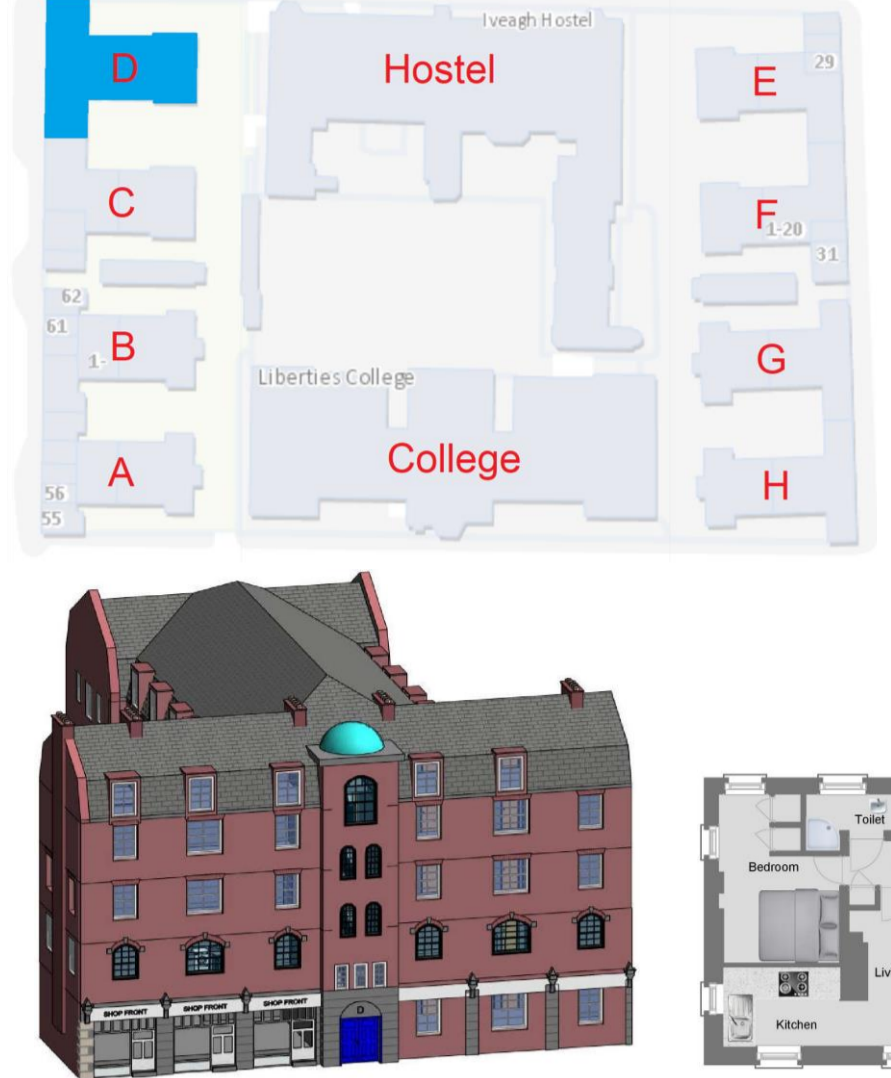


### Introduction

The aim of this study is to evaluate energy efficiency design strategies & targets for existing MUR buildings that can practically be achieved without compromising the integrity of the building fabric. The scope of the study involved performing energy analysis on the Iveagh Trust Bull Alley Estate.



### Case Study Overview

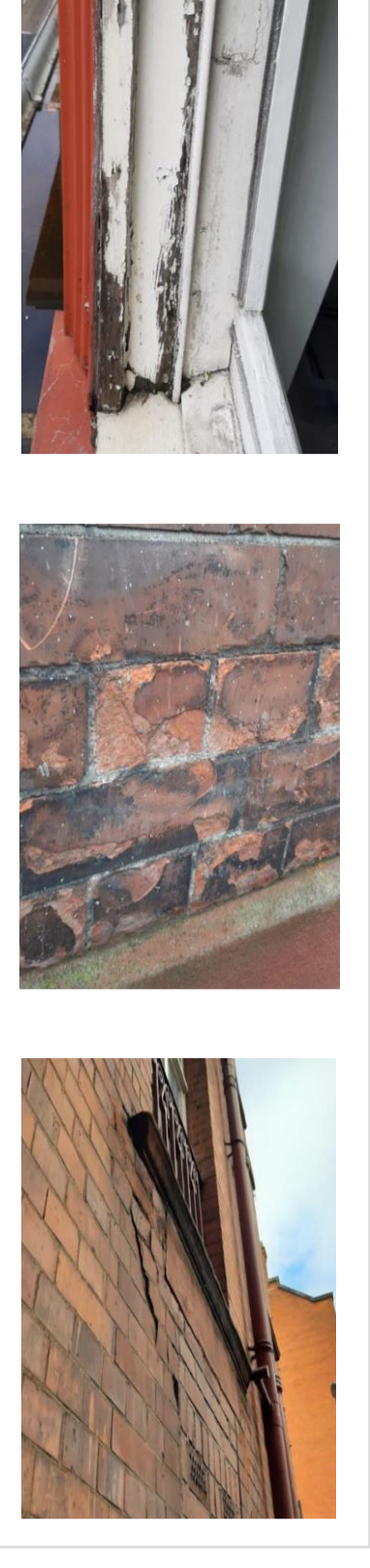
- Bull Alley Estate, Dublin 8 - Constructed late 1800's / early 1900's
- 8 apartment blocks, hostel, college - 242 flats in total
- 5 Storey, brick built, mansard roof - Registered protected structure
- Study focuses on Block D

