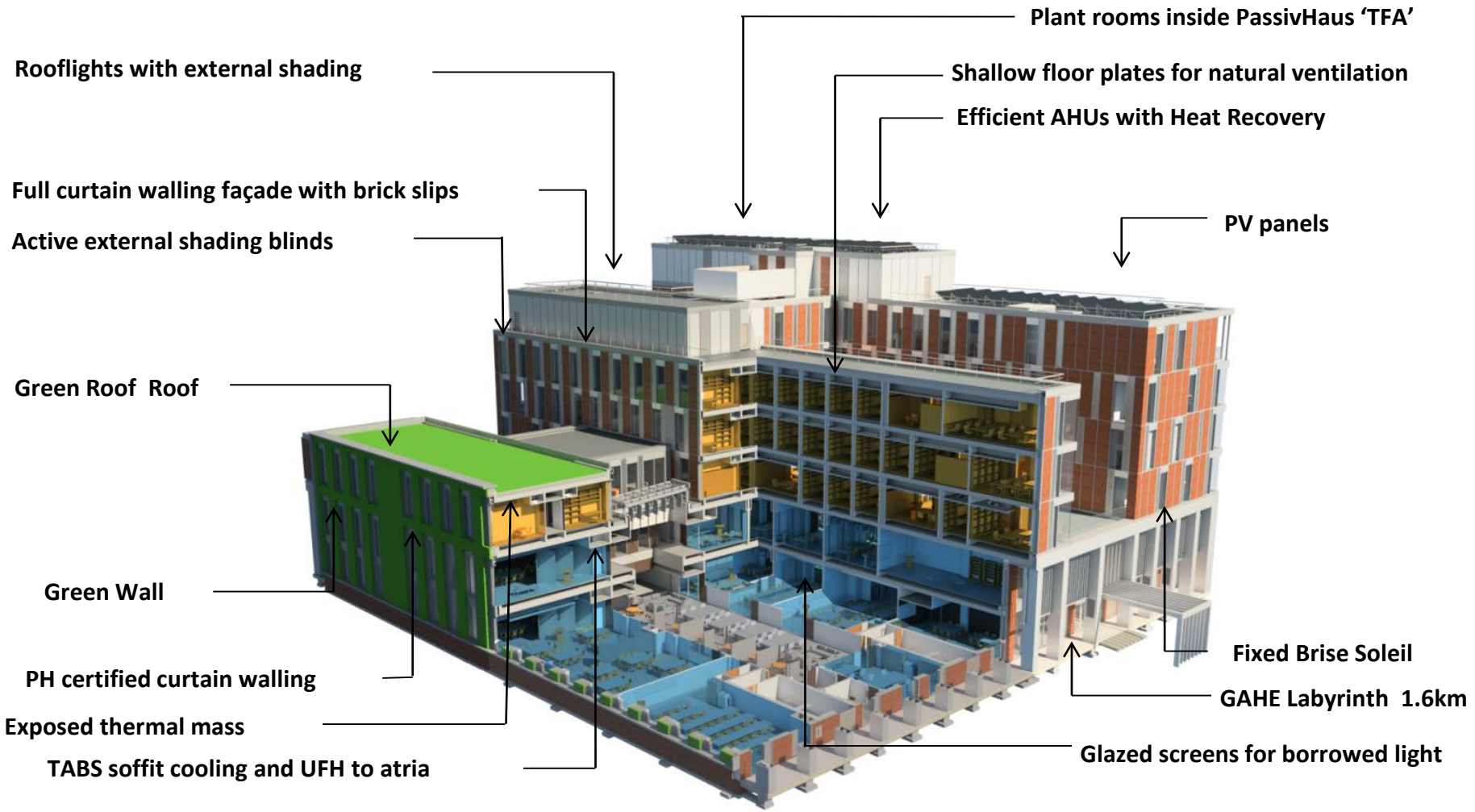
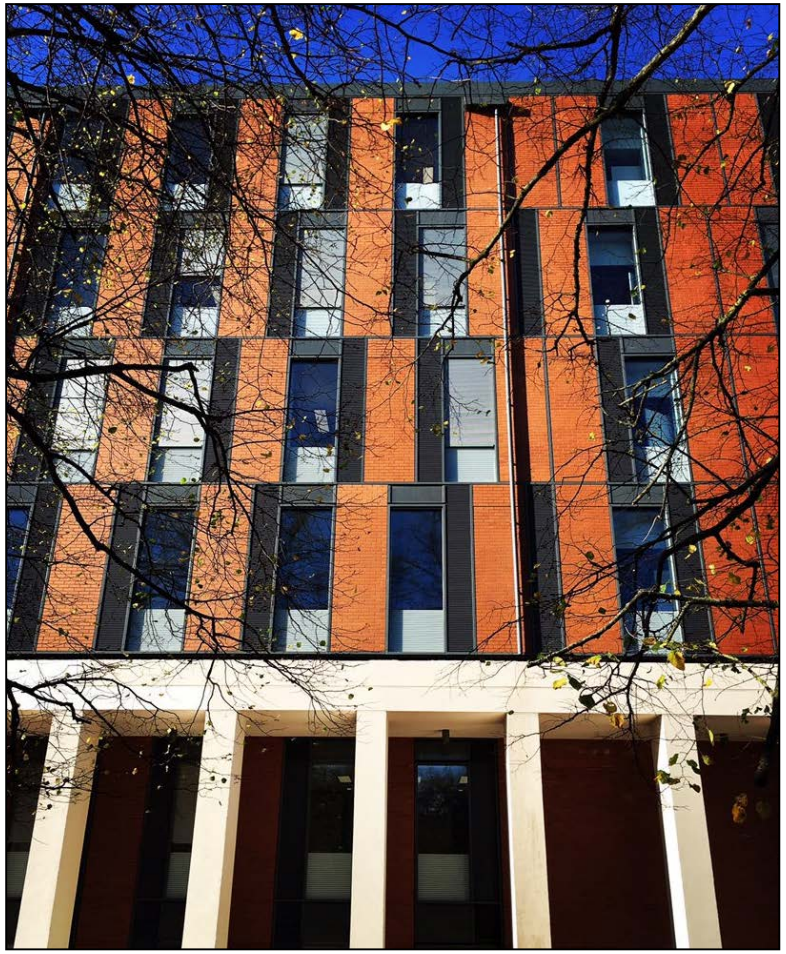


Envelope Mock-up and Testing



Air tightness sampling & testing

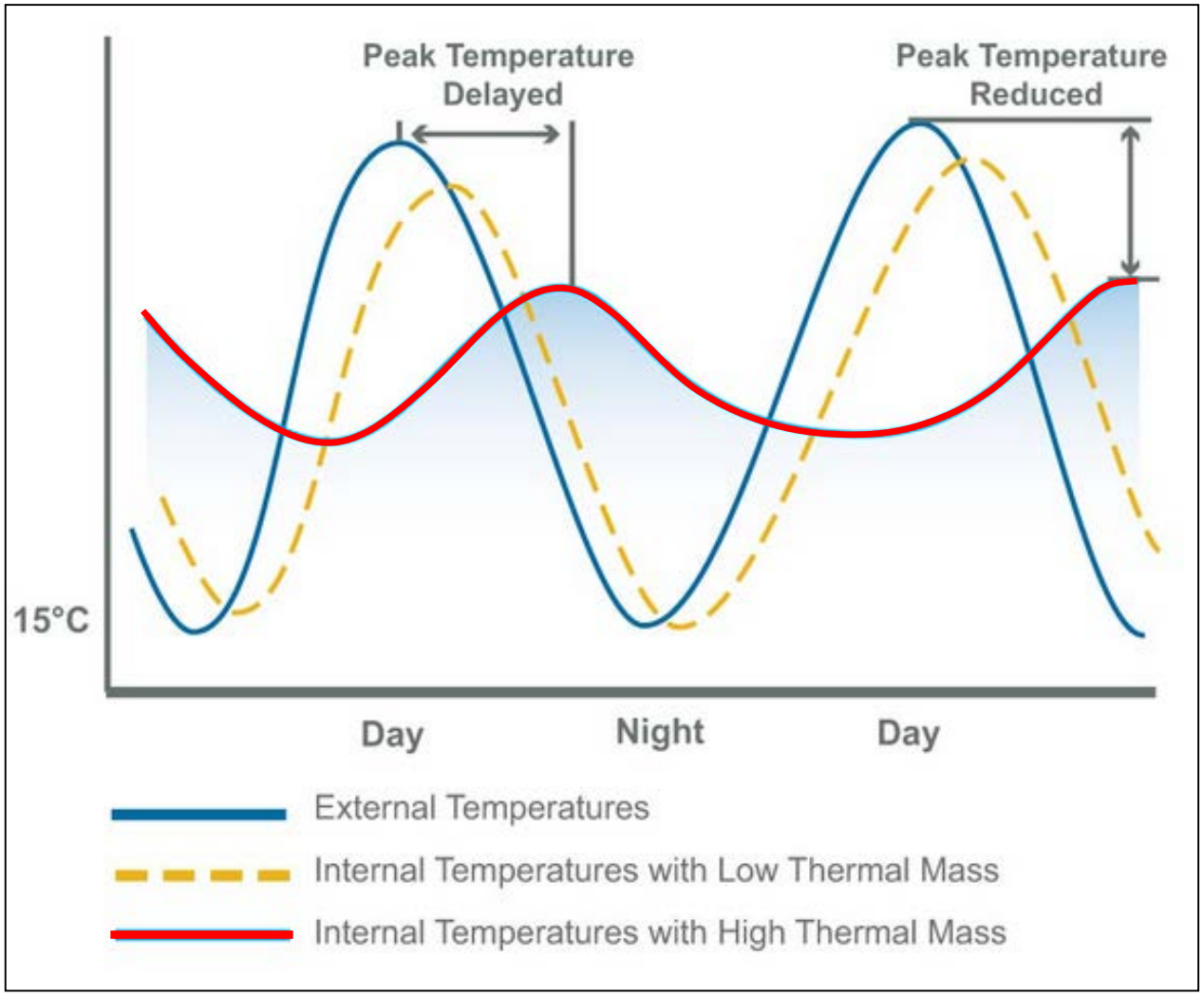
Thermal Mass

Light Weight

Heavy Weight

Admittance – rate at which a material absorbs heat

Thermal Mass



Mechanical Ventilation Heat Recovery (MVHR)

