
Manchester College City Centre Campus, Phase 2

Environmental Standards Statement

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1. Introduction

This Environmental Standards Statement has been proposed on behalf of the LTE Group in support of the detailed planning application for the development of the second phase of a new City Centre campus for The Manchester College. The Phase 2 development is part of an ambitious masterplan through which The Manchester College plan to support Greater Manchester's long-term economic growth by meeting its educational and skills needs. The City Centre Campus will provide Centres of Excellence for the Digital and Creative Industries, and for Business and Professional Services.

The statement seeks to address the requirements of 'A Guide to Development in Manchester and Manchester's Core Strategy (adopted 2012)', demonstrating how the proposals will comply with the environmental standards set out in terms of energy efficiency, renewable energy and environmental design. The report further demonstrates how the scheme meets the minimum target CO₂ reductions from low or zero carbon energy supplies, as set out in the adopted Core Strategy. In line with College's commitment to sustainable design and Manchester Council's 2038 net zero operational carbon target and wider sustainability agenda, the project aims to demonstrate leadership through the adoption of a net zero carbon (NZC) framework. The project team have proposed applying RIBA 2030 Climate Challenge sustainability benchmarks, relevant to operational carbon, to the City Centre Phase 2 development. The UKGBC and LETI frameworks were also considered, however RIBA 2030 has been adopted as, not only are the RIBA targets largely in line with the two other schemes considered, but RIBA 2030 also proposes additional and non-energy related benchmarks for issues such as water consumption, daylight, biodiversity, and health and wellbeing, therefore adopting a broader and more holistic approach to sustainable development.

A separate Energy Statement has been developed by BDP outlining the current proposed energy efficiency measures. A summary of key points are presented in this statement.

The approach to reducing energy demand, a key priority for Manchester City Council, is centred on the energy hierarchy, with a focus on passive design measures and fabric optimisation, followed by the selection of energy efficient plant and then utilisation of the on-site zero or low carbon technologies, namely air source heat pumps (ASHPs) and PVs.

This statement should be read in conjunction with the full suite of supporting documents and drawings that form the planning application submission.

2. Description of the Development

The new City Centre Campus is being developed as part of the wider estates masterplan. Phase 1 of the college occupies the prominent corner of the site, opposite Manchester Arena, Phase 2 will abut the north façade of Phase 1 to complete the city block extending and replacing the current bike store and external storage space. The site has excellent public transport links, being within walking distance of mainline rail and Metrolink services at Victoria Station. The topography is largely flat, with a small number of shrubs, some trees and areas of scrub surrounding the perimeter.

Phase 2 comprises five stories of education space, together with associated amenity space, servicing, accessible parking bays, cycle storage and other works, further expanding on the Phase 1 development. Key facilities to be provided include classrooms, laboratories, meeting rooms, hospitality and catering spaces, and other support facilities.

3. Planning Policy and Drivers

This Environmental Standards Statement seeks to respond to Manchester's local planning policy, in addition to wider national planning policies within the National Planning Policy Framework 2021 (NPPF 2021).

Manchester's current planning policy in respect of environmental standards is set out within the Core Strategy, which was adopted on 11th July 2012 and covers the period of 2012 – 2027. The Strategy is supported by the Supplementary Planning Document (SPD) *Guide to Development in Manchester* (adopted 2007). Section 4 of the SPD, "Environmental Standards", provides guidance to developers of requirements and planning submission documentation to be submitted in support of planning applications in Manchester so as to demonstrate compliance with the relevant Core Strategy planning requirements. This report responds to item 4.4 of the SPD which requires that:

"Developers will be expected to submit a statement on how their proposal will achieve the environmental standards set out in this chapter. This statement will be seen as an addition to the Design and Access Statement [...]. This additional Environmental Standards Statement will be required for all planning applications, both outline and full, with the exception of changes of use where no operational work is required, house extensions and mining or engineering work."

The following planning policies, as detailed within the Core Strategy, are addressed within this Environmental Standards Statement:

- **Policy EN4 (Reducing CO₂ Emissions by Enabling Low and Zero Carbon Development)**

The Council will seek to reduce fuel poverty and decouple growth in the economy, growth in CO₂ emissions, and rising fossil fuel prices, through the following actions:

- All development must follow the principle of the Energy Hierarchy, being designed:
 - to reduce the need for energy through design features that provide passive heating, natural lighting and cooling
 - to reduce the need for energy through design features such as improved insulation and glazing
 - to meet residual energy requirements through the use of low or zero carbon energy generating technologies.
- Wherever possible new development and retrofit projects, including energy generation plant, must be located and designed in a manner that allows advantage to be taken of opportunities for low and zero carbon energy supplies.
- Where possible new development and retrofit projects will be used as a mechanism to help improve energy efficiency and provide low and zero carbon energy supplies to existing buildings.
- Where appropriate new development and retrofit projects will be required to connect to and/or make contributions to low or zero carbon energy schemes and/or to incorporate provision to enable future connection to any existing / potential decentralised energy schemes.
- The use of building materials with low embodied carbon in new development and refurbishment schemes.

- **Policy EN6 (Target Framework for CO₂ Reduction from Low or Zero Carbon Energy Supplies)**

Applications for residential development of 10 or more units and all other development over 1,000m² will be expected as a minimum to meet the target shown in Tables 1 or 2, unless this can be shown not to be viable. This should be demonstrated through an energy statement, submitted as part of the Design and Access Statement. Such a statement will be expected to set out the projected regulated energy demand and associated CO₂ emissions for all phases of the development.

Developments smaller than the above threshold, but involving the erection of a building or substantial improvements to an existing building will also be expected to meet the minimum target, where viable, but will not be expected to submit an energy statement.

The target framework relates to three broad development locations and their potential for low and zero carbon, decentralised energy. The areas are defined as follows:

- Target 1 Network development areas: Locations where the proximity of new and existing buildings, the mix of uses and density of development provide the right conditions to support district heating (and cooling).
- Target 2 Electricity intense areas: Locations where the predominant building type has an all-electric fit-out such as retail units and leisure complexes.
- Target 3 Micro-generation areas: Locations where lower densities and a fragmented mix of uses tend to mean that only building scale solutions are practical.

Table 1: Domestic CO₂ emissions reduction targets

Target	% minimum requirement
Target 1: Network development area	CHP / district heating anchor or, connection or, where not feasible, a 15% increase on Part L 2010.
Target 2: Electricity intense buildings	+15% increase on Part L 2010
Target 3: Micro generation area	+15% increase on Part L 2010

Table 2: Non-domestic CO₂ emissions reduction targets

Target	% minimum requirement
Target 1: Network development area	CHP / district heating anchor or, connection or, where not feasible, a 15% increase on Part L 2010.
Target 2: Electricity intense buildings (applies to commercial uses with a high proportion of emissions from electricity use [$>45\text{kgCO}_2/\text{m}^2$])	+10% increase on Part L 2010
Target 3: Micro generation area	+15% increase on Part L 2010

Where CO₂ emissions reduction required under any future revisions to Part L of the building regulations becomes greater than the ‘% minimum requirement’, the reduction required under building regulations would apply.

Where the Council identifies an ‘allowable solution’, for example within an energy proposals plan, that would produce higher carbon reductions at no extra cost than that of achieving the ‘% Minimum requirement’ (or required under building regulations if greater) the higher percentage reduction will be required. The cost comparison is based on the cost of incorporating the ‘allowable solution’ at design stage.

The energy statement will be required to be submitted at the outset of any proposed development (outline application or before). Developers will be permitted to use green infrastructure elements such as green roofs, green walls, street trees and waterways to contribute to compliance with CO₂ mitigation, subject to the energy statement incorporating evidence such as modelling to demonstrate compliance.

- **Policy EN8** (Adaptation to Climate Change) requires all new developments to be designed so as to be adaptable to future climate conditions in terms of the design, layout, siting and function of buildings and associated external spaces.
- **Policy EN9** (Green Infrastructure) aims to ensure that existing green infrastructure is maintained, and, where the opportunity arises, enhanced in terms of quality, quantity and functionality. Where green infrastructure is lost, this should be mitigated.
- **Policy EN14** (Flood Risk) directs developments away from sites that are at risk of flooding and encourages the use of sustainable urban drainage systems to manage surface water runoff.
- **Policy EN17** (Water Quality) seeks to avoid any adverse impact on water quality, including the construction phase, and, wherever possible, enhance water quality and minimise surface water runoff through the use of sustainable urban drainage techniques (SuDS).

- **Policy EN19 (Waste)** aims to ensure that all developments demonstrate consistency with the principals of the waste hierarchy and for construction and demolition waste to be minimised and recycled on site wherever possible.

- **Policy DM1 (Development Management)**

All developments should have regard to the following specific issues for which more detailed guidance may be given within a supplementary planning document;

- Appropriate siting, layout, scale, form, massing, materials and detail.
- Impact on the surrounding areas in terms of the design, scale and appearance of the proposed development. Development should have regard to the character of the surrounding area.
- Effects on amenity, including privacy, light, noise, vibration, air quality, odours, litter, vermin, birds, road safety and traffic generation. This could also include proposals which would be sensitive to existing environmental conditions such as noise.
- Accessibility: buildings and neighbourhoods fully accessible to disabled people, access to new development by sustainable transport modes.
- Community safety and crime prevention.
- Design for health.
- Adequacy of internal accommodation and external amenity space.
- Refuse storage and collection.
- Vehicular access and car parking.
- Effects relating to biodiversity, landscape, archaeological or built heritage.
- Green infrastructure including open space, both public and private.
- The use of alternatives to peat-based products in landscaping/gardens within development schemes.
- Flood risk and drainage.
- Existing or proposed hazardous installations.
- Subject to scheme viability, developers will be required to demonstrate that new development incorporates sustainable construction techniques as follows (In terms of energy targets this policy should be read alongside policy EN6 and the higher target will apply):-
 - a) For new residential development (note that the requirement to meet Code for Sustainable homes targets has been removed from planning policy)
 - b) For new commercial developments to demonstrate best practice which will include the application of the BREEAM (Building Research Establishment Environmental Assessment Method) standards. By 2019 provisions similar to the Code for Sustainable Homes will also apply to all non-domestic buildings.

4. Sustainability Design Response

The following sections summarise the design response to the sustainability requirements of the Manchester Core Strategy, as set out in Section 3.

4.1 Environmental Design

The development has adopted the RIBA 2030 Climate Challenge (version 2) as a framework for sustainable design. Seeking to achieve net zero operational carbon, compliance with the wider sustainability benchmarks relevant to embodied carbon, water consumption, daylight, biodiversity, and health and wellbeing are also addressed within the design. In addition to this, whilst formal BREEAM certification is not currently sought, a BREEAM pre-assessment exercise was undertaken during the early stages of the design to ensure that the principles of BREEAM have been incorporated into the project. The summary below outlines how this is achieved (see Figure 1 and Table 3).

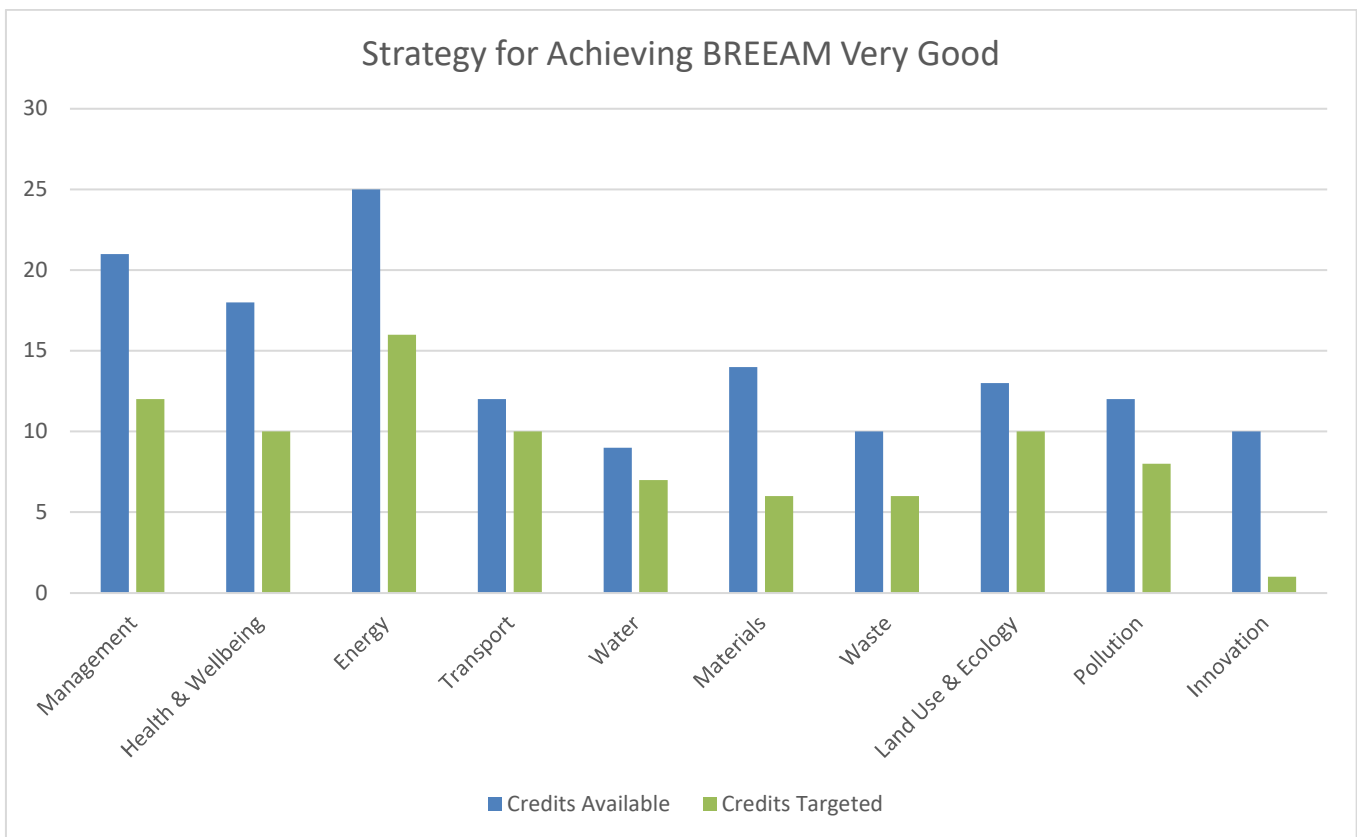


Figure 1: Strategy for Achieving BREEAM Very Good

Table 3: Route to Very Good

Environmental Section	No. credits available	Indicative no. credits targeted	% Credits targeted	Section weighting	Indicative section scoring
Management	21	12	57.14%	11%	6.29%
Health and Wellbeing	18	10	55.6%	14%	7.78%
Energy	25	16	64.0%	16%	10.24%
Transport	12	10	83.3%	10%	8.33%
Water	9	7	77.8%	7%	5.44%
Materials	14	6	42.9%	15%	6.43%
Waste	10	6	60.0%	6%	3.60%
Land Use and Ecology	13	10	76.9%	13%	10.00%
Pollution	12	8	66.7%	8%	5.33%
Innovation	10	1	10%	10%	1.00%
TOTAL:					64.44%

The client has confirmed that when tendering for a contractor, they will include the BREEAM issues relevant to site management, responsible construction practices, commissioning, aftercare and waste management within their key requirements to ensure that these sustainability features are incorporated within the design, construction and operation of the building. This is in line with Council policies DM1 and EN 19. The RIBA 2030 Climate Challenge checklist also requires post occupancy evaluations and the submission of sustainability data, ensuring that buildings continue to operate as designed, and reducing the performance gap.

For further details of the high-level approach to BREEAM Very Good, please refer to Appendix 1.

4.2 Sustainable Travel

As per the Phase 1 design, examples of sustainable transport measures include improvement of the pedestrian crossing outside of the college, and provision of cycle storage spaces and cyclist facilities to encourage active transport. Accessible parking facilities and a cycle storage space are to be incorporated as part of Phase 2.

Further sustainable transport measures are described in the transport assessment and travel plan submitted as part of the Planning application.

4.3 Ecology/Biodiversity

Despite limited external space, the development, in line with the RIBA 2030 checklist criteria, is expected to improve ecological value and opportunities for urban wildlife, e.g. through bird and bat boxes and wildflower planting in the small outdoor area to the rear of the site. In line with the council's policy EN9, existing green infrastructure will be maintained, and, where possible, enhanced in terms of quality, quantity and functionality. An ecology survey has been completed on the Phase 2 site and will be provided and further summarised in line with the EN9 policy once received.

Further ecology and biodiversity measures are described in the ecology report submitted as part of the Planning application.

4.4 Health and Wellbeing

Through the guidance of RIBA 2030 Climate Challenge criteria, the development will aim to achieve the core health and wellbeing metrics of overheating, CO₂ levels, total VOCs and formaldehyde, as detailed in Table 3. Although the targets for daylight factor cannot be met, the design team will endeavor to ensure the design promotes natural light ingress as far as practicable within the design.

Table 3: RIBA 2030 Climate Challenge best practice health metrics

Best Practice Health Metrics	Requirement	References
Overheating	25 - 28°C maximum for 1% of occupied hours	CIBSE TM52, CIBSE TM59
Daylighting	<2% average daylight factor, 0.4 uniformity	CIBSE LG10
CO ₂ levels	<900ppm	CIBSE TM40
Total VOCs	<0.3mg/m ³	Approved Document F
Formaldehyde	<0.1mg/m ³	BREEAM

4.5 Energy Efficiency Measures and Renewable Energy

Compliance with Manchester Core Strategy Policies EN4 and EN6 are addressed in the Energy Statement prepared by BDP (Appendix 2). In line with the project's NZC approach, Phase 2 will be fully electric and not connected to the gas grid. Currently, the energy strategy could potentially reduce regulated carbon to circa 2.35kgCO₂/m².

As per the requirements of Policy EN6 (Target Framework for CO₂ Reduction from Low or Zero Carbon Energy Supplies), developments must achieve a minimum 15% reduction in emissions (i.e., a 15% increase on Part L 2010). Since the issue of the Core Strategy, Part L 2010 has been superseded by Part L 2021 which has more stringent energy requirements. Compliance with the 2021 Part L Regulations translates as approximately a 30% improvement over the Part L 2013 regulations, far exceeding the target of a 15% increase to 2010 Part L Regulations. This development is compliant with the Part L 2021 Regulations and satisfies Policy EN6 (ref: CC-BDP-PH2-XX-RP-MEP-0008).

As required by the Core Strategy, the energy hierarchy (Figure 2) has been implemented. The hierarchy is split into three stages:

- Be Lean (reduce energy demand)
- Be Clean (supply energy efficiently)
- Be Green (reduce carbon emissions further through the use of low and zero carbon technologies)

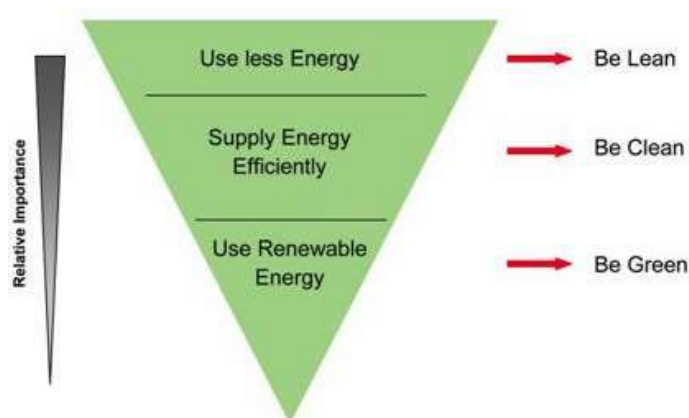


Figure 2: Energy Hierarchy

A summary of the approach, alongside a description of compliance with the aforementioned policies, are summarised below.