### Energy Performance

BER	Front North	Front South	Mid North	Mid South	Rear North	Rear South
4th	771	684	451	470	901	865
3rd	516	378	312	275	463	434
2nd	523	340	320	285	463	467
1st	396	341	327	309	463	406
Gnd	597	513	439	414	656	640

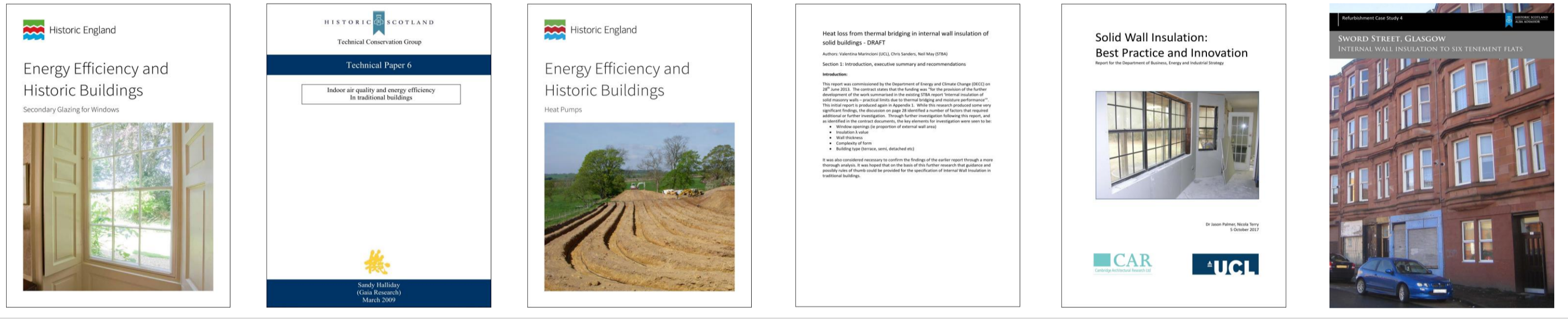
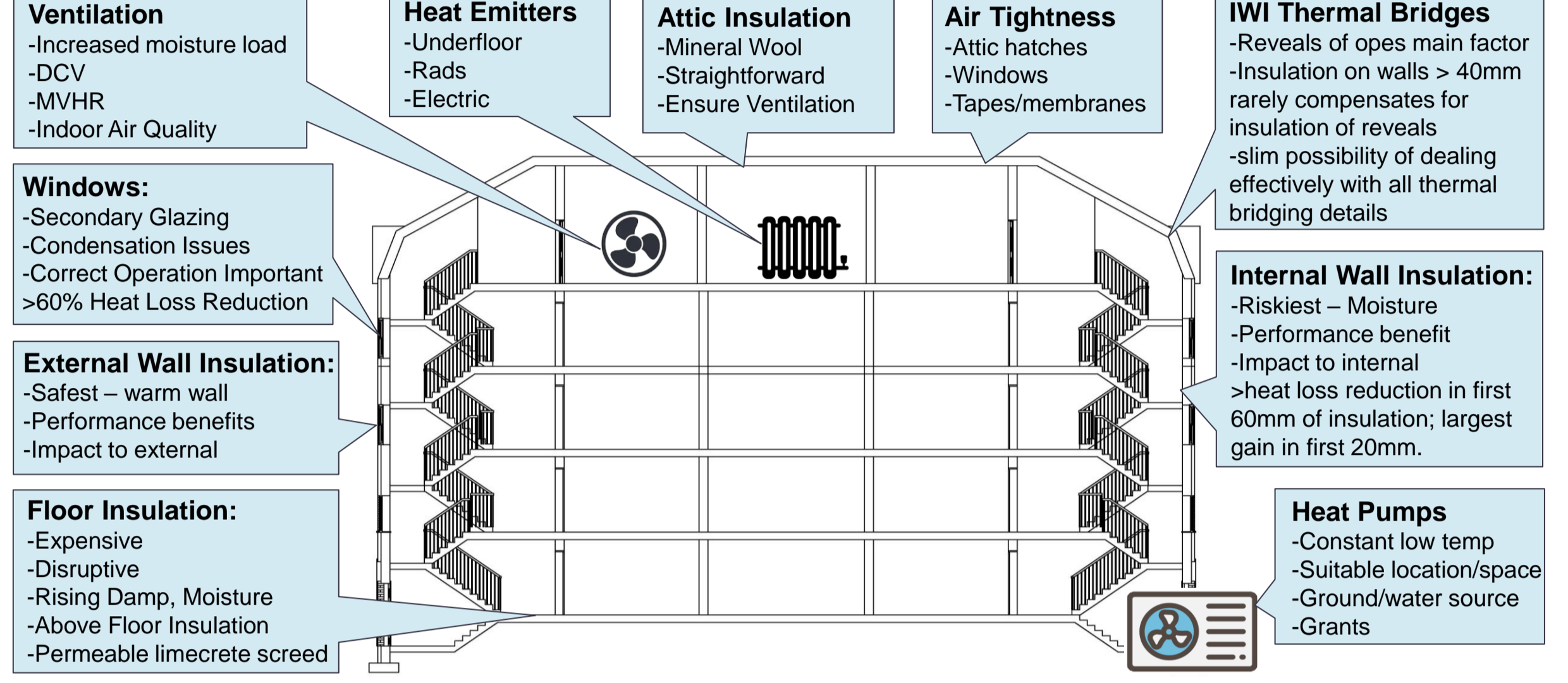
### Condition Overview