Mixed Mode Ventilation Strategy to Further Reduce CO_2 ppm

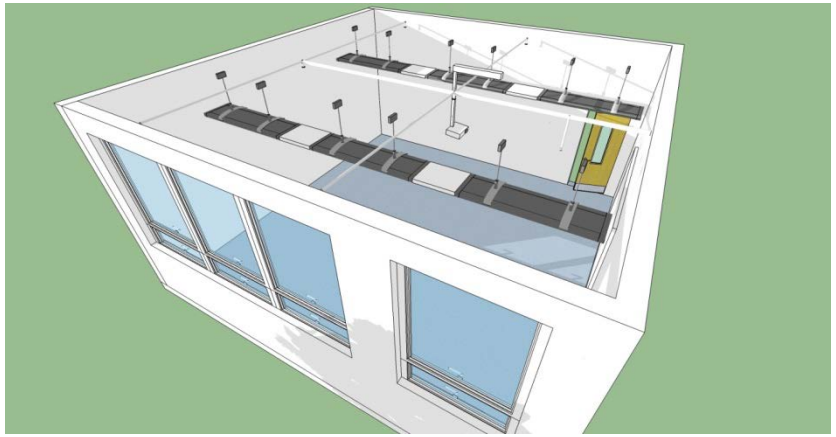
Normal Criteria: 1,500

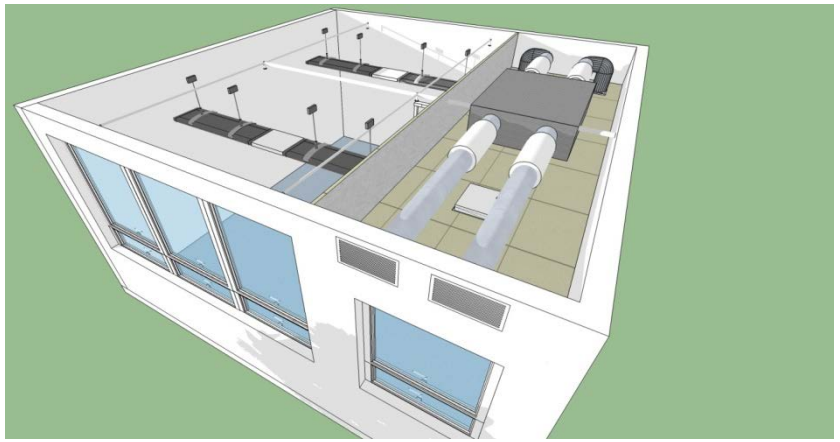
PH schemes: <1,000

Air Quality

Energy Comparison - BRUKL

Natural Ventilation **v** **Mechanical Ventilation**





Energy Consumption by End Use [kWh/m^2]

	Actual	Notional
Heating	18.14	50.39
Cooling	0	0
Auxiliary	16.53	10.19
Lighting	17.04	8.65
Hot water	122.4	114.02
Equipment*	29.65	29.65
TOTAL**	**173.75**	**183.26**

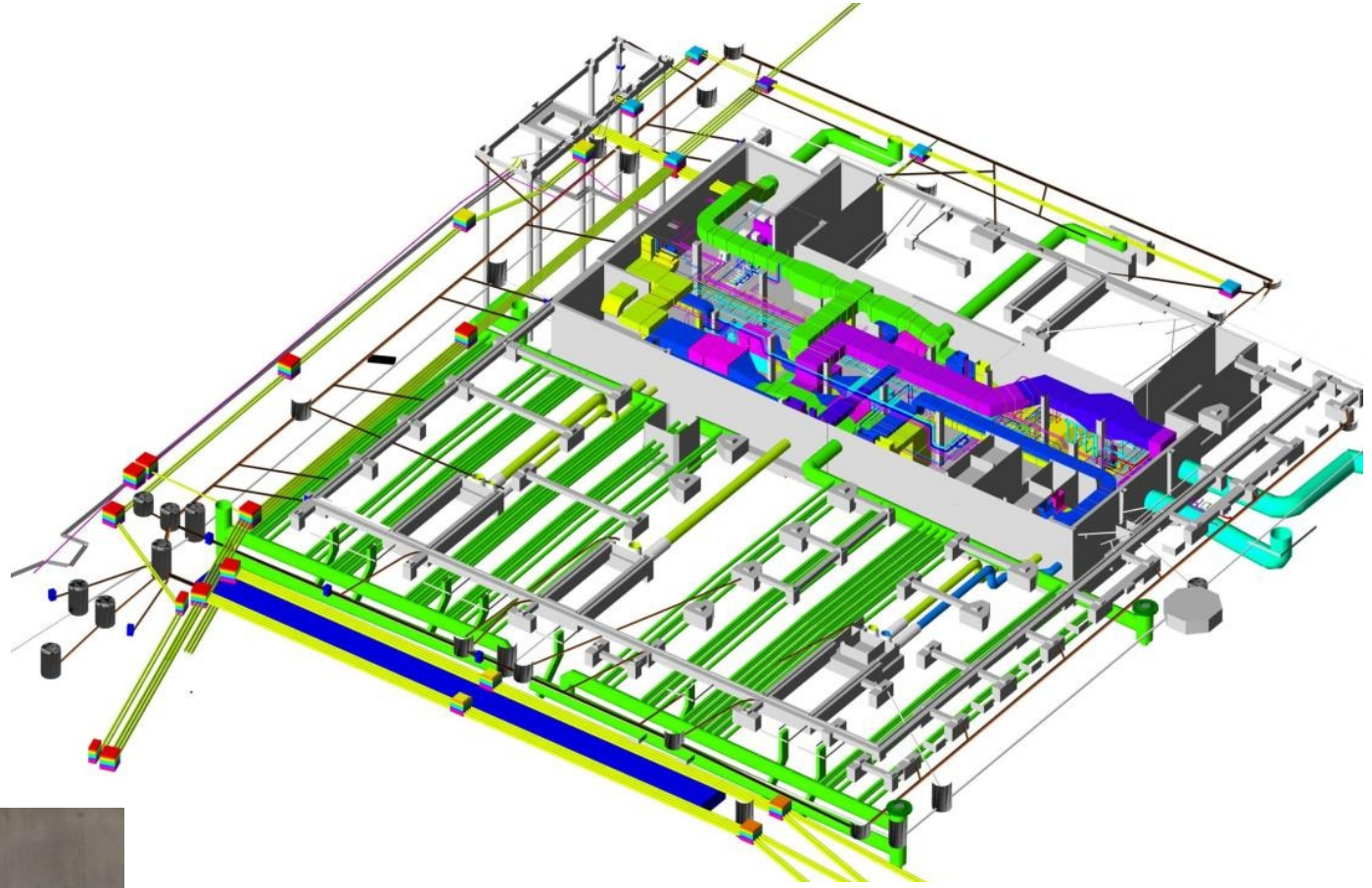
Energy Consumption by End Use [kWh/m^2]

	Actual	Notional
Heating	3.6	49.05
Cooling	0	0
Auxiliary	18.79	12.83
Lighting	17.04	8.65
Hot water	122.36	114.02
Equipment*	29.65	29.65
TOTAL**	**161.55**	**184.56**

Mechanical Ventilation Heat Recovery (MVHR)

Ground to Air Heat Exchanger

- 1.6km of ventilation pipework
- Inner layer lined in silver particles to inhibit microbial growth



Lighting Systems and Controls

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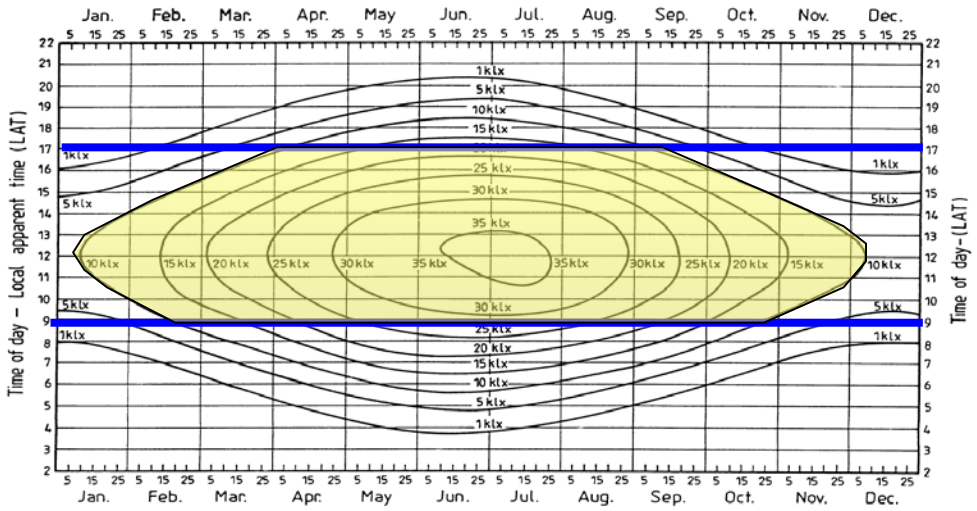
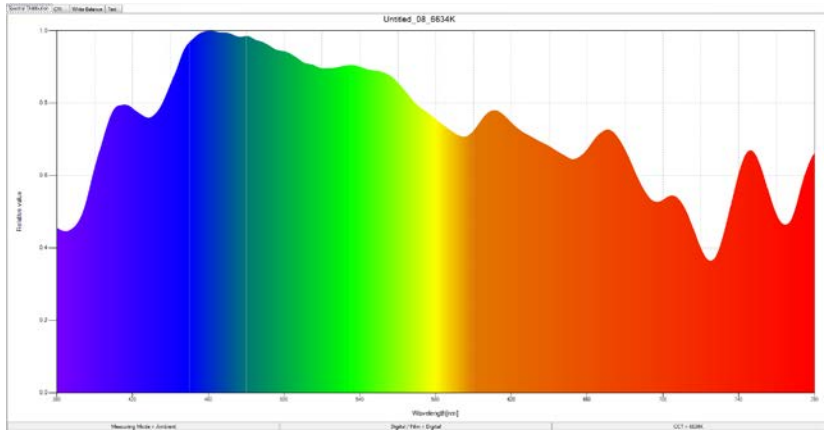
Lighting Systems and Controls