4.5.1 Be Lean

Building fabric performance will be significantly improved beyond the minimum requirements of the Part L Building Regulations. This fabric first design approach allows for less heat demand within the property due to the fabric permitting lower heat loss.

Table 4: Fabric improvements over Building Regulations

Description	Part L minimum	Minimum requirement for this building	Performance Relative to Part L Requirement
External Wall U-Value	0.26 W/m ² .K area-weighted average	0.15 W/m ²	Improvement
Ground Floor U-Value	0.18 W/m ² .K area-weighted average	0.15 W/m ²	Improvement
Roof U-Value	0.17 W/m ² .K area-weighted average	0.15 W/m ²	Improvement
Window / Door glazing U-Value	1.60 W/m ² .K area-weighted average	1.30 W/m ²	Improvement
Building Air Permeability	8 m ³ /(h.m ²) @ 50 Pa	5 m ³ /(h.m ²) @50 Pa.	Improvement
Thermal Bridging	Accredited Construction Details – To be confirmed by architects.		-

4.5.2 Be Clean

A number of additional energy efficient measures are currently under review in order to further reduce the energy demand of the building. These systems will likely be adopted to minimise consumption and contribute further towards reducing emissions (see Table 5).

Table 5: Energy Efficiency Measures

Description	System
Ventilation	Central air handling plant with heat recovery >75%. Demand controlled.
Main Heating	Electric panel heaters and mechanical vent with heat recovery
Emitters	Fan coil units, over door heaters, heater batteries.
Controls	Automatic controls linked to central BMS to monitor energy and meter consumption
Hot Water	CO2 Heat Pump
Secondary Heating	VRF air source heat pumps where cooling loads are also present in the spaces
Renewable Energy	Air source heat pumps, Photovoltaic cells
Lighting	LED with absence / presence detection controls. Daylight dimming where applicable. Daylight linking and an average lighting efficacy of 110 luminaire lumens per circuit Watt.

4.5.3 Be Green

As described above, to offset further emissions, ASHPs and PVs are provided.

4.5.4 Achieving Net Zero Carbon

To demonstrate their commitment to net zero carbon and to Manchester Council's 2038 NZC targets, the project team are applying RIBA 2030 Climate Challenge sustainability benchmarks relevant to operational carbon to the City Centre Phase 2 development. The UKGBC and LETI frameworks have been considered, however RIBA 2030 has been adopted as, not only are the targets largely in line with the two other schemes, but RIBA 2030 proposes additional and non-energy related benchmarks for issues such as water consumption, daylight, biodiversity, and health and wellbeing, therefore adopting a broader and more holistic approach to sustainable development.

Energy benchmarks, with regards to NZC, are currently only available for new build office, school and residential developments. The energy demands, occupancies and general activities required of the College are substantially different to those of a typical office or school environment, and, therefore, it is highly unlikely that an EUI value of <55 kWh/m²/year is realistically achievable. As such, it is proposed that typical energy benchmarks of offices are compared to those of further / higher education establishments, and the difference apportioned to the RIBA EUI target.

CIBSE TM46 offers a comprehensive outline of building energy benchmarks for different building types. Of the available building types, "university campus buildings" are the most closely aligned to Phase 2. The typical energy benchmarks for the two building types are:

- General office: 215 kWh/m²/year
- University campus: 320 kWh/m²/year

It should be noted that benchmarks for offices have been selected, as opposed to those for schools, as these are more stringent and therefore align with the College's high sustainability aspirations.

Based on the CIBSE TM46 data above, a university campus building typically uses 1.49 times more energy than an office. The proposed net zero operational energy EUI benchmarks, based on this and the RIBA benchmarks, are summarised below:

Table 6: Proposed EUI and RIBA Operational Energy Targets

Target	RIBA 2030 Climate Challenge	Proposed EUI
RIBA 2025 interim	<75 kWh/m ² /yr	<111.75 kWh/m ² /yr
RIBA 2030 stretch	<55 kWh/m ² /yr	<81.95 kWh/m ² /yr

The Energy Statement confirms that, based on the current design, the proposed 2025 target for energy use intensity (EUI) of <111.75 kWh/m²/yr is easily achievable for the development, with an EUI of 83.90 kWh/m²/yr. This also satisfies the RIBA 2030 target to reduce operational energy demand by at least 60% from current business as usual baseline figures, before offsetting. The current EUI of 80 kWh/m²/year also achieves the <81.95 kWh/m²/year stretch target, demonstrating exemplar performance.

Despite the PV panels producing 35MWh of electricity annually the remaining 87.1 tonnes of carbon will need to be offset for approximately £565.50 per year (based on £6.50 per tonne per year).

4.6 Water Management

4.6.1 Internal water consumption

In line with the RIBA 2030 Climate Challenge target, the development will aim to reduce potable water consumption to 10 litres/person/day. Alternatively, the BREEAM methodology will be used to ensure that potable water consumption is reduced by at least 40% compared to a baseline performance. Although sanitary and kitchen fittings have not yet been specified, the limits detailed in Table 7 will likely be imposed in order to achieve the 40% reduction.

The proposed development shall seek to emulate the strategy utilised in Phase 1, minimising potable water consumption through the provision of low water consuming sanitary and kitchen fittings and monitoring systems (including flow control systems). These measures have the potential to reduce water consumption significantly, thereby also reducing costs.

Table 7: Water Usage

Component	Proposed performance level (maximum)
Toilets	3.75 litre effective flush volume
Wash hand basin taps	5 litres/min
Showers	6 litres/min
Urinals	1.50 litres/bowl/hour (2 or more urinals)
Kitchen (kitchenette) taps	6 litres/min
Kitchen taps: restaurant (pre-rinse nozzles only)	7.30 litres/min
Dishwashers	12 litres/cycle (domestic sized); 5 litres/cycle (commercial sized)
Washing machines	40 litres/use (domestic scale);

In addition to reducing water consumption, the design team will aim to closely follow the strategy used in Phase 1 and have water meters be fitted to the mains supply to the building, including sub-meters to plant areas and building areas that consume $\geq 10\%$ of the buildings total water demand, in line with BREEAM criteria, thus, allowing the facilities management team to monitor water usage and identify any areas of the building that are consuming water in excess of expected levels.

Flow control devices which regulate the supply of water to each WC area / sanitary facility according to demand (e.g. PIRs and solenoid valves) should be installed in order to minimise water leaks that may otherwise go undetected.

4.6.2 External water consumption

Due to the limited area of soft landscaping and planting provided as part of the development, watering of all vegetation will either be by hand or through precipitation. As such no permanent irrigation systems shall be installed, thereby reducing external water consumption.

4.6.3 Flood risk and drainage strategy

The site specific Flood Risk Assessment (report ref: MCCC-SHD-00-ZZ-RP-C-0001) confirms that the whole development lies within Flood Zone 2 and therefore has between a 1 and 100 and 1 in 1000 annual probability of flooding (1%-0.1%). This is due to the surcharging of the adjacent River Irwell. The site has been assessed against the NPPF 'Sequential Test'. Taking into consideration that the application is for a College Campus in Flood Zone 2, Tables 1, 2, & 3 of the NPPF Technical Guidance have been appraised to confirm the development is 'appropriate'.

In line with the Manchester Local Flood Authority (LLFA) requirements to limit the total surface water runoff rate from the site to the local greenfield rate, and to provide onsite storage and attenuation, discharge will be limited to 5.1 l/s. The required storage volume on site for a 1:100 year attenuation + 20% Climate Change Allowance would be up to 465m³. This responds to both policies EN14 (Flood Risk) and EN17 (Water Quality).

The site benefits from an existing connection to the combined sewer system. The outline strategy is to collect runoff from the roof and external areas and direct it to new below ground storage networks which will connect to the combined sewer via an existing connection. The discharge will be restricted to greenfield runoff rate for Qbar (subject to agreement with United Utilities). There will also be some rainwater storage from the planting provided to the roof area.

4.7 Waste management

Core Strategy Policy EN19 promotes sustainable waste management practices during design, construction and operation. The design team will demonstrate that the provision of waste management facilities for the proposed development are adequate for the higher and further education buildings, considering all waste streams and waste volumes likely to be generated. There will

be recycling available onsite for both building staff and building users and the following are likely to be recycled; paper and card; plastic and tin cans; glass and food.

The design team have also considered the design for future disassembly and adaptability, to give options for future space changes. Due to the more homogenous building design of Phase 2, the future consideration for waste management design will be expected to be standardised as there are fewer specialist requirements compared to the Phase 1 development. Further details about designing for disassembly can be found in the Circular Economy Statement, submitted as part of this planning application.

Sustainable waste management during construction will be led by the guidance of BREEAM criteria (Construction Waste Management) which requires the principal contractor to operate a site waste management plan (SWMP) or a resource management plan (RMP) to promote resource efficiency and prevent illegal waste activities. Resource efficiency includes minimising waste at source to ensure clients, designers and principal contractors assess the use, reuse and recycling of materials and products on the site.

5. Conclusion

This Environmental Standards Statement seeks to respond to several policies listed within the Manchester Core Strategy relevant to energy efficiency, renewable energy environmental design, water management, weather resilience, waste management and construction management. Through the current design proposals and RIBA 2030 Climate Challenge Guidance, compliance with the following policies has been demonstrated:

- Policy DM1 (Development Management)
- Policy EN4 (Reducing CO₂ Emissions by Enabling Low and Zero Carbon Development)
- Policy EN6 (Target Framework for CO₂ Reduction from Low or Zero Carbon Energy Supplies)
- Policy EN8 (Adaptation to Climate Change)
- Policy EN9 (Green Infrastructure)
- Policy EN14 (Flood Risk)
- Policy EN17 (Water Quality)
- Policy EN19 (Waste)

Regarding Policy DM1, although formal certification is not being pursued, the project team have demonstrated, via the pre-assessment exercise, that the development is aligned with BREEAM Very Good requirements. Moving forward, the design team and principal contractor shall continue to embed targets within the design and construction of the development, therefore adhering to the requirements of the aforementioned policies

Appendix 1: BREEAM Pre-Assessment

The Manchester College: City Centre Phase 2

BREEAM New Construction (2018) Education: Pre-assessment

Target: Very Good

10-Jan-24

Assessor: Kat Radford

BDP.

Targeted

Not targeted / Cannot be achieved

Title	Credit Ref	Credits available	Route to Very Good (min 55%)	Potential credits	Compliance Requirements	Responsibility	RIBA Stage	Comments
MANAGEMENT (1 credit = 0.52%)								
Man 01: Project brief and design								
Project Delivery Planning	Man 01-01	1	1		<div>1. Prior to completion of the Concept Design, the project delivery stakeholders (see comments) meet to identify and define for each key phase of project delivery: a. Roles b. Responsibilities c. Contributions</div> <div>2. Consider each one of the following items when defining roles, responsibilities and contributions for each key phase of the project: a. End user requirements b. Aims of the design and design strategy c. Particular installation and construction requirements/limitations d. Occupiers budget and technical expertise in maintaining any proposed systems e. Maintainability and adaptability of the proposals f. Operational energy (see Ene 01 for further details) g. Requirements for the production of project and end user documentation h. Requirements for commissioning, training and aftercare support.</div> <div>3. The project team demonstrate how the project delivery stakeholder's contributions and the consultation process outcomes influence the following: a. Initial Project Brief b. Project Execution Plan c. Communication Strategy d. Concept Design.</div>	Project Manager / Design Team	2	The team have confirmed that this was undertaken.

Title	Credit Ref	Credits available	Route to Very Good (min 55%) 64.44%	Potential credits 36.58%	Compliance Requirements	Responsibility	RIBA Stage	Comments
Stakeholder Consultation (Interested Parties)	Man 01-02	1	0		<p>4. Prior to completion of the Concept Design, the independent third party consults with all interested parties (see comments) on matters that cover the minimum consultation content:</p> <ol style="list-style-type: none"> 1. Functionality, build quality and impact (including aesthetics). 2. Provision of appropriate internal and external facilities (for future building occupants and visitors or users). 3. Management and operational implications. 4. Maintenance resources implications. 5. Impacts on the local community, e.g. local traffic or transportation impact. 6. Opportunities for shared use of facilities and infrastructure with the community or appropriate stakeholders. 7. Compliance with statutory (national or local) consultation requirements. 8. Energy use and sustainability measures. 9. Implementing principles and processes that deliver an inclusive and accessible design. <p>In the case of educational building types, minimum content also includes:</p> <ol style="list-style-type: none"> 10. How the building or grounds could best be designed to facilitate learning and provide a range of social spaces appropriate to the needs of a diverse range of pupils, students and other users, including people of all abilities. <p>In the case of building types containing technical areas or functions, e.g. laboratories, workshops etc., minimum content also includes:</p> <ol style="list-style-type: none"> 11. The end users' broad requirements for such facilities, including appropriate sizing, optimisation and integration of equipment and systems. 	Project Manager / Design Team	2	
					5. Demonstrate how the stakeholder contributions and consultation exercise outcomes influence the Initial Project Brief and Concept Design.	Architect / MEP Team		
					6. Prior to completion of the detailed design (RIBA Stage 4, Technical Design or equivalent), all interested parties give and receive consultation feedback.	Principal Contractor / Design Team	4	
					7. An independent party carries out the consultation exercise. The Design Quality Indicator and the Achieving Excellence Design Evaluation Toolkit could be used as methods to assess the design quality of buildings.	Principal Contractor / Design Team / Client	2	
BREEAM AP (Concept Design)	Man 01 pre	-	-	-	8. The project team, including the client, formally agree strategic performance targets early in the design process with the support of the BREEAM AP where appointed).	Client / BREEAM AP	2	
	Man 01-03	1	0		<p>9. Involve a BREEAM AP in the project at an appropriate time and level to:</p> <ol style="list-style-type: none"> a. Work with the project team, including the client, to consider the links between BREEAM issues and assist them in maximising the project's overall performance against BREEAM, from their appointment and throughout Concept Design. b. Monitor progress against the performance targets agreed under criterion 8 throughout all stages after their appointment where decisions critically impact BREEAM performance. c. Proactively identify risks and opportunities related to the achievement of the targets agreed under criterion 8. d. Provide feedback to the project team as appropriate, to support them in taking corrective actions and achieving their agreed performance targets. e. Monitor and, where relevant, coordinate the generation of appropriate evidence by the project team. 			
BREEAM AP (Developed Design)	Man 01-04	1	0		<p>10. Criteria 8 and 9 are achieved.</p> <p>11. Involve the BREEAM AP in the project at an appropriate time and level to:</p> <ol style="list-style-type: none"> a. Work with the project team, including the client, to consider links between BREEAM issues and to assist them in maximising the project's overall performance against BREEAM throughout developed design. b. Monitor progress against the performance targets agreed under criterion 8, throughout all stages where decisions critically impact the specification and tendering process and the BREEAM performance. c. Proactively identify risks and opportunities related to the achievement of the targets agreed under criterion 8. d. Provide feedback to the project team as appropriate, to support them in taking corrective actions and achieving their agreed performance targets. e. Monitor and, where relevant, coordinate the generation of appropriate evidence by the project team. 	Client / BREEAM AP	4	

Title	Credit Ref	Credits available	Route to Very Good (min 55%)	Potential credits	Compliance Requirements	Responsibility	RIBA Stage	Comments
Man 02: Life Cycle Cost and Service Life Planning								
Elemental Life Cycle Cost (LCC)	Man 02-01	2		2	1. A competent person carries out an outline, entire asset LCC plan at Process Stage 2 (equivalent to Concept Design - RIBA Stage 2) together with any design options appraisals in line with 'Standardised method of life cycle costing for construction procurement' PD 156865:2008.	Cost Consultant	2	08.03.23: BREEAM Shaddow review confirmed these credits should be potential as not in PF scope The team have confirmed that this was undertaken.
					2. The elemental LCC plan: a. Provides an indication of future replacement costs over a period of analysis as required by the client (e.g. 20,30,50 or 60 years); b. Includes service life, maintenance and operation cost estimates. The study period should ideally be agreed by the client, in line with the design life expectancy of the building. However, where the life expectancy of the building is not yet formally agreed (due to being at very early design stages), the default design life of 60 years should be used for modelling purposes (in line with the UK default).	Cost Consultant		
					3. Demonstrate, using appropriate examples provided by the design team, how the elemental LCC plan has been used to influence building and systems design/specification to minimise life cycle costs and maximise critical value.	Design Team		
Component Level LCC Option Appraisal	Man 02-02	1		1	4. A competent person develops a component level LCC options appraisal by the end of Process Stage 4 (equivalent to Technical Design – RIBA Stage 4) in line with PD 156865:2008. The component level LCC includes (where present): a. Envelope, e.g. cladding, windows, and/or roofing b. Services, e.g. heat source cooling source, and/or controls c. Finishes, e.g. walls, floors and/or ceilings d. External spaces, e.g. alternative hard landscaping, boundary protection The component level LCC option appraisal should review all of the above component types (where present). However, you do not need to consider every single example cited under each component; only a selection of those most likely to draw valued comparisons. This is to ensure that a wide range of options are considered and help focus the analysis on components which would benefit the most from the appraisal.	Cost Consultant	4	08.03.23: BREEAM Shaddow review confirmed this credit should be potential as not in PF scope
					5. Demonstrate, using appropriate examples provided by the design team, how the component level LCC options appraisal has been used to influence building and systems design/specification to minimise life cycle costs and maximise critical value.	Design Team		
Capital Cost Reporting	Man 02-03	1		1	6. Report the capital cost for the building in pounds per square metre of gross internal floor area (£k/m2), as part of the submission to BRE. The capital cost for the building includes the expenses related to the initial construction of the building: – Construction, including preparatory works, materials, equipment and labour – Site management – Construction financing – Insurance and taxes during construction – Inspection and testing Costs related to land procurement, clearance, design, statutory approvals and post occupancy aftercare are not included.	Principal Contractor		08.03.23: BREEAM Shaddow review confirmed this credit should be potential as not in PF scope
Man 03: Responsible Construction Practices								
Pre-requisite	Man 03-pre	-	-	-	1. All timber and timber based products used during the construction process of the project are 'Legally harvested and traded timber'.	Principal Contractor		
Environmental Management	Man 03-01	1	1		3. All parties who at any stage manage the construction site (e.g. the principal contractor, the demolition contractor) operate an EMS covering their main operations. The EMS must: a. Be third party certified, to ISO 14001:2015/EMAS or equivalent standard; or b. In compliance with BS 8555:2016 have: i. Appropriate structure ii. Reached implementation stage phase four 'implementation and operation of the environmental management system' iii. Completed defined phase audits one to four.	Principal Contractor		
					4. All parties who at any point manage the construction site (e.g. the principal contractor, the demolition contractor) implement best practice pollution prevention policies and procedures on site in accordance with Working at construction and demolition sites: PPG6, Pollution Prevention Guidelines.			