- Good condition generally
- Structure/roof - appear sound
- Walls - Spalling, staining & cracking
- Windows - poor condition generally
- Evidence of condensation staining
- Inadequate ventilation



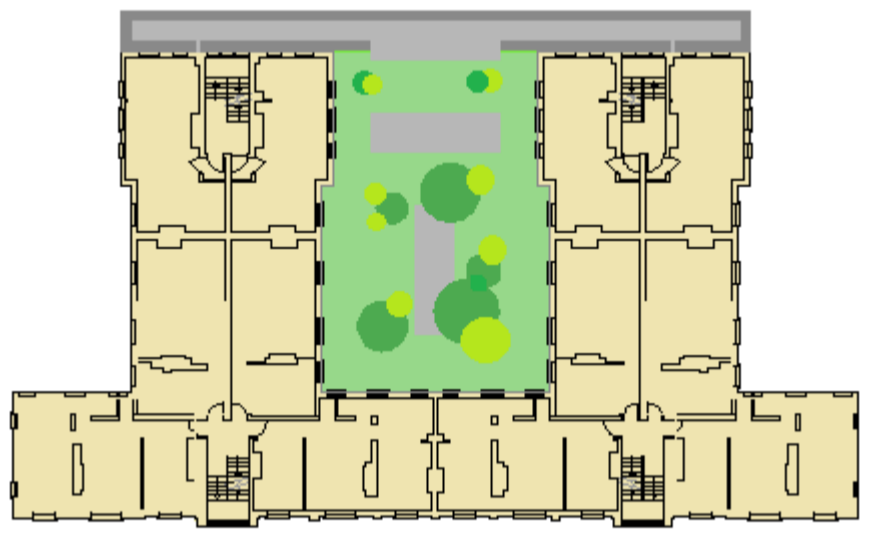
### Research Study

**Findings:**  
- Broadly, two IWI approaches used to avoid moisture accumulation: vapour tight systems & capillary active/vapour open systems  
- Addition of IWI alters ability to moderate temp through a building's thermal mass  
- SWI strategies must adopt adequate dwelling ventilation  
- SWI preference for hygroscopic natural insulation materials  
- IWI will result in some unavoidable thermal bridging  
- PIR & PUR result in unacceptably moisture levels for IWI  
- Tenant behaviour/ understanding has big impact.