Daylight Availability

- 10,000 Lux for 70% working year
- 300 to 500 Lux
- 1,486 hours of sunshine (34% of daylight)
- 4% DF = 400 Lux from 10,000 Lux external

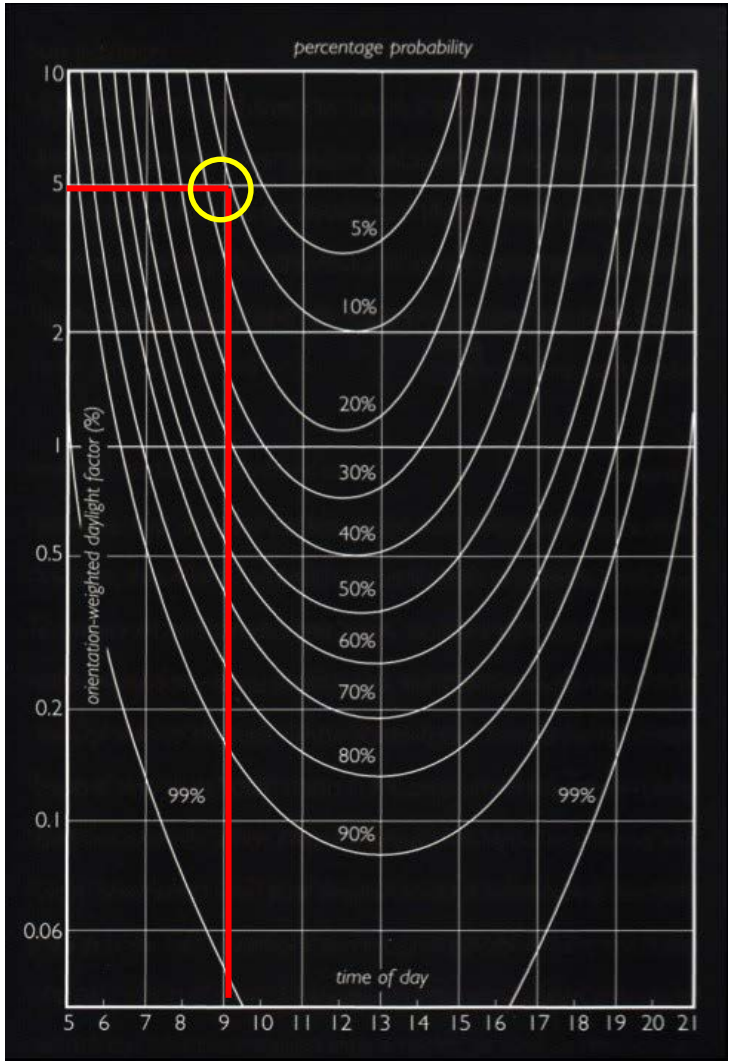




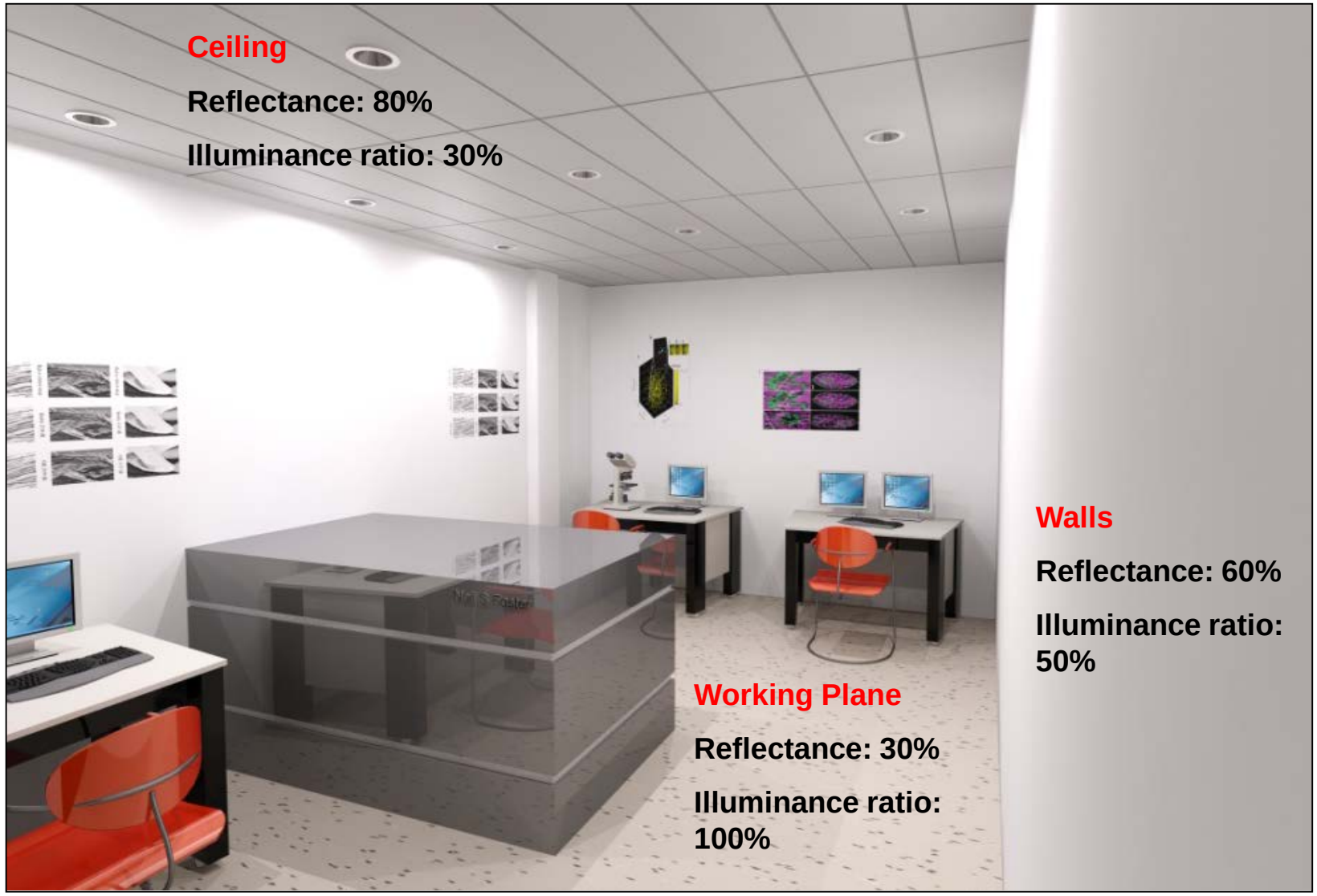
Lighting Systems and Controls

Probability of Turning on Lights at 9am:

- 1% DF : 40% likely
- 3% DF : 25% likely
- 5% DF : 10% likely



Lighting - Reflectances



Soft Landings

Soft landings is a 5 stage process starting off at the first stage of project idea through to final stages of users moving into the building, helping with energy usage and correct set up for university and users.

