6936-A10-XX-XX-RP-O-00002
Energy & Carbon Statement

Maybrook House

Revision P02, May 2026

Document information

Report title:	6936-A10-XX-XX-RP-0-00002 Energy & Carbon Statement
Project name:	Maybrook House
Project number:	6936
Digital file name:	6936-A10-XX-XX-RP-0-00002
Digital file location:	K:\10\6900 - 6999\6936 - Maybrook House\12. A10 Reports\Stage 2 Concept Design\Energy Statement

Prepared

Prepared by:	Zac Vandevoir
Signed:	[redacted]
Date:	22.05.2026

Checked

Checked by:	Nick Colledge
Signed:	[redacted]
Date:	22.05.2026

Approved

Approved by:	Alan Stuart
Signed:	[redacted]
Date:	22.05.2026

Revisions

No	Date	Approved
P01	15.05.2026	AS
P02	22.05.2026	AS

Atelier Ten
Amazon House
3 Brazil Street
Manchester
M1 3PW
0161 518 5999

Disclaimer and copyright notice:
All photos, diagrams and graphs are copyright Atelier Ten unless otherwise noted.
Any publication of this report requires permission from the copyright holders for the use of these images.

Contents

Executive Summary 4

1 Building Fabric & Ventilation 6
1.1 Building Form & Heat Loss Envelope 6
1.2 Elevation Design & Window Proportions 6
1.3 Heated & Unheated Spaces 6
1.4 Building Fabric Specifications & Airtightness 6
1.5 Ventilation 7
1.6 Space Heating Demand 7

2 Maximising Energy Efficiency 8
2.1 Energy Use Intensity (EUI) 8
2.2 Efforts to Reduce Energy Use of Equipment 10
2.3 Lighting 10

3 Renewable Energy Generation 11
3.1 Proposed Renewable Energy Generation System 11
3.2 PV Footprint Area 11
3.3 Renewable Energy Balance 12

4 Low Carbon Heating 14
4.1 Fossil Fuel Free 14
4.2 Proposed Systems for Heating, Cooling and Hot Water 14

5 Overheating 17
5.1 Overheating Risk Assessment 17

6 Offsets 19

Appendices 20

Executive Summary

This Energy and Carbon Statement is provided to support the planning application for the Maybrook House development. It follows and addresses the requirements of the Greater Manchester Combined Authority (GMCA) Net Zero Carbon Design Guidance.

Site Description

Maybrook House is situated on a prominent corner in Manchester City Centre and is bound by Deansgate to the east, Blackfriars to the north, Parsonage to the west and Parsonage Lane to the south. The building extends to G+5 storeys in height and includes a basement level. It comprises a number of existing uses including office, retail, restaurant, café and drinking establishment. Part of the basement space was previously used as a gym however, this has since closed. To the rear of the building is a service yard and a small amount of car parking. Vehicular access to the site is via Parsonage Lane to the rear. The materiality of the existing will be covered in the accompanying Design and Access Statement (DAS).

Development Description

The proposed development comprises a change of use of part basement, part ground and all upper floors from gymnasium, restaurant and office use (Use Class E) to hotel (Use Class C1) together with a two storey vertical extension, external alterations and other associated works. The hotel is to include 226 standard rooms and 12 accessible rooms equating to 238 in total. The hotel rooms are located on floors 1 to 7. Please refer to the DAS for further details.

As the proposed development comprises largely of a refurbishment and change of use of an existing building, this is beneficial in terms of the development's whole life carbon and circular economy approach when compared to demolishing and building a new building on the same site.

Table 0.1 New build and existing building areas

Use	Floorspace (m² GIA)
Refurbishment	5,449
New Build	2,126
TOTAL	7,575

Operational & Compliance Modelling

A CIBSE TM54 operational energy assessment has been carried out for the new build floors (refer to Appendix A for full calculations) which results in an EUI of 143.7 kWh/m². A Part L assessment has also been carried out for the new build floors as well as a draft EPC for the full building incorporating the refurbishment of the existing floors and new build floors (please see Appendix B). The new build elements achieve 4% over Part L 2021 and the whole building achieves an A rated EPC.

Energy and Carbon Proforma

The energy and carbon proforma (Document number: 6936-A10-XX-XX-RP-0-00003) can be found in Appendix C. Two columns have been included to represent the operational energy assessment for the new build elements and the Part L assessment for the full building that were undertaken: A screenshot is included in Figure 0.1 and Figure 0.2

- New construction (L06 upwards) TM54
- Whole building (refurbishment and new construction) EPC

BREEAM

As part of the planning stage BREEAM preassessment, Ene01 calculations were carried out under BREEAM New Construction v7 for the new build elements, achieving 8/9 credits. For the refurbished elements being assessed under BREEAM Refurbishment & Fitout 2014, it has been demonstrated that 15/15 Ene 01 credits have been achieved (please refer to Appendix D). This would meet the ENE01 credit for Outstanding for both schemes.

Simulation Software Used

Simulation software version: IESVE Version 2024.1.0.0

Manchester Planning Policies

All current Manchester planning policies relating to energy and carbon have been met or addressed within this report. This includes the Local Development Framework Core Strategy (2012) and Places for Everyone (PfE) (2024) following the GMCA Design Guide for Net Zero (2025). Although not yet policy, consideration has also been given to the Manchester Draft Local Plan (2025).

Energy and Carbon Proforma
Non-residential
Major development *(+1,000m²)*
Version 1.0

GMCA GREATER MANCHESTER COMBINED AUTHORITY

Project Name: Maybrook House
Application ref:
Date: 22.05.2026

		Ref. name	New construction (L06	Whole building (refurbishme
		Area (m² GIA)	2126	7873
		Target values	**Building 1**	**Building 2**
Minimise energy demand	**Space heating demand (kWh/m²GIA/yr)**	**≤ 15**	36.2	23.12
	Space cooling demand (kWh/m²GIA/yr)	**≤ 15**	5.85	1.16
	Calculation methodology used to calculate space heating demand and confirmation that this covers all homes/blocks	*Predictive energy model*	TM54 model	Compliance model
	Form factor per building	≤ 2	1.3	0.96
	Average external wall U-value (W/m²K)	≤ 0.15	0.18	0.26
	Average window U-value (W/m²K)	≤ 1 (triple)	1.2	1.5
	Air permeability rate (m³/h/m² @ 50 Pa)	≤ 1	5	5
Maximise energy efficiency	**BREEAM Ene 01 rating**	***Excellent***	0.801 EPRnc	N/A
	Energy use intensity (kWh/m²GIA/yr)	-	143.7	150
	Calculation methodology used to calculate energy use intensity and confirmation that this covers all homes/blocks	*Predictive energy model*	TM54 model	Compliance model
Use renewable energy	**PV footprint area (% of ground floor space)**	-	3.80%	3.80%
	Annual renewable energy generation (kWh/m² building footprint/yr)	-	4.8	4.8
	Renewable energy balance (%)	-	2.24	0.58
	Total energy used (kWh/yr)	-	305606	1180950
	Total energy generated on-site (kWh/yr)	-	6831	6831
Use low carbon energy	**Fossil fuel free (yes/no)**	**Yes**	Yes	Yes
	Heat source	*Electric*	Electric	Electric
	Low Carbon Heat Appraisal completed	*Yes*	Yes	Yes
	Heat network suitability	-	No	No
	Exemption requested	-	No	No
	Efficiency of heating system (SCOP)	≥ 3.5	2.88	2.88

Figure 0.1 Energy and carbon proforma screenshot (Part 1)

	Carbon content of heat (gCO₂/kWh)	≤ 100	136	136
Reduce overheating risk	**Has CIBSE TM52 been used to calculate overheating and does the building pass?**	***Yes***	Yes	Yes
	What percentage of spaces are cooled? (% of GIA)	-	74%	65.80%
	Has a CIBSE TM52 assessment been carried out using DSY2 and DSY3 weather files? Have any additional passive measures been included as a result?	*Yes*	Yes	Yes
Minimise embodied carbon	**Upfront embodied carbon (kgCO₂e/m²GIA)**	-		
	List top three materials with the highest upfront embodied carbon emissions (kgCO₂e/m²GIA): Material 1	-	TBA	TBA
	Material 2	-	TBA	TBA
	Material 3		TBA	TBA
	Lifecycle embodied carbon (kgCO₂e/m²GIA) - *for large major developments only*	-	TBA	TBA
Offsets	**Offset contribution (£)**	-	NA	NA

Figure 0.2 Energy and carbon proforma screenshot (Part 2)

1 Building Fabric & Ventilation

1.1 Building Form & Heat Loss Envelope

Viewed from above, the building follows a "U" shape around a central courtyard that mainly contains parking and plant for both Maybrook House and other retail spaces that are outside of the Maybrook House development scope. There will be hotel rooms around all perimeters, meaning that some look outwards and some will overlook the courtyard. Overall this gives a high surface area to volume ratio and hence a larger heat loss area but has the advantage of less "landlocked" spaces; there is generally a central corridor with hotel rooms on either side, so every room has access to daylight.

The building extends to G+7 storeys in height and includes a basement level. The upper two storeys are a new build extension.

The new roof is flat (so as to house plant and PV panels) with a plant screen to improve views form the street and a parapet wall.

The form factor of the Maybrook House building has been calculated with the following considerations:

- The areas of the ground floor that are not within the scope of the development are omitted
- The unheated basement has been omitted
- The roof level stair overruns have been included

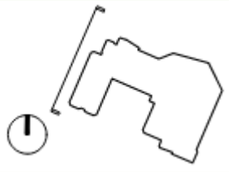
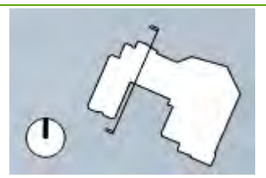
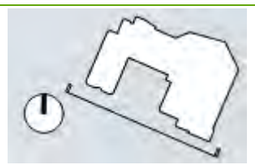
The form factor of the full building is approximately 0.96.
The form factor of only the two new build floors is 1.30.

1.2 Elevation Design & Window Proportions

As the majority of the building is existing, the proposal is to retain the existing window layouts. This gives a typical glazing ratio of ~30% for the hotel rooms. The two new floors also have a glazing ratio of ~30%.

Full wall to window calculations for all elevations have been carried out; please see Appendix E for details, and a summary is provided below:

Table 1.1 Glazing ratios for each orientation

Orientation	Glazing Percentage	
Northeast	32%	
Northwest	30%	
Southeast	31%	
Courtyard NW	30%	
Courtyard SE	29%	
Courtyard SW	32%	

1.3 Heated & Unheated Spaces

Due to the nature of the development being an existing building and that parts of the building are out of the scope of the assessment, the thermal line has been drawn to the best of our knowledge. As more detailed interventions of specific walls are investigated at the detailed design stage, the thermal line may change (e.g., where existing tenants are located and where plant and refuse stores meet the perimeter). The majority of spaces are within the thermal line with the exception of the basement plant and ground floor refuse store.

Thermal line drawings which also contain the servicing strategy can be found in Appendix F

1.4 Building Fabric Specifications & Airtightness

1.4.1 Airtightness

Table 1.2 Airtightness assumptions

Specification	Unit/Element	Notes
Airtightness	Upgraded air permeability • 5 $m^3/m^2.h@50Pa$ Existing air permeability assumption • 15 $m^3/m^2.h@50Pa$	• For the existing elements of the building, it is assumed that through the upgrade of the external walls and replacement of all glazing that the air permeability will be improved from 15 to <5$m^3/m^2.h@50Pa$ • For the new upper floors, it is assumed that an air permeability of <5$m^3/m^2.h@50Pa$ will be achieved • For the whole building EPC, this is averaged to 5$m^3/m^2@50Pa$

1.4.2 Average U-Values

Table 1.3 Average U-values

Specification	Unit/Element	Notes
Ground floor U-value	Existing ground floor (basement) • 0.58 W/m²K Proposed upgrade between L00 and basement • 0.18 W/m²K	• The ground floor assumption (basement) is 0.58 W/m²K based on iSBEM 1965-1981 default solid ground floor • It is not proposed that the basement floor is upgraded as part of the works due to the basement being largely unheated • 200mm of insulation is proposed to be added to the ground floor (between L00 and the basement), resulting in an assumed U-value of 0.18 W/m²K
External wall U-value	Existing external wall • 0.89 W/m²K Upgrade to existing external wall • 0.3 W/m²K New external wall • 0.18 W/m²K	• The existing external wall is based on 340mm uninsulated concrete • Insulation added to the existing external walls to achieve 0.3 W/m²K • The new build external walls will be designed to meet 0.18 W/m²K
Roof U-value	Existing roof • 1.8 W/m²K New roof • 0.12 W/m²K	• 1.8 W/m²K existing roof based on flat roof on precast or in situ concrete slab - iSBEM 1965-1981 • The existing roof at L01 does not have any planned interventions, 1.8 W/m²K assumed
Window U-value	Replaced windows (existing building) • 1.6 W/m²K (inc. frame) New windows (extension) • 1.2 W/m²K (inc. frame)	• U-values include glazing and frame • A frame factor of 5% has been assumed for all windows
Door U-value	All opaque doors • 1.6 W/m²K All glazed doors • 1.6 W/m²K	• All external new/replaced doors will meet at least 1.6 W/m²K

1.4.3 Glazing Properties

Table 1.4 Glazing properties

Specification	Unit/Element	Notes
Glazing g-value and light transmittance	All glazing • 0.4g • 71% VLT	• Due to the overshadowed nature of the urban surroundings, high specification low g-value glazing is not required • Visible light transmittance is high to improve indoor daylighting quality

1.4.4 Solar Shading

Table 1.5 Solar shading

Specification	Unit/Element	Notes
Reveal depths and shading types	No additional solar shading is proposed	• Due to the heating load being much higher than the cooling load, there is no need for any additional solar shading • Reveal depths are kept to minimum to maximise daylight penetration • Cooling is currently around 20x more than heating, meaning that solar control below 0.4g is not recommended

1.4.5 Thermal Bridging

Table 1.6 Thermal bridging

Specification	Unit/Element	Notes
Thermal bridging	y-value	• Part L 2021 default thermal bridging values used as a worst case • Linear thermal bridging allowance added to the fabric heat loss, rather than modelling each junction individually (y-value) • Detailed thermal bridging may be calculated at the detailed design stage – conservative assumption made

1.5 Ventilation

For the full ventilation descriptions and explanations, please refer to the Stage 2 Report (6936-A10-XX-XX-RP-Z-00-001). Table 1.7 contains a summary of the system information.

Table 1.7 Building ventilation

Space Typology	Proposed Ventilation Strategy
Guest Rooms	• 4-pipe FCU along with mechanical ventilation heat recovery (MVHR) with the fresh air being provided from roof-mounted AHU • Full VAV damper control on supply and extract linked to space CO_2 sensors • AHU SFP = 1.4 W/l/s and the terminal SFPs of the FCU are modelled as 0.3 W/l/s • Heat recovery effectiveness is modelled as 79%
Front of House (bar/restaurant/reception)	• The VRF system is also served by roof mounted AHU • The SFP for the VRF MVHR is modelled as 1.6 W/l/s • Heat recovery effectiveness is modelled as 80%
WC, Changing & Kitchens	• Local MVHR modelled along with electric panel heaters • The SFP for the MVHR is modelled as 1.6 W/l/s • Heat recovery effectiveness is modelled as 80%
Comms Rooms	• DX split system along with mechanical ventilation with heat recovery • The SFP for the MVHR is modelled as 1.14 W/l/s • Heat recovery effectiveness is modelled as 79%
Housekeeping	• Extract SFP is modelled as 0.3 W/l/s • Housekeeping on each floor has a dedicated extract system providing 1.5 ACH^{-1}

1.6 Space Heating Demand

The space heating demand for the new build areas is 23.53kWh/m² (compliance model). While this seems high, the combined heating and cooling load should be considered (25.18 kW/m²) as an increase in insulation levels will increase the cooling load while decreasing the heating load. Fabric specifications beyond Part L 2021 limiting new build values have been selected for this reason.