Title	Credit Ref	Credits available	Route to Very Good (min 55%)	Potential credits	Compliance Requirements	Responsibility	RIBA Stage	Comments
BREEAM AP (Site)	Man 03-02 pre	-	-	-	5. The client and the contractor formally agree performance targets.	Principal Contractor		08.03.23: BREEAM Shaddow review confirmed this credit should be removed
	Man 03-02	1	0		6. Involve a BREEAM AP in the project at an appropriate time and level to: a. Work with the project team, including the client, to consider the links between BREEAM issues and assist them in achieving and if possible going beyond the design intent, to maximise the project's performance against the agreed performance targets throughout the Construction, Handover and Close Out stages. b. Monitor construction progress against the performance targets agreed under criterion 5 above throughout all stages where decisions critically impact BREEAM performance. c. Proactively identify risks and opportunities related to the procurement and construction process and the achievement of the targets agreed under criterion 5. d. Provide feedback to the constructors and the project team as appropriate, to support them in taking corrective actions and achieving their agreed performance targets. e. Monitor and, where relevant, coordinate the generation of appropriate evidence by the project team and the provision to the assessor.	Principal Contractor		
Responsible Construction Management	Man 03-03	2	2		One credit: 7. Achieve items listed as required for one credit in table 4.1 of the guidance manual. Two credits: 8. Achieve criterion 7 9. Achieve six additional items in table 4.1 of the guidance manual.	Principal Contractor		

Title	Credit Ref	Credits available	Route to Very Good (min 55%) 64.44%	Potential credits 36.58%	Compliance Requirements	Responsibility	RIBA Stage	Comments
Monitoring of Construction-Site Impacts	Man 03-04	2	2		10. Responsibility has been assigned to an individual(s) for monitoring, recording and reporting energy use, water consumption and transport data (where measured) resulting from all on-site construction processes (and dedicated off-site manufacturing) throughout the build programme. To ensure the robust collection of information, this individual(s) must have the appropriate authority and responsibility to request and access the data required. Where appointed, the BREEAM AP could perform this role.	Principal Contractor		
					First Monitoring Credit - Utility consumption Energy consumption 11. Achieve criterion 10. 12. Set targets for the site energy consumption in kWh (and where relevant, litres of fuel used) as a result of the use of construction plant, equipment (mobile and fixed) and site accommodation. 13. Monitor and record date for the energy consumption described in criterion 12. 14. Report the total carbon dioxide emissions (total kgCO2/project value) from the construction process via the BREEAM Projects (for the purposes of potential future BREEAM performance benchmarking). Water consumption 15. Achieve criterion 10. 16. Set targets for the potable water consumption (m³) arising from the use of construction plant, equipment (mobile and fixed) and site accommodation. 17. Monitor and record data for the potable water consumption described in criterion 18. Use the collated data to report the total net water consumption (m³), i.e. consumption minus any recycled water use from the construction process via BREEAM Projects (for the purposes of potential future BREEAM performance benchmarking).	Principal Contractor		
					Second Credit - Transport of construction materials and waste 19. Achieve Criterion 10. 20. Set targets for transportation movements and impacts resulting from delivery of the majority of construction materials to site and construction waste from site. As a minimum cover: 20.a. Transport of materials from the point of supply to the building site, including any transport, intermediate storage and point of supply. Monitor as a minimum: 20.a.i. Materials used in major building elements (e.g. those defined in BREEAM issue Mat01 Environmental impacts from construction products - Building life cycle assessment (LCA). 20.a.ii. Ground works and landscaping materials. 20.b. Transportation of construction waste from the construction gate to waste disposal processing or recovery centre gate. This monitoring must cover the construction waste groups outlined in the project's resource management plan. 21. Monitor and record data for the transportation movement as described in criterion 20. 22. Using the collated data, report separately for materials and waste, the total transport-related carbon dioxide emissions (kgCO ₂ -eq) plus total distance travelled (km) via BREEAM Projects (for the purposes of potential future BREEAM performance benchmarking).	Principal Contractor		
Exemplary Level Criteria	Man 03-Ex	1	0	1	23. Achieve all items in Table 4.1 of the guidance manual.	Principal Contractor		

Title	Credit Ref	Credits available	Route to Very Good (min 55%) 64.44%	Potential credits 36.58%	Compliance Requirements	Responsibility	RIBA Stage	Comments
Man 04: Commissioning and handover								
Commissioning and Testing Schedule and Responsibilities	Man 04-01	1	1		<div>1. Prepare a schedule of commissioning and testing. The schedule identifies a suitable timescale for commissioning and re-commissioning of all complex and non-complex building services and control systems and for testing and inspecting building fabric.</div> <div>2. The schedule identifies the appropriate standards for all commissioning activities to be conducted, where applicable, in accordance with: a. Current Building Regulations b. BSRIA guidelines c. CIBSE guidelines d. Other appropriate standards (see Methodology) Exclude from the assessment any process or manufacture-related equipment specified as part of the project. However, include such equipment in cases where they form an integral part of the building HVAC services, such as some heat recovery systems.</div> <div>3. Where a building management system (BMS) is specified: a. Carry out the commissioning of air and water systems when all control devices are installed, wired and functional b. Include physical measurements of room temperatures, off-coil temperatures and other key parameters, as appropriate, in Commissioning results. c. The BMS or controls installation should be running in auto with satisfactory internal conditions prior to handover d. All BMS schematics and graphics (if BMS is present) are fully installed and functional to user interface prior to handover e. Fully train the occupier or facilities team in the operation of the system.</div> <div>4. Appoint an appropriate project team member to monitor and programme pre-commissioning, commissioning and testing. Where necessary include, re-commissioning activities on behalf of the client.</div> <div>5. The principal contractor accounts for the commissioning and testing programme, responsibilities and criteria within their budget and the main programme of works. Allow the required time to complete all commissioning and testing activities prior to handover,</div>	Principal Contractor		Mandatory for BREEAM Very Good
Commissioning - Design and Preparation	Man 04-02	1	1		<div>6. Achieve criteria 1-5.</div> <div>7. During the design stage, the client or the principal contractor appoints an appropriate project team member provided they are not involved in the general installation works for the building services systems: with responsibility for: a. Undertaking design reviews and giving advice on suitability for ease of commissioning. b. Providing commissioning management input to construction programming and during installation stages. c. Management of commissioning, performance testing and handover or post-handover stages. For buildings with complex building services and systems, this role needs to be carried out by a specialist commissioning manager.</div>	Principal Contractor		
Testing and Inspecting Building Fabric	Man 04-03	1	1		<div>8. Achieve criteria 1-5.</div> <div>9. Complete post-construction testing and inspection to quality-assure the integrity of the building fabric, including continuity of insulation, avoidance of thermal bridging and air leakage paths (this is through airtightness testing and a thermographic survey). A suitably qualified professional undertakes the survey and testing in accordance with the appropriate standard.</div> <div>10. Rectify any defects identified during post-construction testing and inspection prior to building handover and close out. Any remedial work must meet the required performance characteristics for the building or element as defined at the design stage.</div>	Principal Contractor		
Handover	Man 04-04	1	1		<div>11. Prior to handover, develop two building user guides for the following users: a. A non-technical user guide for distribution to the building occupiers b. A technical user guide for the premises facilities managers c. A draft copy is developed and discussed with users first (where the building occupants are known) to ensure the guide is most appropriate and useful to potential users.</div> <div>12. Prepare two training schedules timed appropriately around handover and proposed occupation plans for the following users: a. A non-technical training schedule for the building occupiers b. A technical training schedule for the premises facilities managers.</div>	Principal Contractor		Provision of a building user guide is mandatory for BREEAM Very Good

Title	Credit Ref	Credits available	Route to Very Good (min 55%) 64.44%	Potential credits 36.58%	Compliance Requirements	Responsibility	RIBA Stage	Comments
Man 05: Aftercare								
Aftercare Support	Man 05-01	1	1		<p>1. Provide aftercare support to the building occupiers through having in place operational infrastructure and resources. This includes as a minimum:</p> <p>a. A meeting between the aftercare support team or individual, and the building occupier or management team (prior to initial occupation, or as soon as possible thereafter) to:</p> <p>i. Introduce the aftercare support available, including the content of the building user guide (where it exists) and training schedule.</p> <p>ii. Present key information on the building including the design intent and how to use the building to ensure it operates as efficiently and effectively as possible.</p> <p>b. On-site facilities management training including:</p> <p>i. a walkabout of the building</p> <p>AND</p> <p>ii. introduction and familiarisation with the building systems, their controls and how to operate them in accordance with the design intent and operational demands.</p> <p>c. Provide initial aftercare support for at least the first month of building occupation, e.g. weekly attendance on-site, to support building users and management (the level of frequency will depend on the complexity of the building and building operations).</p> <p>d. Provide longer term aftercare support for occupiers for at least the first 12 months from occupation, e.g. a helpline, nominated individual or other appropriate system to support building users/management.</p> <p>2. Establish operational infrastructure and resources to coordinate the collection and monitoring of energy and water consumption data for a minimum of 12 months, once the building is substantially occupied. This facilities analysis of discrepancies between actual and predicted performance, with a view to adjusting systems and/or user behaviours accordingly.</p>	Principal Contractor		
Commissioning - Implementation	Man 05-02	1	0		<p>3. Complete the following commissioning activities over a minimum 12-month period, once the building becomes substantially occupied:</p> <p>a. Complex systems - Specialist Commissioning Manager will:</p> <p>i. Identify changes made by the owner or operator that might have caused impaired or improved performance.</p> <p>ii. Test all building services under full load conditions, i.e. heating equipment in mid-winter, cooling and ventilation equipment in mid-summer and under part load conditions (spring and autumn).</p> <p>iii. Where applicable, carry out testing during periods of extreme (high or low) occupancy.</p> <p>iv. Interview building occupants (where they are affected by the complex services) to identify problems or concerns regarding the effectiveness of the systems.</p> <p>v. Produce monthly reports comparing sub-metered energy performance to the predicted one (see Ene01 Reduction of energy use and carbon emissions).</p> <p>vi. Identify inefficiencies and areas in need of improvement.</p> <p>vii. Re-commission systems (following any work needed to serve revised loads), and incorporate any revisions in operating procedures into the operations and maintenance (O&M) manuals.</p> <p>b. Simple systems (naturally ventilated) - external consultant/aftercare team/facilities manager will:</p> <p>i. Review thermal comfort, ventilation, and lighting, at three, six and nine month intervals after initial occupation, either by measurement or occupant feedback.</p> <p>ii. Identify deficiencies and areas in need of improvement.</p> <p>iii. Re-commission systems and incorporate any relevant revisions in operating procedures into the O&M manuals.</p>	Principal Contractor		

Title	Credit Ref	Credits available	Route to Very Good (min 55%) 64.44%	Potential credits 36.58%	Compliance Requirements	Responsibility	RIBA Stage	Comments
Post Occupancy Evaluation	Man 05-03	1	1		<p>4. The client or building occupier makes a commitment to carry out a post-occupancy evaluation (POE) exercise one year after building is substantially occupied. This gains comprehensive in-use performance feedback and identifies gaps between design intent and in-use performance. The aim is to highlight any improvements or interventions that need to be made and inform operational processes.</p> <p>5. An independent party carries out the POE covering:</p> <p>a. A review of the design intent and construction process (review of design, procurement, construction and handover processes)</p> <p>b. Feedback from a wide range of building users including facilities management on the design and environmental conditions of the building covering:</p> <p>i. Internal environmental conditions (light, noise, temperature, air quality)</p> <p>ii. Control, operation and maintenance</p> <p>iii. Facilities and amenities</p> <p>iv. Access and layout</p> <p>v. Energy and water consumption</p> <p>vi. Other relevant issues</p> <p>6. The independent party provides a report with lessons learned to the client and building occupiers.</p> <p>7. The client or building occupier commits funds to pay for the POE in advance. This requires an independent party to be appointed to carry out the POE. Evidence of the appointment of the independent party and schedule of responsibilities which fulfils the BREEAM criteria are acceptable to demonstrate compliance.</p>	Client		An independent third party will need to be appointed by the client.
HEALTH AND WELLBEING (1 credit = 0.78%)								
Hea 01: Visual Comfort								
Control of Glare from Sunlight	Hea 01-01	1	1		<p>1. Identify areas at risk of glare using a glare control assessment, The glare control assessment also justifies any areas deemed not at risk of glare.</p> <p>2. A glare control strategy designs out potential glare in all relevant building areas where risk has been identified. This should be achieved through building form and layout or building design measures.</p> <p>3. The glare control strategy does not increase energy and consumption used for lighting. This is achieved by:</p> <p>a. Maximising daylight levels in all weather, cloudy or sunny AND</p> <p>b. Ensuring the use or location of shading does not conflict with the operation of lighting control systems.</p>	Architect		
Daylighting	Hea 01-02	2	0		<p>4. Daylighting criteria have been met using either of the following options:</p> <p>a. The relevant building areas meet good practice daylight factor(s) and other criterion as outlined in Table -5.1 and Table - 5.2:</p> <p>2 credits: In all areas, a point daylight factor of at least 2% is achieved in at least 80% of the area (and either compliance with the uniformity ratio requirements OR view of sky and room depth criteria in Table 5.2.)</p> <p>OR</p> <p>b. The relevant building areas meet good practice average and minimum point daylight illuminance criteria as outlined in Table - 5.3.</p>	Architect / Lighting Designer / MEP Team		
View Out	Hea 01-03	1	0	1	<p>5. 95% of the floor area in relevant building areas is within 8m of an external wall. The external wall has a window or permanent opening that provides an adequate view out.</p> <p>6.The window/opening must be ≥ 20% of the surrounding wall area. Where the room depth is greater than 8m, compliance is only possible where the percentage of window/opening is the same as, or greater than, the values in Table 1.0 of BS 8206:part 2.</p>	Architect		

Title	Credit Ref	Credits available	Route to Very Good (min 55%) 64.44%	Potential credits 36.58%	Compliance Requirements	Responsibility	RIBA Stage	Comments
Internal and External Lighting Levels, Zoning and Control	Hea 01-03	1	1		<p>Internal Lighting</p> <p>8. Internal lighting in all relevant areas of the building is designed to provide illuminance (lux) levels and colouring rendering index in accordance with the SLL code for lighting 2012. and any other relevant industry standard. Internal lighting should be appropriate to the tasks undertaken, accounting for building user concentration and comfort levels.</p> <p>9. For areas where computer screens are regularly used, the lighting design complies with CIBSE Lighting Guide 7 sections 2.4, 2.13, 2.15, 2.20, and 6.10 to 6.20. This gives recommendations highlighting:</p> <p>a. Limits to the luminance of the luminaires to avoid screen reflections. (Manufacturers' data for the luminaires should be sought to confirm this.)</p> <p>b. Any area where surface is used to reflect light in to a space such as uplighting, the recommendations refer to the luminance of the lit ceiling rather than the luminaire; a design team calculation is usually required to demonstrate this.</p> <p>c. Recommendations for direct lighting, ceiling illuminance, and average wall illuminance.</p> <p>External Lighting</p> <p>10. All external lighting located within the construction zone is specified in accordance with BS5489-1:2013 Code for the practice for the design of road lighting. Lighting of roads and public amenity areas and BS EN 12464-2:2014 Light and lighting - lighting of work places - Part 2: Outdoor workplaces. External lighting should provide illuminance levels that enable users to perform outdoor visual tasks efficiently and accurately, especially during the night.</p> <p>11. Where no external light fittings are specified (either separate from or mounted on the external building façade of roof), the criteria relating to external lighting do not apply and the credit can be awarded on the basis of compliance with criteria 8-9.</p> <p>Zoning and occupant control</p> <p>12. Internal lighting is zoned to allow for occupant control. Zoning is in accordance with the criteria below for relevant areas present within the building:</p> <p>a. In office areas, zones of no more than four workplaces</p> <p>b. Workstations adjacent to windows/atria and other building areas separately zoned and controlled</p> <p>c. Seminar and lecture rooms: zoned for presentation and audience areas</p> <p>d. Library spaces: separate zoning of stacks, reading and counter areas</p> <p>e. Teaching space or demonstration area</p> <p>f. Whiteboard or display screen</p> <p>g. Auditoria: zoning of seating areas, circulation space and lectern area</p> <p>h. Dining, restaurant, café areas: separate zoning of server and seating/dining areas</p> <p>i. Retail: separate zoning of display and counter areas</p> <p>j. Bar areas: separate zoning of bar and seating areas</p> <p>k. Wards or bedded areas: zoned lighting control for individual bed spaces and control for staff over groups of bed spaces</p> <p>l. Treatment areas, dayrooms, waiting areas: zoning of seating and activity areas and circulation space with controls accessible to staff.</p> <p>13. Areas used for teaching, seminar or lecture purposes have lighting controls provided in accordance with CIBSE Lighting Guide 5.</p> <p>14. In addition, for education buildings: Manual lighting controls are easily accessible for the teacher while teaching and on entering or leaving the teaching space. Manual lighting controls need only be provided for staff, not the children.</p> <p>Lighting zoning and control - auditoria spaces: The controls specified will depend on the size and use of the space but a typical auditorium or lecture theatre with stepped seating and a formal lectern, demonstration or performance area would typically be expected to have lighting controls as follows:</p> <p>1. Full normal lighting (to allow for entry, exit, cleaning etc.)</p> <p>2. Demonstration area lighting off and audience area lighting reduced to a low level (for the purpose of line slide projection, but allowing enough light for the audience to take notes)</p> <p>3. All lighting off (for the projection of tone slides, colour slides, and for the purposes of visual demonstrations or performances)</p> <p>4. Separate localised lectern lighting.</p>	MEP Team		

Title	Credit Ref	Credits available	Route to Very Good (min 55%) 64.44%	Potential credits 36.58%	Compliance Requirements	Responsibility	RIBA Stage	Comments
Exemplary Level Criteria	Hea 01-03 EX	1	0	1	15. To achieve an exemplary performance credit for daylighting: Daylighting criteria have been met using either of the following options: a. Relevant building areas meet exemplary daylight factors and the relevant criteria in Table 5.8 of the guidance manual. b. Relevant building areas meet exemplary average and minimum point daylight illuminance criteria in Table 5.9 of the guidance manual.	Architect / Lighting Designer / MEP Team		
	Hea 01-03 EX	1	1		16. To achieve an exemplary performance credit for Internal and external lighting levels, zoning and control: Lighting in each zone can be manually dimmed by occupants down to 20% of the maximum light output using dimmer switches positioned in accessible locations. Dimming and control gear should avoid flicker and noise.	MEP Team		
Hea 02: Indoor Air Quality								
Pre-requisite	Hea 02-Pre	-	-	-	1. A site-specific indoor air quality plan has been produced and implemented in accordance with the guidance in Guidance Note GN06. The objective of the plan is to facilitate a process that leads to design, specification and installation decisions and actions that minimise indoor air pollution during occupation of the building. The indoor air quality plan must consider the following: a. Removal of contaminant sources b. Dilution and control of contaminant sources: i. Where present, consideration is given to the air quality requirements of specialist areas such as laboratories c. Procedures for pre-occupancy flush out d. Third party testing and analysis e. Maintaining good indoor air quality in-use.	Architec / MEP Team		
Ventilation	Hea 02-01	1	0	1	2. The building has been designed to minimise the indoor concentration and recirculation of pollutants in the building as follows: a. Provide fresh air into the building in accordance with the criteria of the relevant standard for ventilation b. Ventilation pathways are designed to minimise the ingress and build-up of air pollutants inside the building (see methodology) c. Where present, HVAC systems must incorporate suitable filtration to minimise external air pollution, as defined in BS EN 13779:2007 Annex A3. The specified filters should achieve a minimum Indoor Air Quality of IDA2. d. Areas of the building subject to large and unpredictable or variable occupancy patterns have carbon dioxide (CO ₂) or air quality sensors specified and : i. In mechanically ventilated buildings or spaces: sensors are linked to the mechanical ventilation system and provide demand-controlled ventilation to the space. ii. In naturally ventilated buildings or spaces: sensors either have the ability to alert the building owner or manager when CO ₂ levels exceed the recommended set point, or are linked to controls with the ability to adjust the quantity of fresh air, i.e. automatic opening windows or roof vents. e. For naturally ventilated or mixed mode buildings, the design demonstrates that the ventilation strategy provides adequate cross flow of air to maintain the required thermal comfort conditions and ventilation rates in accordance with CIBSE AM10.	MEP Team		
Emissions from Construction Products	Hea 02-02	2	1	1	One credit: 3. Three out of the five product types meet the emission limits, testing requirements and any additional requirements listed in Table 5.11 of the guidance manual. Where wood-based products are not one of the three selected product types, all wood-based products used for internal fixtures fittings must be tested and classified as formaldehyde E1 class as a minimum.	Architect / Principal Contractor		
					Two credits: 4. All of the product types listed meet the emission limits, testing requirements and any additional requirements listed in Table 5.11 of the guidance manual.			