Early User Engagement

Current Working Environment:

Warm in Summer
Cold in Winter

Early User Engagement

Current Working Environment – 2kW Heaters under Desk

Soft Landings – The Performance Gap

The Dream

Energy

Occupant Comfort

Satisfaction

The Reality

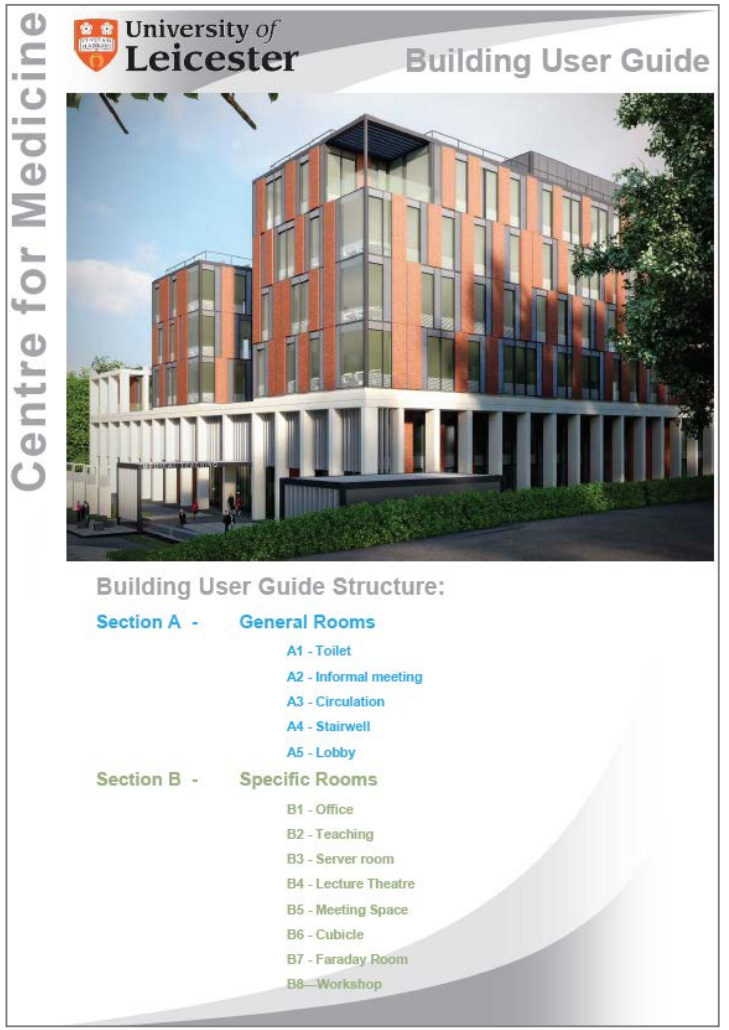
Soft Landings

3 Year Soft Landings Programme

User Feedback and Engagement Workshops

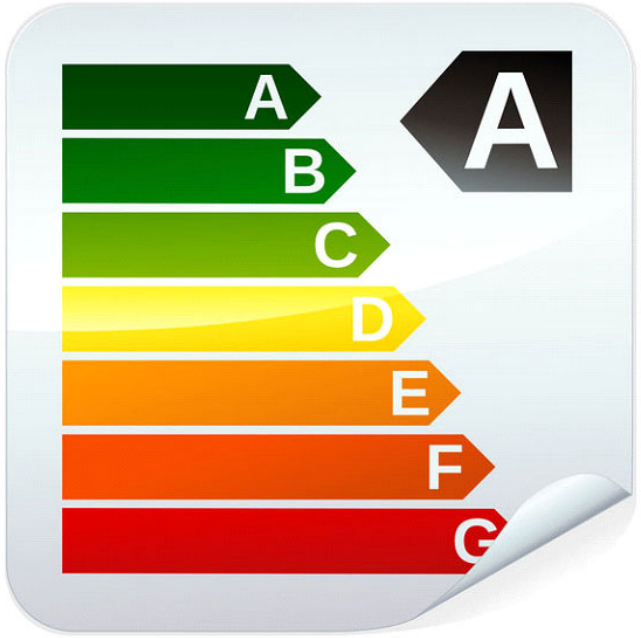
Building User Guide

BSRIA



Reality check

One year post-occupancy:



> If degree certificates were awarded for outstanding building performance, then the University of Leicester's Centre for Medicine would have graduated with first class honours.

– ***Andy Pearson, ICIBSE Journal***

- **East Midlands Property Awards: Sustainable Project of the Year 2016** (Winner)
- **Procon Leicestershire Awards: Sustainable Development of the Year Award 2016** (Winner)
- **ENDS Environmental Impact Awards: Project of the Year 2016 in the Built Environment** (Winner)
- **S-Lab Awards: Sustainable Science Building Award 2017** (Winner)
- **Global Goods Awards: Building Sustainability Project of the Year 2017** (Winner)

ENVIRONMENTAL SUSTAINABILITY at OXFORD

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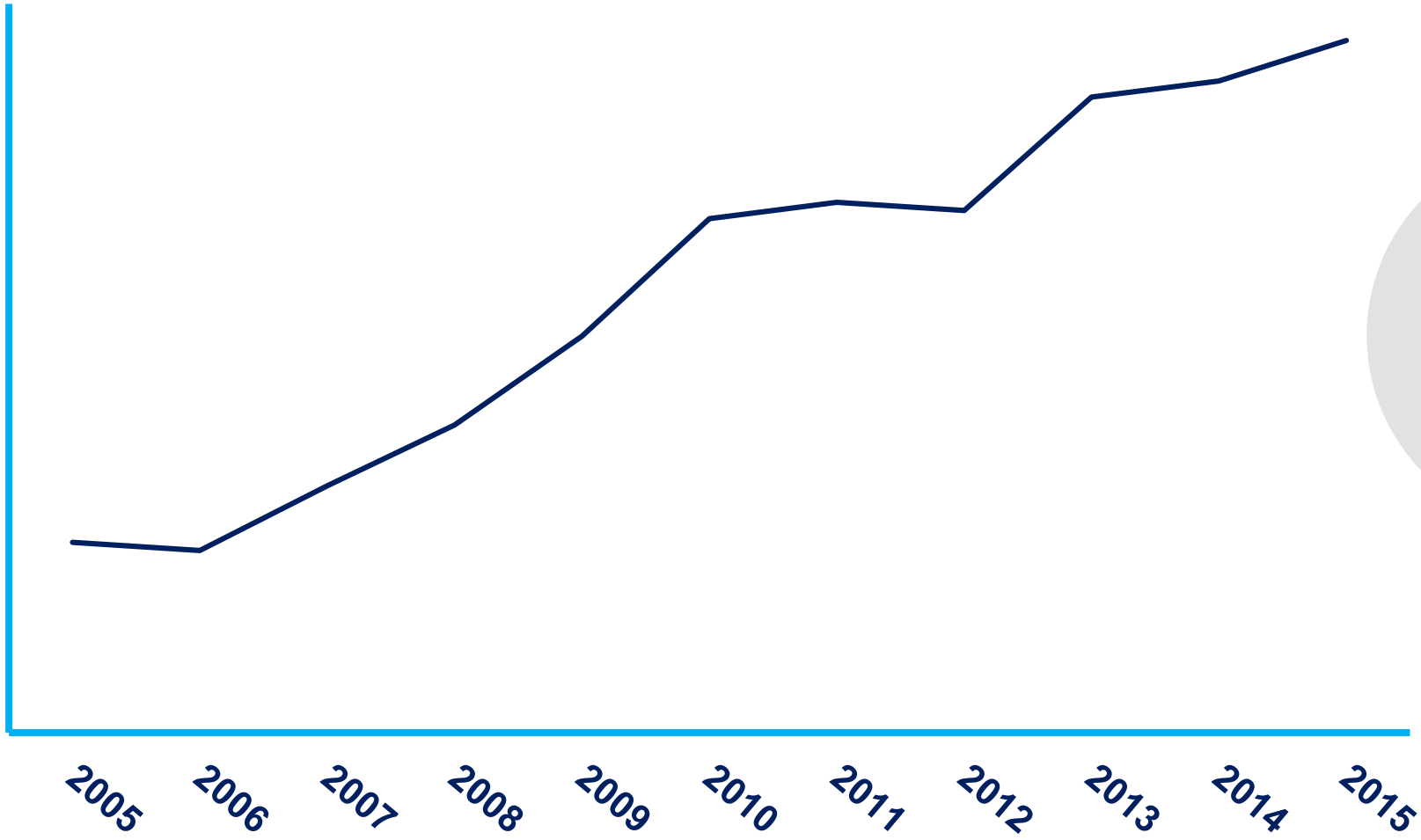
BETTER BUILDINGS WITH PASSIVHAUS