### Strategic Study

- Main Issues : Site Visit & Energy Study**
- Energy use / carbon emissions
  - Protected structure, directly on public footpath
  - Poor natural daylighting
  - Accessibility
  - Limited storage in flats
  - Lack of external private spaces, balconies

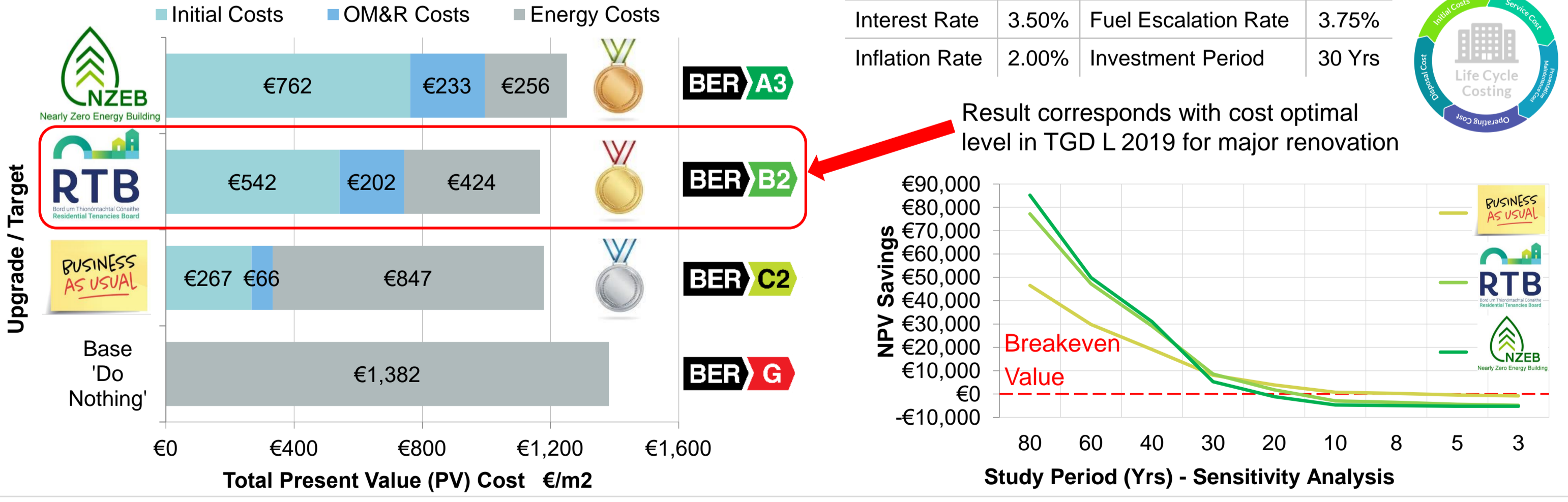


- Main Problems : Client Briefing**
- Energy efficiency improvement
  - Indoor air quality - health issues
  - Universal approach & systems
  - Simple maintenance regime
  - BER increase in 7 grades to increase rent
  - Limited size of flats - 1-2 beds
  - Funding/payback of retrofit measures

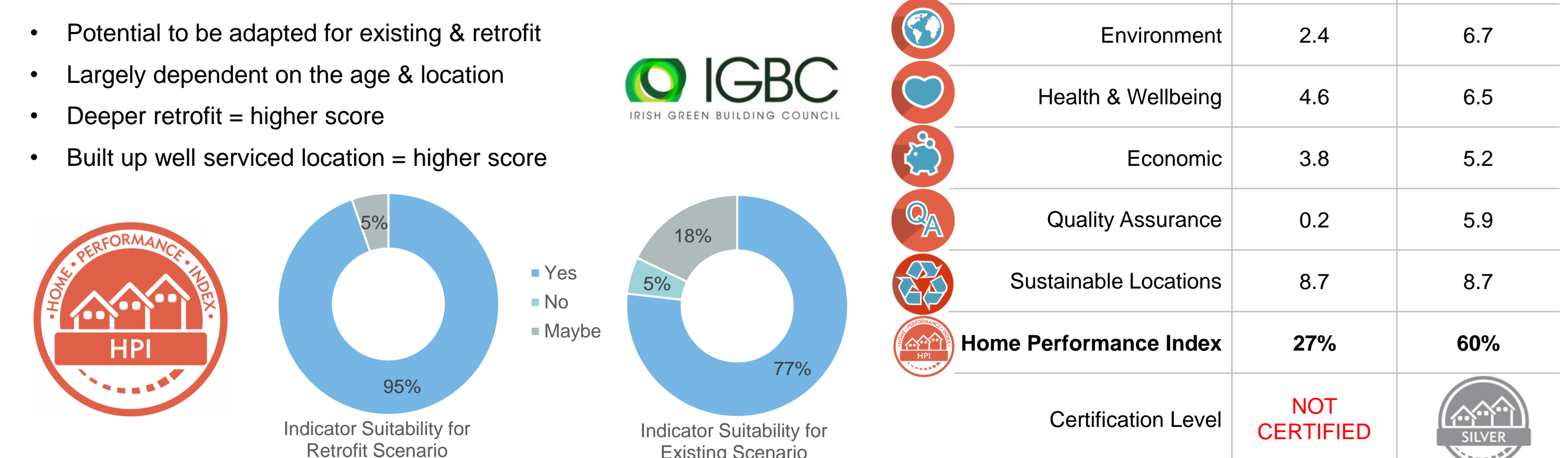
System Strategies:	Capital Cost:	Maintenance:	Energy Use:	Fuel Cost:	Space:	IAQ:	Disruption:	Reversible:	Fuel Price:
Gas Boiler									
Heat Pump									
Electrical Panel Heaters									
Underfloor									
DCV									
Natural Vent									
LED Lighting									
Heating Controls									
Centralised System									