Title	Credit Ref	Credits available	Route to Very Good (min 55%)	Potential credits	Compliance Requirements	Responsibility	RIBA Stage	Comments
Post Construction Indoor Air Quality Measurement	Hea 02-03	1	0	1	5. The formaldehyde concentration indoor air is measured post construction (but pre-occupancy) and does not exceed 100µg/ m³ averaged over 30 minutes. (World Health Organisation guidelines for indoor air quality: Selected pollutants, 2010).	Principal Contractor		08.03.23: BREEAM Shaddow review confirmed this credit should be moved to potential
					6. The formaldehyde sampling and analysis is performed in accordance with ISO 16000-2 and ISO 16000-3.			
					7. The total volatile organic compound (TVOC) concentration in indoor air is measured post construction (but pre-occupancy) and does not exceed 500µg/ m³ over 8 hours.			
					8. The TVOC sampling and analysis is performed in accordance with ISO 16000-5 and ISO 16000-6 or ISO 16017-1.			
					9. Where levels are found to exceed these limits, the project team confirms the measures that have, or will be, undertaken in accordance with the IAQ plan, to reduce TVOC and formaldehyde levels to within the above limits.			
					10. The measured concentration levels of formaldehyde (µg/ m³) are reported via the BREEAM Scoring and Reporting Tool.			
Exemplary Level Criteria	Hea 02-Ex	1	0	1	11. Three of the product types listed meet the emission limits, testing requirements and any additional requirements listed in Table 5.12 of the guidance manual. Where wood-based products are not one of the three selected product types, all wood-based products used for internal fixtures and fittings must be tested and classified as formaldehyde E1 class as a minimum,	Architect		
Hea 04: Thermal Comfort								
Thermal Modelling	Hea 04-01	1	1		1. Thermal modelling has been carried out using software in accordance with CIBSE AM11 Building Energy and Performance Modelling. 2. The software used to carry out the simulation at the detailed design stage provides full dynamic thermal analysis. For smaller and more basic building designs with less complex heating or cooling systems, an alternative less complex means of analysis may be appropriate (such methodologies must still be in accordance with CIBSE AM11). 3. The modelling demonstrates that: a. For air conditioned buildings, summer and winter operative temperature ranges in occupied spaces are in accordance with the criteria set out in CIBSE Guide A Environmental design, Table 1.5; or other appropriate industry standard (where this sets a higher or more appropriate requirement/level for the building type) or the thermal environment in occupied spaces meet the Category B requirements for PPD, PMV and local discomfort set out in Table A.1 of Annex A of ISO 7730:2005. b. For naturally ventilated buildings: i. Winter operative temperature ranges in occupied spaces are in accordance with the criteria set out in CIBSE Guide A Environmental design, Table 1.5; or other appropriate industry standard (where this sets a higher or more appropriate requirement/level for the building type). ii. The building is designed to limit the risk of overheating, in accordance with the adaptive comfort methodology outlined in CIBSE TM52: The limits of thermal comfort: avoiding overheating in European buildings or CIBSE TM59: Design methodology for the assessment of overheating risk in homes. 4. For air conditioned buildings, the PMV (predicted mean vote) and PPD (predicted percentage of dissatisfied) indices based on the above modelling are reported via the BREEAM assessment scoring and reporting tool.	MEP Team		
Design for Future Thermal Comfort	Hea 04-02	1	1		5. Criteria 1 to 4 are achieved. 6. The thermal modelling demonstrates that the relevant requirements set out in criteria 3 are achieved for a projected climate change environment. 7. Where criterion 6 is not met, the project team demonstrated how the building has been adapted or designed to be easily adapted in future using passive design solutions in order to subsequently meet the requirements under criterion 6. 8. For air conditioned buildings, the PMV and PPD indices based on the above modelling are reported via the BREEAM assessment scoring and reporting tool.	MEP Team		08.03.23: To confirm if this is included within the Building Physics scope of services

Title	Credit Ref	Credits available	Route to Very Good (min 55%) 64.44%	Potential credits 36.58%	Compliance Requirements	Responsibility	RIBA Stage	Comments
Thermal Zoning and Controls	Hea 04-03	1	1		<p>9. Criteria 1 to 4 are achieved</p> <p>10. The thermal modelling analysis (criteria 1 to 4) has informed the temperature control strategy for the building and its users.</p> <p>11. The strategy for proposed heating/cooling system(s) demonstrates that it has addressed the following:</p> <p>a. Zones within the building and how the building services could efficiently and appropriately heat or cool these areas. For example consider the different requirements for the central core of a building compared with the external perimeter adjacent to the windows.</p> <p>b. The degree of occupant control required for these zones, based on discussions with the end user (or alternatively building type or use specific design guidance, case studies, feedback) considers:</p> <p>b.i. User knowledge of building services</p> <p>b.ii. Occupancy type, patterns and room functions (and therefore appropriate level of control required)</p> <p>b.iii. How the user is likely to operate or interact with the system(s), e.g. are they likely to open windows, access thermostatic radiator valves (TRV) on radiators, change air-conditioning settings etc.</p> <p>b.iv. The user expectations (this may differ in the summer and winter) and degree of individual control (i.e. obtaining the balance between occupant preferences, for example some occupants like fresh air and others dislike draughts).</p> <p>c. How the proposed systems will interact with each other (where there is more than one system) and how this may affect the thermal comfort of the building occupants.</p> <p>d. The need or otherwise for an accessible building user actuated manual override for any automatic systems.</p>	MEP Team		
Hea 05: Acoustic Performance								
Acoustic Performance	Hea 05-01	3	2	1	<p>1. The building meets the appropriate acoustic performance standards and testing requirements defined in Table 5.14 of the guidance manual which defines criteria for the acoustic principles of:</p> <p>a. Sound insulation</p> <p>b. Indoor ambient noise level</p> <p>c. Room acoustics.</p> <p>OR</p> <p>2. A suitably qualified acoustician (SQA) is appointed to define a bespoke set of performance requirements for all function areas in the building. The bespoke performance requirements use the three acoustic principles defined in criterion Hea05 Acoustic Performance - Criterion 1, setting out the performance requirements for each and the testing regime required.</p>	Acoustician / Principal Contractor		
Hea 06: Security								
Security of Site and Building	Hea 06-01	1	1		<p>1. A suitably qualified security specialist (SQSS) conducts an evidence-based Security Needs Assessment (SNA) during or prior to Concept Design (RIBA Stage 2 or equivalent). The purpose of the SNA will be to identify attributes of the proposal, site and surroundings which may influence the approach to security for the development.</p> <p>2. The SQSS develops a set of security controls and recommendations for incorporation into the proposals. These controls and recommendations shall directly relate to the threats and assets identified in the preceding SNA.</p> <p>3. The controls and recommendations shall be incorporated into proposals and implemented in the as-built development. Any deviation from those controls and recommendations shall be justified and agreed with the SQSS.</p>	Security Consultant	2	
Exemplary Level Criteria	Hea 06-Ex	1	0	1	<p>4. To achieve an exemplary level performance credit:</p> <p>A compliant risk based security rating scheme has been used. The performance against the scheme has been confirmed by independent assessment and verification.</p>	TBC		

Title	Credit Ref	Credits available	Route to Very Good (min 55%) 64.44%	Potential credits 36.58%	Compliance Requirements	Responsibility	RIBA Stage	Comments
Hea 07: Safe and Healthy Surroundings								
Safe Access	Hea 07-01	1	1		<p>1. Where external site areas form part of the assessed development the following apply: Dedicated and safe cycle paths are provided from the site entrance to any cycle storage, and connect to off-site cycle paths where applicable.</p> <p>2. Dedicated and safe footpaths are provided on and around the site providing suitable links for the following: a. The site entrance to the building entrance b. Car parks (where present) to the building entrance c. The building to outdoor space d. Connecting to off-site paths where applicable.</p> <p>3. Pedestrian drop-off areas are designed off, or adjoining to, the access road and should provide direct access to other footpaths.</p> <p>Where vehicle delivery access and drop-off areas form part of the assessed development, the following apply (criteria 4, 5 and 6): 4. Delivery areas are not accessed through general parking areas and do not cross or share the following: a. pedestrian and cyclist paths b. outside amenity areas accessible to building users and general public.</p> <p>5. There is a dedicated parking or waiting area for goods vehicles with appropriate separation from the manoeuvring area and staff and visitor car parking.</p> <p>6. Parking and turning areas are designed for simple manoeuvring according to the type of delivery vehicle likely to access the site, thus avoiding the need for repeated shunting.</p>	Landscape Architect / Architect		
Outside Space	Hea 07-02	1	0	1	7. There is an outside space providing building users with an external amenity area.	Architect		
ENERGY (1 credit = 0.64%)								
Ene 01: Reduction of energy use and carbon emissions								
Energy Performance	Ene 01-01	9	6	3	1. Calculate an Energy Performance Ratio for New Constructions (EPRNC). Compare the EPRNC achieved with the benchmarks in Table 6.1 in the guidance manual and award the corresponding number of BREEAM credits.	MEP Team		
Prediction of Operational Energy Consumption	Ene 01-02	4	4		<p>2. Involve relevant members of the design team in an energy design workshop, focusing on operational energy performance.</p> <p>3. Undertake additional energy modelling during the design and post-construction stage to generate predicted operational energy consumption figures. (see Prediction of operational energy consumption on page 125 of the guidance manual - assessor to provide.)</p> <p>4. Report predicted energy consumption targets by end use, design assumptions and input data (with justifications).</p> <p>5. Carry out a risk assessment to highlight any significant design, technical and process risks that should be monitored and managed throughout the construction and commissioning process.</p>	MEP Team		
Exemplary Level Criteria	Ene 01-Ex	2	0	2	<p>6. The building achieves an EPR NC ≥ 0.9 and zero net regulated CO₂-eq emissions.</p> <p>7. Energy generation from on-site and near-site LZC sources is sufficient to offset carbon emissions from regulated energy use plus a percentage of emissions from unregulated energy use.</p> <p>8. Award the exemplary credits based on the percentage of additional emissions from unregulated energy that are offset by LZC sources. (Table 6.2 guidance manual).</p>	MEP Team		
	Ene 01-Ex	3	0	3	9. The building is deemed carbon negative where >100% (see Table 6.2 guidance manual) of carbon emissions from unregulated (and regulated) energy use are offset by energy generated from on-site and near-site LZC sources.	MEP Team		

Title	Credit Ref	Credits available	Route to Very Good (min 55%)	Potential credits	Compliance Requirements	Responsibility	RIBA Stage	Comments
Ene 02: Energy Monitoring								
Sub-Metering of End-Use Categories	Ene 02-01	1	1		1. Install energy metering systems so at least 90% of the estimated annual energy consumption of each fuel is assigned to the end-use categories. 2. Meter the energy consumption in buildings according to the total useful floor area: a. If the area is greater than 1,000m², by end-use category with an appropriate energy monitoring and management system. b. If the area is less than 1,000m², use either: i. an energy monitoring and management system or ii. separate accessible energy sub-meters with pulsed or other open protocol communication outputs, for future connection to an energy monitoring and management system 3. Building users can identify the energy consuming end users, for example through labelling or data outputs.	MEP Team		Mandatory for BREEAM Very Good
Sub-Metering of High Energy Load and Tenancy Areas	Ene 02-02	1	0		4. Monitor a significant majority of the energy supply with: a. An accessible energy monitoring and management system for: i. tenanted areas or ii. Relevant function areas or departments in single occupancy buildings OR b. Separate accessible energy sub-meters with pulsed or other open protocol communication outputs for future connection to an energy monitoring and management system for: i. tenanted areas ii. relevant function areas or departments in single occupancy buildings. 5. Sub-meter per floor plate in large single occupancy or single-tenancy buildings with one homogenous function, for example hotel bedrooms, offices.	MEP Team		08.03.23: BREEAM Shaddow review confirmed this credit should be removed
Ene 03: External Lighting								
External Lighting	Ene 03-01	1	1		1. No external lighting (which includes lighting on the building, at entrances and signs). OR 2. External light fittings within the construction zone with: a. Average initial efficacy of not less than 70 luminaire lumens per circuit Watt. b. Automatic control to prevent operation during daylight hours. c. Presence detection in areas of intermittent pedestrian traffic.	MEP Team		
Ene 04: Low carbon design								
Passive Design Analysis	Ene 04-01	1	0	1	1. Achieve the first credit Hea 04 Thermal comfort: One credit - Thermal modelling to demonstrate that the building design delivers appropriate thermal comfort levels in occupied spaces. 2. The project design team analyses the proposed building design and development during concept design to identify opportunities for the implementation of passive design measures. 3. Implement passive design measures to reduce the total heating, cooling, mechanical ventilation, lighting loads and energy consumption in line with the passive design analysis findings. 4. Quantify the reduced total energy demand and carbon dioxide (CO ₂) emissions resulting from the passive design measures.	MEP Team	2	
Free Cooling	Ene 04-02	1	0	1	5. Achieve the passive design analysis credit. 6. Include free cooling analysis in the passive design analysis carried out under criterion 2. 7. Identify opportunities for the implementation of free cooling solutions. 8. The building is naturally ventilated or uses any combination of the free cooling strategies listed in free cooling analysis.	MEP Team		

Title	Credit Ref	Credits available	Route to Very Good (min 55%) 64.44%	Potential credits 36.58%	Compliance Requirements	Responsibility	RIBA Stage	Comments
Low and Zero Carbon Feasibility Study	Ene 04-03	1	1		9. An energy specialist completes a feasibility study by the end of the concept design. 10. Establish the most appropriate recognised local (on-site or near-site) low or zero carbon (LZC) energy sources for the building or development based on the feasibility study. 11. Specify local LZC technologies for the building or development in line with the feasibility study recommendations. 12. Quantify the reduced regulated carbon dioxide (CO ₂) emissions resulting from the feasibility study.	MEP Team	2	08.03.23: To confirm if this is included within the scope of services
Ene 05: Energy Efficient Cold Storage								
Refrigeration Energy Consumption	Ene 05-01	1	1		1. Design, install and commission the refrigeration system: a. In accordance with the Code of Conduct for carbon reduction in the refrigeration retail sector and BS EN 378-2:2016. b. Using robust and tested refrigeration systems or components included on the Enhanced Capital Allowance Energy Technology Product List or and equivalent list.	MEP Team		
Indirect Greenhouse Gas Emissions	Ene 05-02	1	0	1	2. Commission the refrigeration plant in compliance with the commissioning criteria in BREEAM issue Man 04 Commissioning and handover. 3. Achieve criteria 1 and 2. 4. Demonstrate a saving in indirect greenhouse gas emissions (CO ₂ -eq) from the installed refrigeration system over the course of its operational life.	MEP Team		
Ene 06: Energy Efficient Transportation Systems								
Energy Consumption	Ene 06-01	1	1		1. For specified lifts, escalators and moving walks (transportation types) : 1.a. Analyse the transportation demand and usage patterns for the building to determine the optimum number and size of lifts, escalators and/or moving walks. b. Calculate the energy consumption in accordance with BS EN ISO 25745 Energy performance of lifts, escalators and moving walks, Part 2 : Energy calculation and classification for lifts (elevators) and/or Part 3 - Energy calculation and classification for escalators and moving walks, for one of the following: i. At least two types of system (for each transportation type required); OR ii. An arrangement of systems (e.g. for lifts, hydraulic, traction, machine room-less lift (MRL)); OR iii. A system strategy which is 'fit for purpose'. c. Consider the use of regenerative drives, subject to the requirements in the guidance manual. d. Specify the transportation system with the lowest energy consumption.	Lift Consultant		
Energy Efficient Features	Ene 06-02	1	1		2. Criterion 1 is achieved. 3. Specify the following three energy efficient features for each lift: a. A standby condition for off-peak periods. b. The lift car lighting and display lighting provides an average luminous efficacy, (across all fittings in the car) of > 70 luminaire lumens/circuit Watt. c. The lift uses a drive controller capable of variable speed, variable-voltage, and variable-frequency (VVVF) control of the drive motor. 4. Specify regenerative drives where their use is demonstrated to save energy.	Lift Consultant		
Ene 08: Energy Efficient Equipment								
Energy Efficient Equipment	Ene 08-01	2	0	2	1. Identify the building's unregulated energy consuming loads and estimate their contribution to the total annual unregulated energy consumption of the building, assuming a typical/standard specification. 2. Identify the systems and/or processes that use a significant proportion of the total annual unregulated energy consumption of the building. 3. Demonstrate a meaningful reduction in the total annual unregulated energy demand of the building. Table 6.5 in the guidance manual lists examples of significant contributors to unregulated energy consumption and the associated criteria. If additional significant contributors, not listed in the table, will be specified, the design team should justify how a meaningful reduction will be achieved for these contributors.	MEP Team / Client		

Title	Credit Ref	Credits available	Route to Very Good (min 55%)	Potential credits	Compliance Requirements	Responsibility	RIBA Stage	Comments
TRANSPORT (1 credit = 0.83%)								
Tra 01: Transport Assessment and Travel Plan								
Travel Plan	Tra 01-01	2	2		1. No later than Concept Design stage, undertake a site-specific transport assessment (or statement) and draft travel plan, which can demonstrably be used to influence the site layout and built form (in line with the BREEAM methodology).	Transport Consultant	2	The team have confirmed that this was undertaken.
					2. The site-specific travel assessment or statement covers as a minimum: a. Existing travel patterns and opinions of existing building or site users towards cycling and walking, identifying constraints and opportunities if relevant. b Travel patterns and transport impacts of future building users c. Current local environments for walkers and cyclists (accounting for visitors who may be accompanied by young children.) d. Reporting the number and type of existing accessible amenities, see table 7.1 in the guidance manual, within 500m of the site. e. Disabled access (accounting for varying levels of disability and visual impairment). f. Calculation of the existing public transport Accessibility Index. g. Current facilities for cyclists.			
					3. Following a transport assessment (in accordance with the requirements set out in criteria 2a-2g) develop a site-specific travel plan, that provides a long term management strategy which encourages more sustainable travel. The travel plan includes measures to increase or improve more sustainable modes of transport and movement of people and goods during the building's operation (in line with the BREEAM methodology).			
					4. If the occupier is known, involve them in the development of the travel plan.	Client		
					5. Demonstrate that the travel plan will be implemented and supported by the building's management in operation.			
Tra 02: Sustainable Transport Measures								
Sustainable Transport Measures	Tra 02-Pre	-	-	-	1. Achieve criteria 3-5 in the Tra 01 transport assessment and travel plan Issue	Design Team		
	Tra 02-01	10	8	2	2. Identify the sustainable transport measures in table 7.4 of the guidance manual (see criterion 3 and comments section).			
					3. Award credits according to the Accessible Index of the project and the total number of points achieved for the options implemented. The following sustainable transport measures should be considered: 1. Accessibility Index of ≥8 2. Demonstrate an increase over the existing Accessibility Index or provide a dedicated bus service 3. Provide a compliant real-time public transport information system. 4. Provide electric recharging stations of a minimum of 3kW for at least 10% of the total car parking capacity for the development. 5. Provide compliant car sharing facilities. 6. a) During preparation of the brief, the design team consults with the local authority (LA) on the state of the local cycling network and public accessible pedestrian routes, to focus on whichever the LA deems most relevant to the project, and how to improve it. b) Agree and implement one proposition chosen with the local authority. The proposition supported by the development is additional to existing local plans and has a significant impact on the local cycling network or on pedestrian routes open to the public. 7. Install compliant cycle storage spaces. 8. Provide at least 2 compliant cyclists' facilities for the building users (including pupils) -Showers, -Changing facilities, -Lockers, -Drying spaces. 9. At least three existing accessible amenities are present where relevant for a building group. 10. Ensure a minimum of one new accessible amenity is provided. 11. Ensure more than one new accessible amenity is provided. 12. Implement one site-specific improvement measure, not covered by the options already listed in this issue, in line with the recommendations of the travel plan. Submit this for review by BRE.			