Tom Heel – Deputy Head of Environmental Sustainability, University of Oxford

Chris Swinburn – Principal, CBG Consultants

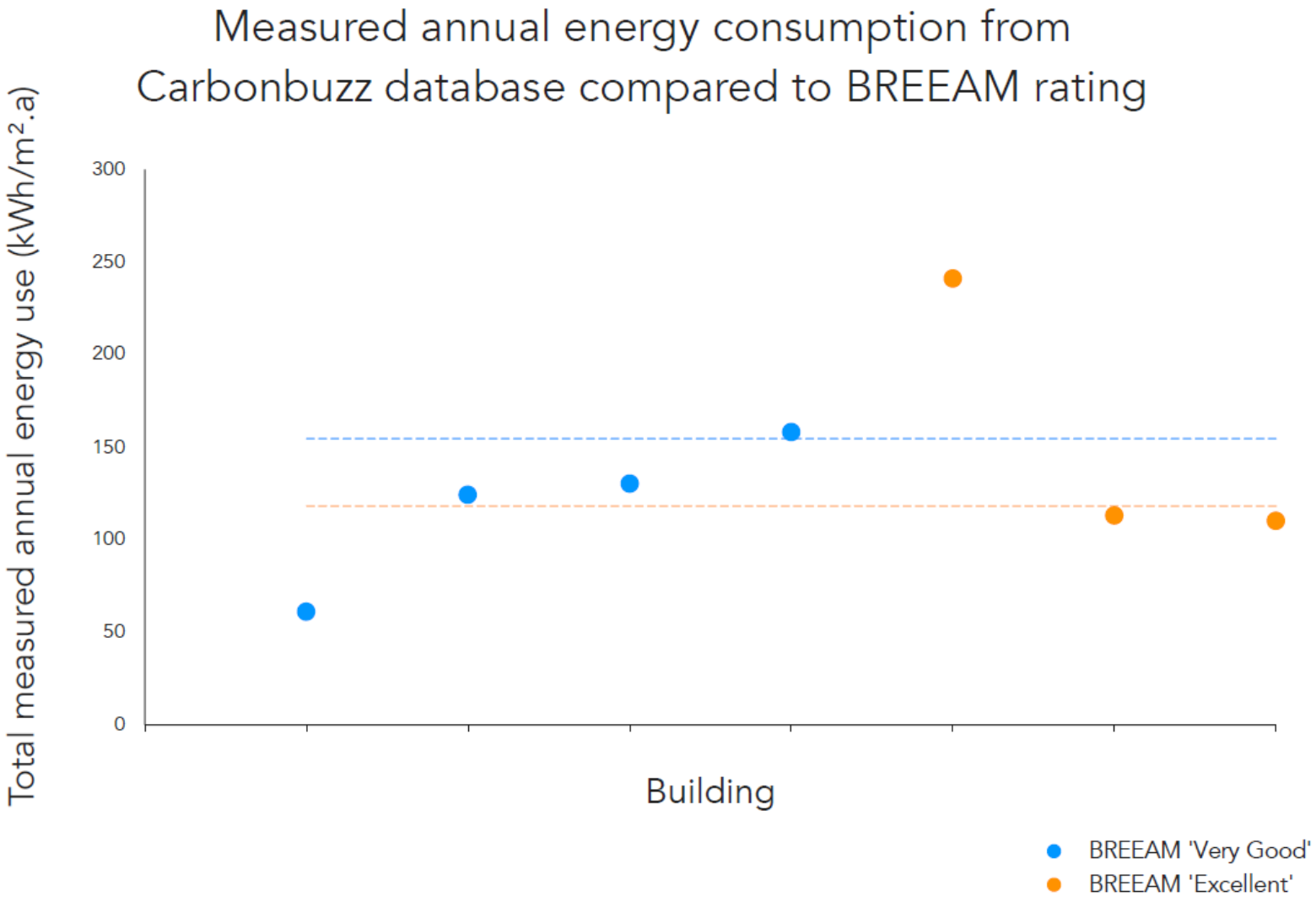
CONTEXT



-33%

DELIVERING TARGETS

DELIVERING TARGETS



"What got us here won't get us there"

Marshall Goldsmith

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EVIDENCE BASED

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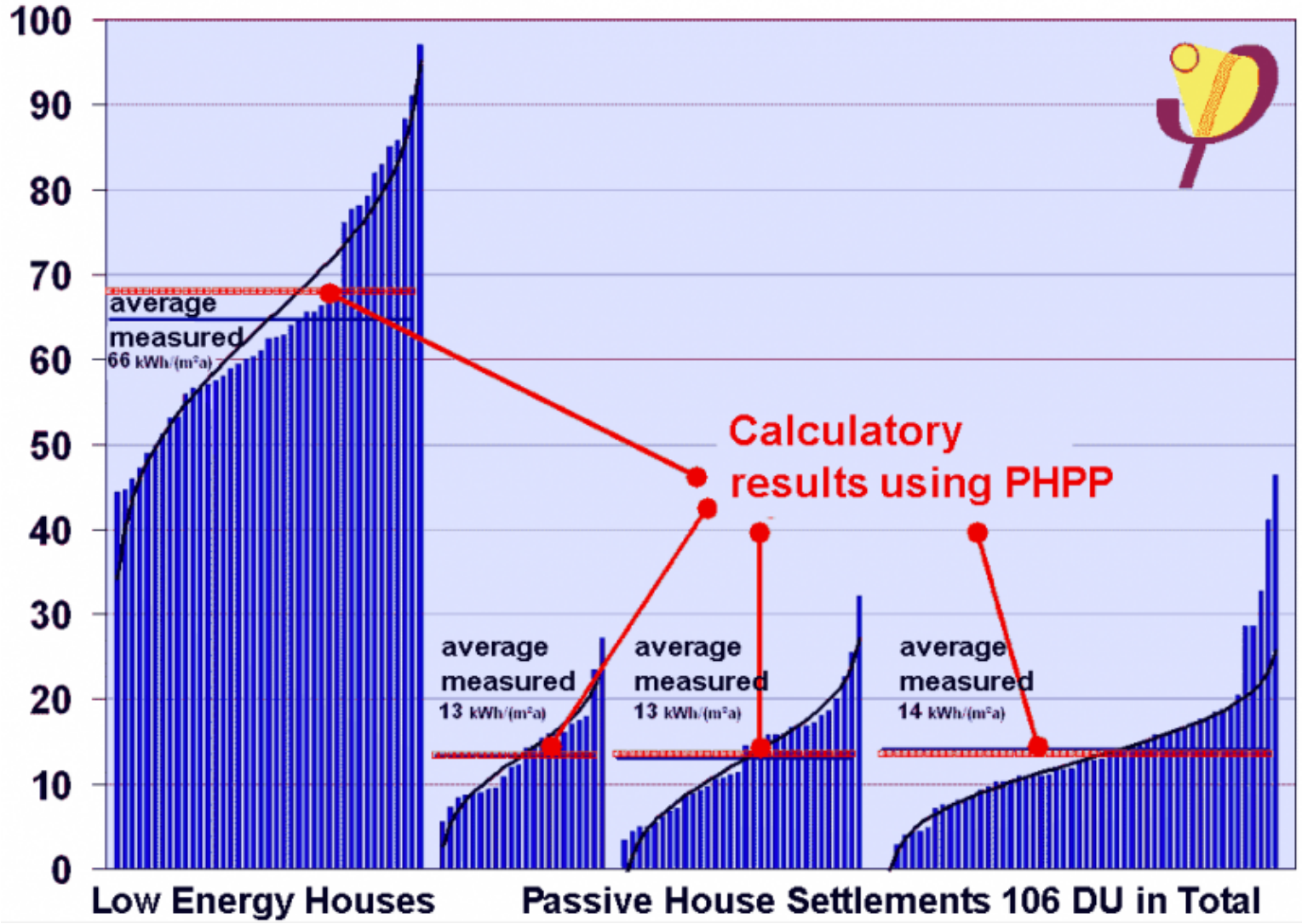
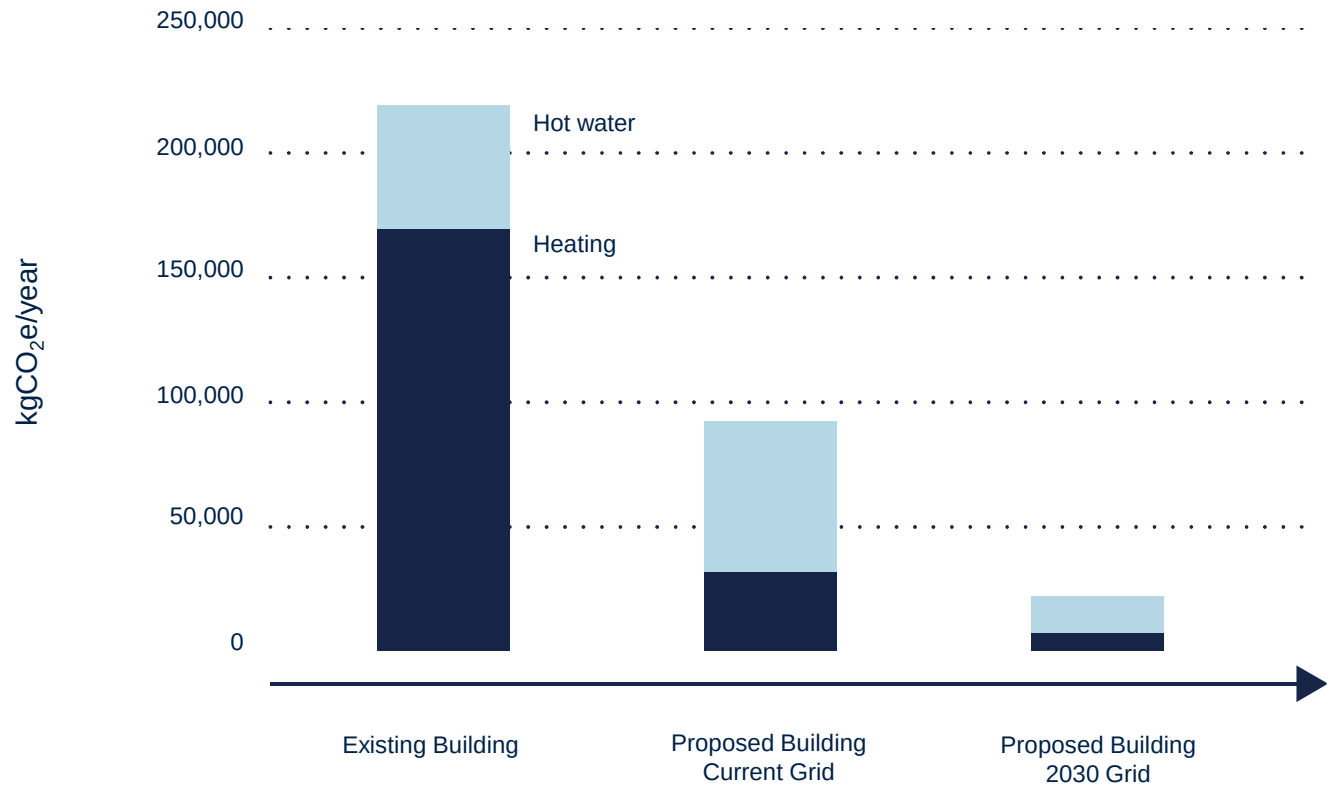
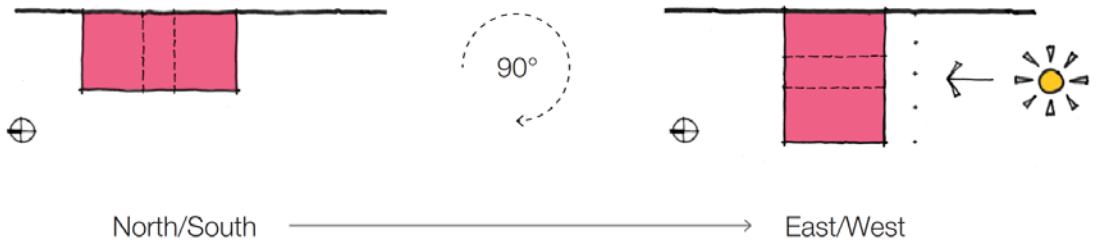