Table 1.8 Space heating demand

Area	Space Heating Demand (kWh/m²/year)
New build floors only Part L	23.53 kWh/m²
Whole building EPC	23.12 kWh/m²
New build floors only TM54	36.21 kWh/m²

2 Maximising Energy Efficiency

In the UK, energy models are typically applied at the design stage to check compliance against the carbon emission requirements of the Building Regulations and to determine the building potential EPC rating. These models are not intended as predictions of the building's actual energy use as they only consider regulated energy consumptions (i.e. energy associated with heating, cooling, ventilation, domestic hot water generation and artificial lighting, as well as energy for operating pumps and fans) and exclude unregulated energy associated with lifts, servers and plug in equipment (although it does include an unregulated estimate based on the NCM templates used but does not include it in the rating).

Figure 2.1 below illustrates the difference between the energy consumptions calculated in a Building Regulation Part L/ EPC model, compared to a CIBSE TM54 model and in-use energy monitoring. The compliance model tends to significantly underestimate the building's energy consumption as it only considers the regulated energy consumption (it does provide an unregulated estimate based on the NCM templates used but does not use it in the rating). A CIBSE TM54 operational energy model however provides a much closer result to actual performance. It should be noted that this illustration is for a case study building and that the results can vary depending on building type and use.

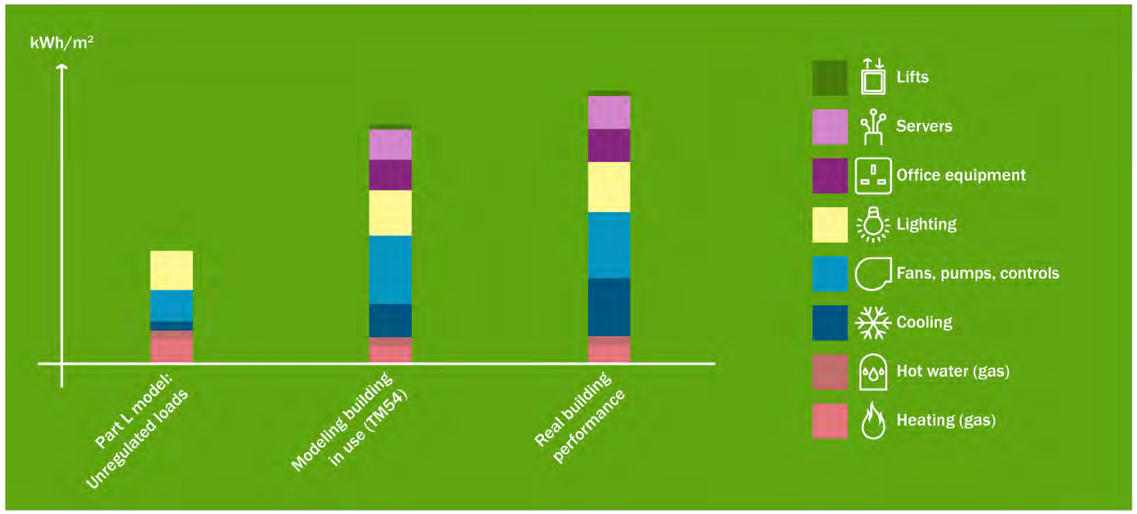


Figure 2.1 Part L model, TM54 model and real building energy use comparison

2.1 Energy Use Intensity (EUI)

The EUI has been calculated using Part L compliance modelling for:

- New Build Elements only:
  - 121kWh/m² (including unregulated energy estimate from Part L model)
- Whole Building (refurbishment and new build)
  - 150kWh/m² (including unregulated energy estimate from compliance model)

In addition to the compliance modelling, EUI for the new build has also been calculated used CIBSE TM54 methodology operational energy assessment.

- New Build Elements only:
  - 147.0 kWh/m² (including all energy TM54 energy uses as per 0, excluding PV)
  - 143.7 kWh/m² (including all energy TM54 energy uses as per 0, including PV)

Due to the nature of hotels having large domestic water consumption and ventilation, the EUI will naturally be higher than less energy intensive buildings. Figure 2.2 compares the energy breakdown between the Part L assessment (where an unregulated energy estimate is included as small power) and the TM54 assessment which contains all energy uses predicted in the assessment.

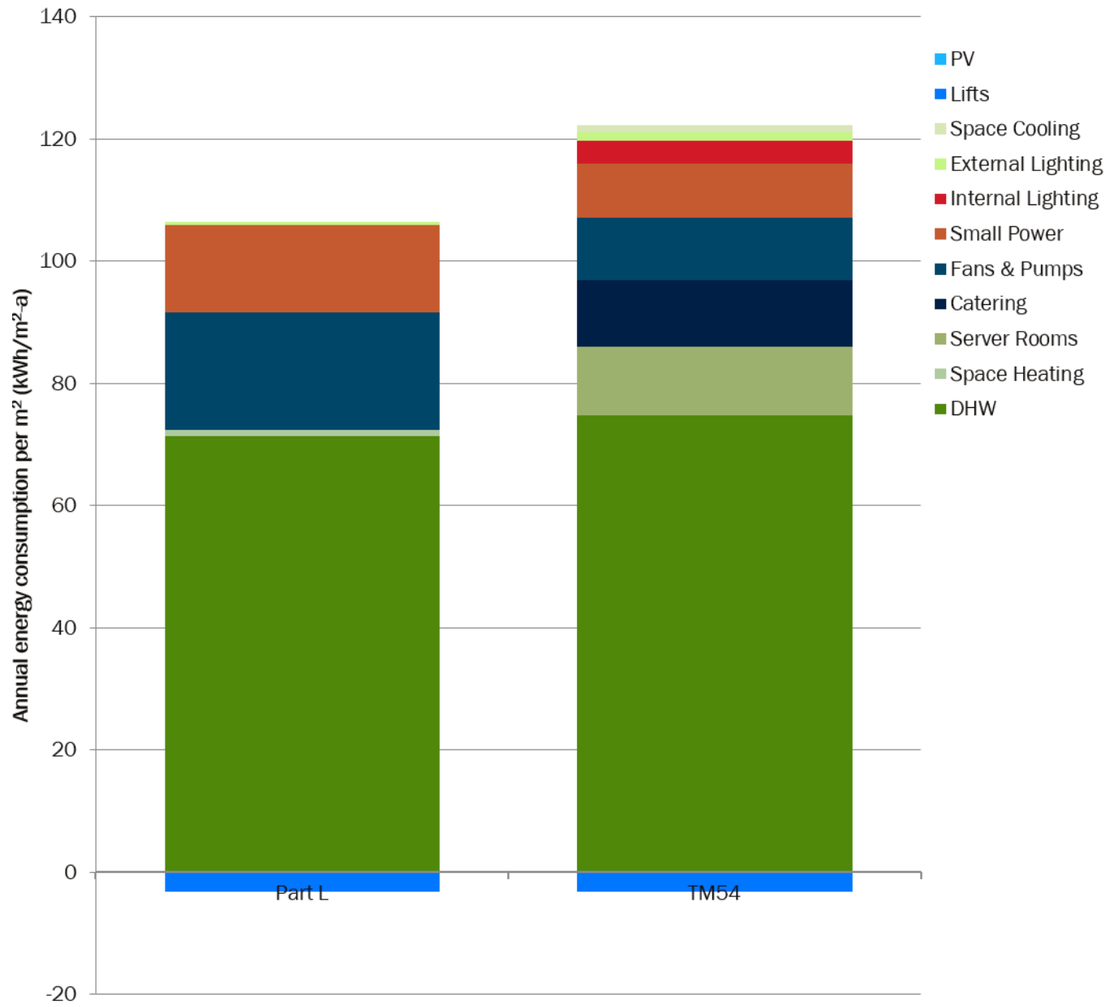


Figure 2.2 Energy breakdown comparing Part L (including the unregulated estimate) to TM54 modelling

This is further shown in Figure 2.3 and Figure 2.4 separately.

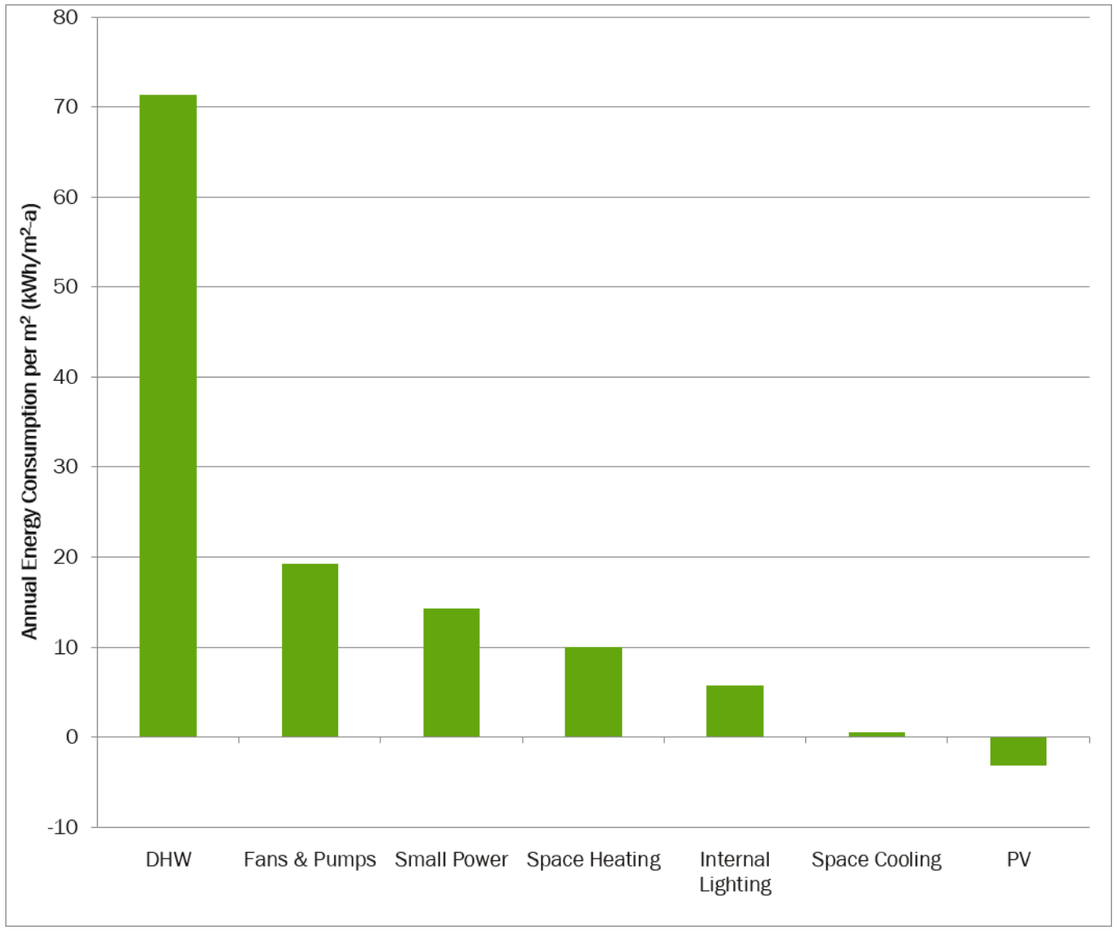


Figure 2.3 Energy balance from Part L model

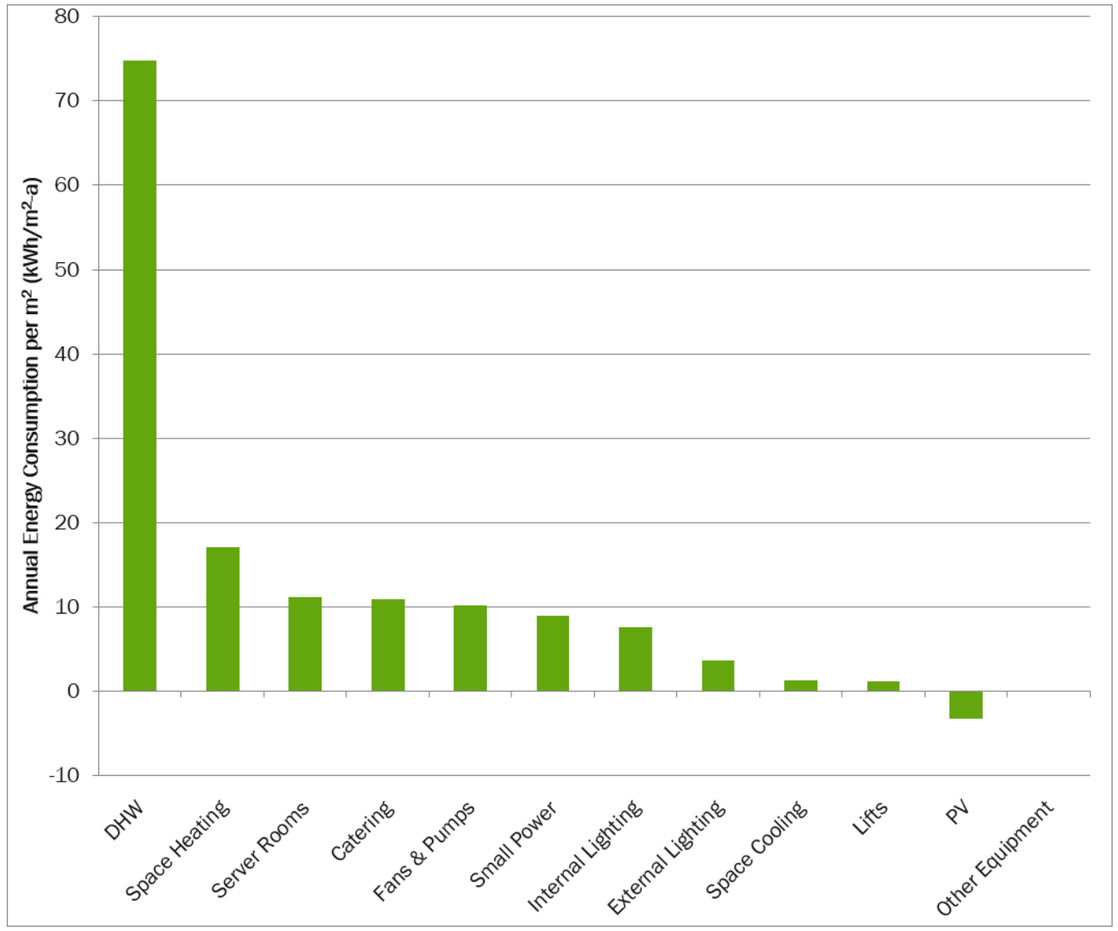


Figure 2.4 Energy balance from the operational energy modelling

2.2 Efforts to Reduce Energy Use of Equipment

Due to the nature of hotels, the plug loads that users would be likely to use can vary. In general, the charging of phones and similar technology along with hair dryers are the most likely plug loads. The development specification also outlines speakers, the use of guitar amplifiers, TVs, lamps and mirrors with lights around the frame which it is anticipated would be used infrequently.

Much of the individual hotel room plug loads has been reduced through the use of “galleys” on each floor which contain irons and hot drink facilities centrally rather than in every room. They may also contain vending machines subject to detailed design of the spaces. The interpretation of this is that the space requires a low occupancy ancillary profile such as a kitchenette rather than a profile that would overstate the gains such as laundry or food preparation. Refer to Appendix A for initial TM54 considerations.

One of the scenarios in the TM54 assessment shown in Appendix A.9 shows the impact of adding an additional 50% to the plug load estimates in the baseline model.

2.3 Lighting

Table 2.1 Lighting information modelled

	Modelled in Part L Assessment
Lighting Efficacy	110lm/cw throughout on average.
Lighting Controls	Occupancy sensing to all circulation areas Manual switches in all other areas
Display Lighting	Assumed to be 90lm/cw at this stage where appropriate

3 Renewable Energy Generation

3.1 Proposed Renewable Energy Generation System

We have examined the opportunities to install Low and Zero Carbon Technologies (LZCT) and present the results from this feasibility study below. Water source heat pumps and hydroelectricity have been excluded from the assessment as no large body of water is close to the site. We have also excluded fuel cells from the assessment due to the infancy of this technology, which would result in a significant technical, commercial, and economic risk to the project. The outcomes conclude that air source heat pumps and photovoltaic panels are the most appropriate for the proposed development.