Title	Credit Ref	Credits available	Route to Very Good (min 55%)	Potential credits	Compliance Requirements	Responsibility	RIBA Stage	Comments
WATER (1 credit = 0.78%)								
Wat 01: Water Consumption								
Water Consumption	Wat 01-01	5	3	2	<p>1. Use the BREEAM Wat 01 calculator to assess the efficiency of the domestic water-consuming components.</p> <p>2. Use the standard Wat01 method to compare the water consumption (litres/person/day) for the assessed building against a baseline performance. Award BREEAM credits based upon the following: 1 credit: 12.5% 2 credits: 25% 3 credits: 40% 4 credits: 50% 5 credits: 55% Where it is not possible to use the standard method, and for some building types, complete the assessment using the alternative Wat 01 method.</p> <p>3. If a greywater or rainwater system is specified, use its yield in L/person/day to offset potable water demand from components.</p> <p>4. If a greywater or rainwater system is specified and installed: a. Greywater systems in compliance with BS 8525-1:2010 Greywater systems - Part 1 Code of Practice. b. Rainwater systems in compliance with BS 8515:2009+A1:2013 Rainwater harvesting systems - Code of practice Achieve Assessment scope - Criterion 6 on page 201, if you intend to pursue a post occupancy stage certification.</p>	Architect / MEP Team		A minimum of 1 credit is mandatory for BREEAM Very Good
Exemplary Level Criteria	Wat 01-Ex	1	0	1	<p>To achieve an exemplary performance credit: 7. Achieve criteria 1 to 4.</p> <p>8. The water consumption (litres/person/day) for the assessed building achieves the 65% improvement described as exemplary performance in Table 8.1 of the guidance manual.</p>	Architect / MEP Team		
Wat 02: Water Monitoring								
Water Monitoring	Wat 02-01	1	1		<p>1. The specification of a water meter on the mains water supply to each building; this includes instances where water is supplied via a borehole or other private source.</p> <p>2. Water-consuming plant or building areas, consuming 10% or more of the building's total water demand: a. Fit easily accessible sub-meters OR b. Install water monitoring equipment integral to the plant or area.</p> <p>3. For each meter (main and sub): a. Install a pulsed or other open protocol communication output AND b. Connect it to an appropriate utility monitoring and management system e.g. a building management system (BMS), for the monitoring of water consumption. If there is no BMS system in operation at Post-Construction stage, award credits provided that the system used enables connection when the BMS becomes operational.</p> <p>4. In buildings with swimming pools, or large water tanks and aquariums, fit separate sub-meters on the water supply of the above and any associated changing facilities (toilets, showers etc.) irrespective of their water consumption levels.</p> <p>5. In buildings containing laboratories, fit a separate water meter on the water supply to any process cooling loop for 'plumbed in' laboratory process equipment, irrespective of their water consumption levels.</p> <p>6. The water monitoring strategy used enables the identification of all water consumption for sanitary uses as assessed under Wat 01 (l/p/d), if a post occupancy stage certification is sought.</p>	MEP Team		Criterion 1 is mandatory for BREEAM Very Good

Title	Credit Ref	Credits available	Route to Very Good (min 55%) 64.44%	Potential credits 36.58%	Compliance Requirements	Responsibility	RIBA Stage	Comments
Wat 03: Water Leak Detection and Prevention								
Leak Detection System	Wat 03-01	1	1		<div>1. Install a leak detection system capable of detecting a major water leak: a. On the utilities water supply within the buildings, to detect any major leaks within the buildings AND b. Between the buildings and the utilities water supply, to detect any major leak between the utilities supply and the buildings under assessment.</div> <div>2. The leak detection system is: a. A permanent automated water leak detection system that alerts the building occupants to the leak OR an inbuilt automated diagnostic procedure for detecting leaks. b. Activated when the flow of water passing through the water meter or data logger is at a flow rate above a pre-set maximum for a pre-set period of time. This usually involves installing a system which detects higher than normal flow rates at meters or sub-meters. It does not necessarily require a system that directly detects water leakage along part or the whole length of the water supply system. c. Able to identify different flow and therefore leakage rates e.g. continuous, high or low level, over set time periods. Although high and low level leakage rates are not specified, the leak detection equipment installed must have the flexibility to distinguish between different flow rates to enable it to be programmed to suit the building type and owners or occupiers usage patterns. d. Programmable to suit the owner's or occupiers water consumption criteria. e. Where applicable, designed to avoid false alarms caused by normal operation of large water-consuming plant such as chillers. Where there is physically no space for a leak detection system between the utilities water meter and the building, alternative solutions can be used, provided that a major leak can still be detected.</div>	MEP Team		
Flow Control Devices	Wat 03-02	1	1		2. Install flow control devices that regulate the supply of water to each WC area/sanitary facility according to demand, in order to minimise undetected wastage and leaks from sanitary fittings and supply pipework.	MEP Team		
Wat 04: Water Efficient Equipment								
Water Efficient Equipment	Wat 04-01	1	1		<div>1. Identify all water demands from users other than those considered under Wat 01 that could be realistically mitigated or reduced. Where there is no water demand from uses other than domestic -style, sanitary use components in the building, this issue is not applicable.</div> <div>2. Identify systems or processes to reduce the relevant water demand (criterion 1) and establish, through either good practice design or specification, a demonstrable reduction in the total water demand of the building.</div>	MEP Team		

Title	Credit Ref	Credits available	Route to Very Good (min 55%) 64.44%	Potential credits 36.58%	Compliance Requirements	Responsibility	RIBA Stage	Comments
MATERIALS (1 credit = 1.07%)								
Mat 01: Life Cycle Impacts								
Superstructure	Mat 01-01	6	0		Option appraisal during Concept Design (all building types). 4. During Concept Design, identify opportunities for reducing environmental impacts as follows: a. Carry out building LCA options appraisal of 2 to 4 significantly different superstructure design options (applicable to the Concept Design stage) b. Use a building LCA tool that is recognised by BREEAM (as suitable for assessing superstructure during Concept Design) according to the methodology. c. For each design option, fulfil the same functional requirements specified by the client and all statutory requirements (to ensure functional equivalency). d. Integrate the LCA options appraisal activity within the wider design decision-making process. Record this in an options appraisal summary document. e. Record the following in the Mat 01/02 Results Submission Tool: The differences between the design options; the design option selected by the client to be progressed beyond Concept Design; the reasons for selecting it and the reasons for not selecting the other design options. f. Submit the Mat 01/02 Results Submission Tool to BRE at the end of Concept Design, and before planning permission is applied for (that includes external material or product specifications). If the building LCA tool recognised by BREEAM and used for criteria 3 to 5 (and 6 to 9, if pursued) is not an IMPACT Compliant LCA tool and criteria 1 to 2 are applicable, then BREEAM Simplified Building LCA tool (or an IMPACT Compliant LCA tool) shall be used for criteria 1 to 2.	Architect / LCA Specialist	2	
					Options appraisal during Technical Design (all building types) 5. During Technical Design identify opportunities for reducing environmental impacts as follows: a. Carry out building LCA options appraisal of 2 to 3 significantly different superstructure design options (based on the selected Concept Design option and as applicable to the Technical Design stage). b. Use a building LCA tool that is recognised by BREEAM (as suitable for assessing superstructure during Technical Design) according to the methodology. c. As criteria 4.c. to 4.e. above. Where an options appraisal summary document was produced during Concept Design, update it to include the Technical Design options. d. Submit the Mat 01/02 Results Submission Tool to BRE at the end of Technical Design. Where a project has not achieved criteria 3 and 4, criterion 5 may still be achieved.			
Substructure and Hard Landscaping options appraisal	Mat 01-02	1	0		6. Criteria 3 and 4 are achieved. 7. During Concept Design identify opportunities for reducing environmental impacts as follows: a. Carry out building LCA options appraisal of a combined total of at least six significantly different substructure or hard landscaping design options (at least two shall be substructure and at least two shall be hard landscaping). b. Using a building LCA tool that is recognised by BREEAM (as suitable for assessing substructure and hard landscaping during Concept Design) according to the methodology. c As criteria 4.c. to 4.f.	C&S Engineer / Landscape Architect / LCA Specilaist	2	
Exemplary Performance Criteria	Mat 01-Ex1	1	0		8. Criteria 3-4 are achieved. 9. During Concept Design, identify opportunities for reducing environmental impacts as follows: a. Carry out building LCA options appraisal of at least 3 significantly different core building services design options. b. Use a building LCA tool that is recognised by BREEAM (as suitable for assessing core building services during Concept Design) according to the methodology. c. As criteria 4.c.to 4.f.	MEP Team / LCA Specialist	2	

Title	Credit Ref	Credits available	Route to Very Good (min 55%)	Potential credits	Compliance Requirements	Responsibility	RIBA Stage	Comments
Exemplary Performance Criteria	Mat 01-Ex2	1	0		10. Achieve criteria 3 to 5.	Design Team	2	
					11. Achieve the Elemental LCC plan and Component Level LCC options appraisal credits (Man 02 Life cycle cost and service life planning).			
					12. Include design options appraised for criteria 3 to 4 (and 6 to 7 and 8 to 9, if pursued) during Concept Design in Assessment scope- The elemental LCC plan.			
					13. Include the design options appraised for criterion 5 during Concept Design in the 'Component Level LCC option appraisal' (in Man 02 Life cycle cost and service life planning)			
	14. Integrate the aligned LCA and LCC options appraisal activity within the wider design decision-making process. Record this in an options appraisal summary document including the relevant cost information from the 'elemental LCC plan' and 'Component Level LCC option appraisal'.					Design Team		
	15.Criteria 1 to 7 (As applicable to the building type) are achieved.							
	16. A suitably qualified third party carries out the building LCAs or produces a report verifying the building LCAs accurately represent the designs under consideration during Concept Design and Technical Design with reference to the requirements of criteria 1 to 7 (and 8 to 14 if pursued).							
	17. For each LCA option, itemise the findings of the verification checks made by the suitably qualified third party in the report including, as a minimum, the quality requirements shown in Table 9.4 of the guidance manual.							
18. Include details of the suitable qualified third party's relevant skills and experience and a declaration of their third party independence from the project client and design team in the report.								
Mat 02: Environmental Impacts from Construction Products - Environmental Product Declarations (EPD)								
Specification of Products with a Recognised EPD	Mat 02-01	1	1		1. Specify construction products with EPD that achieve a total EPD points score of at least 20, according to the BREEAM methodology (to be supplied by the assessor).	Architect / Principal Contractor		
					2. Enter the details of each EPD into the Mat 01/02 Results Submission Tool, including the material category classification. The mat 01/02 results submission tool will verify the EPD points score and credit award.	BREEAM assessor		
Mat 03: Responsible Sourcing of Construction Products								
Ensuring Sustainable Procurement	Mat 03-Pre	-	-	-	1. All timber and timber based products used on the project is ' Legally harvested and traded timber' as per the UK government's Timber Procurement Policy (TPP)	Principal Contractor		Criterion 1 is mandatory for BREEAM Very Good It is assumed that the sustainable procurement plan produced for Phase 1 has been applied to Phase 2.
	Mat 03-01	1	1		2. A sustainable procurement plan must be used by the design team to guide specification towards sustainable construction products. The plan must: a. Be in place before Concept Design b. Include sustainability aims, objectives and strategic targets to guide procurement activities. Note: targets do not need to be achieved for the credit to be awarded but justification must be provided for targets that are not achieved. c. Include a requirement for assessing the potential to procure construction products locally. There must be a policy to procure construction products locally where possible. d. Include details of procedures in place to check and verify the effective implementation of the sustainable procurement plan. In addition if the plan is applied to several sites or adopted at an organisational level it must: e. Identify the risks and opportunities of procurement against a broad range of social, environmental and economic issues following the process set out in BS ISO 20400:2017.	Client	1	
Measuring Responsible Sourcing	Mat 03-02	3	2	1	3. Use the Mat 03 calculator tool and methodology to determine the number of credits achieved for the construction products specified or procured. Credits are awarded in proportion to the scope of the assessment and the number of points achieved. (Use table 9.10 in the guidance manual).	Principal Contractor		

Title	Credit Ref	Credits available	Route to Very Good (min 55%)	Potential credits	Compliance Requirements	Responsibility	RIBA Stage	Comments
Mat 05: Designing for Durability and Resilience								
Designing for Durability and Resilience	Mat 05-01	1	1		Protecting vulnerable parts of the building from damage 1. Protection measures are incorporated into the building's design and construction to reduce damage to the building's fabric or materials in case of accidental or malicious damage occurring. These measures must provide protection against: a. Negative impacts of high user numbers in relevant areas of the building (e.g. corridors, lifts, stairs, doors etc.) b. Damage from any vehicle or trolley movements within 1m of the internal building fabric in storage, delivery, corridor and kitchen areas. c. External building fabric damage by vehicle. Protection where parking or manoeuvring areas are within 1 metre of the building facade and where delivery areas or routes are within 2 metres of the facade i.e. specifying bollards or protection rails. d. Potential malicious damage to building materials and finishes in public and common areas where appropriate.	Architect		
					Protecting exposed parts of the building from material degradation 2. Key exposed building elements have been designed and specified to limit long and short term degradation due to environmental factors. This can be demonstrated through one of the following: a. The element or product achieving an appropriate quality or durability standard or design guide, see Table 9.14 of the guidance manual. If none are available use BS 7543:2015 as the default appropriate standard. OR b. A detailed assessment of the element's resilience when exposed to the applicable material degradation and environmental factors.			
					3. Include convenient access to the roof and façade for cost-effective cleaning, replacement and repair in the building's design.			
					4. Design the roof and façade to prevent water damage, ingress and detrimental ponding. See Table 9.14 in the guidance manual for an example list of relevant industry durability and quality standards.			
Mat 06: Material efficiency								
Material Efficiencies	Mat 06-01	1	1		1. At the Preparation and Brief and Concept Design stages, set targets and report on opportunities and methods to optimise the use of materials. These must be done for each of the following stages: a. Preparation and Brief b Concept Design c. Developed Design d Technical design e. Construction	Architect	1 to 5	
					2. Develop and record the implementation of material efficiency during: a. Developed Design b. Technical Design c. Construction			
					3. Report the targets and actual material efficiencies achieved.			
WASTE (1 credit = 0.60%)								
Wst 01: Construction Waste Management								
Pre-Demolition Audit	Wst 01-01	1	1		1. Complete a pre-demolition audit of any existing buildings, structures or hard surfaces being considered for demolition. This must be used to determine whether refurbishment or reuse is feasible and, in the case of demolition, to maximise the recovery of material for subsequent high grade or value applications. The audit must cover the content of pre-demolition audit scope and: a. Be carried out at Concept Design stage (RIBA Stage 2) by a competent person prior to strip-out or demolition works. b. Guide the design, consider materials for reuse and set targets for waste management. c. Engage all contractors in the process of maximising high grade reuse and recycling opportunities. d. Compare actual waste arisings and waste management routes used with those forecast and investigate significant deviations from planned targets.	Demolition Contractor / Design Team	2	
					2. Make reference to the audit in the resource management plan (RMP).	Principal Contractor		