### Life Cycle Cost Analysis

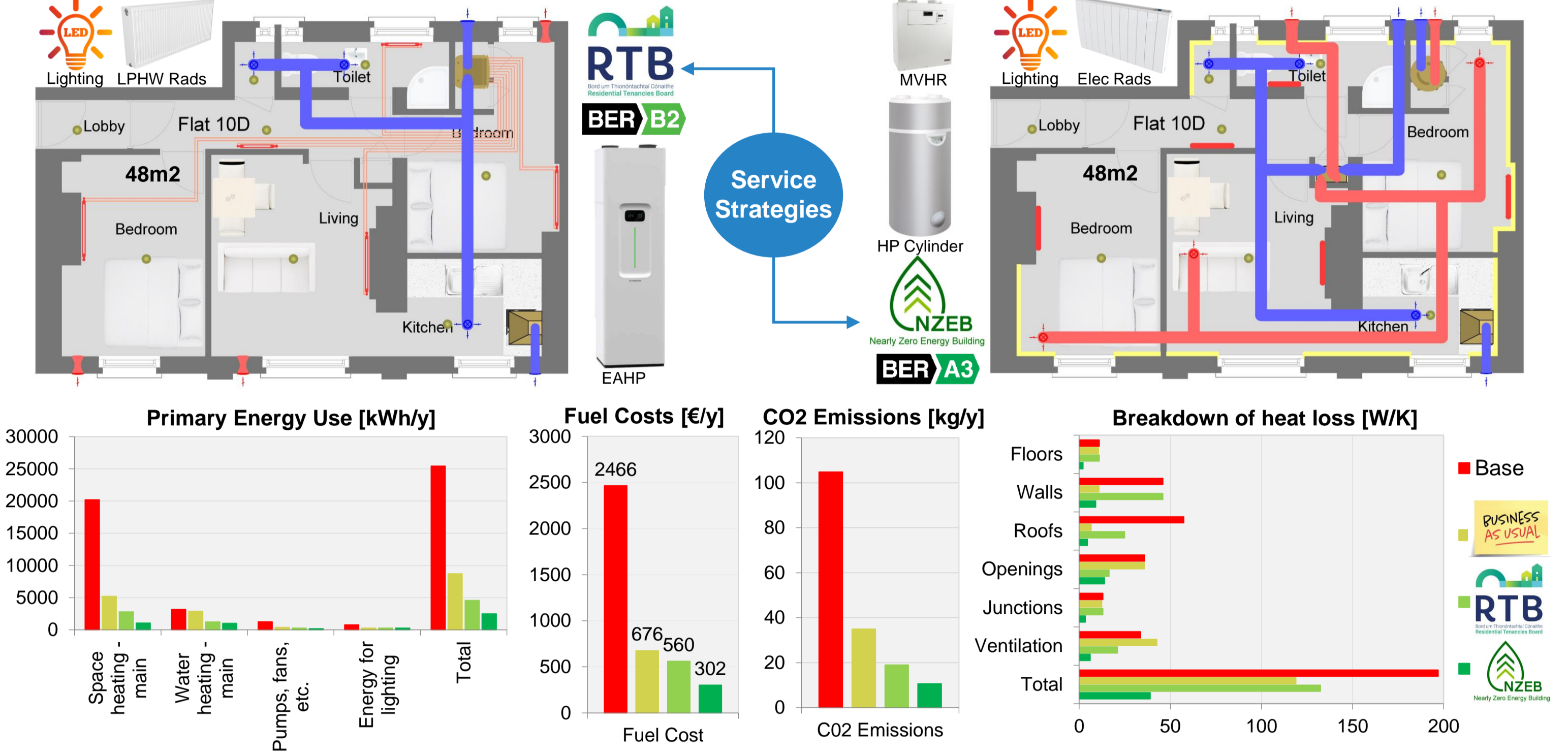