3.1.1 Air Source Heat Pumps

Air source heat pumps can provide space heating, cooling and domestic hot water. Current assumptions for the ASHP performance are as follows for each of the system types (see Section 4.2 for further details):

- ASHP serving 4-pipe fan coil system serving bedrooms
  - 2.88 SCoP
  - 5.27 SEER
- ASHP serving VRF system serving public area
  - 3.6 SCoP
  - 4.5 SEER
- ASHP serving Domestic hot water CO_2 heat pumps
  - 3.33 SCoP

3.1.2 Photovoltaic (PV) Panels

PV panels generate electricity through the conversion of solar energy into usable energy. Due to the constrained roof space and the locations of plant and green roof, a number of PV panels are proposed on the east and west side of the roof, located so as to not be too overshadowed by the plant screen. However, due to the close proximity of the plant screen which is required to hide the plant from street view, there will be some overshading in the afternoon to evening. To take this into account, the PV panels are placed in the IESVE model and the Suncast module accounts for the overshading at different times of the year.

Table 3.1 PV information

Orientation	South
Tilt	12°
Peak output (kWp)	25Nr 440W panels (8.54kWp based on total generation divided by 800)
Panel properties	Sunpower Maxeon 6, 440W, 1.832x1.036m, raised 400mm and 300mm gap between panels (subject to specialist designer input)
PV area as a percentage of ground floor area	3.80%
Expected annual renewable energy generation (kWh/yr)	6831 kWh/annum
Annual renewable energy generation per m² GIA	3.33 kWh/m² (using new floors only) 0.87 kWh/m² (using whole building)
Annual renewable energy generation per m² building footprint	4.8 kWh/m² of footprint (using a typical mid-level as the footprint)
Balance between total energy use and renewable energy generation	2.75% (of the new build element Part L regulated + unregulated energy estimates) 0.58% (of the whole building Part L regulated + unregulated energy estimates)
Shading constraints	3m plant screen, no adjacent buildings overshading
Data source	Sunpower specification along with IESVE model and architectural information

3.2 PV Footprint Area

The PV layout can be found in Figure 3.1.

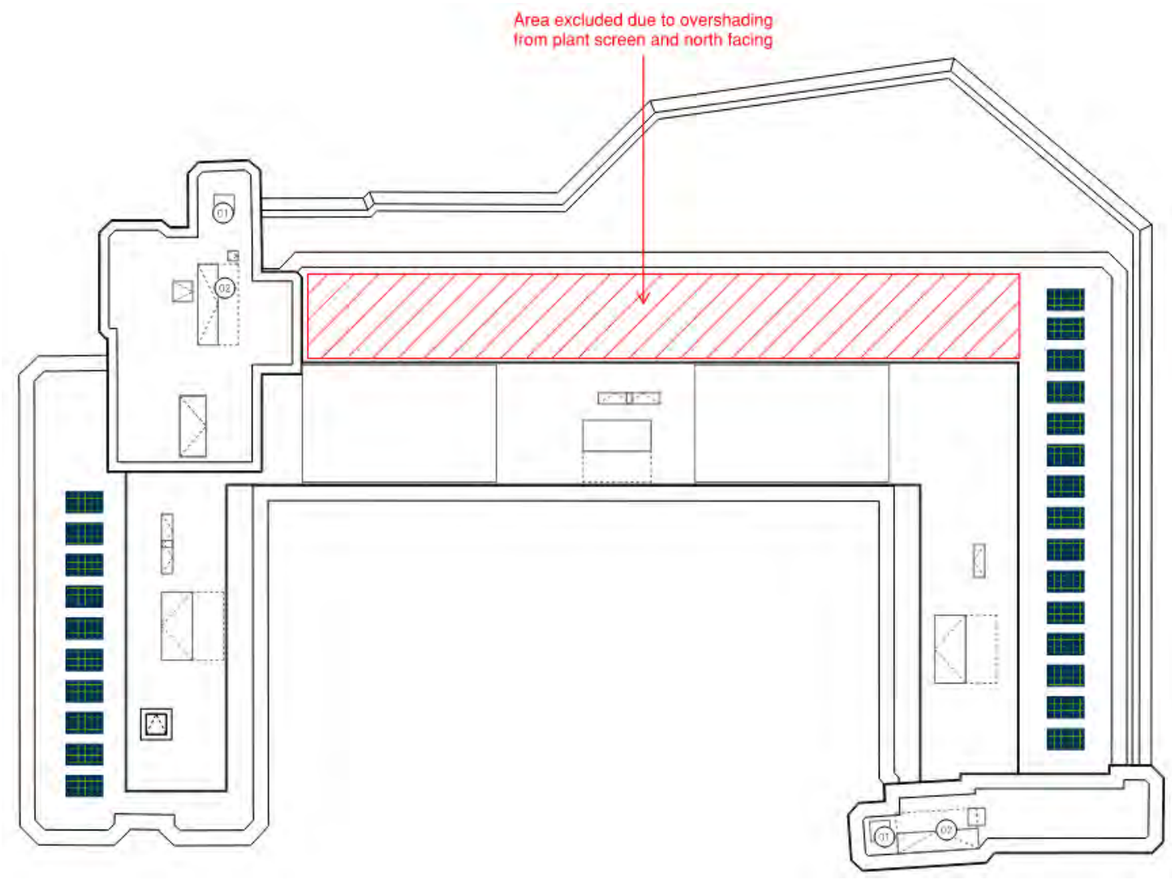


Figure 3.1 PV layout

The footprint used is a typical mid-level floor which represents the total roof area. This works out to be 4.8kWh/m² generation where the area is the building footprint. The percentage of PV area divided by the footprint area gives 4.8%.

3.3 Renewable Energy Balance

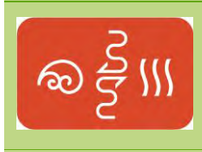
The renewable energy balance is the total PV generation divided by the total energy used.

- Total PV generation from the models is 6831 kWh/annum
- The total energy used (for the new build elements TM54) is 305,606 kWh/annum
- The total energy used (for the whole building compliance model, regulated + unregulated) is 1,180,950 kWh/annum

Therefore, the total renewable energy balance is:

- 2.24% when considering just the new build elements in the TM54 assessment
- 0.58% when considering the whole building EPC assessment

Table 3.2 Low and zero carbon technology feasibility study

	Photovoltaic Panels	Building mounted solar photovoltaic panels to generate renewable electricity	PV panels provide clean green energy. Contributes to Manchester Policies ZC 1 (Sustainable Design & Construction) & ZC 2 (Towards Zero Carbon) Part of client specification Operating and maintenance costs for PV panels are considered to be low compared to other renewable energy systems. Reduction in annual grid electricity consumption and running costs for the operator Simple and cost-effective technology to reduce CO_2 emissions. Technology recommended subject to further energy analysis and space planning on the roof	
	Solar Thermal Heating	Building mounted solar collectors to generate domestic hot water for use in each building	If a roof mounted generation system is chosen, PV would be prioritised for the reasons above Capital cost of the system result in a poor pay pack. Development has a relatively high domestic hot water demand which presents an opportunity for this system. Difficult to use in conjunction with ASHP generation, requiring more plant, space and associated equipment compared to PV Non-domestic renewable heat incentive in the UK closed in March 2021 and is no longer available Technology not recommended due to the above.	
	Wind Turbines	Free standing mast mounted micro wind turbine to generate renewable electricity	Roof mounted wind turbine will require significant structural support and present maintenance issues. Large-scale free-standing wind turbines are not feasible in an urban environment Wind turbines are also contentious planning issues and can impact wildlife Due to the unstable wind patterns in urban areas, the energy generation and resulting CO_2 emission reductions are minimal. Technology not recommended due to the above.	
	Biomass	Use of wood biomass or biofuel to generate hot water for space heating and DHW.	The design aims to avoid energy generation through combustion The project aims to be all-electric; therefore combustion technology does not align with this target There is also minimal space within the constraints of the site to install the biomass plant, boiler flue and associated fuel stores. Biofuels are not readily available and would cause commercial and economic risk to the project Technology not recommended due to the above.	
	CHP	Combined generation of heat and power from a single fuel source	The design aims to avoid energy generation through combustion To be economically viable, CHP requires at least 4,500 hours of high and constant heat demand which would likely be achieved Dumping of excess heat is not an efficient operation of the system in terms of cost, energy and CO_2 emission savings. CHP is contentious to class as renewable generation Technology not recommended due to the above.	
	Ground Source Heat Pumps	Use of the thermodynamic refrigeration cycle to generate hot water from a ground heat sink	Ground area is restricted to the building footprint, resulting in a limited heat sink. As a result, deep geothermal boreholes are the only option resulting in high risk, cost and implication on programme. Significantly more cost and more invasive groundworks than air source heat pumps Non-domestic renewable heat incentive in the UK closed in March 2021 and is no longer available Technology not recommended due to the above.	
	Air Source Heat Pump	Use of the thermodynamic refrigeration cycle to generate hot water using air as a heat sink	ASHP technology can provide heating and cooling simultaneously with high efficiencies achieved. Technology can be combined with cooling systems Technology can provide domestic hot water Performance of technology subject to external ambient air temperatures Acoustic attenuation often required due to noise from ASHPs Non-domestic renewable heat incentive in the UK closed in March 2021 and is no longer available Technology recommended based the above	
	Geothermal	Use of the thermodynamic refrigeration cycle to generate hot water using deep geothermal boreholes	Ground area is restricted to the building footprint, resulting in a limited heat sink. As a result, deep geothermal boreholes are the only option resulting in high risk, cost and implication on programme. Significantly more cost and more invasive groundworks than air source heat pumps Deeper depths required than ground source heat pumps Technology not recommended due to the above.	
	Energy Storage and Exportation	Use of thermal stores or batteries to store surplus heat and/or electricity, and/or the ability to export electricity to the grid	Plant space required for batteries or thermal stores Efficiency of batteries declines over lifespan Thermal stores can retain rejected heat to be used when needed, reducing peak output requirement of plant Batteries can store intermittent renewable generation until needed (e.g., PV generation in peak midday summer) Electricity can be exported on evenings and weekends when it is not required by the building Storage capacity would need to be determined by plant space, cost, and how much continuous use would be required Ability to export both not recommended due to the above, not enough plant space or generation to justify storage	

4 Low Carbon Heating

4.1 Fossil Fuel Free

Before the proposed refurbishment the building was served via gas boilers. There will be no natural gas provided to the proposed refurbishment or new build elements.

The proposed development has been designed as a fully electric building, with no reliance on fossil fuels for its normal operation. All building services, including space heating, cooling, ventilation, and domestic hot water generation, will be provided by all electric systems. The proposed kitchen is intended for light food preparation/reheating activities and will be all electric.

The only exception to this strategy is the inclusion of a standby generator required to serve life safety and essential building services during a mains power failure, in accordance with relevant statutory and safety requirements. The generator will operate only intermittently for emergency use and routine testing.

Whilst the generator is currently specified to operate using diesel fuel, the project is committed to minimising associated greenhouse gas emissions. Subject to fuel availability, supply chain considerations, and equipment compatibility, the development will seek to utilise lower-carbon alternative fuels such as Hydrotreated Vegetable Oil (HVO) or biodiesel. These fuels provide a reduced carbon intensity compared to conventional diesel and support a transition towards lower-emission backup power solutions.

4.2 Proposed Systems for Heating, Cooling and Hot Water

Table 4.1 outlines all space heating and hot water generation sources and distribution information. Heat sources include:

- VRF with ASHP
- FCU with ASHP
- Split system with ASHP
- Electric panel radiators
- ASHP DHW

Table 4.1 Heating, cooling and DHW systems

Space	System Type	System Parameters
Hotel Bedroom	ASHP fed, water based 4-pipe FCU with heat recovery	2.88 SCoP, 5.27 SEER, 79% heat recovery, change over mechanical mixed mode, 1.4 central SFP, 0.3 terminal SFP
Reception/Bar	FCUs connect to VRF with heat recovery	3.6 SCoP, 4.5 SEER, 80% HR, 1.6 SFP,
Domestic Hot Water	ASHP	3.33 SCoP CO2 heat pump, 85% delivery
BoH (changing, WC, office)	Electric Panel & MVHR	1.0 SCoP, 1.6 W/ls
Kitchen	Electric Panel & MVHR	1.0 SCoP, 1.6 W/ls

The following sections contain the feasibility studies of different systems that was carried out during the Stage 2 design process. Based on the various feasibility studies, the most appropriate systems are the air cooled chillers serving the hotel room 4-pipe FCU system, VRF serving the public areas and air source heat pumps providing the domestic hot water, see Table 4.1.

4.2.1 Heating & Cooling Options

Air Cooled Chillers / Heat Pump Chillers



Figure 4.1 Air cooled chillers

2 pipe air-cooled chillers reject heat directly to ambient air using condenser fans. They are located externally and generate chilled water to feed buffer vessels from which the water is circulated through secondary pump sets to AHUs and terminal units.

2 pipe air cooled chillers can also be reversible whereby the unit can also provide either heating or cooling but cannot do both simultaneously.

4 pipe air cooled chillers include two independent hydronic circuits (chilled water (CHW) and low temperature hot water (LTHW). They can operate to provide simultaneous heating and cooling by recovering heat from the cooling process.

Advantages

- Lower installation complexity – no cooling tower, condenser water pumps or water treatment.
- Lower capital cost.
- Reduced water consumption.
- Provides heating in colder seasons.

Disadvantages

- Air cooled performance reduces in high dry-bulb temperatures.
- Higher operating cost due to reduced efficiency in high outdoor temperatures.
- Higher noise levels due to external fans.
- Shorter lifespan in comparison to water cooled systems.

Variable Refrigerant Flow (VRF)

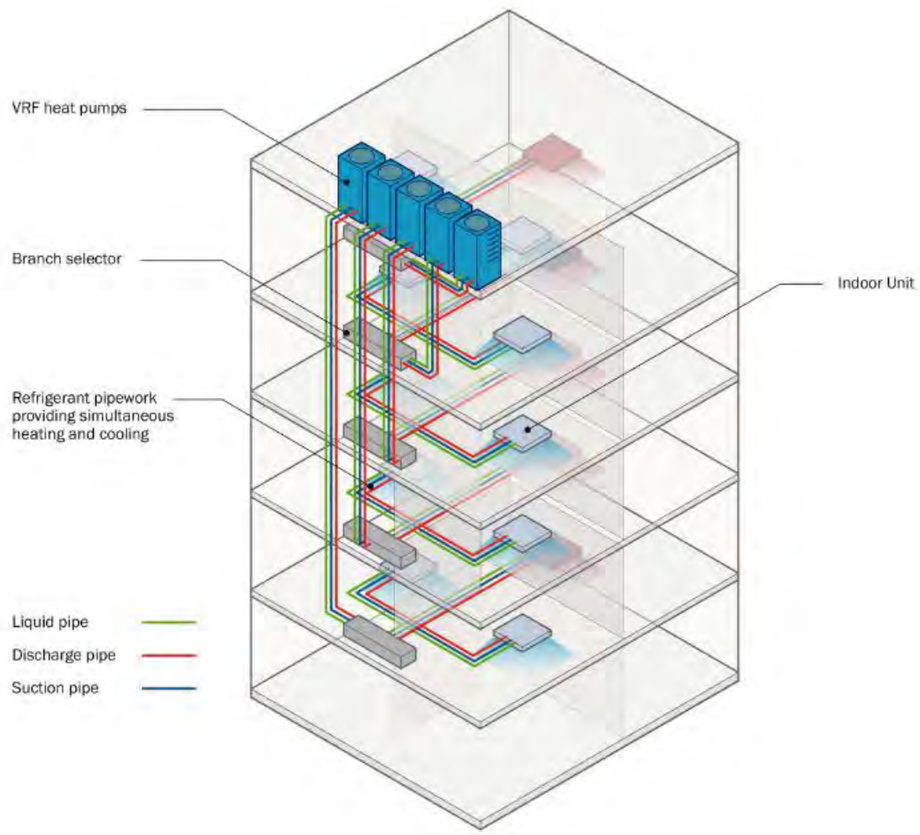


Figure 4.2 VRF system

Water cooled chillers are central plant cooling systems that use a water loop and heat rejection device to dissipate heat from the building via evaporation. The chiller, which is located internally, transfers heat from the chilled water circuit into the condenser water circuit which is then rejected outdoors.