Title	Credit Ref	Credits available	Route to Very Good (min 55%) 64.44%	Potential credits 36.58%	Compliance Requirements	Responsibility	RIBA Stage	Comments
Construction Resource Efficiency	Wst 01-02	3	2	1	<div>3. Prepare a compliant Resource Management Plan (RMP) covering: a. Non-hazardous waste materials (from on-site construction and dedicated off-site manufacturer or fabrication) including demolition and excavation waste. b. Accurate data records on waste arising's and waste management routes.</div> <div>4. Meet or improve upon the benchmarks below for non-hazardous construction waste, excluding demolition and excavation waste: Amount of waste generated per 100m2 GIFA: 1 credit: ≤ 13.3m2 actual volume (not bulk) / ≤ 11.1 tonnes 2 credits: ≤ 7.5m2 actual volume (not bulk) / ≤ 6.5 tonnes 3 credits: ≤ 3.4m2 actual volume (not bulk) / ≤ 3.2 tonnes Exemplary level: ≤ 1.6m2 actual volume (not bulk) / ≤ 1.9 tonnes</div>	Principal Contractor		
Diversion of Resources from Landfill	Wst 01-03	1	1		<div>5. Meet, where applicable, the diversion from landfill benchmarks below for non-hazardous construction waste and demolition and excavation waste generated: Non-demolition: 70% volume / 80% tonnage Demolition: 80% volume / 90% tonnage Excavation: n/a</div> <div>6. Sort waste materials into separate key waste groups as per Table 10.3 of the guidance manual, either on-site or through a licensed contractor for recovery.</div>	Principal Contractor		
Exemplary Performance Criteria	Wst 01-Ex	1	0	1	<div>7. Non-hazardous construction waste generated, excluding demolition and excavation waste is less than or equal to the exemplary level resource efficiency benchmarks: Exemplary level: ≤ 1.6m2 actual volume (not bulk) / ≤ 1.9 tonnes</div> <div>8. The percentage of non-hazardous construction (on-site and dedicated off-site manufacture/fabrication), demolition and excavation waste (if relevant) diverted from landfill meets or exceeds the exemplary level percentage benchmarks outlined below: Non-demolition: 85% volume / 90% tonnage Demolition: 85% volume / 95% tonnage Excavation: 95% volume / 95% tonnage</div> <div>9. All key waste groups in Table 10.3 of the guidance manual, for diversion from landfill are covered in the RMP.</div> <div>10. Waste data obtained from licenced external waste contractors is reliable and verifiable, by using data from EA/SEPA/EA Wales/NIEA Waste Return Forms or from PAS 402:2013 compliant company.</div>	Principal Contractor		
Wst 02: Recycled Aggregates								
Pre-Requisite	Wst 02-Pre	-	-	-	1. If demolition occurs on site, to encourage the reuse of site-won material on site, complete a pre-demolition audit of any existing buildings, structures or hard surfaces in accordance with Assessment scope- Criterion 1 and Assessment Scope - Criterion 2	C&S Engineer		
Sustainable Aggregate Points	Wst 02-01	1	0	1	<div>2. Identify all aggregate uses and types on the project Table 10.5, and Table 10.6 in the guidance manual.</div> <div>3. Determine the quantity in tonnes for each identified use and aggregate type.</div> <div>4. Identify the region in which the aggregate source is located.</div> <div>5. Calculate the distance in kilometres travelled by all aggregates by transport type.</div> <div>6. Enter the information into the BREEAM Wst 02 calculator to calculate the Project Sustainable Aggregate points. The corresponding number of BREEAM credits will be awarded (refer to Table 10.4 in the guidance manual).</div>	C&S Engineer		
Exemplary Performance Criteria	Wst 02-Ex	1	0	1	<div>To achieve an exemplary performance credit:</div> <div>7. The Project Sustainable Aggregate Points score meets or exceeds the exemplary level performance benchmark in Table 10.4 of the guidance manual.</div>	C&S Engineer		

Title	Credit Ref	Credits available	Route to Very Good (min 55%) 64.44%	Potential credits 36.58%	Compliance Requirements	Responsibility	RIBA Stage	Comments
Wst 03: Operational Waste								
Operational Waste	Wst 03-01	1	1		<p>1. Provide a dedicated space for the segregation and storage of operational recyclable waste generated. The space is:</p> <p>a. Clearly labelled, to assist with segregation, storage and collection of the recyclable waste streams</p> <p>b. Accessible to building occupants or facilities operators for the deposit of materials and collections by waste management contractors</p> <p>c. Of a capacity appropriate to the building type, size, number of units (if relevant) and predicted volumes of waste that will arise from daily/weekly operational activities and occupancy rates.</p> <p>2. For consistent and large amounts of operational waste generated, provide:</p> <p>a. Static waste compactors or balers; situated in a service area or dedicated waste management space</p> <p>b. Vessels for composting suitable organic waste OR adequate spaces for storing segregated food waste and compostable organic material for collection and delivery to an alternative composting facility</p> <p>c. A water outlet provided adjacent to or within the facility for cleaning and hygiene purposes where organic waste is to be stored or composted on site.</p>	Architect / Client		
Wst 05: Adaptation to Climate Change								
Resilience of Structure, Fabric, Building Services and Renewables Installation	Wst 05-01	1	1		<p>1. Conduct a climate change adaptation strategy appraisal using:</p> <p>a. A systematic risk assessment to identify the impact of expected extreme weather conditions arising from climate change on the building over its projected life cycle. The assessment covers the installation of building services and renewable systems, as well as structural and fabric resilience aspects and includes:</p> <p>i. Hazard identification</p> <p>ii. Hazard assessment</p> <p>iii. Risk estimation</p> <p>iv. Risk evaluation</p> <p>v. Risk management.</p> <p>2. Develop recommendations or solutions based on the climate change adaptation strategy appraisal, before or during concept design, that aim to mitigate the identified impact.</p> <p>3. Provide an update during Technical Design demonstrating how the recommendations or solutions proposed at Concept Design have been implemented where practical and cost effective. Omissions have been justified in writing by the assessor.</p>	Design Team	2	
						Design Team	4	
Exemplary Criteria	Wst 05-Ex	1	0		<p>Achievement of the following criteria demonstrates a holistic approach to the design and construction of the building's life cycle to mitigate against the impacts of climate change.</p> <p>To achieve an exemplary level performance credit:</p> <p>4. Meet criteria 1-3.</p> <p>5. Meet the criteria or achieve credits of the assessment issues given below:</p> <ul style="list-style-type: none"> - Hea 04: Criterion 6 - Ene 01: Minimum 6 credits - Ene 04: Passive design credit - Wat 01: Minimum 3 credits - Mat 05: Criteria 2 - 4 - Pol 03: Minimum 1 credit for flood resilience and 2 credits under Surface Water Runoff 	Design Team		

Title	Credit Ref	Credits available	Route to Very Good (min 55%)	Potential credits	Compliance Requirements	Responsibility	RIBA Stage	Comments
Wst 06: Design for Disassembly and Adaptability								
Recommendations	Wst 06-01	1	0	1	<div>1. Conduct a study to explore the ease of disassembly and the functional adaptation potential of different design scenarios by the end of Concept Design.</div> <div>2. Develop recommendations or solutions based on the study during or prior to Concept Design, that aim to enable and facilitate disassembly and functional adaptation.</div>	Architect	2	
Implementation	Wst 06-02	1	0	1	<div>3. Achieve criteria 1 and 2.</div> <div>4. Provide an update, during Technical Design, on:<div>a. How the recommendations or solutions proposed by Concept Design have been implemented where practical and cost effective. Omissions have been justified in writing to the assessor.</div>b. Changes to the recommendations and solutions during the development of the Technical Design,</div> <div>5. Produce a building adaptability and disassembly guide to communicate the characteristics allowing functional adaptability and disassembly to prospective tenants.</div>	Architect	4	
LAND USE AND ECOLOGY (1 credit = 1.00%)								
LE 01: Site Selection								
Previously Occupied Land	LE 01-01	1	1		1. At least 75% of the proposed development is on previously occupied land	Architect		
Contaminated Land	LE 01-02	1	0		<div>2. A contaminated land professional undertakes a site investigation, risk assessment and appraisal, which deems that land within the development footprint to be affected by contamination. This report identifies:<div>a. The degree of contamination</div>b. The contaminant sources/types</div> c. The options for remediating sources of contamination which present an unacceptable risk. <div>3. The client or principal contractor confirms that a remediation strategy will be implemented, in line with the report.</div>	C&S Engineer		No contamination on Phase 1.
LE 02: Ecological Risks and Opportunities								
Pre-Requirement (Statutory Obligations)	LE 02-Pre	-	-	-	1. The client or contractor confirms compliance is monitored against all relevant UK and EU or international legislation relating to the ecology of the site.	Client / Principal Contractor		
Survey and Evaluation	LE 02-01	1	1		<div>3. A Suitably Qualified Ecologist (SQE) carries out a survey and evaluation for the site early enough to influence site preparation works, layout and, where necessary, strategic planning decisions (typically Preparation and brief stage).</div> <div>4. The SQE's survey and evaluation determines the site's ecological baseline, including:<div>a. Current and potential ecological value and condition of the site and related areas within the Zone of Influence.</div>b. Direct and indirect risks to current ecological value from the project.</div> c. Capacity and feasibility for enhancement of the site's ecological value and, where relevant, areas within the Zone of Influence. <div>5. Recommendations and data collected from the survey and evaluation are shared with appropriate project team members to influence decisions made for activities during site preparation, design and construction works, which can support ecological features.</div>	Ecologist	1	
						Ecologist / Design Team		

Title	Credit Ref	Credits available	Route to Very Good (min 55%) 64.44%	Potential credits 36.58%	Compliance Requirements	Responsibility	RIBA Stage	Comments
Determining Ecological Outcomes	LE 02-02	1	1		<p>6. Achieve the LE 02-01 "Survey and Evaluation" credit.</p> <p>7. The project team liaise and collaborate with representative stakeholders early enough to influence key planning decisions (typically Concept Design stage), to:</p> <p>a. Identify the optimal ecological outcomes for the site.</p> <p>b. Identify, appraise and select measures to meet the optimal ecological outcomes for the site (criterion 7a), in line with the mitigation hierarchy of action:</p> <p>1. Avoidance 2. Protection 3. Reduction or limitation of negative impacts 4. On site compensation and 5. Enhancement, considering the capacity and feasibility within the site, or where viable, offsite.</p>	Ecologist / Design Team	2	
Exemplary Level Criteria	LE 02-Ex	1	0	1	<p>To achieve one exemplary performance credit:</p> <p>Wider site sustainability</p> <p>8. Achieve criteria 7 / LE02-02 above.</p> <p>9. Wider sustainability related activities and potential ecosystem service benefits are considered as part of determining the optimal ecological outcomes for the site (criterion 7), including the areas outlined in the Methodology below.</p> <p>10 Achieve the credits of the assessment issues outlined below:</p> <p>a. Hea 07 Safe and healthy surroundings - Both credits b. Pol 03 Flood and surface water management - Achieve credits for 'Surface water run-off' and 'Minimising watercourse pollution' c. Pol 05 Reduction of noise pollution</p>	Ecologist / Design Team		
LE 03: Managing Impacts on Ecology								
Pre-Requisite	LE 03-Pre	-	-	-	1. LE 02's 'Survey and evaluation and Determining ecological outcomes' criteria have been achieved.	Design Team		
Planning and Measures On-Site	LE 03-01	1	1		2. Further planning to avoid and manage negative ecological impacts on-site is carried out (see Methodology in guidance manual) early enough to influence the concept design and design brief as well as site preparation planning (typically Concept Design stage).	Design Team	1 or 2	
					3. On-site measures for managing negative ecological impacts during site preparation and construction are implemented in-practice (e.g. mitigation measures to protect existing ecological features) (see Methodology in guidance manual).	Principal Contractor		
					4 Criteria 2-3 are based on input from the project team in collaboration with representative stakeholders and data collated as part of the 'Determining ecological outcomes' in LE 02 Ecological risks and opportunities (see Methodology).	Design Team		
Managing Negative Impacts of the Project	LE 03-02	2	1	1	<p>7. Criteria 2-4 have been achieved.</p> <p>8. Negative impacts from site preparation and construction works have been managed according to the mitigation hierarchy, in line with the SQE's recommendations and, either:</p> <p>a No overall loss of ecological value has occurred (two credits). OR where criterion 8.a is not possible: b. The loss of ecological value has been minimised (Minimising Loss) (one credit)</p>	Ecologist / Principal Contractor / Design Team		

Title	Credit Ref	Credits available	Route to Very Good (min 55%) 64.44%	Potential credits 36.58%	Compliance Requirements	Responsibility	RIBA Stage	Comments
LE 04: Ecological Change and Enhancement								
Pre- Requisite	LE 04-Pre	-	-	-	1. Criterion 8 in LE 03 has been achieved.	Design Team		
					2. The client or contractor confirms compliance is monitored against all relevant UK, EU or international legislation relating to the ecology of the site.	Principal Contractor / Client		
Change and Enhancement of Ecology	LE 04-01	3	2	1	4. Up to three credits are awarded based on the change in ecological value occurring as a result of the project. This must be calculated in accordance with the process set out in GN36 - BREEAM, CEEQUAL and HQM Ecology Calculation Methodology – Route 2. Credits are awarded in line with the Reward Scale table in GN36 where there are no residual impacts on protected sites or irreplaceable habitats.	Ecologist / Landscape Architect		
Ecological Enhancement	LE 04-02	1	1		5 Measures have been implemented that enhance ecological value, which are based on input from the project team and SQE in collaboration with representative stakeholders and data collated as part of the 'Determining ecological outcomes' in LE 02. Measures are implemented in the following order: a. On site, and where this is not feasible, b. Off site within the Zone of Influence.	Ecologist / Architect		
					6. Data collated are analysed and where potentially valuable, provided to the local environmental records centres nearest to, or relevant for, the site.			
Exemplary Level Criteria	LE 04-EX	1	0	1	7. The change in ecological value calculated under criterion 6 above confirms significant net gain has been achieved as set out in GN36 - BREEAM, CEEQUAL and HQM Ecology Calculation Methodology – Route 2. The credit is awarded as follows: a. Significant net gain of ecological value (percentage score of 110 or above)	Ecologist / Architect		
LE 05: Long Term Ecological Management and Maintenance								
Pre- Requisite	LE 05-Pre	-	-	-	1 The client or contractor has confirmed that compliance is being monitored against all relevant UK, EU and international standards relating to the ecology of the site.			
					2. Criterion 8 in LE 03 has been achieved, and at least one credit under LE 04 for 'Change and Enhancement of Ecology' has been awarded.			
Planning, Liaison, Data, Monitoring and Review Management and Maintenance	LE 05-01	1	1		3. Measures have been implemented to manage and maintain ecology throughout the project. These measures are based on input from the project team in collaboration with representative stakeholders and data collated as part of the 'Determining ecological outcomes' in LE 02. To ensure the optimal ecological outcomes agreed in LE 02 are met in-practice, these measures must monitor and review the effectiveness of the mitigation and enhancement measures in place for LE 03 & LE 04 to ensure they are implemented.	Principal Contractor / Design Team		
					4. A section on Ecology and Biodiversity has been included as part of the tenant or building owner information supplied, to inform the owner or occupant of local ecological features, value and biodiversity on or near the site. This should include detailed management and maintenance plans as required by landscape and asset managers as well as relevant parts of the handover information for occupiers written in a format that encourages understanding and supportive behaviours.	Ecologist / Principal Contractor / Design Team		
Landscape and Ecology Management Plan (or similar) development	LE 05-02	1	1		5. A Landscape and Ecology Management Plan, or equivalent, has been developed in accordance with BS 42020:2013 Section 11.1(213) covering at least the first five years after project completion as a minimum and including: a. Actions and responsibilities of relevant individuals prior to handover b. The ecological value and condition of the site at handover and how this is expected to develop and change over time c. Identification of opportunities for ongoing alignment with activities beyond the development project, which support the aims of BREEAM's Strategic Ecology Framework d. Identification and guidance to trigger appropriate remedial actions to address previously unforeseen impacts e. Clearly defined and allocated roles and responsibilities for delivering the plan	Landscape Architect / Ecologist		
					6. The landscape and management plan or similar will be updated to support maintenance of the ecological value of the site (see sections relating to Maintenance and Monitoring in CIEEM, CIRIA, IEMA, for helpful guidance).			

Title	Credit Ref	Credits available	Route to Very Good (min 55%)	Potential credits	Compliance Requirements	Responsibility	RIBA Stage	Comments
POLLUTION (1 credit = 0.67%)								
Pol 01: Impact of Refrigerants								
Impact of Refrigerant	Pol 01-01	2	0	2	<div>Three credits - No refrigerant use</div> <div>1. Where the building does not require the use of refrigerants within its installed plant/systems.</div> <div>OR alternatively, where the building does require the use of refrigerants, the three credits can be awarded as follows:</div> <div>Pre-requisite</div> <div>2. All systems (with electric compressors) must comply with the requirements of BS EN 378:2016 (parts 2 and 3) and where refrigeration systems containing ammonia comply with the Institute of Refrigeration Ammonia Refrigeration Systems Code of Practice</div> <div>Two credits - Impact of refrigerant</div> <div>3. Where the systems using refrigerants have Direct Effect Life Cycle CO2 equivalent emissions (DELCO2e) of ≤ 100 kgCO2e/kW cooling/heating capacity. For systems which provide cooling and heating, the worst performing output based on the lower of kW cooling output and kW heating output is used to complete the calculation.</div> <div>OR</div> <div>4. Where air-conditioning or refrigeration systems are installed the refrigerants used have a Global Warming Potential (GWP) ≤10.</div> <div>OR</div> <div>One credit - Impact of refrigerant</div> <div>5. Where the systems using refrigerants have Direct Effect Life Cycle CO2equivalent emissions (DELCO2e) of ≤ 1000 kgCO2e/kW cooling/heating capacity.</div>	MEP Team		
Leak Detection	Pol 01-02	1	1		<div>6. All systems are hermetically sealed or only use environmentally benign refrigerants.</div> <div>OR</div> <div>7. Where the systems are not hermetically sealed:</div> <div>a. Systems have:</div> <div>i. A permanent automated refrigerant leak detection system, that is robust and tested, and capable of continuously monitoring for leaks.</div> <div>OR</div> <div>ii. An inbuilt automated diagnostic procedure for detecting leakage is enabled.</div> <div>b. In the event of a leak, the system must be capable of automatically responding and managing the remaining refrigerant charge to limit loss of refrigerant (see automatic isolation and containment of refrigerant).</div>	MEP Team		
Pol 02: Local Air Quality								
Local Air Quality	Pol 02-01	2	2		<div>1. All heating and hot water is supplied by non-combustion systems. For example, only powered by electricity</div> <div>OR alternatively;</div> <div>2. Emissions from all installed combustion plant that provide space heating and domestic hot water do not exceed the levels set in Table 12.4 and Table 12.5 in the guidance manual (assessor to provide). The measurements must be provided by manufacturers, following the labelling requirements of the European Directive 2009/125/EC. No credits can be awarded for Pol02 if any of the combustion appliances are not covered in Table 12.4 and Table 12.5 in the guidance manual.</div> <div>3. Emissions from all installed combustion plant that provide space heating and domestic hot water do not exceed the levels set in table 12.4 and 12.15 of the guidance manual.</div>	MEP Team		