### Home Performance Index

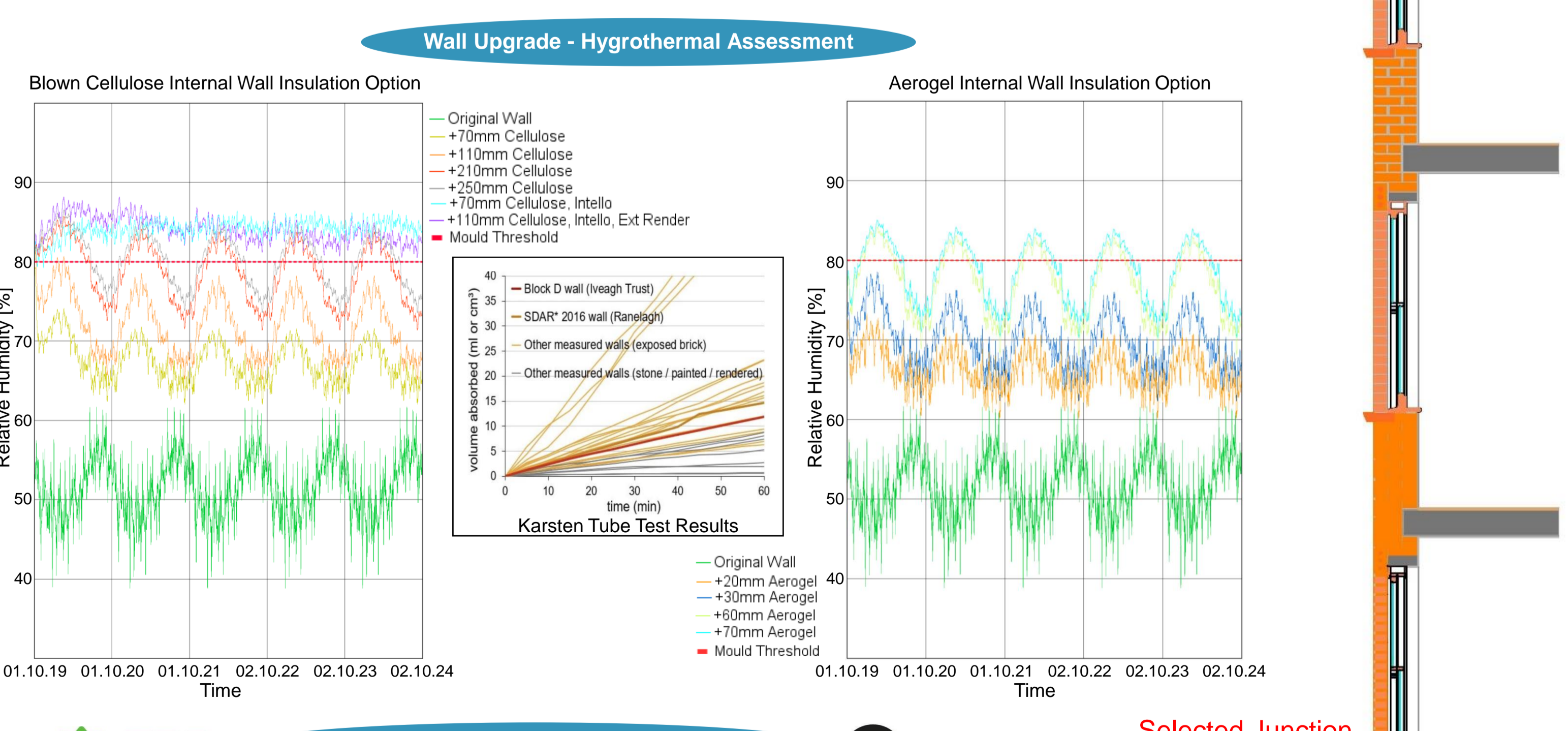