Heat rejection plant must reject both the evaporator load (cooling load) and the compressor heat of compression which in total is typically 15-25% greater than the cooling load. Heat rejection options include.

- Cooling towers
- Evaporative condensers
- Adiabatic Coolers

Variable Refrigerant Flow (VRF) systems, unlike FCUs and chilled beams that use water-based systems to provide the air conditioning, circulate refrigerant directly to the indoor units. They consist of condenser units, located externally, which connects to several indoor units (for instance ceiling cassettes or FCUs) via a network of refrigerant pipework. The variable term comes from an inverter within the AC unit, which can vary its speed to match the exact heating and cooling requirements of the end space.

Advantages

- Precise zonal control – each indoor unit operations individually.
- High energy efficiency.
- Simultaneous heating and cooling –a VRF Heat Recovery system can move heat from “hot” spaces and utilise it in “cold” spaces.
- Flexible system that allows for more indoor units to be added in the future.

Disadvantages

- Refrigerant leak risks – the primary concern if a VRF system is if refrigerant leaks into the space. As the liquid is pumped through the building, a leak could lead to a build-up of gas. Therefore, the selection of which refrigerant to use is very important.
- Limited ventilation capacity – VRF systems only provide heating and cooling; they do not provide fresh air.
- Maintenance specialisation – VRF systems are highly proprietary. If a sensor fails for instance, specific replacements would have to be used as replacement, as well as the repairs requiring specially trained technicians.
- Lifespan – VRF systems typically have a shorter lifespan (approximately 10-15 years), compared to standard water systems (approximately 20-25 years). This is due to the compressors working under such high pressures.

Hybrid VRF

Water cooled chillers are central plant cooling systems that use a water loop and heat rejection device to dissipate heat from the building via evaporation. The chiller, which is located internally, transfers heat from the chilled water circuit into the condenser water circuit which is then rejected outdoors.

Heat rejection plant must reject both the evaporator load (cooling load) and the compressor heat of compression which in total is typically 15-25% greater than the cooling load. Heat rejection options include.

- Cooling towers
- Evaporative condensers
- Adiabatic Coolers

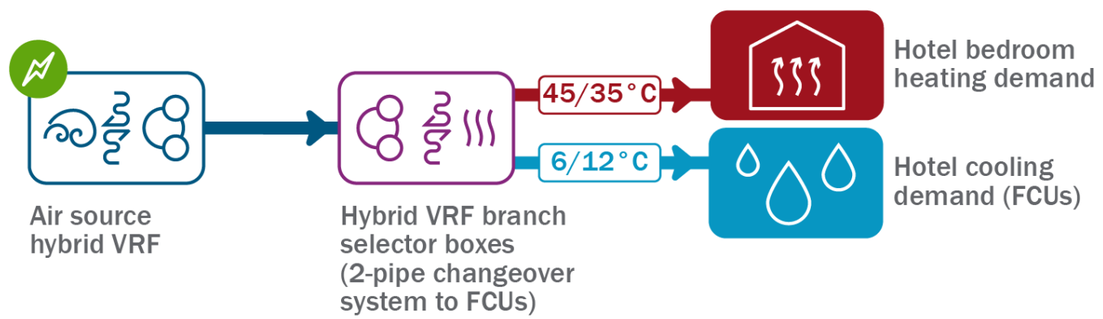


Figure 4.6.2 – Water cooled chillers

Advantages

- Highly reliable and stable performance.
- High energy efficiency due to water being a more efficient heat transfer medium than air.
- Suited to high cooling loads and hot climates.

Disadvantages

- Higher installation cost requiring heat rejection plant, pumps and water treatment.
- Higher maintenance demand and legionella prevention.
- Large space requirement – basement and roof plant requirements.
- Significant water use depending on heat rejection type.

4.2.2 District Heat Network Connection

The development site is not located within 500m from any low carbon heat networks (existing or planned) and not within a Heat and Energy Network Opportunity Area. On this basis a low carbon heat appraisal was completed with the proposed systems detailed within this section selected. These systems include DHN compatible hydraulic design based on low-temperature heat distribution.

5 Overheating

5.1 Overheating Risk Assessment

The overheating assessment for the hotel rooms has been carried out by assigning internal gains, ventilation and heating & cooling setpoints to determine the dry resultant temperatures achieved throughout the year. There are no openable windows in the scheme. Table 1.5 contains solar shading information. As shown in the energy and carbon proforma, 65.8% of the whole building is mechanically cooled.

5.1.1 CIBSE Guide A

CIBSE Guide A states that for a hotel bedroom, the winter operative temperature (based on standard activity and clothing levels) range is 19-21°C and the summer operative for air-conditioned buildings (based on standard activity and clothing levels) is 21-25°C.

5.1.2 CIBSE TM52

A heating setpoint of 21°C and a cooling setpoint of 24°C has been selected for the bedrooms to align with the Hotel Operator specification and CIBSE Guide A temperature limits. The heating and cooling capacity for the FCU serving each room will be sized to provide the required kW to achieve these temperatures.

The profiles used for the TM52 assessment are based on a combination of NCM profiles and design criteria data; see Table 5.2.

It is recommended that an overheating risk assessment is also carried out at the detailed design stage.

5.1.3 Weather Data

As per GMCA planning guidance, the overheating assessment has been run under DSY2 & DSY3 as well as DSY1. A description of these weather files is contained in Table 5.1.

5.1.4 Overheating Results

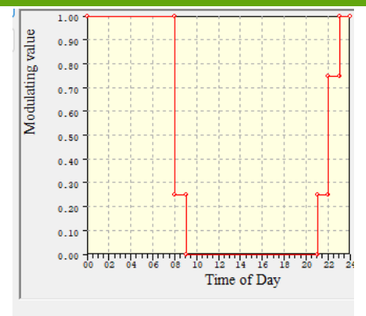
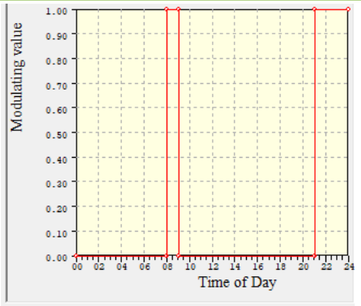
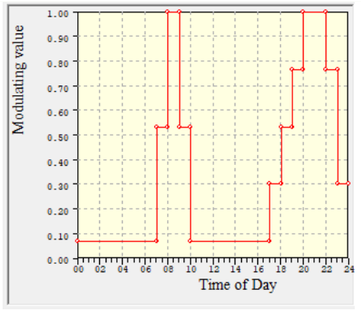
A summary of the results has been presented in Table 5.1. Results have not be presented for all 238 hotel rooms, however, these can be made available on request.

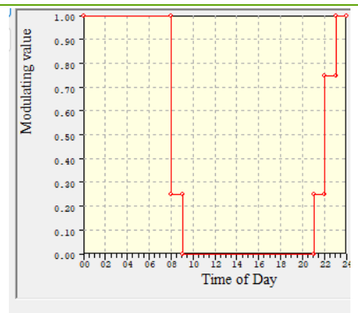
Table 5.1 Overheating results summary

Weather File	Weather File Description	Minimum Winter Temperature (°C)	Maximum Winter Temperature (°C)
Manchester DSY1_2020high50	Primary dataset used to assess thermal comfort for a moderately warm summer	20.09	24.91
Manchester DSY2_2020high50	A year with a very intense single warm spell	20.09	25.12
Manchester DSY3_2020high50	A year with a prolonged period of sustained warmth	19.9	25.13

There is one space under the DSY2 weather file and two spaces under DSY3 that go slightly over the 25°C operative temperature threshold. This is due to a high radiant temperature not being offset by the cooling of the air temperature in the early morning. The spaces in question are the L04 and L07 northeast corner hotel room. This can either be resolved by a marginal drop in the cooling setpoint or more detailed modelling of the space at the next design stage (i.e., more detailed modelling of all thermal mass available).

Table 5.2 Hotel room internal gains and ventilation modelled information

Model Input	Values and Profile Basis	Profile
Occupancy	• 10.59 m²/person occupancy (as per NCM) • 61.15W sensible, 42.85W latent	
Lighting	• 5.2 W/m² lighting (as per NCM)	
Equipment	• 2.67 W/m² sensible gain (as per NCM)	

Ventilation	• 25 l/s (design) following occupancy profile	

6 Offsets

The GMCA planning submission guidance states: “Developments should seek to provide an operational energy balance on-site, i.e. 100% of the building’s energy use should be matched by on-site renewable generation on an annual basis. For those major developments unable to meet this balance on-site, an offset mechanism will be used in future to enable the development to be deemed ‘Net Zero Carbon compliant’.”

We understand that in the future offsetting requirements will be determined by the local authority, and at this time there is no requirement for offsetting or specific guidance for refurbishments.

Please refer to Section 2.1 and Appendix A for details of the operational energy balance.

Appendices

Appendix A - Operational Energy Assumptions
A.1 CIBSE TM54 Operational Energy Assessment Methodology
A.2 Spaces Assessed
A.3 Infiltration
A.4 Environmental Design Criteria
A.5 TM54 Internal Gain & Ventilation Templates
A.6 Energy Uses
A.7 Heating, Ventilation & Air Conditioning Systems (HVAC)
A.8 Baseline Results
A.9 Scenario Testing

Appendix B - BRUKL & EPC Results
B.1 Predicted Whole Building EPC
B.2 Predicted New Floors BRUKL

Appendix C – Energy & Carbon Proforma

Appendix D – BREEAM Ene01 Modelling
D.1 BREEAM v7 New Construction Ene 01 Modelling
D.2 BREEAM 2014 RFO Ene01 Modelling

Appendix E - Glazing Ratios

Appendix F – Thermal Line and Environmental Strategy Drawings

Appendix A - Operational Energy Assumptions

A.1 CIBSE TM54 Operational Energy Assessment Methodology

A.1.1 General

In the UK, energy models are used at the design stage to compare design options and to check compliance with Building Regulations. These energy models are not intended as predictions of operational energy use but are sometimes mistakenly used as such. This has contributed to the term 'energy performance gap' where the compliance modelling results fail to accurately reflect the actual in-use building performance.

To address this issue, CIBSE have published TM54 which sets out a methodology to evaluate the anticipated energy performance of a building at the design stages. The methodology sets out a series of steps that the energy modeller is to apply to develop a bespoke energy model of the building, including anticipated occupancy and operation of the building, as well as energy consumptions not covered within the EPC model, such as plug in appliances, external lighting and lifts.

In order to assess the proposed design's energy performance, a combination of Dynamic Simulation Modelling (DSM) and desk-based energy analysis has been carried out.

The process consists of two stages:

- Three-dimensional thermal modelling of the building to determine the heating and cooling loads, including heating, ventilation and air-conditioning (HVAC) modelling
- Calculations of energy use regarding other categories such as lifts, lighting control, domestic hot water and plug in loads

This report has been based on the assumptions outlined in this section. It should be noted that while computer simulation provides an estimate of building performance, this estimate is based on inherent simplifications that do not and cannot fully represent all performance parameters of the actual occupied building. Therefore, simulation results only represent an interpretation of the building potential performance.

In practice, buildings can perform differently from the energy modelling for a variety of reasons, including incorrect plant and equipment commissioning or operation, seasonal occupancy fluctuations or abnormal weather patterns. The estimates made in this report should not be regarded as exact predictions of energy use in operation.

The thermal and HVAC modelling of the proposed building was carried out using the accredited software package IESVE 2024. IESVE is an in-depth suite of integrated analysis tools that dynamically calculates environmental conditions within a defined space. It provides a prediction of a building's thermal envelope response, HVAC system performance and associated energy consumption.

IESVE uses three-dimensional geometry to represent the building design, configuration and shading, including the form of any surrounding buildings that could have an influence on the proposed developments' solar gains. IESVE is certified in accordance with the ASHRAE Standard 140-1:2004, 2007 and 2014 "Standard Method of Test for Evaluation of Building Energy Analysis Computer Programs".

The integrated HVAC systems modelling package (ApacheHVAC) included with IES allows for the analysis of hourly heating, cooling and airflow requirements within a typical year, using a flexible schematic component-based approach. This analysis enables the incorporation of performance details for HVAC plant into the analysis for accurate modelling of equipment, particularly at part load conditions. This method results in far greater accuracy compared to other analysis techniques.

The following subsections summarise the operational profiles, plant and equipment loads, small power loads as well as fabric thermal performances applied within the operational energy model.

Internal gains that relate to the design criteria, such as lighting and small power loads or ventilation requirements are applied from hotel operator specification documents and/or the Atelier Ten 2 MEP specification.

In the absence of detailed profiles, NCM BRE estimates have been used for profile inputs such as hours of operation, heating/cooling setpoints, occupancy and small power loads. Profile graphs are presented on a scale of 0 to 1, where 0 is no input of the variable and 1 is the full input of the variable, e.g., if full occupancy is 30, 0.5 in this scale would be 15.

The CIBSE Manchester TRY16 weather file was selected for these simulations as it represents the most recent 'typical year' dataset for the nearest weather station.

A.2 Spaces Assessed

The new build elements are subject to a CIBSE TM54 operational energy assessment. This is in order to predict the operational energy used under a range of usage scenarios and sensitivity tests.

The floor area considered in the operational energy assessment has been provided by Jon Matthews Architects as the GIA of the new build elements only: **2,126m²**.

A.3 Infiltration

Infiltration has been modelled based on the air change rates given in CIBSE Guide A (see Figure A.1) and is modelled as a constant 0.15 ACH^{-1}.

Table 4.23 Empirical values for air infiltration rate due to air infiltration for rooms in buildings on normally exposed sites in winter: hotels; partial exposure

Air permeability / ($m^3/m^2 \cdot h$ at 50 Pa)	Infiltration rate (ACH) for given building size / h^{-1}							
	1 storey (50 m × 12 m × 3 m)*		2 storeys (50 m × 12 m × 3 m)*		5 storeys (50 m × 12 m × 3 m)*		10 storeys (50 m × 12 m × 3 m)*	
	Peak	Average	Peak	Average	Peak	Average	Peak	Average
20.0 (leaky)	1.15	0.85	0.85	0.65	0.80	0.60	0.90	0.65
10.0 (Part L (2002))	0.60	0.45	0.45	0.35	0.40	0.30	0.45	0.30
7.0 (Part L (2005))	0.40	0.30	0.30	0.25	0.30	0.20	0.35	0.25
5.0	0.30	0.20	0.25	0.20	0.20	0.15	0.25	0.15
3.0	0.20	0.15	0.15	0.10	0.15	0.10	0.15	0.10
Air change rate at 50 Pa ($/ h^{-1}$)		8.75		5.40		3.40		2.73
AGR_{50} divisor		21.3		16.9		12.1		9.1

* (length × width × height) for each storey

Note: tabulated values should be adjusted for local conditions of exposure

Figure A.1 CIBSE Guide A infiltration

A.4 Environmental Design Criteria

The standards for typical hotels are given in CIBSE Guide A. This aligns with the hotel operator specification and therefore a heating setpoint of 21°C and a cooling setpoint of 24°C has been applied in order to maintain the 19°C minimum winter temperature and the 25°C maximum temperature.