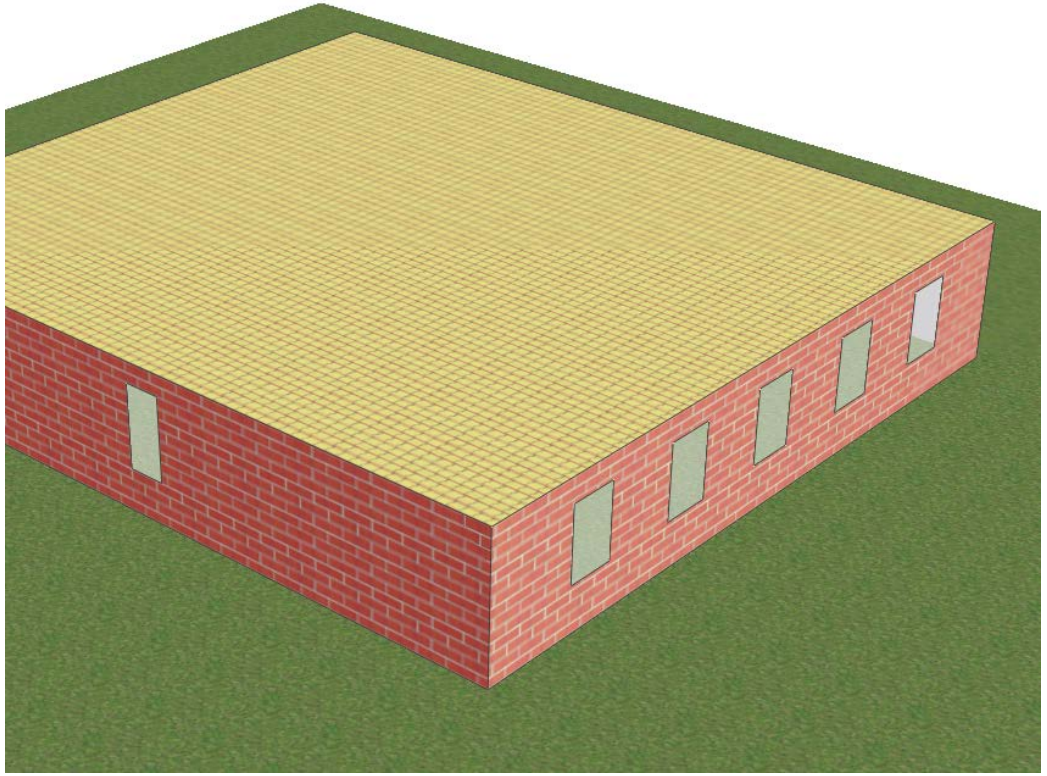
POTENTIAL IMPACT



EARLY DESIGN STEERS



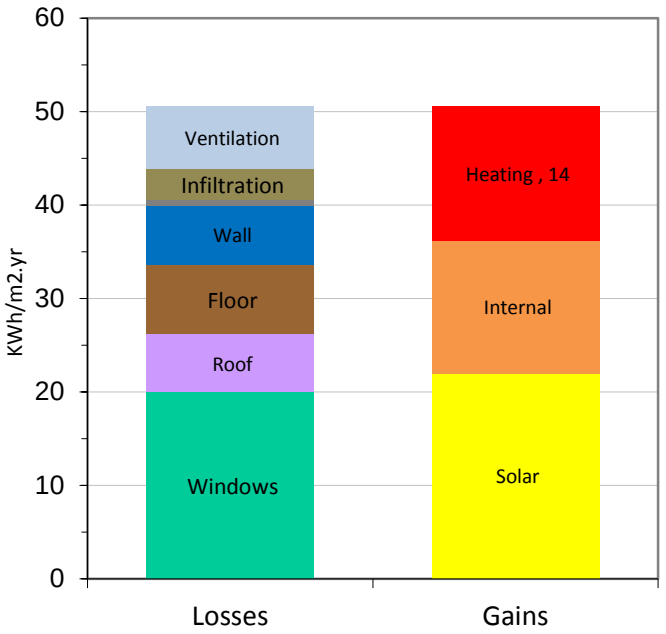
BREAKING RULES

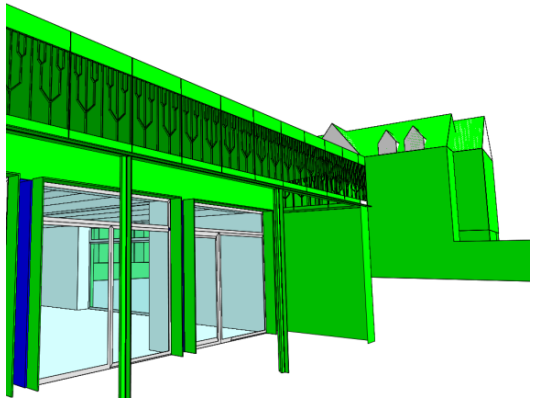


Optimised for Energy/Overheating

Architectural design

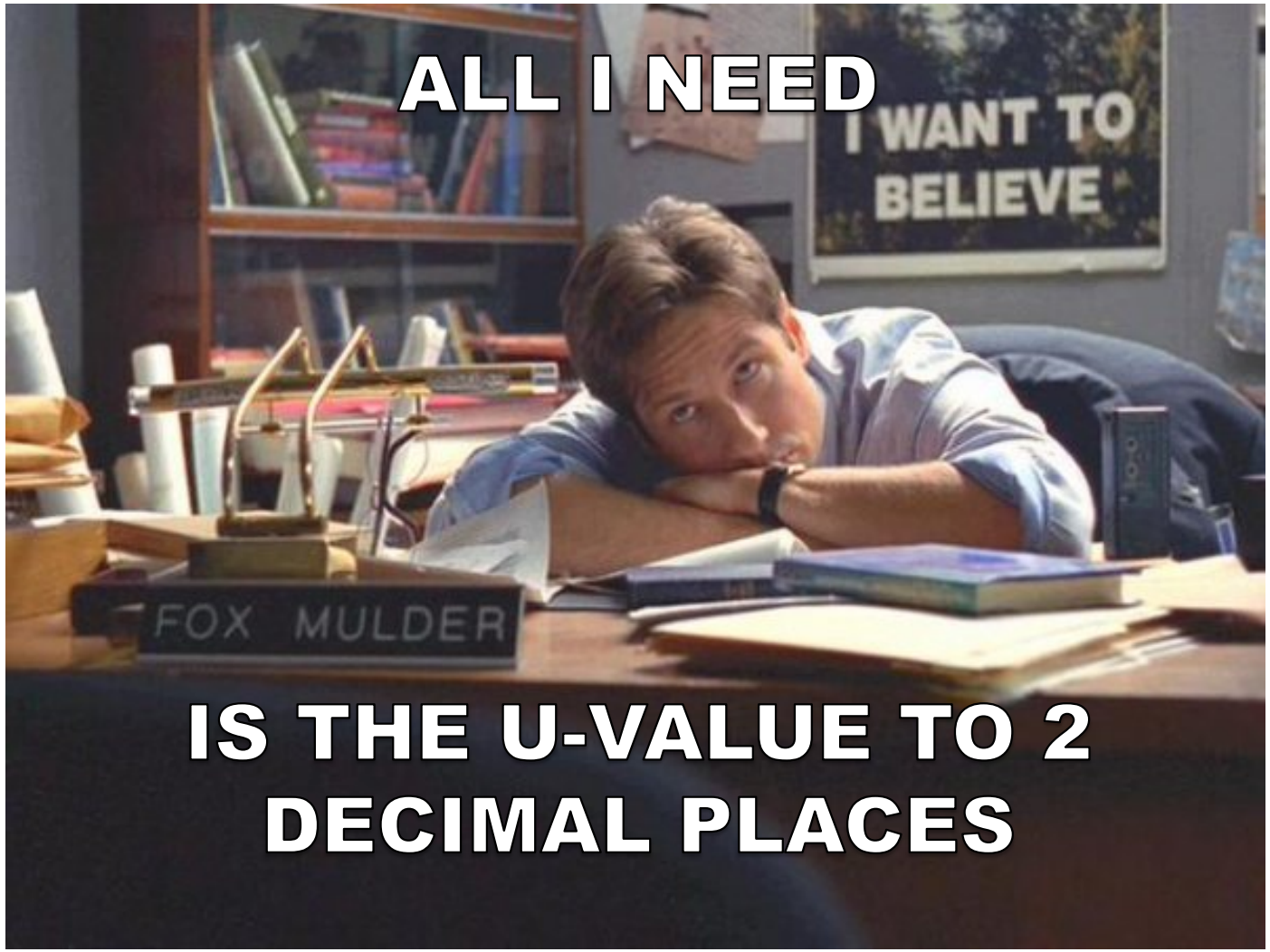
BREAKING RULES





- Key to building energy balance & very sensitive.
- Winter heat gains vs summer overheating.
- Optimised Shading design
- Careful modelling required (and counting pixels!)