Title	Credit Ref	Credits available	Route to Very Good (min 55%) 64.44%	Potential credits 36.58%	Compliance Requirements	Responsibility	RIBA Stage	Comments
Pol 03: Flood and Surface Water Management								
Flood Resilience	Pol 03-01	2	1		<p>1. An appropriate consultant is appointed to carry out and demonstrate the development's compliance with all criteria. Two credits - Low flood risk</p> <p>2. A site-specific flood risk assessment (FRA) confirms that the development is in a flood zone that is defined as having low annual probability of flooding. The FRA takes all current and future sources of flooding into consideration. One credit - Medium/high flood risk</p> <p>3. A site-specific FRA confirms the development is in a flood zone that is defined as having a medium or high annual probability of flooding and is not in a functional floodplain. The FRA must take all current and future sources of flooding into consideration. For smaller sites, refer to Level of detail required in the FRA for smaller sites which overrides criterion 2.</p> <p>4. To increase the resilience of the development to flooding, one of the following must be achieved: a. The ground level of the building and access to both the building and the site, are designed (or zoned) so they are at least 600mm above the design flood level of the site's flood zone. b. The final design of the building and wider site reflects the recommendations made by an appropriate consultant with the hierarchy approach outlined in section 5 of BS 8533:2017.</p>	C&S Engineer		Phase 1 is in a medium flood risk zone.
Surface Water Run-off	Pol 03-Pre	-	-	-	5. Surface water run-off design solutions must be bespoke, i.e. they must take account of the specific site requirements and natural or man-made environment of and the surrounding site. The priority levels detailed in the Methodology must be followed, with justification given by the appropriate consultant where water is allowed to leave the site.	C&S Engineer		
	Pol 03-02	1	1		<p>One credit - Surface water run-off - Rate</p> <p>6. The following must comply: a. For brownfield sites, drainage measures are specified so that the peak rate of run-off from the site to the watercourses (natural or municipal) shows a 30% improvement for the developed site compared with the pre-developed site. This should comply at the 1-year and 100-year return period events. b. For Greenfield sites, drainage measures are specified so that the peak rate of run-off from the site to the watercourses (natural or municipal) is no greater for the developed site than it was for the pre-development site. This should comply at the 1-year and 100-year return period events.</p> <p>7. Relevant maintenance agreements for the ownership, long term operation and maintenance of all specified Sustainable Drainage Systems (SuDs) are in place.</p> <p>8. Calculations include an allowance for climate change. This should be made in accordance with the current best practice planning guidance.</p>	C&S Engineer		
	Pol 03-03	1	1		<p>One credit - Surface Run-off - Volume</p> <p>9. Flooding of property will not occur and in the event of local drainage system failure (caused by either extreme rainfall or a lack of maintenance); AND EITHER</p> <p>10. Drainage design measures are specified so that the post-development run-off volume, over the development lifetime, is no greater than it would have been prior to the assessed site's development. This must be for the 100-year-6-hour event, including an allowance for climate change.</p> <p>11. Any additional predicted volume run-off for this event is prevented from leaving the site by using infiltration or other Suds techniques.</p> <p>OR (only where criteria 10 and 11 for this credit cannot be achieved):</p> <p>12. Justification from the appropriate consultant indicating why the above criteria cannot be achieved, i.e. where infiltration or other Suds techniques are not technically viable options.</p> <p>13. Drainage design measures are specified so that that post-development peak run-off is reduced to the limiting discharge. The limiting discharge is defined as the highest flow rate from the following options: a. the pre-development one-year peak flow rate b. The mean annual flow rate (Qbar) c 2L/s/ha.</p> <p>For the one-year peak flow rate, the one-year return period event criterion applies.</p> <p>14. Relevant maintenance agreements for the ownership, long term operation and maintenance of all specified Suds are in place.</p> <p>15. For either option, above calculations must include an allowance for climate change; this should be made in accordance with current best practice planning guidance.</p>	C&S Engineer		

Title	Credit Ref	Credits available	Route to Very Good (min 55%) 64.44%	Potential credits 36.58%	Compliance Requirements	Responsibility	RIBA Stage	Comments
Minimising Water Course Pollution	Pol 03-04	1	0	1	16. There is no discharge from the developed site for rainfall up to 5mm (confirmed by the Appropriate Consultant). 17. Areas with a low risk source of watercourse pollution, an appropriate level of pollution prevention treatment is provided, using appropriate Suds techniques. 18. Areas with a high risk of contamination of spillage of substances, such as petrol and oil have separators (or an equivalent system) are installed in surface water drainage systems. 19. Chemical or liquid gas storage areas have a means of containment fitted to the site drainage system (i.e. shut-off valves). This is to prevent the escape of chemicals to natural watercourses in the event of spillage or bunding failure. 20. All water pollution prevention systems have been designed and installed in accordance with the recommendations of documents such as the Suds manual and other relevant industry best practice. They must be bespoke solutions taking account of the specific site requirements and natural or man-made environment of and surrounding the site. 21. A comprehensive and up to date drainage plan of the site will be made available for the building or site occupiers. 22. Relevant maintenance agreements for the ownership, long term operation and maintenance of all specified Suds must be in place. 23. All external storage and delivery areas are designed and detailed in accordance with the current best practice planning guidance.	C&S Engineer		
Pol 04: Reduction of Night Time Light Pollution								
Reduction of Night Time Light Pollution	Pol 04-01	1	1		1. External lighting pollution has been eliminated through effective design that removes the need for external lighting. This does not adversely affect the safety and security of the site and its users. OR alternatively, where the building does have external lighting one credit can be awarded as follows: 2. The external lighting strategy has been designed in compliance with Table 2 (and its accompanying notes) of the Institution of Lighting Professionals (LP) Guidance notes for the reduction of obtrusive light, 2011. 3. All external lighting (except for safety and security lighting) can be automatically switched off between 23:00 and 07:00 4. If safety or security lighting is provided and will be used between 23:00 and 07:00, this part of the lighting system complies with the lower levels of lighting recommended during these hours in Table 2 of the ILP guidance notes. 5. Illuminated advertisements are designed in compliance with IPL PLG05 The Brightness of Illuminated Advertisement.	MEP Team		
Pol 05: Reduction of noise pollution								
Reduction of Noise Pollution	Pol 05-01	1	1		1. There are no noise-sensitive areas within the assessed building or within 800m radius of the assessed site. OR 2. Where there are noise-sensitive areas within the assessed building or noise-sensitive areas within 800m radius of the assessed site, a noise impact assessment compliant with BS4142:2014 is commissioned. Noise levels must be measured or determined for: a. Existing background noise levels: i. at the nearest or most exposed noise-sensitive development to the proposed assessed site. ii. Including existing plant on a building, where the assessed development is an extension to the building. b. Noise rating level from the assessed building 3. The noise impact assessment must be carried out by a suitably qualified acoustic consultant. 4. The noise level from the assessed building, as measured in the locality of the nearest or most exposed noise-sensitive development, must be at least 5dB lower than the background noise throughout the day and night. 5. If the noise sources from the assessed building are greater than the levels described in criterion 4, measures have been installed to attenuate the noise at its source to a level where it will comply with the criterion.	Acoustician		
						Principal Contractor		

Appendix 2: Energy Statement

Manchester City College Phase 2

Energy Statement

Doc No: CC-BDP-PH2-XX-RP-MEP-0008
Issue: PV Quantum revised to suit design development
Rev: P06
Date: 19th March 2024



Revision	Date	Description	By	Approved
P01	16 th Jan 2022	For Information – Stage 3 Lite	RAB	AR
P02	6 th Feb 2023	Increased PV provision	ABS	RAB
P03	11 th April 2023	Geometry updates and issue for tender – Stage 4a Lite	ABS	RAB
P04	26 th July 2023	Added demand control vent	STM	AR
P05	9 th Jan 2024	Updated BRUKL following latest BRUKL issue and updated PV	RB	AR
P06	19 th March 2024	PV Quantum revised to suit design development	RB	AR

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Executive summary

Using the NCM to demonstrate compliance with Building Regulation Part L, regulated carbon building emissions rate (BER) with the proposed energy strategy has been calculated to be 2.31 kgCO₂/m²/yr. This is a 1.7% reduction over the notional building target emissions rate (TER) of 2.35 kgCO₂/m²/yr.

To achieve this the following key measures are required:

- All electric building services
- Air source heat pumps to provide heating, cooling, and domestic hot water
- Building fabric improved significantly beyond the minimum required by the Building Regulations
- Air permeability improved significantly to reduce the loss caused by air infiltration
- An average lighting efficacy of 110 luminaire lumens per circuit watt
- Daylight linking to reduce lighting energy use and heat gains
- Other key features include:
 - Demand control ventilation
 - Power factor correction of >0.95
- Photovoltaic panels introduced after all the above are implemented

A CIBSE TM54 operational energy analysis has also been carried out to assess the route to net zero carbon. These results are available in a separate report.

Introduction

BDP has been commissioned to perform an energy strategy assessment of the proposed Phase 2 of the City Campus Manchester. The Project is in Central Manchester.

The purpose of this report is to present the energy modelling that has been carried out for Building Regulations compliance according to the National Calculation Methodology (NCM) for non-domestic buildings.

The energy models are not intended as calculations of actual energy use. The NCM is to determine whether the building meets a minimum compliance standard, in a repeatable manner using prescribed templates for operating conditions (e.g. occupancy levels, heating/cooling set points, air flow rates etc) and by comparison with a notional reference building of the same size and shape.

The NCM calculations only include regulated energy uses which are: heating, cooling, ventilation, domestic hot water, and lighting. The NCM calculations do not include unregulated energy uses such as: small power, servers, external lighting, catering, lifts, etc.

A separate energy modelling exercise has been carried out using the CIBSE TM54 methodology. TM54 is designed to give a more accurate prediction of operational energy usage including both regulated and unregulated energy use. The TM54 energy modelling is described in a separate report which also outlines the proposed route to net zero carbon including any necessary carbon offsetting.

Tools and Methods

A dynamic simulation model (DSM) approved by DLUHC for Part L2A calculations was used.

- Network airflow was not modelled.
- Some near field shading such local buildings have been modelled.
- HVAC was modelled with basic Apache systems.

The software used was IES Virtual Environment 2022. The analysis was supervised by a CIBSE accredited Low Carbon Energy Assessor (LCEA).

Design Inputs

Weather data

The Test Reference Years are synthetically generated from average months selected from a historical baseline of the past 20 years. This used in line with CIBSE Guide A and the NCM Modelling Guide 2022.

- Location: Manchester
- CIBSE Test Reference Year

Geometry

The geometry will be consistent across both the passive design, low carbon, and energy strategy simulations.

Layout and Orientation

- The geometry was based on the Revit model: CCPH2-BDP-ZZ-ZZ-M3-ME-0001 as well as internal discussions with engineers and architects.

Shading

- Shading elements have been modelled in a simple manner at this stage.
- Shading from the surrounding areas of Manchester City Centre have been modelled.

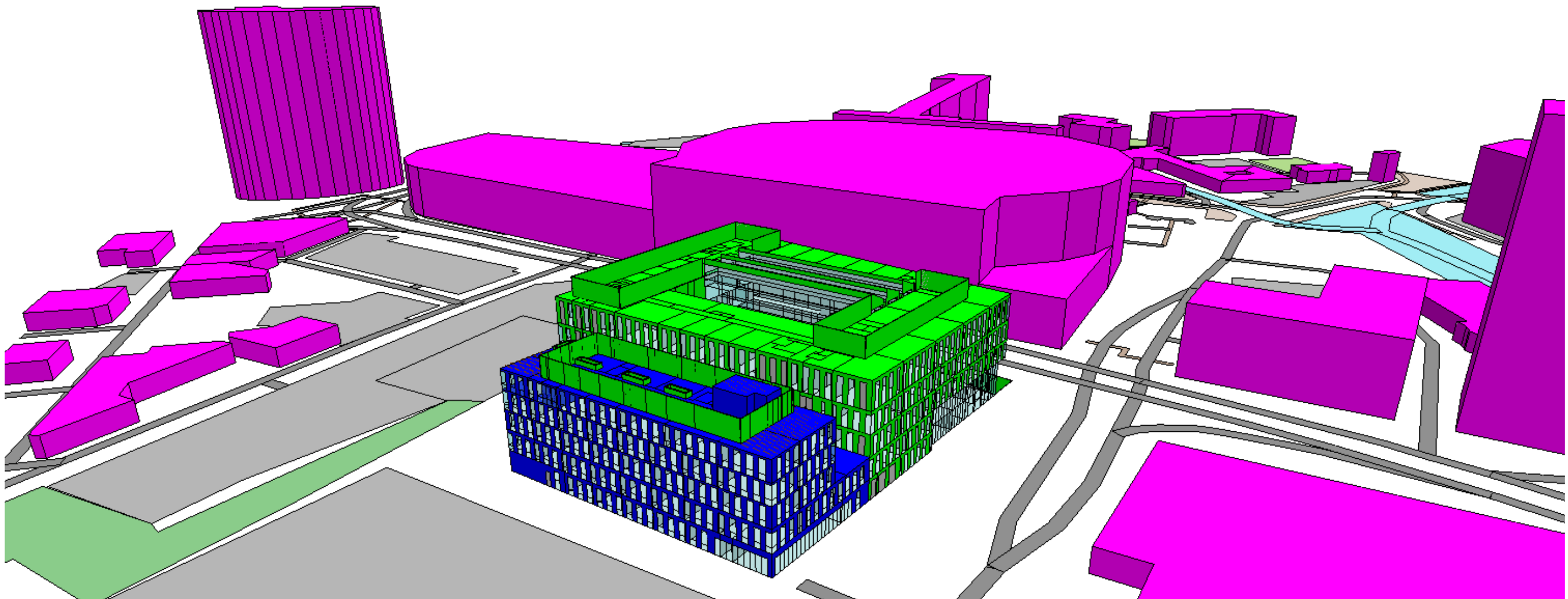


Figure 1 - Model view (Phase 2 in blue)

Activity Assignments

At this stage, a low-resolution modelling approach has been followed for the inner zones while the perimeter zones are modelled more accurately to reflect the façade. Construction parameters can be seen in the Appendix on p.11.

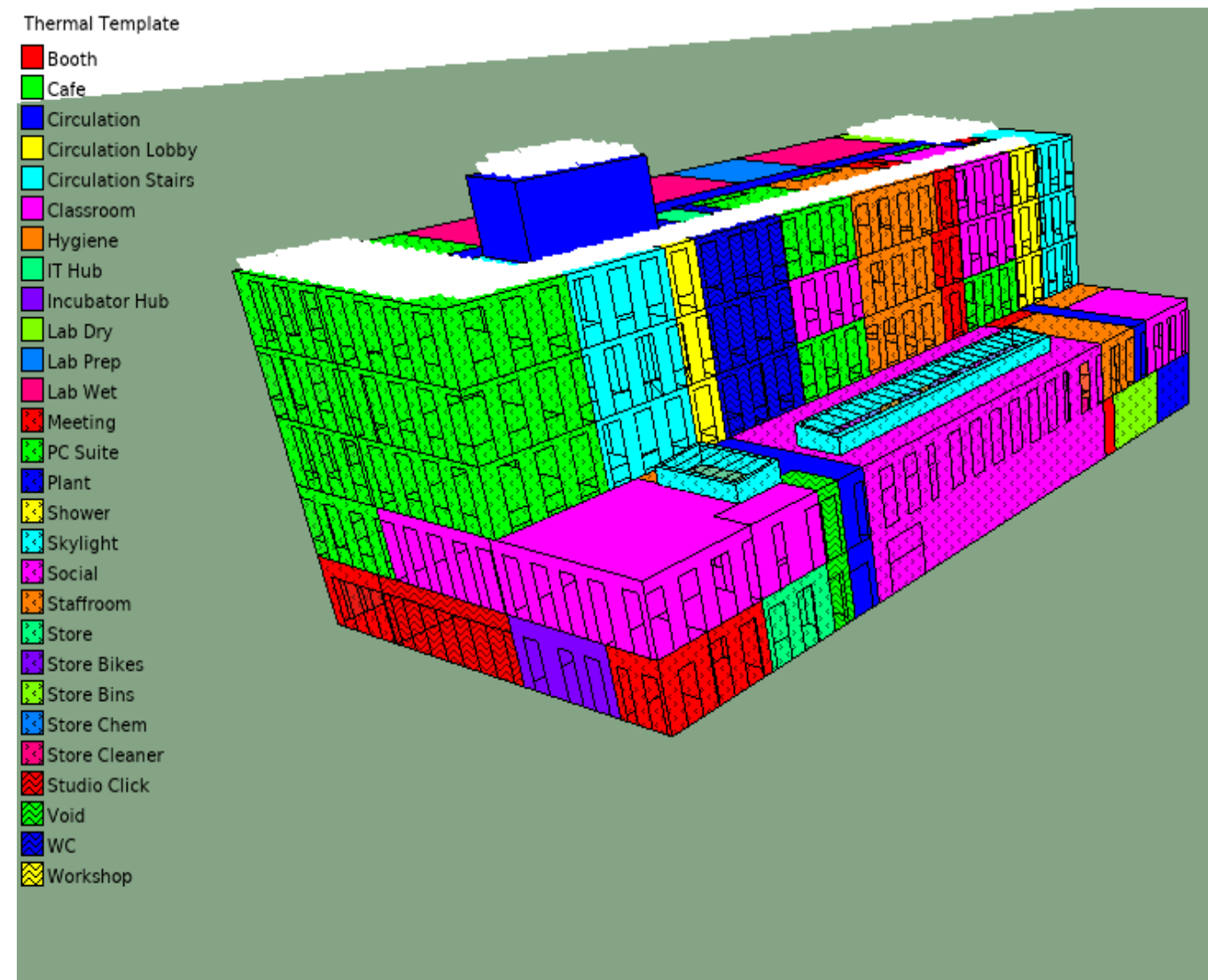


Figure 2 - Space activities as seen in model

HVAC Systems

Unlike Phase 1, Phase 2 of the building is proposed to be fully electric, in keeping with the Net Zero aspiration. Efficiencies can be seen in the Appendix on p.11.

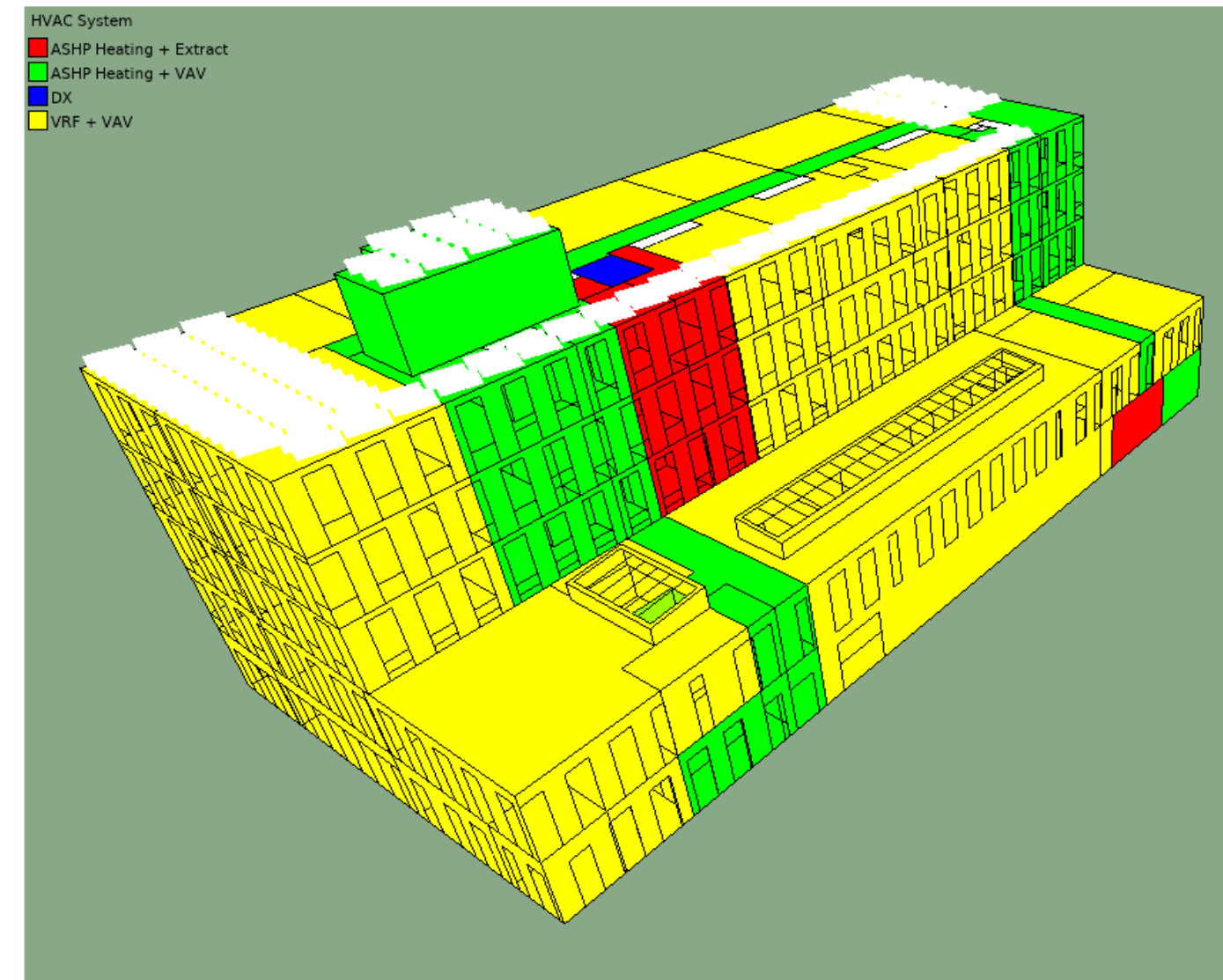


Figure 3 - HVAC systems as seen in model

Lighting and Other Settings

Lighting occupancy sensing & daylight linking is carried forward from the Phase 1 strategy.