Table 1.5 Recommended comfort criteria for specific applications — *continued*

Building/room type	Customary winter operative temperatures for stated activity and clothing levels*			Customary summer operative temperatures (air conditioned buildings†) for stated activity and clothing levels*			Suggested air supply rate / ($L \cdot s^{-1}$ per person unless stated otherwise)	Filtration grade‡	Maintained illuminance¶ / lux	Noise criterion§		
	Temp. / °C	Activity / met	Clothing / clo	Temp. / °C	Activity / met	Clothing / clo				NR	dBA§	dBC§
Factories:												
— heavy work	11–14[12]	2.5	0.9	—[13]	—	—	—[14]	Depends on use	—[15,16]	50–65	55–70	60–85
— light work	16–19	1.8	0.9	—[13]	—	—	—[14]	Depends on use	—[15,16]	45–55	50–60	70–80
— sedentary work	19–21	1.4	1.0	21–25	1.3	0.6	—[14]	Depends on use	—[15,16]	45	50	75
Fire/ambulance stations:												
— recreation rooms	20–22	1.3	1.0	22–25	1.3	0.6	10[2]	F5	300	35–40	40–45	65–70
— watchroom	22–23	1.1	1.0	24–26	1.1	0.6	10[2]	F5	200	35–40	40–45	65–70
Garages:												
— parking	—	—	—	—	—	—	6 ACH (extract)	—	75/300	55	60	85
— servicing	16–19	1.8	0.9	—	—	—	—	G2–G3	300/500	45–50	50–55	75–80
General building areas:												
— corridors	19–21	1.4	1.0	21–25	1.3	0.6	10[2]	—[17]	100	40	45	70
— entrance halls/lobbies	19–21	1.4	1.0	21–25	1.3	0.6	10[2]	—[17]	100/200[4]	35–40	40–45	65–70
— kitchens (commercial)	15–18	1.8	1.0	18–25	1.6	0.6	—[18]	G2–G4	500	40–45	45–50	70–75
— toilets	19–21	—	—	21–25	—	—	>5 ACH	G4–G5	200	35–45	40–50	65–75
— waiting areas/rooms	19–21	1.4	1.0	21–25	1.3	0.6	10[2]	—[17]	200	30–35	35–40	60–65
Hospitals and health care buildings:												
— audiometric rooms	—	—	—	—	—	—	—	—	—	20–25	20–25	50–55
— bedheads/wards	22–24	0.9	1.4	23–25	0.9	1.2	10[2]	F7–F9	—[19]	30	35	60
— circulation spaces (wards)[20]	19–24[1]	1.8	0.8	21–25[1]	1.8	0.6	10[2]	F7–F9	—[19]	35	40	65
— consulting/treatment rooms	22–24	1.4	0.6	23–25	1.4	0.4	10[2]	F7–F9	300/500[19]	30	35	60
— corridors	19–21	1.4	1.0	21–25	1.3	0.6	10[2]	—[17]	100	35–40	40–45	65–70
— kitchens	—	—	—	—	—	—	—	—	500	35–40	40–45	65–70
— laboratories	19–21	1.4	1.0	21–25	1.3	0.6	10[2]	—[17]	100	35-40	40–45	65–70
— nurses' station[20]	19–22	1.4	0.9	21–25	1.3	0.6	10[2]	F7–F9	—[19]	35	40	65
— operating theatres	17–19	1.8	0.8	17–19	1.8	0.8	0.65–1.0 $m^3 \cdot s^{-1}$	F9	—[19]	30–35	35–40	60–65
— staffroom, recreation room	19–21	1.4	1.0	21–25	1.3	0.6	10[2]	G4–G5	300[11]	30–40	35–45	55–65
— washroom/toilet	19–21	—	—	21–25	—	—	>5 ACH	G4–G5	200	35–45	40–45	65–70
Hotels:												
— ballroom	—	—	—	—	—	—	—	—	—	30–35	35–40	60–65
— banquet room	—	—	—	—	—	—	—	—	—	30–35	35–40	60–65
— bathrooms	20–22	—	—	23–25	—	—	12[2]	F5–F7	150	40	45	65
— bedrooms	19–21	1.0	1.0	21–25	1.0	1.2	10[2]	F5–F7	50/100	20–30	25–35	50–60
— corridor, lobby	19–21	1.4	1.0	21–25	1.3	0.6	10[2]	—[2]	100	35–40	40–45	65–70
— kitchen	—	—	—	—	—	—	—	—	—	40–45	45–50	70–75
— laundry	—	—	—	—	—	—	—	—	300	40–45	45–50	70–75

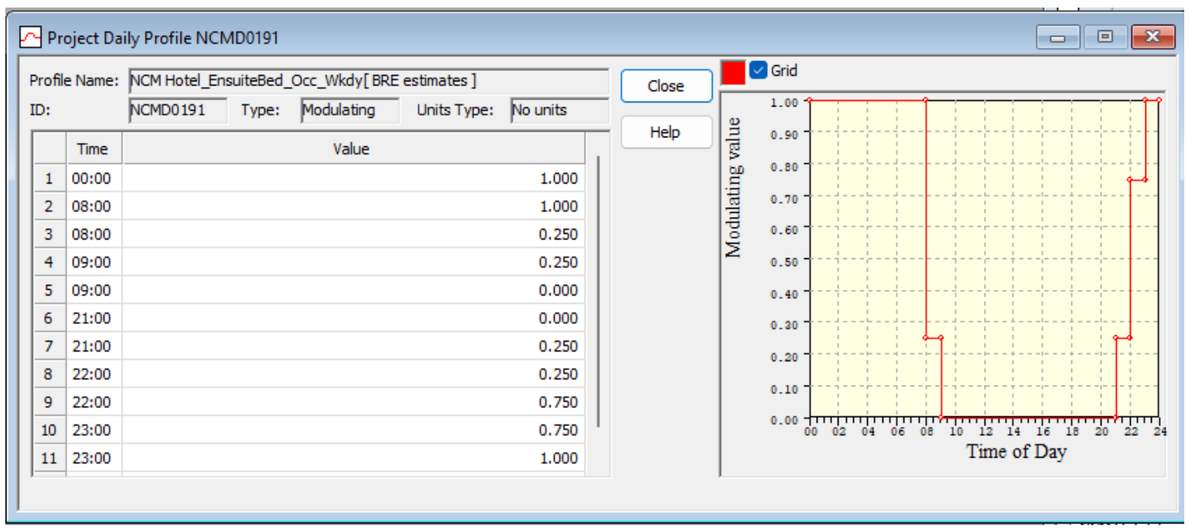
Figure A.2 CIBSE Guide A environmental design criteria

A.5 TM54 Internal Gain & Ventilation Templates

Table A.1 Internal gain and ventilation summary

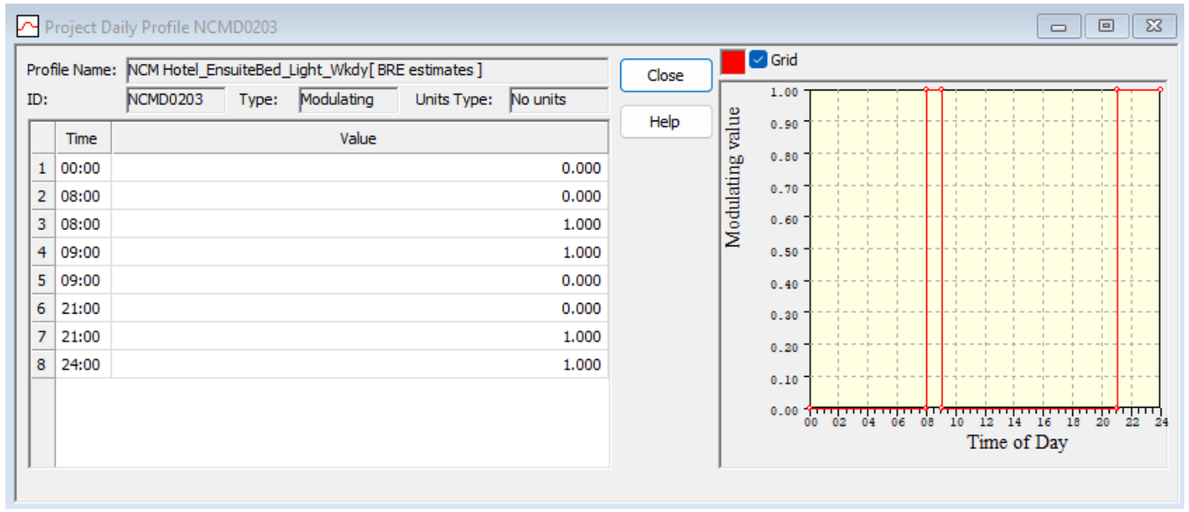
	Occupancy	Lighting	Equipment	Ventilation
Ensuite Hotel Bedroom	• 10.59m²/person occupancy (as per NCM) – 61.15 W sensible, 42.85 W latent	• 2.7 W/m² lighting (based on 110lm/cw efficacy))	• 2.67 W/m² sensible gain (as per NCM)	• 25l/s (design) following occupancy profile
Galley/Housekeeping	• 10 m²/person occupancy (low occupancy) – 90 W sensible, 60 W latent	• 5.2 W/m² lighting (as per NCM) following hotel room equipment profile	• 20 W/m² sensible gain (representative of unknown gains) following hotel room equipment profile	• 0.5 ACH-1 (design) continuous
Housekeeping	• 10 m²/person occupancy (low occupancy) – 90 W sensible, 60 W latent	• 5.2 W/m² lighting (as per NCM) following hotel room equipment profile	• 20 W/m² sensible gain (representative of unknown gains) following hotel room equipment profile	• 1.5 ACH-1 (design) continuous
Circulation	• 8.72 m²/person (as per NCM) – 70 W sensible, 70 W latent	• 2.3 W/m² lighting (based on 110lm/cw efficacy)	• 2.0 W/m² equipment (as per NCM)	• 0.5 ACH^{-1} (design continuous)

A.5.1 Hotel



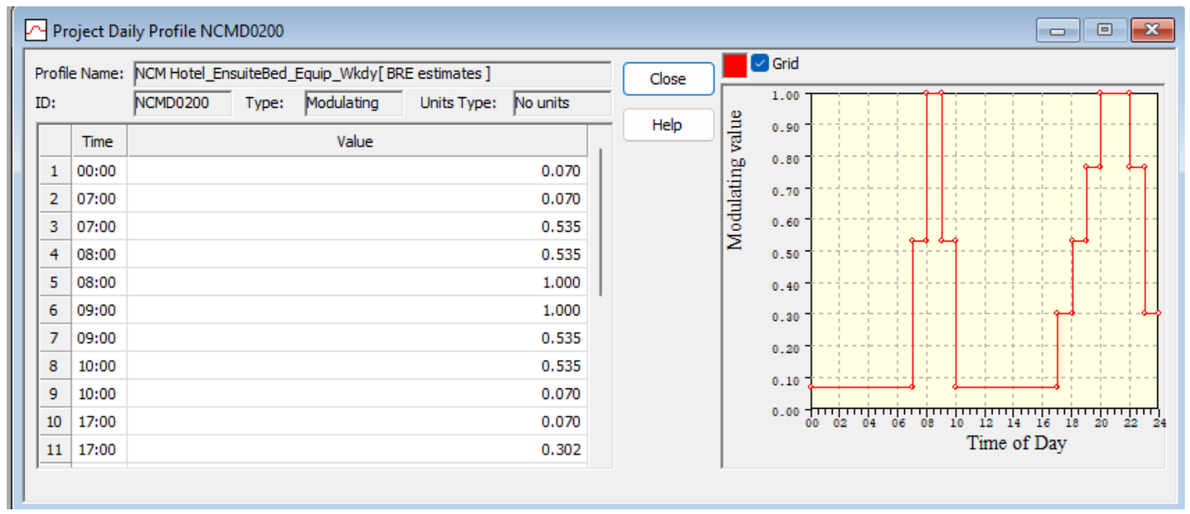
	Time	Value
1	00:00	1.000
2	08:00	1.000
3	08:00	0.250
4	09:00	0.250
5	09:00	0.000
6	21:00	0.000
7	21:00	0.250
8	22:00	0.250
9	22:00	0.750
10	23:00	0.750
11	23:00	1.000

Figure A.3 Hotel ensuite bedroom occupancy profile (also to be used for ventilation profile)



	Time	Value
1	00:00	0.000
2	08:00	0.000
3	08:00	1.000
4	09:00	1.000
5	09:00	0.000
6	21:00	0.000
7	21:00	1.000
8	24:00	1.000

Figure A.4 Hotel ensuite bedroom lighting profile



	Time	Value
1	00:00	0.070
2	07:00	0.070
3	07:00	0.535
4	08:00	0.535
5	08:00	1.000
6	09:00	1.000
7	09:00	0.535
8	10:00	0.535
9	10:00	0.070
10	17:00	0.070
11	17:00	0.302