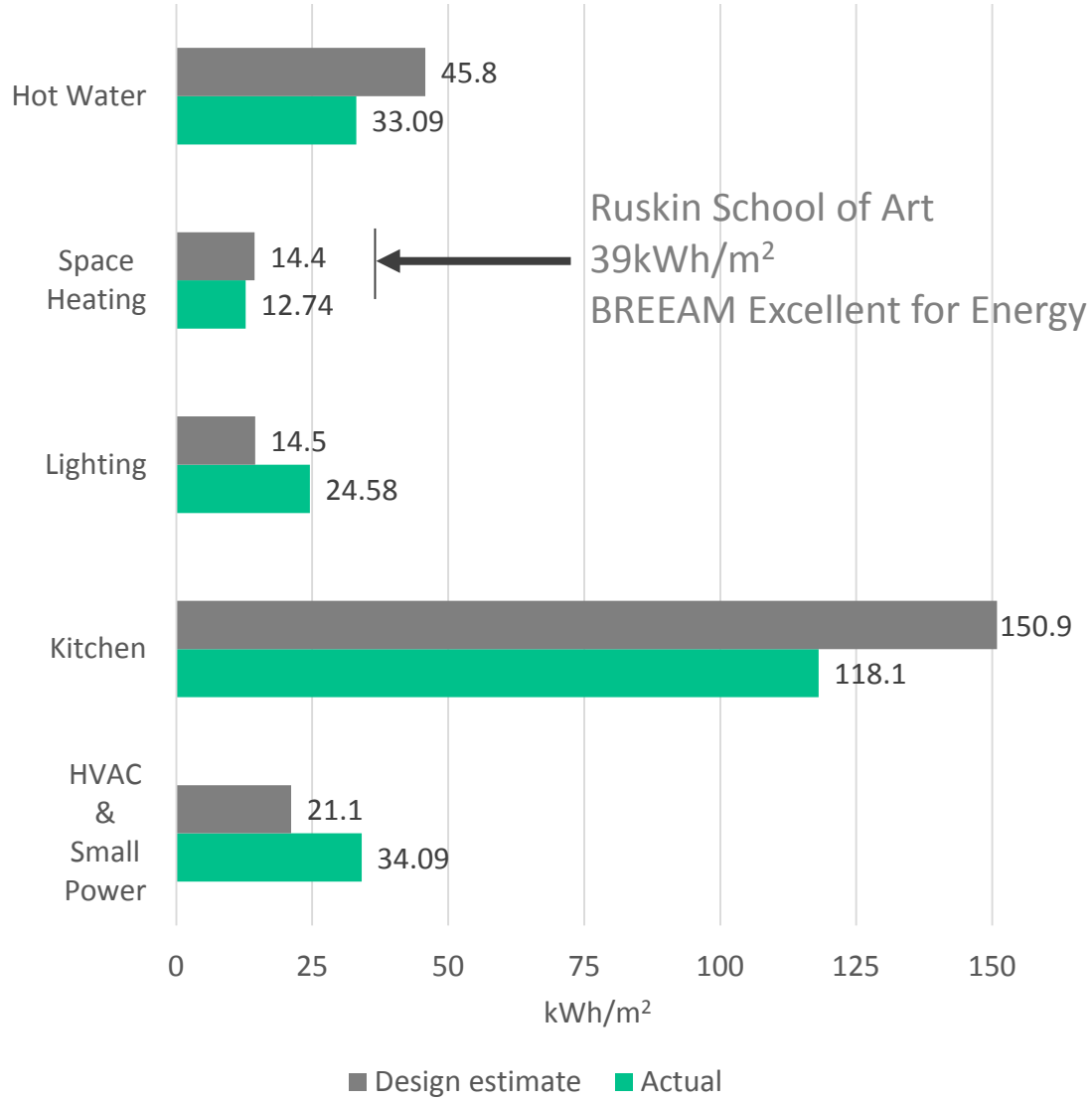
CHASING DETAIL



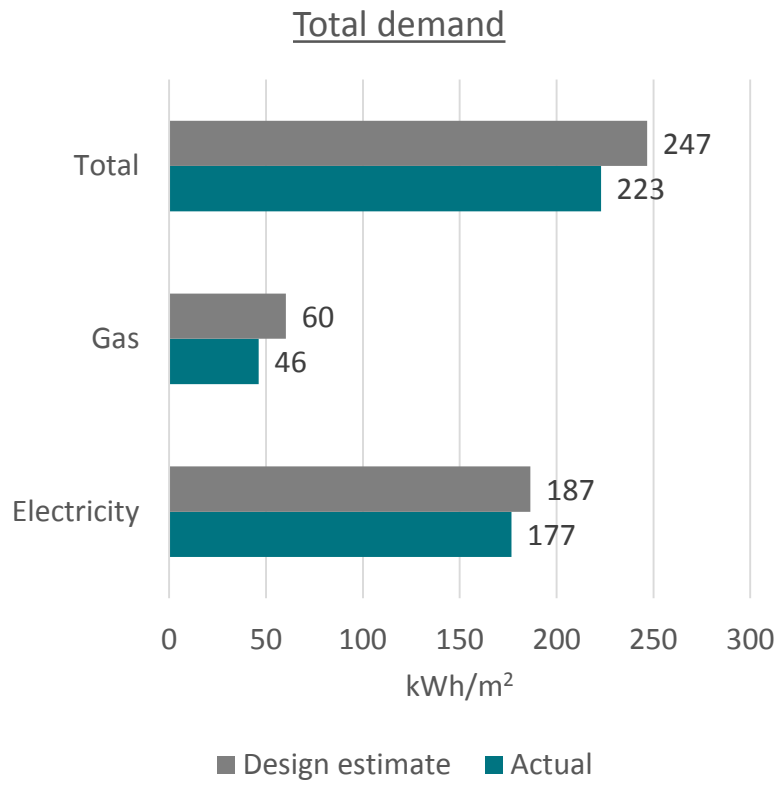
SITE DETAILING

KEEP IT SIMPLE

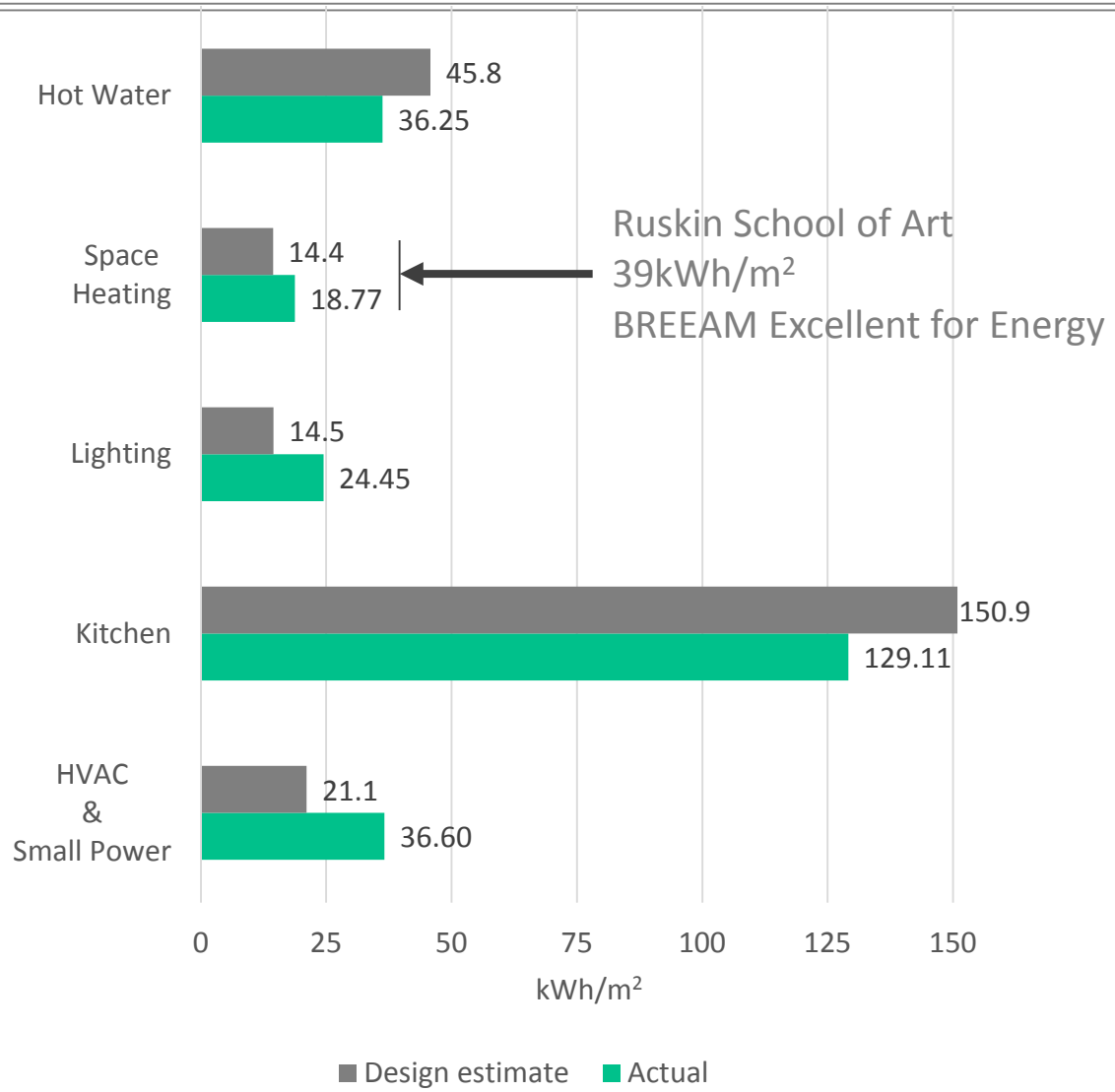
PERFORMANCE

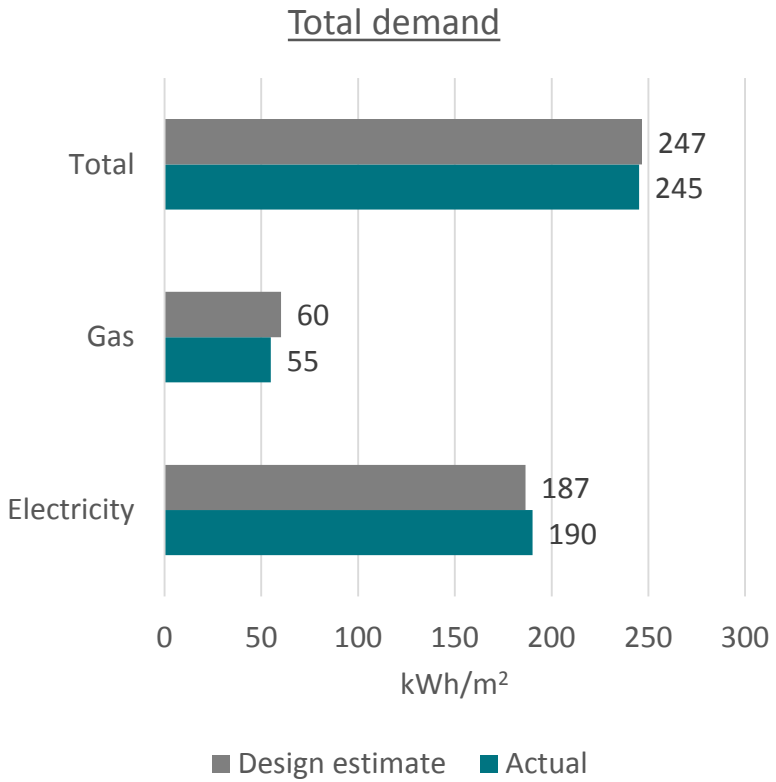


Ruskin School of Art
39kWh/m²
BREEAM Excellent for Energy

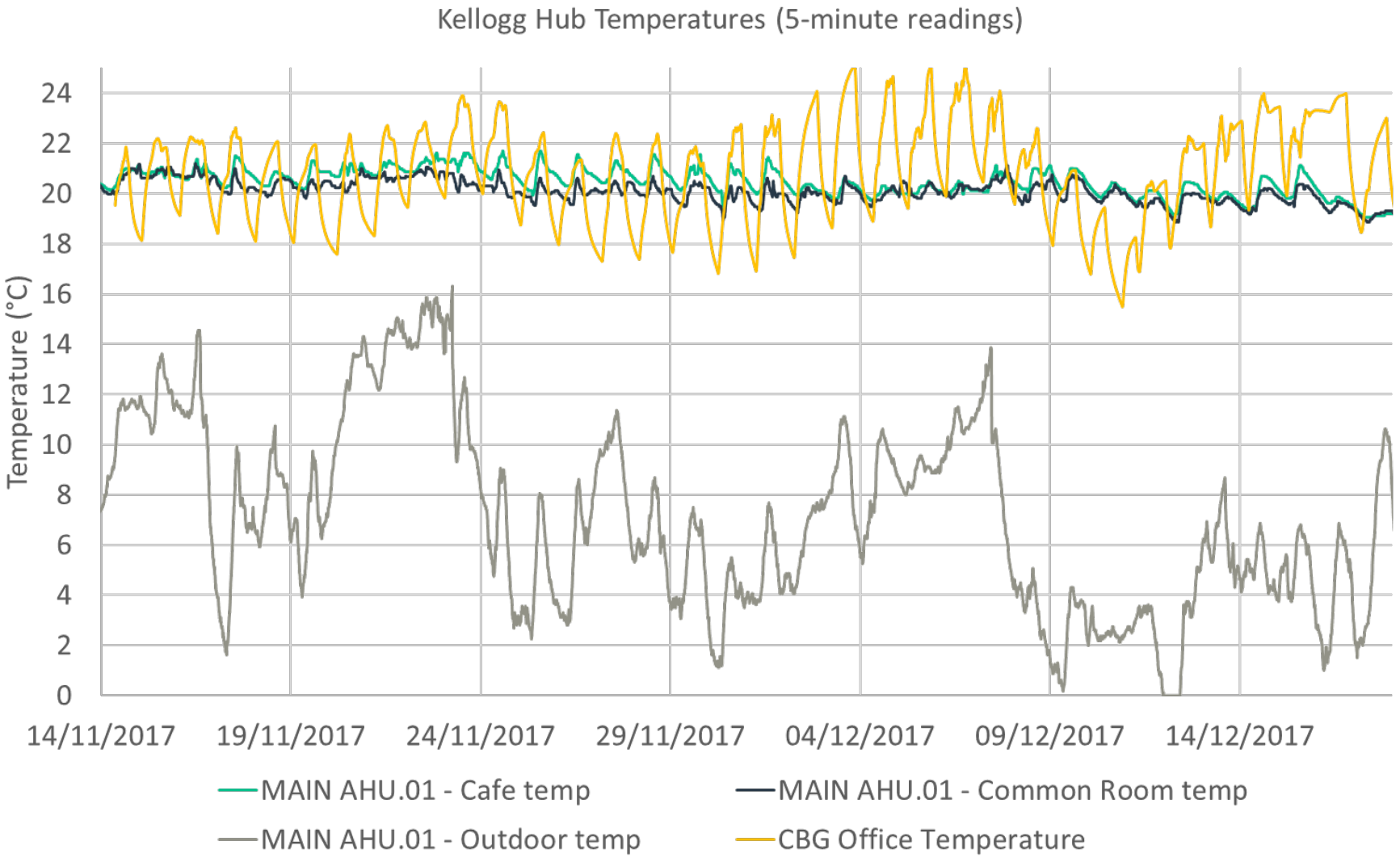


PERFORMANCE

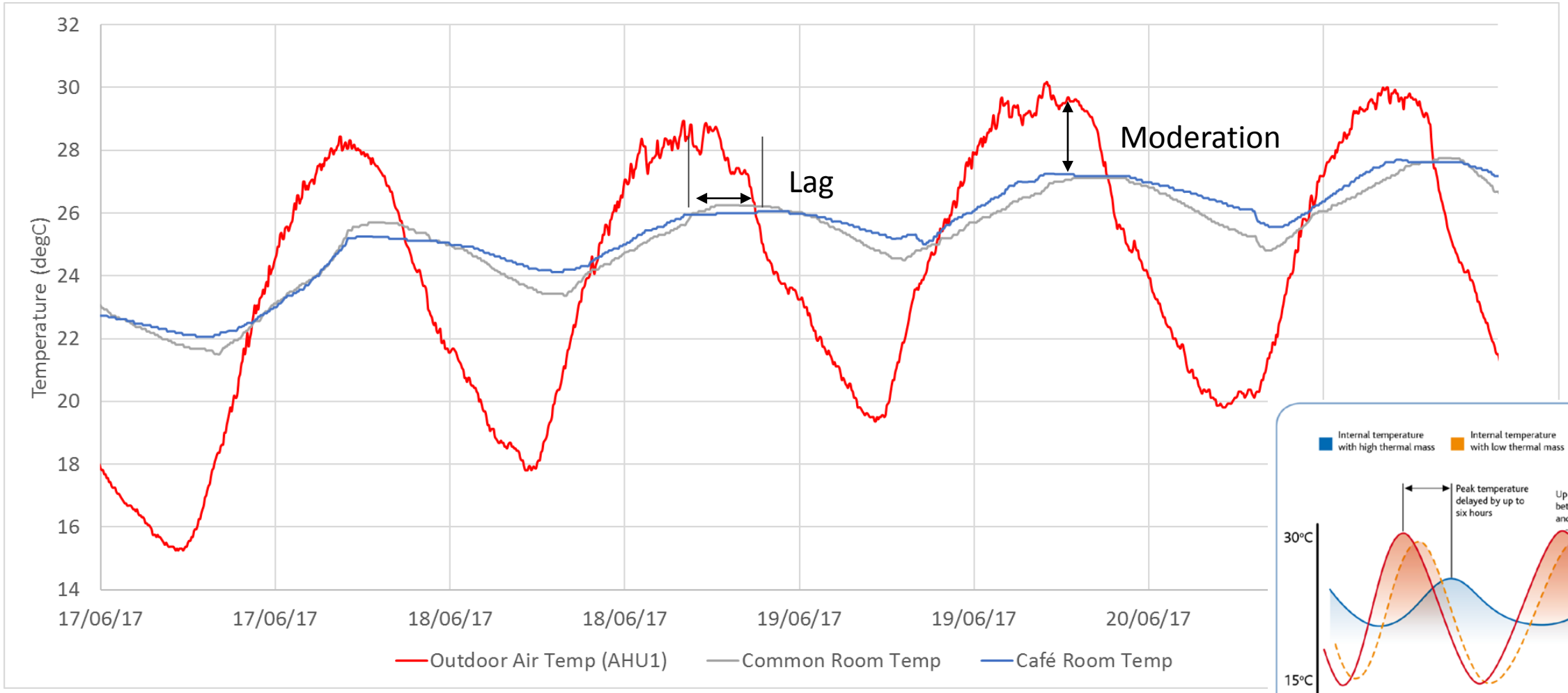




WINTER COMFORT



OVERHEATING



Your Q&A and takeaways from the session

Takeaways from the session:

- 'Physics works!' – spend time on modelling your buildings
- Detailing is critical
- Give people what they need – not what they ask for
- You're wasting your time using BREEAM for CO_2 reduction

The SDG Accord

The University and College Sector's Collective Response to the Global Goals

End extreme poverty, inequality and climate change

www.sdgaccord.org

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