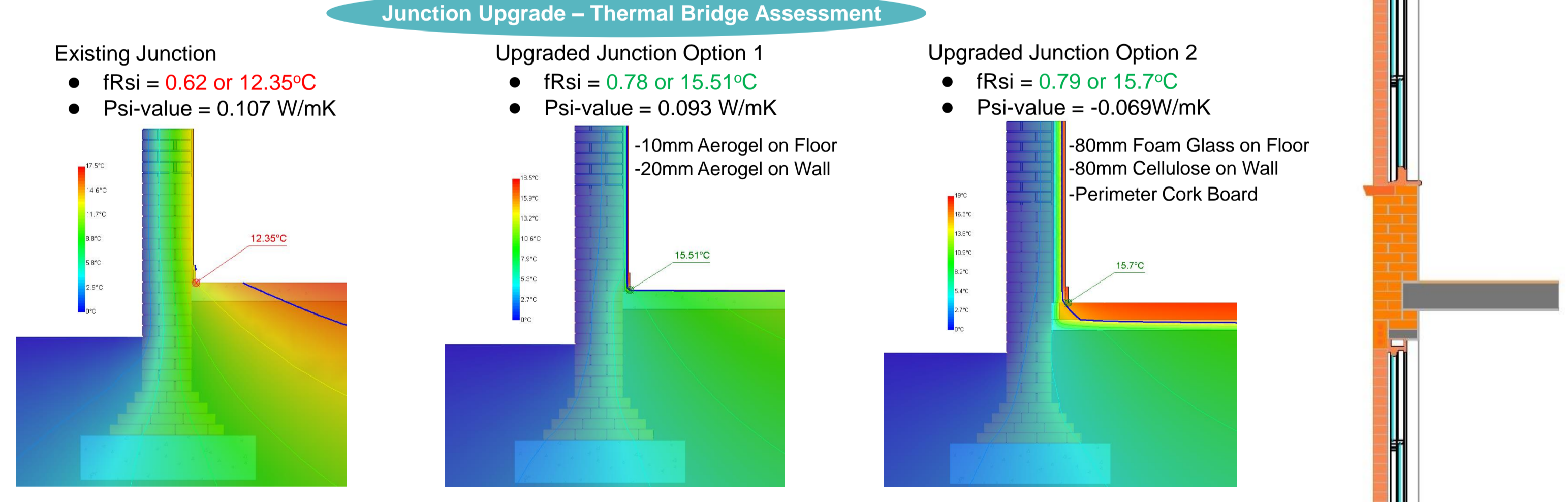
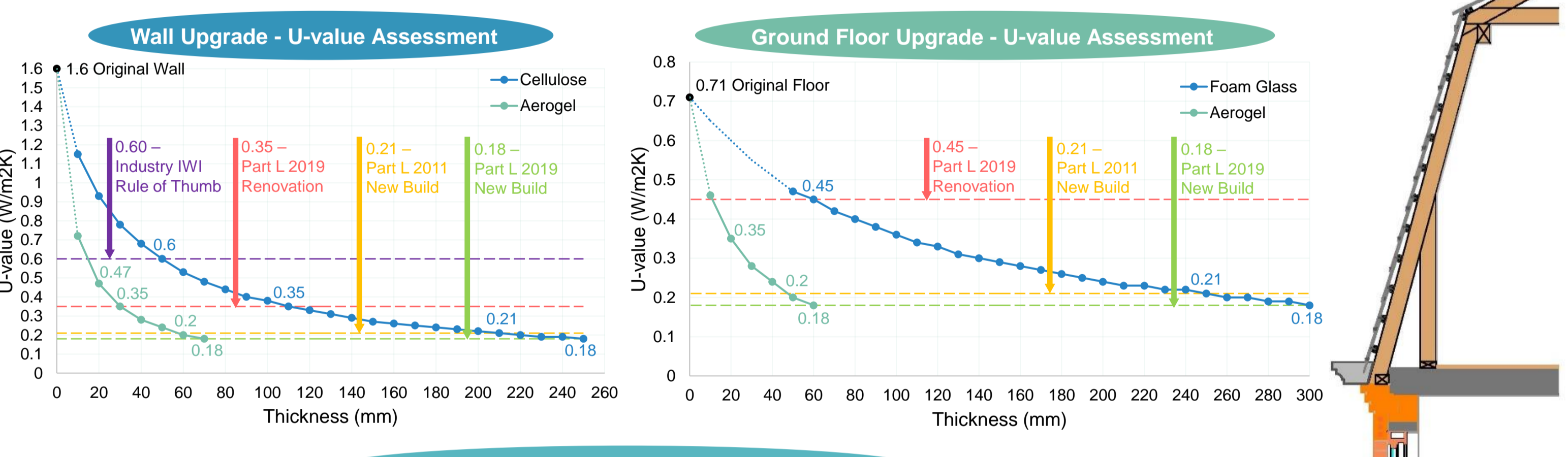