Figure A.5 Hotel ensuite bedroom equipment profile

A.5.2 Circulation

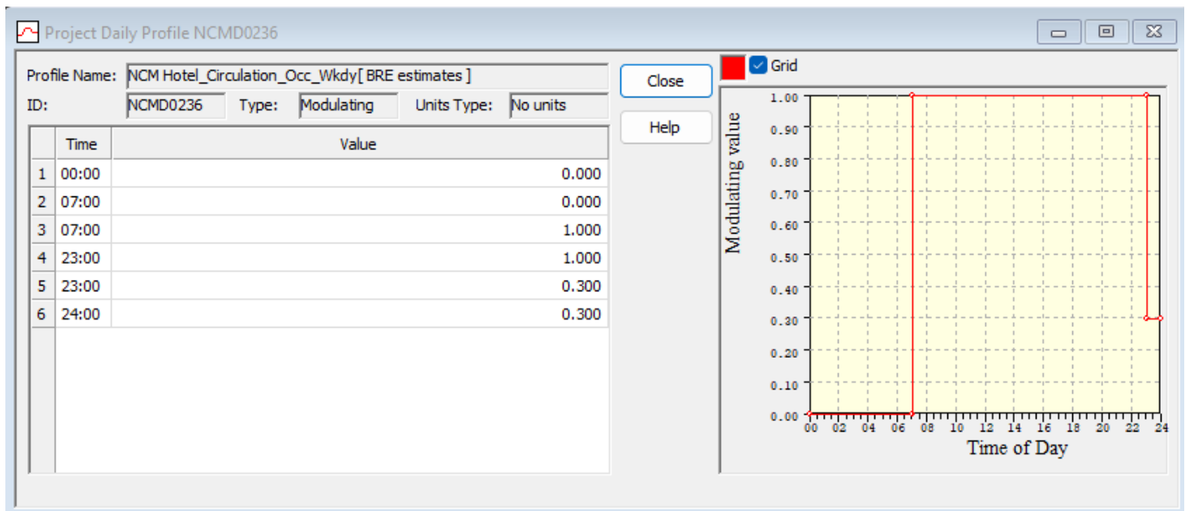


Figure A.6 Hotel circulation occupancy profile

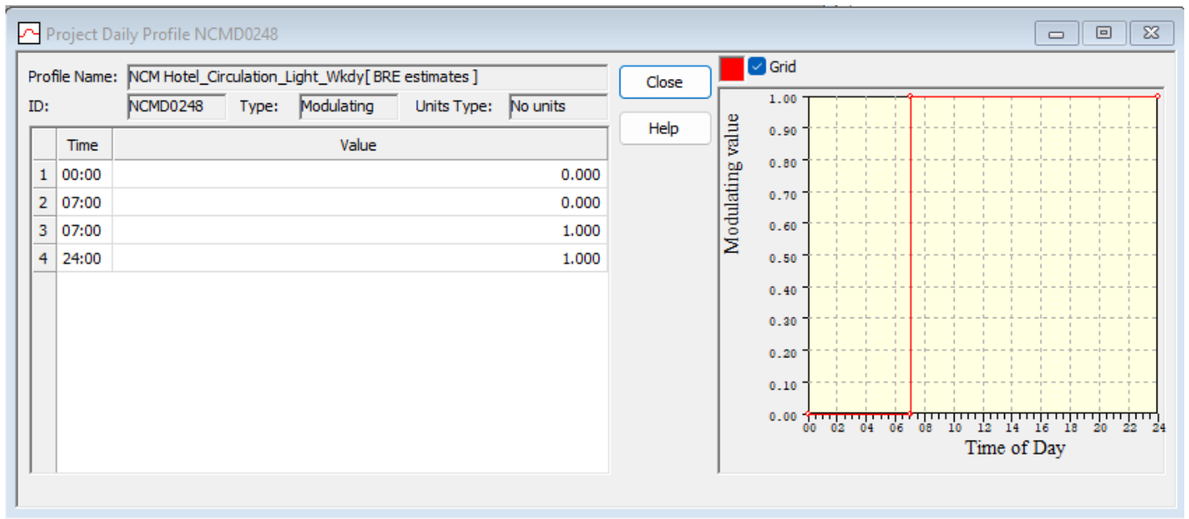


Figure A.7 Hotel circulation lighting profile

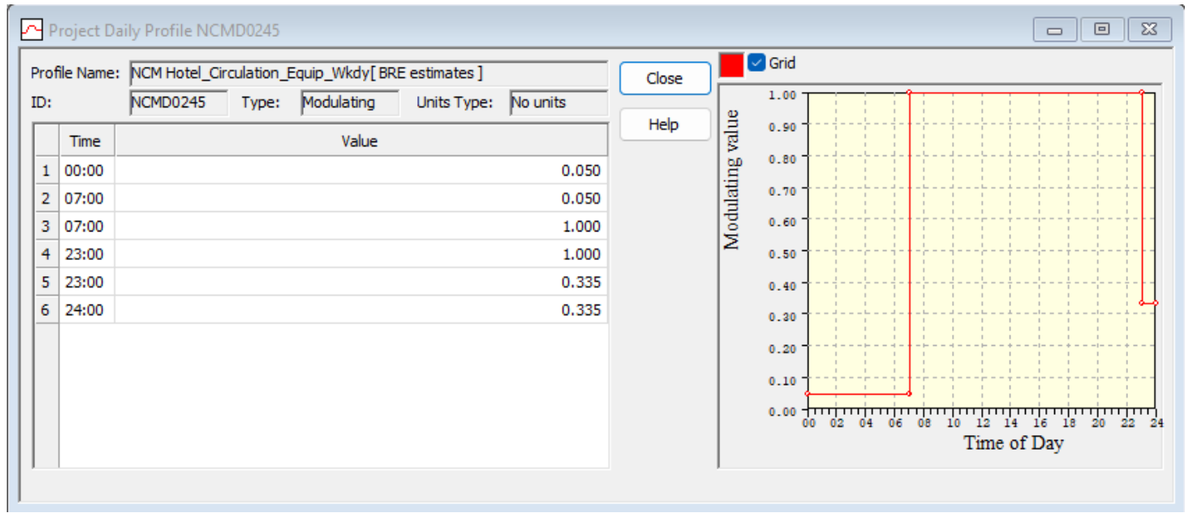
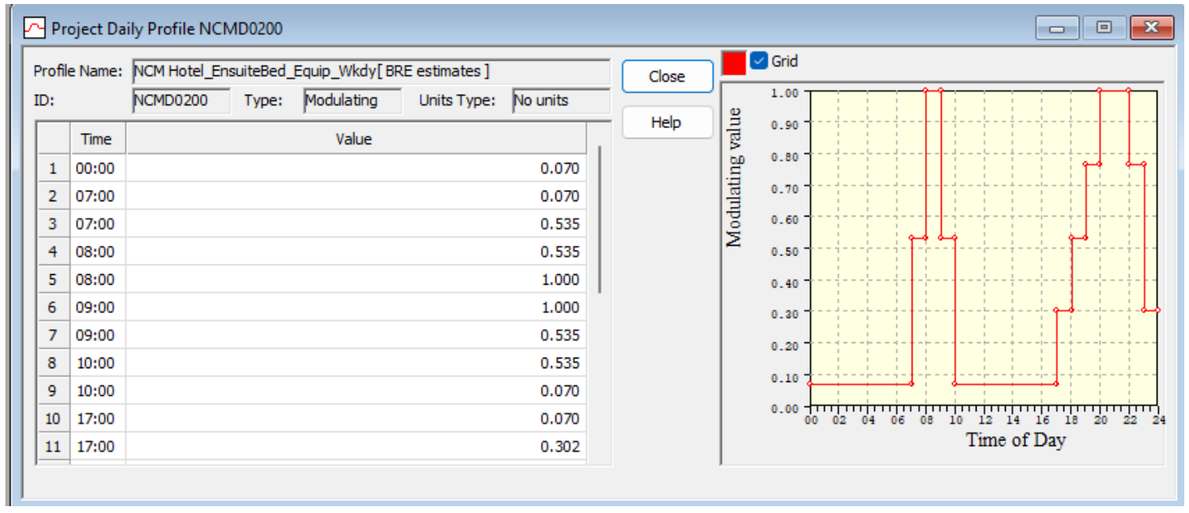


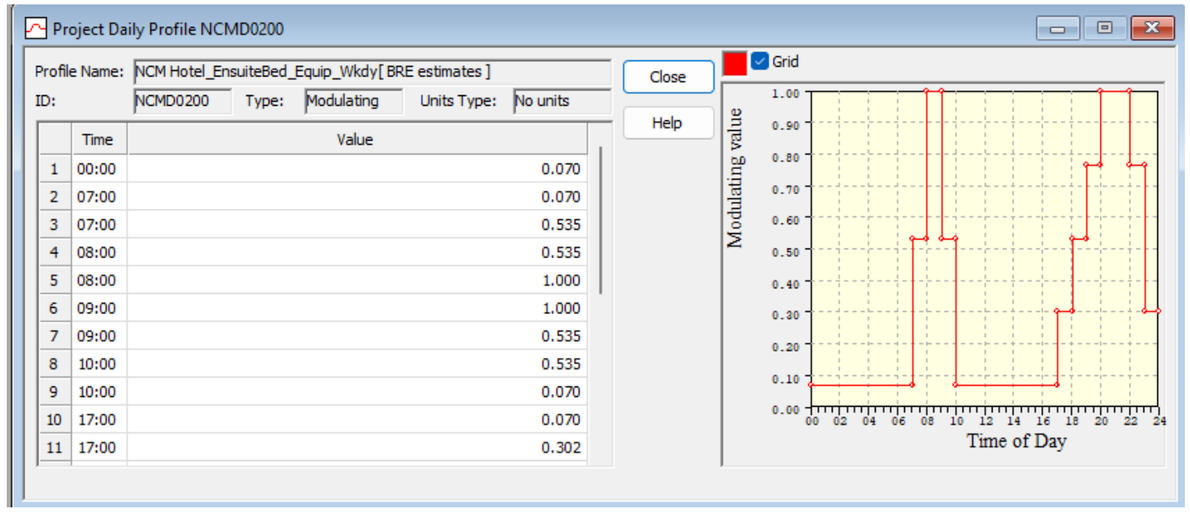
Figure A.8 Hotel circulation equipment profile

A.5.3 Galley/Housekeeping



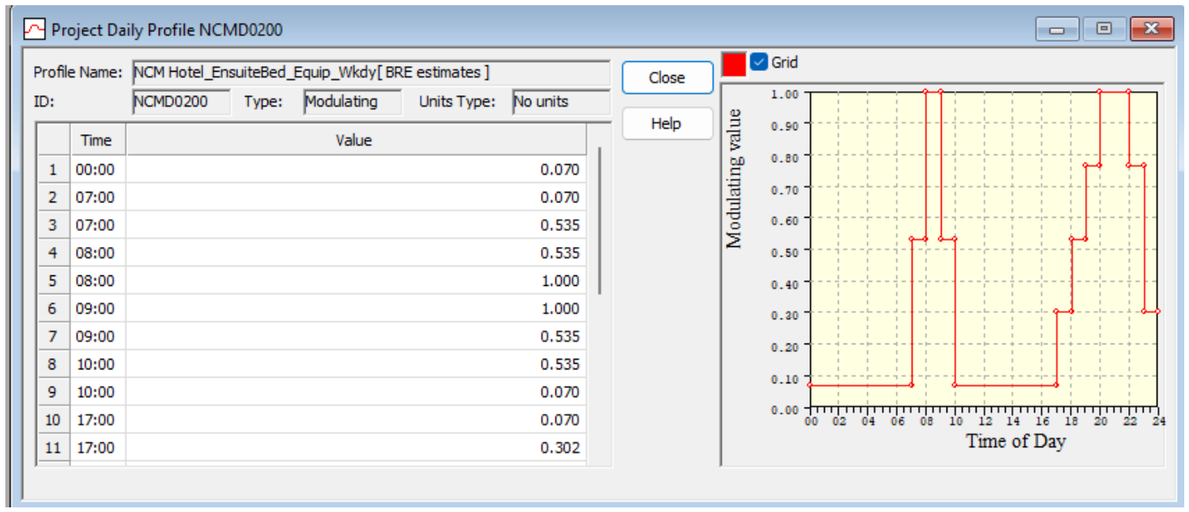
	Time	Value
1	00:00	0.070
2	07:00	0.070
3	07:00	0.535
4	08:00	0.535
5	08:00	1.000
6	09:00	1.000
7	09:00	0.535
8	10:00	0.535
9	10:00	0.070
10	17:00	0.070
11	17:00	0.302

Figure A.9 Hotel galley occupancy profile (based on ensuite hotel bedroom equipment profile)



	Time	Value
1	00:00	0.070
2	07:00	0.070
3	07:00	0.535
4	08:00	0.535
5	08:00	1.000
6	09:00	1.000
7	09:00	0.535
8	10:00	0.535
9	10:00	0.070
10	17:00	0.070
11	17:00	0.302

Figure A.11 Hotel galley equipment profile (based on ensuite hotel bedroom equipment profile)



	Time	Value
1	00:00	0.070
2	07:00	0.070
3	07:00	0.535
4	08:00	0.535
5	08:00	1.000
6	09:00	1.000
7	09:00	0.535
8	10:00	0.535
9	10:00	0.070
10	17:00	0.070
11	17:00	0.302

Figure A.10 Hotel galley lighting profile (based on ensuite hotel bedroom equipment profile)

A.6 Energy Uses

A.6.1 Lifts

Three lifts have been applied within the operational energy model. The following parameters have been applied in the calculation of the lift motor annual energy consumption:

- Starts per day — 300 (as per BS ISO/DIS 25745-1 medium duty)
- Days per year — 365
- Number of starts per year — 109,200 per lift
- Power rating of electric motor — 15 kW
- Travel height — 23.5m
- Assumed speed — 1 m/s
- Standby energy loss rate — 1.5 kW (10%)

For three lifts, prorated for just the new build floors = **1.16 kWh/m².**

A.6.2 General Lighting

Using the values in the compliance model (110lm/cw efficacy and 100 lux) the average W/m² for hotel bedrooms is ~2.7 W/m². There is additional lighting in the form of lamps and the bulbs around the mirrors in the hotel operator specification which will be accounted for in small power.

Similarly for circulation areas, this is around 2.3 W/m² with the addition of occupancy sensing present.

Other spaces, such as galley, housekeeping and comms are modelled at 5.2 W/m².

Internal lighting based on the above is estimated to be **7.63kWh/m².**

A.6.3 External Lighting

External lighting with a total electrical load of 2kW has been applied within the model, as advised by the Stage 2 electrical allowance. This is based on an initial allowance for external lighting for the building. The lighting is controlled via photoelectric sensors that turn the lights off in daylight hours. Control profile is shown in Figure A.12 where "igh" is the global horizontal solar flux (total amount of solar radiation received per unit area on a horizontal surface measured in W/m²).

	Time	Value
1	00:00	(igh<1)
2	24:00	(igh<1)

Figure A.12 External lighting profile

External lighting based on the above is estimated to be **3.68 kWh/m².**

A.6.4 Domestic Hot Water

A domestic hot water consumption of 136 litres per person per day has been applied within the operational energy model. The occupancy figure used is assumed to be equal to the number of hotel rooms on the new build floors (156) with the assumption that the diversity that would be applied for an increased occupancy per bedroom is cancelled out by assuming one occupant per room (e.g., assuming 1.25 occupants per room and 80% diversity would be the same figure). Occupied days per year is 365.

The entire hot water demand is assumed to be provided by the centralised ASHP system with a SCoP of 3.33 and 15% combined storage and distribution losses.

Using standard values for the calculation (1.0 kg/litre water density, 50°C dT, 4.187 kJ/kg.K specific heat capacity) estimates the annual DHW energy consumption of **74.8 kWh/m².**

A.6.5 Server Rooms

An allowance of 12kW server cooling load in the comms room was made served by a cooling system with a SEER of 5.0. The annual server consumption is estimated to be **11.1 kWh/m².**

A.6.6 Catering

It is understood that the kitchen is a reheat kitchen rather than a full restaurant style kitchen. Using a benchmark figure (for good practice electrical consumption) of 1.46 kWh/meal and 156 meals per day (number of hotel rooms in the new build floors) is an estimated annual energy use of **11.0 kWh/m².**

A.7 Heating, Ventilation & Air Conditioning Systems (HVAC)

The ASHP water based 4-pipe FCU system serves the VAV boxes to hotel rooms and galley on each floor. The same parameters for heating and cooling efficiency, specific fan power and heat recovery as the Part L assessment were used.

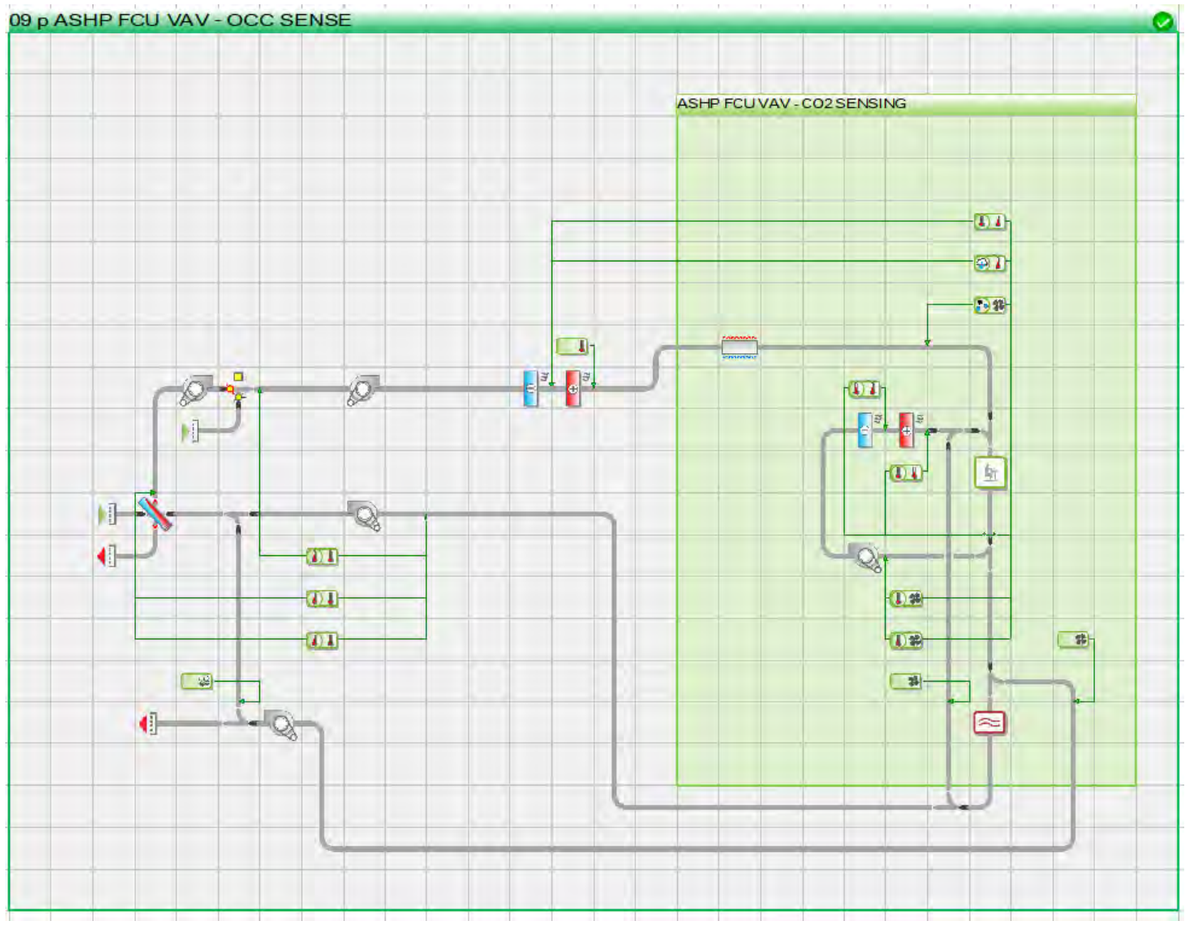


Figure A.13 Apache HVAC system modelled for heating, cooling and ventilation

The result of the simulation was estimated annual energy uses of:

- **Space heating = 17.1 kWh/m²**
- **Space cooling energy = 1.35 kWh/m²**
- **Auxiliary energy = 10.1 kWh/m²**

A.8 Baseline Results

The results from the baseline model are contained in Table A.2 and are illustrated in the following Figure A.15 and Figure A.14. The results show an energy use intensity of 147 kWh/m² (without PV) and 143.7 kWh/m² (including PV).

Table A.2 TM54 baseline results

Energy Use	Annual Energy (kWh/m²)
DHW	74.8
Space Heating	17.1
Server Rooms	11.1
Catering	11.0
Fans & Pumps	10.1
Small Power	9.0
Internal Lighting	7.63
External Lighting	3.7
Space Cooling	1.3
Lifts	1.2
PV	-3.2

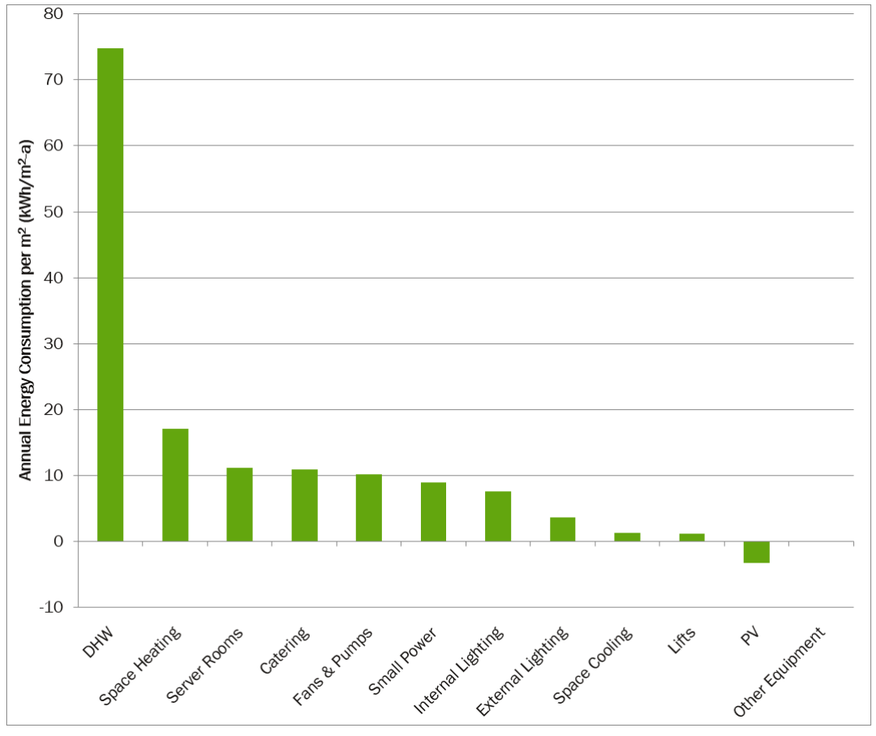


Figure A.14 TM54 baseline energy breakdown (bar chart)

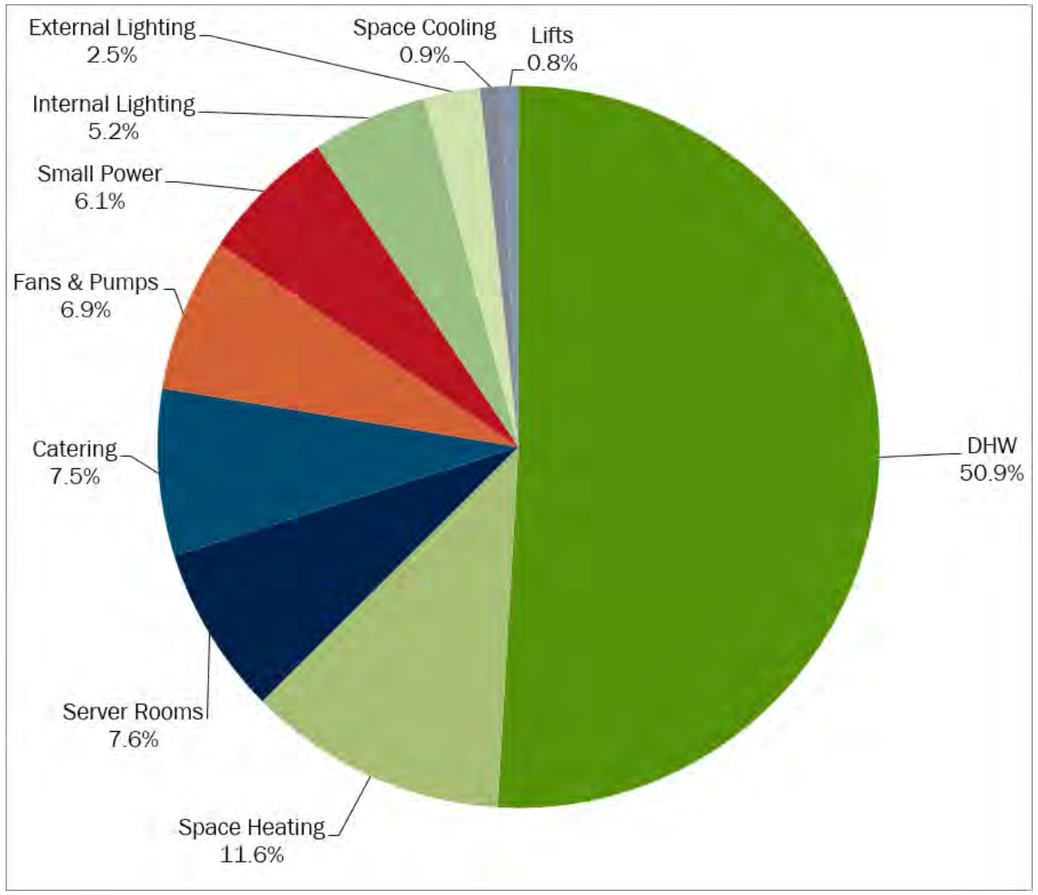


Figure A.15 TM54 baseline energy breakdown (pie chart)

A.9 Scenario Testing

Further to the baseline model, shown in Section A.8, three further scenarios have been tested.

- DHW consumption
  - An additional 50% occupancy used
- Small power
  - An additional 50% of small power to the hotel rooms
- Weather file
  - Run under a 2050 climate change weather file

The results are shown in Table A.3, demonstrating that increased DHW consumption has a high impact on overall EUI, an extra 50% small power allowance for the bedrooms results in an increase of 2.5 kWh/m²/year and that the high space heating load under current weather conditions actually performs better under a future weather scenario.

Table A.3 TM54 scenario results

Energy Use	Baseline Annual Energy (kWh/m²)	DHW Scenario Annual Energy (kWh/m²)	Small Power Scenario Annual Energy (kWh/m²)	Future Weather Scenario Annual Energy (kWh/m²)
DHW	74.8	112.3	74.83	74.83
Space Heating	17.1	17.1	16.5	13.1
Server Rooms	11.1	11.1	11.1	11.1
Catering	11.0	11.0	11.0	11.0
Fans & Pumps	10.1	10.1	10.2	10.2
Small Power	9.0	9.0	11.6	9.0
Internal Lighting	7.63	7.6	7.8	7.6
External Lighting	3.7	3.7	3.7	3.7
Space Cooling	1.3	1.3	1.5	2.2
Lifts	1.2	1.2	1.2	1.2
PV	-3.2	-3.2	-3.2	-3.2
Total	143.7	181.2	146.2	140.6

The results from Table A.3 have been illustrated in Figure A.16.

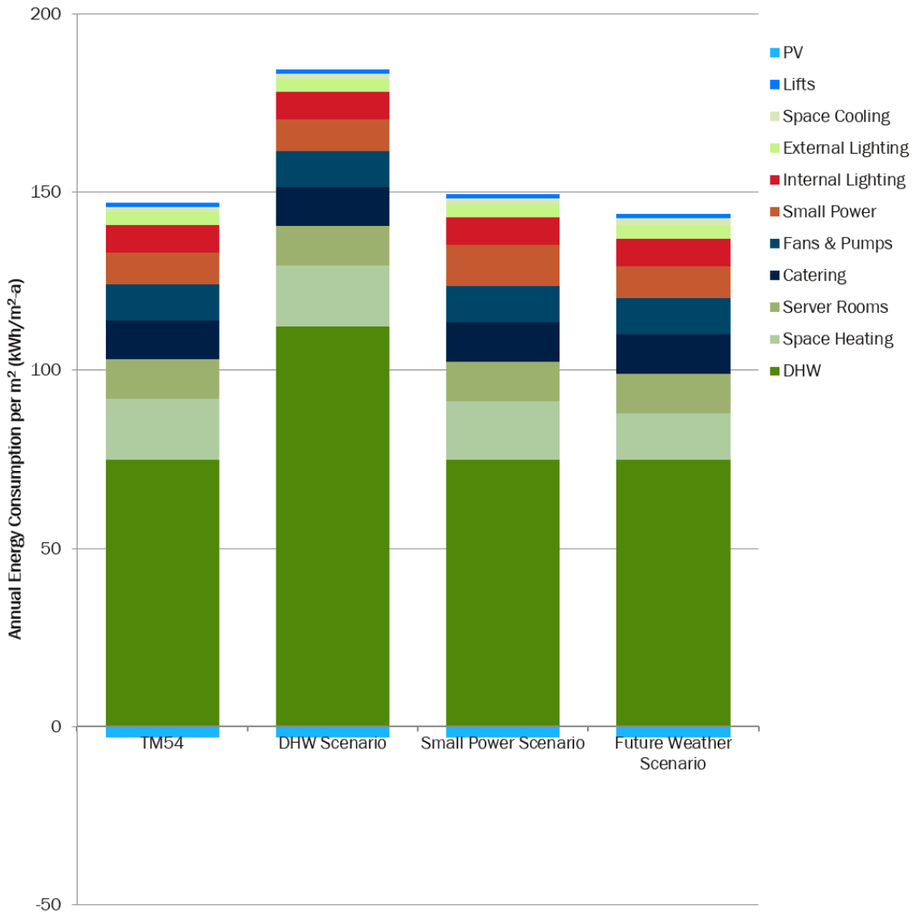


Figure A.16 TM54 baseline results compared to the three scenarios tested

Appendix B - BRUKL & EPC Results

B.1 Predicted Whole Building EPC

Energy Performance Certificate

Non-Domestic Building

HM Government

Address 1
Address 2
Address 3
Address 4
City
Postcode

Certificate Reference Number:
2372-5601-2383-4221-0772

This certificate shows the energy rating of this building. It indicates the energy efficiency of the building fabric and the heating, ventilation, cooling and lighting systems. The rating is compared to two benchmarks for this type of building: one appropriate for new buildings and one appropriate for existing buildings. There is more advice on how to interpret this information in the guidance document *Energy Performance Certificates for the construction, sale and let of non-dwellings* available on the Government's website at www.gov.uk/government/collections/energy-performance-certificates.

Energy Performance Asset Rating

More energy efficient

A+

Net zero CO_2 emissions

A 0-25

B 26-50

C 51-75

D 76-100

E 101-125

F 126-150

G Over 150

9 This is how energy efficient the building is.

Less energy efficient

Technical information

Main heating fuel:	Grid Supplied Electricity
Building environment:	Air Conditioning
Total useful floor area (m^2):	7872.495
Building complexity:	Level 5
Building emission rate ($kgCO_2/m^2$ per year):	13.97
Primary energy use (kWh_{PE}/m^2 per year):	150.86

Benchmarks

Buildings similar to this one could have ratings as follows:

8 If newly built

32 If typical of the existing stock

ONLY FOR ILLUSTRATION

Administrative information

This is an Energy Performance Certificate as defined in the Energy Performance of Buildings Regulations 2012 as amended.

Assessment Software:	Virtual Environment v7.0.28 using calculation engine ApacheSim v7.0.28
Property Reference:	UPRN-000000000000
Assessor Name:	Name
Assessor Number:	TEST000000
Accreditation Scheme:	Information not available
Assessor Qualifications:	NOS5
Employer/Trading Name:	Trading Name
Employer/Trading Address:	Trading Address
Issue Date:	15 May 2026
Valid Until:	14 May 2036 (unless superseded by a later certificate)
Related Party Disclosure:	Not related to the owner

Recommendations for improving the energy performance of the building are contained in the associated Recommendation Report: 5825-2562-8826-2732-7714

About this document and the data in it

This document has been produced following an energy assessment undertaken by a qualified Energy Assessor, accredited by Information not available. You can obtain contact details of the Accreditation Scheme at Information not available.

A copy of this certificate has been lodged on a national register as a requirement under the Energy Performance of Buildings Regulations 2012 as amended. It will be made available via the online search function at www.ndepcregister.com. The certificate (including the building address) and other data about the building collected during the energy assessment but not shown on the certificate, for instance heating system data, will be made publicly available at www.opendatacommunities.org.

This certificate and other data about the building may be shared with other bodies (including government departments and enforcement agencies) for research, statistical and enforcement purposes. For further information about how data about the property are used, please visit www.ndepcregister.com. To opt out of having information about your building made publicly available, please visit www.ndepcregister.com/optout.

There is more information in the guidance document *Energy Performance Certificates for the construction, sale and let of non-dwellings* available on the Government website at: www.gov.uk/government/collections/energy-performance-certificates. It explains the content and use of this document and advises on how to identify the authenticity of a certificate and how to make a complaint.

Opportunity to benefit from a Green Deal on this property

The Green Deal can help you cut your energy bills by making energy efficiency improvements at no upfront costs. Use the Green Deal to find trusted advisors who will come to your property, recommend measures that are right for you and help you access a range of accredited installers. Responsibility for repayments stays with the property - whoever pays the energy bills benefits so they are responsible for the payments.

To find out how you could use Green Deal finance to improve your property please call 0300 123 1234.