### DEAP Unit Study

Specification	Base	BUSINESS AS USUAL	RTB	NZEB
<b>Average Flat :</b>				
<b>Fabric:</b>				
Floor	Solid Concrete (Uninsulated) 0.7W/m <sup>2</sup> K	Solid Concrete (Uninsulated) 0.7W/m <sup>2</sup> K	Solid Concrete (Uninsulated) 0.7W/m <sup>2</sup> K	Replace Floor incl Insulation 0.14W/m <sup>2</sup> K
External Walls	Brick, Lime Plaster (Uninsulated) 1.6W/m <sup>2</sup> K	IWI Added 0.3W/m <sup>2</sup> K	Brick, Lime Plaster (Uninsulated) 1.6W/m <sup>2</sup> K	IWI Added 0.4W/m <sup>2</sup> K
Roof	Ventilated Attic 2.3W/m <sup>2</sup> K	Mineral Wool Layers Added, 0.27W/m <sup>2</sup> K	Mineral Wool Layer Added, 1.0W/m <sup>2</sup> K	Mineral Wool Layers Added, 0.11W/m <sup>2</sup> K
Mansard	Timber Structure (Uninsulated) 2.3W/m <sup>2</sup> K	PIR Insulation Added 0.27W/m <sup>2</sup> K	Mineral Wool Layer Added, 1.0W/m <sup>2</sup> K	PIR Insulation Added 0.30W/m <sup>2</sup> K
Windows	Single Glazed, Sash - 4.8W/m <sup>2</sup> K	Single Glazed, Sash - 4.8W/m <sup>2</sup> K	Secondary Fitted - 1.8W/m <sup>2</sup> K	Secondary Glazing - 1.8W/m <sup>2</sup> K
Thermal Bridging	Default Factor - 0.15	Default Factor - 0.15	Default Factor - 0.15	TD Detailing Performed - 0.05
Air Tightness	No Draft Sealing Visible - 0%	No Draft Sealing Visible - 0%	Air Tightness Regime - Q50 3m <sup>3</sup> /hr/m <sup>2</sup>	Air Tightness Regime - Q50 1m <sup>3</sup> /hr/m <sup>2</sup>
<b>Systems:</b>				
Space Heating	Electric Storage Heaters	Nat Gas Combi Boiler - 90.2% Eff	Exhaust Air Heat Pump - 402% Eff	Electric Panel Heaters - 100% Eff
Water Heating	Electric, 110L Storage, 50mm Jacket	Nat Gas Combi Boiler - 90.2% Eff	EAHP - 239% Eff, Declared Losses	DHW HP - 307% Eff, Declared Losses
Ventilation	3 Chimneys Blocked up with Vents Nat Vent, No Wall Vents	3 Chimneys Blocked up with Vents Nat Vent, 5 Wall Vents (Not closable)	Chimneys Blocked up, 1 Cooker Vent MEV - 0.68(w/m <sup>2</sup> ) SFP	Chimneys Blocked up, 1 Cooker Vent MVHR - 90% Eff, 0.6(w/m <sup>2</sup> ) SFP
Controls	SH - Manual Charge WH - Immersion	SH - LPHW Rads, Time/Temp Control WH - Keep-Hot Facility & Time Clock	SH - LPHW Rads, Time/Temp Control WH - Time & Temp Control	SH - Elec Heaters, Time/Temp Control WH - Time/Temp Control
Lighting	Incandescent Lighting	LED Lighting	LED Lighting	LED Lighting
Landlord Heating	None Present	None	None	Electric Heaters
<b>BER Rating:</b>	<b>BER G</b>	<b>BER C2</b>	<b>BER B2</b>	<b>BER A3</b>



### Façade Investigation Study



**Insulation Material - Environmental Assessment**

Global Warming Potential Comparison

Element	Product	GWP	Units	U-Value	Thickness	Common Metric
Wall	Aerogel	1.25E+01	kg CO2 eq /m <sup>2</sup>	0.47	0.02	25
Wall	Cellulose	1.3	kg CO2 eq /m <sup>3</sup>	0.48	0.07	0.091
Floor	Aerogel	1.25E+01	kg CO2 eq /m <sup>2</sup>	0.18	0.06	75
Floor	Foam Glass	35.5	kg CO2 eq /m <sup>3</sup>	0.18	0.3	10.65