NOT FOR LEGISLATION

B.2 Predicted New Floors BRUKL

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2021

Project name

TOP FLOOR BRUKL

As designed

Date: Fri May 15 10:04:38 2026

Administrative information

Building Details

Address: Address 1, City, Postcode

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.28

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.28

BRUKL compliance module version: v6.1.e.1

Certifier details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Foundation area [m^2]: 505.45

The CO_2 emission and primary energy rates of the building must not exceed the targets

Target CO_2 emission rate (TER), $kgCO_2/m^2$annum	14.79	
Building CO_2 emission rate (BER), $kgCO_2/m^2$annum	14.2	
Target primary energy rate (TPER), kWh_{PE}/m^2annum	160.07	
Building primary energy rate (BPER), kWh_{PE}/m^2annum	153.4	
Do the building's emission and primary energy rates exceed the targets?	BER =< TER	BPER =< TPER

The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Fabric element	$U_{a\text{-Limit}}$	$U_{a\text{-Calc}}$	$U_{i\text{-Calc}}$	First surface with maximum value
Walls*	0.26	0.2	0.3	L000027F:Surf[0]
Floors	0.18	0.58	0.58	L0000225:Surf[7]
Pitched roofs	0.16	-	-	No pitched roofs in building
Flat roofs	0.18	0.12	0.12	L00001E0:Surf[8]
Windows** and roof windows	1.6	1.2	1.2	L00000FE:Surf[0]
Rooflights***	2.2	-	-	No roof lights in building
Personnel doors^	1.6	-	-	No personnel doors in building
Vehicle access & similar large doors	1.3	-	-	No vehicle access doors in building
High usage entrance doors	3	-	-	No high usage entrance doors in building

$U_{a\text{-Limit}}$ = Limiting area-weighted average U-values [$W/(m^2K)$] $U_{i\text{-Calc}}$ = Calculated maximum individual element U-values [$W/(m^2K)$]

$U_{a\text{-Calc}}$ = Calculated area-weighted average U-values [$W/(m^2K)$]

* Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.

** Display windows and similar glazing are excluded from the U-value check. *** Values for rooflights refer to the horizontal position.

^ For fire doors, limiting U-value is 1.8 W/m^2K

NB: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air permeability	Limiting standard	This building
$m^3/(h.m^2)$ at 50 Pa	8	5

Building services

For details on the standard values listed below, system-specific guidance, and additional regulatory requirements, refer to the Approved Documents.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	>0.95

1- 4 PIPE (HOTEL ROOMS)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	2.88	5.27	0	1.4	0.79
Standard value	2.5*	4.5**	N/A	2^	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.

** Standard shown is for air-cooled chillers >=400 kW. For chillers <400 kW, limiting SEER is 4.

^ Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.

2- DX SPLIT SYSTEM

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3	5	0	-	0.79
Standard value	2.5*	5	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.

"No HWS in project, or hot water is provided by HVAC system"

Zone-level mechanical ventilation, exhaust, and terminal units

ID	System type in the Approved Documents
A	Local supply or extract ventilation units
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal balanced supply and extract ventilation system
E	Local balanced supply and extract ventilation units
F	Other local ventilation units
G	Fan assisted terminal variable air volume units
H	Fan coil units
I	Kitchen extract with the fan remote from the zone and a grease filter

NB: Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**		
Standard value	0.3	1.1	0.5	2.3	2	0.5	0.5	0.4	1	**Zone**	**Standard**
L06 BEDROOM (E)	-	-	-	-	-	-	-	0.3	-	-	N/A
L06 BEDROOM (E)	-	-	-	-	-	-	-	0.3	-	-	N/A
L06 BEDROOM (E)	-	-	-	-	-	-	-	0.3	-	-	N/A
L06 BEDROOM (E)	-	-	-	-	-	-	-	0.3	-	-	N/A
L06 BEDROOM (E)	-	-	-	-	-	-	-	0.3	-	-	N/A
L06 BEDROOM (E)	-	-	-	-	-	-	-	0.3	-	-	N/A
L06 BEDROOM (E)	-	-	-	-	-	-	-	0.3	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	2.3	2	0.5	0.5	0.4	1	Zone	Standard
L06 BEDROOM (E)	-	-	-	-	-	-	-	0.3	-	-	N/A
L06 BEDROOM (E) ENSUITE	-	-	-	-	-	-	-	0.3	-	-	N/A
L06 BEDROOM (E) ENSUITE	-	-	-	-	-	-	-	0.3	-	-	N/A
L06 BEDROOM (E) ENSUITE	-	-	-	-	-	-	-	0.3	-	-	N/A
L06 BEDROOM (E) ENSUITE	-	-	-	-	-	-	-	0.3	-	-	N/A
L06 BEDROOM (E) ENSUITE	-	-	-	-	-	-	-	0.3	-	-	N/A
L06 BEDROOM (E) ENSUITE	-	-	-	-	-	-	-	0.3	-	-	N/A
L06 BEDROOM (E) ENSUITE	-	-	-	-	-	-	-	0.3	-	-	N/A
L06 BEDROOM (E) ENSUITE	-	-	-	-	-	-	-	0.3	-	-	N/A
L06 BEDROOM (N)	-	-	-	-	-	-	-	0.3	-	-	N/A
L06 BEDROOM (N)	-	-	-	-	-	-	-	0.3	-	-	N/A
L06 BEDROOM (N)	-	-	-	-	-	-	-	0.3	-	-	N/A
L06 BEDROOM (N)	-	-	-	-	-	-	-	0.3	-	-	N/A
L06 BEDROOM (N)	-	-	-	-	-	-	-	0.3	-	-	N/A
L06 BEDROOM (N)	-	-	-	-	-	-	-	0.3	-	-	N/A
L06 BEDROOM (N)	-	-	-	-	-	-	-	0.3	-	-	N/A
L06 BEDROOM (N)	-	-	-	-	-	-	-	0.3	-	-	N/A
L06 BEDROOM (N)	-	-	-	-	-	-	-	0.3	-	-	N/A
L06 BEDROOM (N)	-	-	-	-	-	-	-	0.3	-	-	N/A
L06 BEDROOM (N) ENSUITE	-	-	-	-	-	-	-	0.3	-	-	N/A
L06 BEDROOM (N) ENSUITE	-	-	-	-	-	-	-	0.3	-	-	N/A
L06 BEDROOM (N) ENSUITE	-	-	-	-	-	-	-	0.3	-	-	N/A
L06 BEDROOM (N) ENSUITE	-	-	-	-	-	-	-	0.3	-	-	N/A
L06 BEDROOM (N) ENSUITE	-	-	-	-	-	-	-	0.3	-	-	N/A
L06 BEDROOM (N) ENSUITE	-	-	-	-	-	-	-	0.3	-	-	N/A
L06 BEDROOM (N) ENSUITE	-	-	-	-	-	-	-	0.3	-	-	N/A
L06 BEDROOM (N) ENSUITE	-	-	-	-	-	-	-	0.3	-	-	N/A
L06 BEDROOM (N) ENSUITE	-	-	-	-	-	-	-	0.3	-	-	N/A
L06 BEDROOM (NW)	-	-	-	-	-	-	-	0.3	-	-	N/A
L06 BEDROOM (NW) ENSUITE	-	-	-	-	-	-	-	0.3	-	-	N/A
L06 BEDROOM (S)	-	-	-	-	-	-	-	0.3	-	-	N/A
L06 BEDROOM (S)	-	-	-	-	-	-	-	0.3	-	-	N/A
L06 BEDROOM (S)	-	-	-	-	-	-	-	0.3	-	-	N/A
L06 BEDROOM (S)	-	-	-	-	-	-	-	0.3	-	-	N/A
L06 BEDROOM (S)	-	-	-	-	-	-	-	0.3	-	-	N/A
L06 BEDROOM (S)	-	-	-	-	-	-	-	0.3	-	-	N/A
L06 BEDROOM (S)	-	-	-	-	-	-	-	0.3	-	-	N/A
L06 BEDROOM (S)	-	-	-	-	-	-	-	0.3	-	-	N/A
L06 BEDROOM (S) ENSUITE	-	-	-	-	-	-	-	0.3	-	-	N/A
L06 BEDROOM (S) ENSUITE	-	-	-	-	-	-	-	0.3	-	-	N/A
L06 BEDROOM (S) ENSUITE	-	-	-	-	-	-	-	0.3	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	2.3	2	0.5	0.5	0.4	1	Zone	Standard
L06 BEDROOM (S) ENSUITE	-	-	-	-	-	-	-	0.3	-	-	N/A
L06 BEDROOM (S) ENSUITE	-	-	-	-	-	-	-	0.3	-	-	N/A
L06 BEDROOM (S) ENSUITE	-	-	-	-	-	-	-	0.3	-	-	N/A
L06 BEDROOM (S) ENSUITE	-	-	-	-	-	-	-	0.3	-	-	N/A
L06 BEDROOM (S) ENSUITE	-	-	-	-	-	-	-	0.3	-	-	N/A
L06 BEDROOM (S) ENSUITE	-	-	-	-	-	-	-	0.3	-	-	N/A
L06 BEDROOM (SE)	-	-	-	-	-	-	-	0.3	-	-	N/A
L06 BEDROOM (SE)	-	-	-	-	-	-	-	0.3	-	-	N/A
L06 BEDROOM (SE) ENSUITE	-	-	-	-	-	-	-	0.3	-	-	N/A
L06 BEDROOM (SE) ENSUITE	-	-	-	-	-	-	-	0.3	-	-	N/A
L06 BEDROOM (SW)	-	-	-	-	-	-	-	0.3	-	-	N/A
L06 BEDROOM (SW) ENSUITE	-	-	-	-	-	-	-	0.3	-	-	N/A
L06 BEDROOM (W)	-	-	-	-	-	-	-	0.3	-	-	N/A
L06 BEDROOM (W)	-	-	-	-	-	-	-	0.3	-	-	N/A
L06 BEDROOM (W)	-	-	-	-	-	-	-	0.3	-	-	N/A
L06 BEDROOM (W)	-	-	-	-	-	-	-	0.3	-	-	N/A
L06 BEDROOM (W)	-	-	-	-	-	-	-	0.3	-	-	N/A
L06 BEDROOM (W)	-	-	-	-	-	-	-	0.3	-	-	N/A
L06 BEDROOM (W)	-	-	-	-	-	-	-	0.3	-	-	N/A
L06 BEDROOM (W)	-	-	-	-	-	-	-	0.3	-	-	N/A
L06 BEDROOM (W) ENSUITE	-	-	-	-	-	-	-	0.3	-	-	N/A
L06 BEDROOM (W) ENSUITE	-	-	-	-	-	-	-	0.3	-	-	N/A
L06 BEDROOM (W) ENSUITE	-	-	-	-	-	-	-	0.3	-	-	N/A
L06 BEDROOM (W) ENSUITE	-	-	-	-	-	-	-	0.3	-	-	N/A
L06 BEDROOM (W) ENSUITE	-	-	-	-	-	-	-	0.3	-	-	N/A
L06 BEDROOM (W) ENSUITE	-	-	-	-	-	-	-	0.3	-	-	N/A
L06 BEDROOM (W) ENSUITE	-	-	-	-	-	-	-	0.3	-	-	N/A
L06 GALLEY	-	-	-	-	-	-	-	0.3	-	-	N/A
L07 BEDROOM (E)	-	-	-	-	-	-	-	0.3	-	-	N/A
L07 BEDROOM (E)	-	-	-	-	-	-	-	0.3	-	-	N/A
L07 BEDROOM (E)	-	-	-	-	-	-	-	0.3	-	-	N/A
L07 BEDROOM (E)	-	-	-	-	-	-	-	0.3	-	-	N/A
L07 BEDROOM (E)	-	-	-	-	-	-	-	0.3	-	-	N/A
L07 BEDROOM (E)	-	-	-	-	-	-	-	0.3	-	-	N/A
L07 BEDROOM (E)	-	-	-	-	-	-	-	0.3	-	-	N/A
L07 BEDROOM (E)	-	-	-	-	-	-	-	0.3	-	-	N/A
L07 BEDROOM (E) ENSUITE	-	-	-	-	-	-	-	0.3	-	-	N/A
L07 BEDROOM (E) ENSUITE	-	-	-	-	-	-	-	0.3	-	-	N/A
L07 BEDROOM (E) ENSUITE	-	-	-	-	-	-	-	0.3	-	-	N/A
L07 BEDROOM (E) ENSUITE	-	-	-	-	-	-	-	0.3	-	-	N/A
L07 BEDROOM (E) ENSUITE	-	-	-	-	-	-	-	0.3	-	-	N/A
L07 BEDROOM (E) ENSUITE	-	-	-	-	-	-	-	0.3	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	2.3	2	0.5	0.5	0.4	1	Zone	Standard
L07 BEDROOM (E) ENSUITE	-	-	-	-	-	-	-	0.3	-	-	N/A
L07 BEDROOM (E) ENSUITE	-	-	-	-	-	-	-	0.3	-	-	N/A
L07 BEDROOM (N)	-	-	-	-	-	-	-	0.3	-	-	N/A
L07 BEDROOM (N)	-	-	-	-	-	-	-	0.3	-	-	N/A
L07 BEDROOM (N)	-	-	-	-	-	-	-	0.3	-	-	N/A
L07 BEDROOM (N)	-	-	-	-	-	-	-	0.3	-	-	N/A
L07 BEDROOM (N)	-	-	-	-	-	-	-	0.3	-	-	N/A
L07 BEDROOM (N)	-	-	-	-	-	-	-	0.3	-	-	N/A
L07 BEDROOM (N)	-	-	-	-	-	-	-	0.3	-	-	N/A
L07 BEDROOM (N)	-	-	-	-	-	-	-	0.3	-	-	N/A
L07 BEDROOM (N)	-	-	-	-	-	-	-	0.3	-	-	N/A
L07 BEDROOM (N)	-	-	-	-	-	-	-	0.3	-	-	N/A
L07 BEDROOM (N) ENSUITE	-	-	-	-	-	-	-	0.3	-	-	N/A
L07 BEDROOM (N) ENSUITE	-	-	-	-	-	-	-	0.3	-	-	N/A
L07 BEDROOM (N) ENSUITE	-	-	-	-	-	-	-	0.3	-	-	N/A
L07 BEDROOM (N) ENSUITE	-	-	-	-	-	-	-	0.3	-	-	N/A
L07 BEDROOM (N) ENSUITE	-	-	-	-	-	-	-	0.3	-	-	N/A
L07 BEDROOM (N) ENSUITE	-	-	-	-	-	-	-	0.3	-	-	N/A
L07 BEDROOM (N) ENSUITE	-	-	-	-	-	-	-	0.3	-	-	N/A
L07 BEDROOM (N) ENSUITE	-	-	-	-	-	-	-	0.3	-	-	N/A
L07 BEDROOM (NW)	-	-	-	-	-	-	-	0.3	-	-	N/A
L07 BEDROOM (NW) ENSUITE	-	-	-	-	-	-	-	0.3	-	-	N/A
L07 BEDROOM (S)	-	-	-	-	-	-	-	0.3	-	-	N/A
L07 BEDROOM (S)	-	-	-	-	-	-	-	0.3	-	-	N/A
L07 BEDROOM (S)	-	-	-	-	-	-	-	0.3	-	-	N/A
L07 BEDROOM (S)	-	-	-	-	-	-	-	0.3	-	-	N/A
L07 BEDROOM (S)	-	-	-	-	-	-	-	0.3	-	-	N/A
L07 BEDROOM (S)	-	-	-	-	-	-	-	0.3	-	-	N/A
L07 BEDROOM (S)	-	-	-	-	-	-	-	0.3	-	-	N/A
L07 BEDROOM (S)	-	-	-	-	-	-	-	0.3	-	-	N/A
L07 BEDROOM (S)	-	-	-	-	-	-	-	0.3	-	-	N/A
L07 BEDROOM (S) ENSUITE	-	-	-	-	-	-	-	0.3	-	-	N/A
L07 BEDROOM (S) ENSUITE	-	-	-	-	-	-	-	0.3	-	-	N/A
L07 BEDROOM (S) ENSUITE	-	-	-	-	-	-	-	0.3	-	-	N/A
L07 BEDROOM (S) ENSUITE	-	-	-	-	-	-	-	0.3	-	-	N/A
L07 BEDROOM (S) ENSUITE	-	-	-	-	-	-	-	0.3	-	-	N/A
L07 BEDROOM (S) ENSUITE	-	-	-	-	-	-	-	0.3	-	-	N/A
L07 BEDROOM (S) ENSUITE	-	-	-	-	-	-	-	0.3	-	-	N/A
L07 BEDROOM (S) ENSUITE	-	-	-	-	-	-	-	0.3	-	-	N/A
L07 BEDROOM (S) ENSUITE	-	-	-	-	-	-	-	0.3	-	-	N/A
L07 BEDROOM (SE)	-	-	-	-	-	-	-	0.3	-	-	N/A