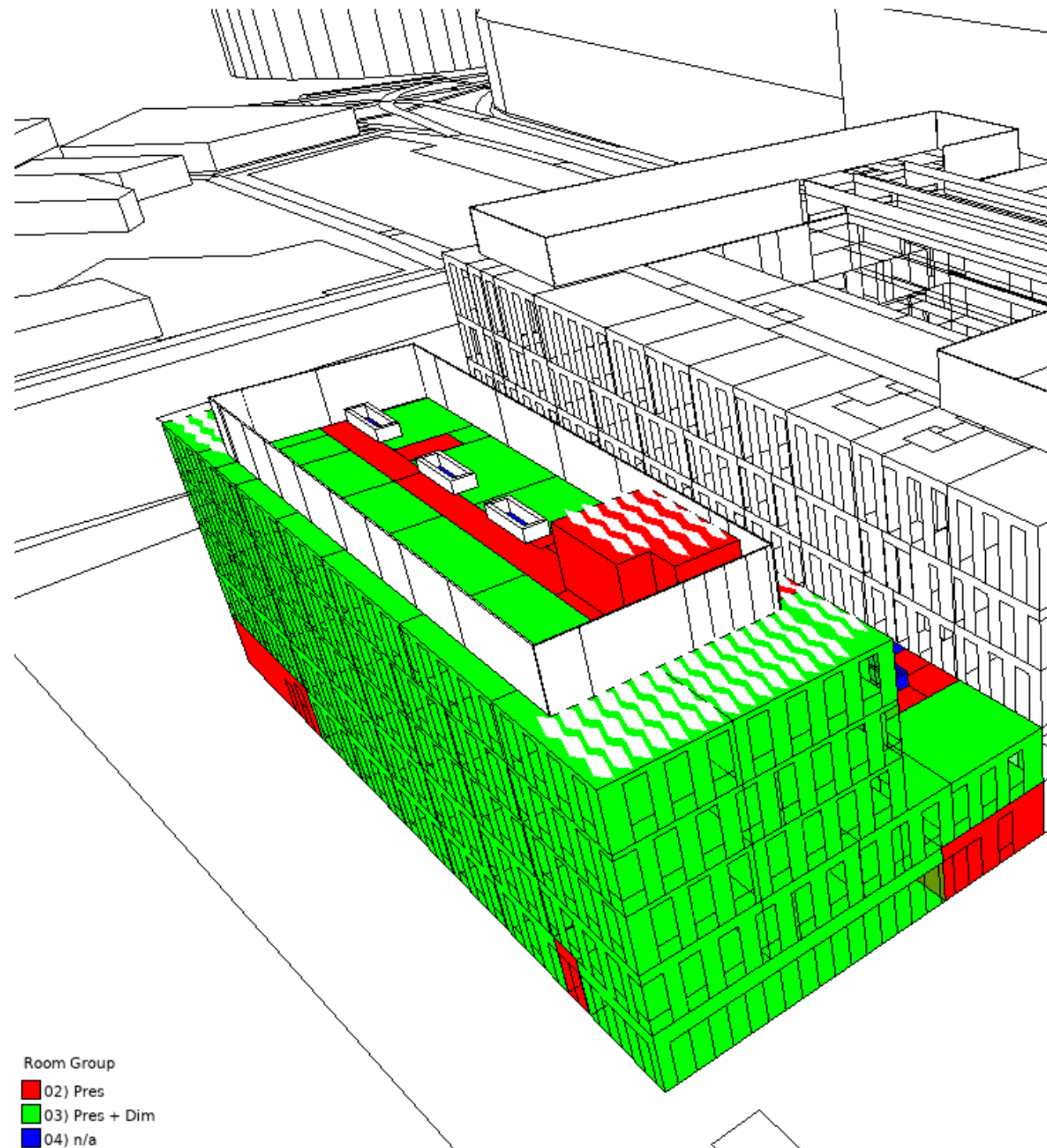


Figure 4 - Occupancy sensing areas

Renewables

Photovoltaic panels are required to achieve Net Zero. The intention is to reduce regulated energy use to as low as possible within reason, then to introduce PV to handle unregulated energy uses, i.e., small power, cooking, and miscellaneous plug loads.

Carbon Emission Factors

The carbon emissions improvement for this report was calculated based on carbon factors from the current building regulations Part L 2021, which came into force 15th June 2022, a month after P01 of this report. Table 1 shows a comparison between carbon factors between current and previous building regulations.

Part L 2021 carbon factors are a better reflection of modern technology compared to the previous version of the building regulations.

Carbon emitted by mains gas is unlikely to reduce significantly with the advent of cleaner energy production. In Part L2A 2013, 1kWh of gas emitted 0.216 kg of CO₂. That figure has more or less remained constant, at 0.210kgCO₂/kWh today.

Grid electricity however has seen a 69% reduction in carbon emissions. In Part L 2013, 1kWh of electricity emitted 0.519kg of CO₂. Today, in Part L 2021, this is now 0.163kgCO₂/kWh which is significantly better than gas. The BEIS estimates that grid electricity will produce as little as 0.041kgCO₂/kWh by 2035.

Electricity will only get cleaner over time, but gas, oil, and other fossil fuels will not. Therefore, an all-electric strategy is considered by the design team to be the ideal way to future-proof the proposed scheme and aid in achieving Net Zero.

Fuel	Emission Factor kgCO ₂ /kWh		% Difference
	Part L 2013	Part L 2021	
Mains Gas	0.216	0.210	-3%
Grid Electricity	0.519	0.163	-69%
Oil	0.319	0.298	-7%
LPG	0.241	0.241	0

Table 1 - Previous and current carbon factors comparison

Results

Building Regulations UK L (BRUKL)

BRUKL Output Document

 HM Government

Compliance with England Building Regulations Part L 2021

Project name	
Manchester City College Phase 2	As designed
Date: Thu Aug 17 13:41:22 2023	

Administrative information

Building Details

Address: Manchester,

Certifier details

Name:

Telephone number:

Address: , ,

Certification tool

Calculation engine: TAS

Calculation engine version: "v9.5.5"

Interface to calculation engine: TAS

Interface to calculation engine version: v9.5.5

BRUKL compliance module version: v6.1.e.0

Foundation area [m²]: 903.03

The CO₂ emission and primary energy rates of the building must not exceed the targets

Target CO ₂ emission rate (TER), kgCO ₂ /m²annum	2.35
Building CO ₂ emission rate (BER), kgCO ₂ /m²annum	2.31
Target primary energy rate (TPER), kWh _{pe} /m²annum	25.64
Building primary energy rate (BPER), kWh _{pe} /m²annum	24.07
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 -Limit	U _a -Calc	U _i -Calc	First surface with maximum value
Walls*	0.26	0.15	0.15	External Wall 485mm
Floors	0.18	0.18	0.18	Ground Floor
Pitched roofs	0.16	0.15	0.15	Roof 2.9m @ 4.05m
Flat roofs	0.18	-	-	No flat roofs in project
Windows** and roof windows	1.6	1.26	1.4	D10 UPPER PANE
Rooflights***	2.2	-	-	No rooflights in project
Personnel doors^	1.6	1.71	2.21	D10 LOUVRE DOOR
Vehicle access & similar large doors	1.3	-	-	No vehicle access or similar large doors in project
High usage entrance doors	3	-	-	No high usage entrance doors in project
<div>U_a-Limit = Limiting area-weighted average U-values [W/(m²K)]</div> <div>U_a-Calc = Calculated area-weighted average U-values [W/(m²K)]</div> <div>U_i-Calc = Calculated maximum individual element U-values [W/(m²K)]</div> <div>* Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.</div> <div>** Display windows and similar glazing are excluded from the U-value check. *** Values for rooflights refer to the horizontal position.</div> <div>^ For fire doors, limiting U-value is 1.8 W/m²K</div> <div>NB: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.</div>				
Air permeability	Limiting standard	This building		
m³/(h.m²) at 50 Pa	8	5		

Figure 5 - BRUKL

Discussion

Prior to the pause in design, a parametric analysis was performed to determine what improvements could be made and what resulting increases in energy efficiency there may be. A few observations follow:

- The Phase 1 energy strategy is already a marked improvement on carbon emissions compared to the notional building. Most of the improvements are therefore incremental.
- The biggest single reduction on carbon emissions can be achieved by simply switching from gas to electricity. Under Part L 2021 carbon factors, this represents an approximately 79.6% reduction in carbon emissions compared to a gas heated building using Phase 1 systems.
 - In reality, the client may opt for an all-renewable energy tariff as well to further reduce carbon emissions.
 - Heating and cooling systems are already highly efficient (see p.11). Although the roof and floor do affect heating and cooling demand, energy demand is already so low that the overall result appears unaffected.
- The second most significant reduction in carbon emissions, apart from photovoltaics, is achieved by increasing lighting efficacy to 110lm/cW. Lighting is therefore one of the most important variables since it is more feasible to improve on than others.
 - This is achievable by a full LED lighting design. Currently, it is assumed that all lighting is 110lm/cW, however as the design develops the efficacy figure should be treated as an average, with some lighting better and some lighting lower.
 - NB: illuminance is based on NCM default figures. These are broadly in line with CIBSE minimum to mid-range figures, e.g., offices are set to 400lux whereas CIBSE recommends 300-500lux. Care must be taken not to over-light spaces by designing to a higher illuminance than necessary. This would increase energy consumption and carbon emissions.
 - The Part L 2021 minimum lighting efficacy is 95lm/cW, as opposed to 60lm/cW in previous versions of Part L. This means lighting improvements over the notional building are slightly lower.
- Reducing air permeability and reducing parasitic power provide about the same benefit. Ideally, the design team would opt for both, however it is potentially more feasible to achieve lower parasitic power than it is to achieve a lower air permeability (especially considering the proposed building will be attached to an existing building). Parasitic power can be reduced by careful placement of PIRs and daylight sensors.
- Having the VAV ventilation be controlled on a room-by-room basis allows for the system to be set back when some spaces are unoccupied. This is known as demand-controlled ventilation and can lead to a 20% reduction in predicted carbon emissions associated with regulated energy usage.

There are some energy reduction measures that may be incorporated into the design but have not at this stage. A few comments follow:

- It is possible to further reduce building energy demand by targeting glazing. However, the glazing U-value is already quite low at less than 1.3 on average, so it would be a difficult task to source more efficient windows. Moreover, there could be a mismatch in façades if this option were undertaken. There is some discussion regarding the feasibility of introducing triple glazing into the building; BDP would welcome the resulting increase in energy efficiency, however this has not been incorporated at this time since discussions are ongoing.
- Due to the building form, improvements to the external wall U-value leads to a 3.48% reduction in carbon emissions, however reducing the roof and floor U-values had no significant impact. This is due to the external walls' larger surface area compared to the roof and floor. This option has been discarded due to issues posed by thicker walls.
- Likewise, it may not be feasible to reduce glazing g-value to lower than the ≈ 0.3 from Phase 1.
- Blinds would also reduce solar gains, and the benefits can be modelled, however it cannot be certain that occupants would use blinds appropriately in reality.

Conclusion

Using the NCM, regulated carbon building emissions rate (BER) with the proposed energy strategy has been calculated to be 2.31 kgCO₂/m²/yr. This is a 1.7% reduction over the notional building target emissions rate (TER) of 2.35 kgCO₂/m²/yr.

To achieve this the following key measures are required:

- All electric building services
- Air source heat pumps to provide heating, cooling, and domestic hot water
- Building fabric improved significantly beyond the minimum required by the Building Regulations
- Air permeability improved significantly to reduce the loss caused by air infiltration
- An average lighting efficacy of 110 luminaire lumens per circuit watt
- Daylight linking to reduce lighting energy use and heat gains
- Other key features include:
 - Demand control ventilation
 - Power factor correction of >0.95
- Photovoltaic panels introduced after all the above are implemented

A CIBSE TM54 operational energy analysis has also been carried out to assess the route to net zero carbon. These results are available in a separate report.

Appendix – Detailed Results Table

Table 2 - Results in detail

Building Data	
Location	Manchester
Orientation (° from North)	75
Part L Weather File (TRY)	Manchester
Building HVAC control	Air temperature
Building Type	Mix of Residential Institutions, Non-Residential Institutions, and 24-Hour Activities
Air Permeability (m³/h/m² @ 50Pa)	5
Portable / Modular?	No
Power Factor	n/a
Provision for metering / out of range values?	No

Constructions	U-Value (W/m²K)
Door	1.71
External Wall	0.15
External Window	1.26
Ground/Exposed Floor	0.18
Roof	0.15

Heating & Cooling System	
Heating Only Zones	Electric panel heaters and mechanical vent with heat recovery
Pump Type	Variable speed with differential sensor across pump
VRF Split System Zones	VRF and mechanical vent with heat recovery
System Fuels	All electric
Heating Seasonal Efficiency	VRF=3.5 DX=4.4 Electric heaters=1.0
Cooling Seasonal Efficiency	VRF=3.5 nominal, 5.9 seasonal DX=3.95 nominal, 6.5 seasonal

Ventilation	
Supply & Extract SFP (W//s) (LEV for toilets, showers, cleaners etc.)	<ul style="list-style-type: none">Supply & Extract w/ Heat Recovery = 1.8Extract = 0.05
Heat Recovery Efficiency	75%
Supply & Extract Demand Control?	Speed Control
Zonal Extract Demand Control?	n/a

DHW	
DHW System	Heat Pump
Heating Efficiency	300%
Delivery efficiency	Per contractor calculations
Circulation losses (W/m)	n/a
Pump Power (kW)	n/a

Lighting & Controls	
Lighting Power Density W/m²/100lux	n/a lighting efficacy used
Illuminance (lux)	Per NCM
Lighting Efficacy lm/cW	110
Light Output Ratio	1
Display Lighting Efficacy (lm/W)	n/a
Display Light Time Switching	n/a
Occupancy Sensing	
Dimming	<ul style="list-style-type: none">• Cafe Seating• Classroom• Social• Staffroom• Study
Different Sensor in Back Half?	Yes
Dimming Time Switch?	Yes
Presence Detection	<ul style="list-style-type: none">• Booth• Café• Circulation• Classroom• Hygiene• IT Hub• Meeting• Plant• Shower• Social• Staffroom• Store• Study• WC
Absence Detection	n/a
Parasitic Power (W/m²)	Per contractor calculations
Occupancy Sensing Time Switch?	Yes

Renewable Energy Systems	
Photovoltaic Array	Yes
Area (m²)	275
Azimuth (°Clockwise from North)	155
Incline (° from horizontal)	22°
PV module Nominal Efficiency	Per contractor’s data, based on minimum required to achieve Part L compliance
Conversion Efficiency	Per contractor’s data, based on minimum required to achieve Part L compliance
NOCT Irradiance (W/m²)	Per contractor’s data, based on minimum required to achieve Part L compliance
NOCT Cell Temperature (°C)	Per contractor’s data, based on minimum required to achieve Part L compliance

Appendix 3: Net Zero Carbon Technical Note

TO The Manchester College Phase 2 Project Team DATE 10th January 2024

FROM Kat Radford (BDP) CC Steve Merridew (BDP)

FILE REF P3000166

SUBJECT **THE MANCHESTER COLLEGE PHASE 2: APPROACH TO NET ZERO CARBON AND SUSTAINABILITY**

1. Introduction

This note has been produced to communicate The Manchester College's commitment to the net zero carbon (NZC) agenda, and the approach to the sustainable design of the City Centre Campus Phase 2 development. In line with Manchester Council's 2038 net zero operational carbon target and wider sustainability agenda, the project will seek to demonstrate leadership through the adoption of a NZC framework.

2. Net Zero Carbon Frameworks

At the time of writing, the three leading and widely accepted NZC frameworks are:

- UKGBC Net Zero Carbon guidance
- London Energy Transformation Initiative (LETI)
- RIBA 2030 Climate Challenge v2

Although largely aligned, each framework varies slightly, e.g. LETI does not allow for offsetting or "interim steps", and the UKGBC guidance currently only provides benchmarks for offices, whereas LETI and RIBA provide benchmarks for offices, schools and residential developments.

A summary of the net zero operational carbon targets and benchmarks for offices and schools are provided in Tables 1 and 2. Residential benchmarks have been purposely excluded from this report as they are not relevant.

Table 1: Operational energy benchmarks (offices)

NEW BUILD OFFICES		Baseline scenario	2025 target	2030 target	Offsetting allowed?
Operational energy / energy use intensity (kWh/m ² (GIA)/year)	UKGBC	≤130 (DEC D90)	≤90 (DEC C65)	≤70 (DEC B50) (<55 by 2050, DEC B40)	Yes
	LETI*	≤90 (DEC B)	n/a	≤55 (DEC A)	No
	RIBA 2030	<130 (DEC D90)	<75 (DEC B50)	<55 (DEC B40)	Yes

*In addition to the EUI benchmark, LETI also requires that space heating demand is reduced to at least 15kWh/m²/year.

MEMORANDUM CONT.

Table 2: Operational energy benchmarks (schools)

NEW BUILD SCHOOLS		Baseline scenario	2025 target	2030 target	Offsetting allowed?
Operational energy / energy use intensity (kWh/m ² (GIA)/year)	LETI*	≤90	n/a	≤65	No
	RIBA 2030	<130	<70	<60	Yes

*In addition to the EUI benchmark, LETI also requires that space heating demand is reduced to at least 15kWh/m²/year.

Unlike the UKGBC and LETI guidance, RIBA 2030 also considers wider sustainability and wellbeing issues, e.g. biodiversity, water consumption, daylight and overheating. As such, and to align with the project's wider sustainability ambitions, the RIBA 2030 Climate Challenge benchmarks have been adopted.

3. RIBA 2030 Climate Challenge

The RIBA has developed voluntary performance targets for operational energy use, water use and embodied carbon. These performance targets form the basis of the 2030 Climate Challenge which the RIBA has developed in consultation with other professional UK construction bodies. The performance targets align with the future legislative horizon and set out a challenging but achievable trajectory to realise the significant reductions necessary by 2030 in order to have a realistic prospect of achieving net zero carbon for the whole UK building stock by 2050. The purpose of the RIBA 2030 Climate Challenge is to encourage organisations to take action now and to collaboratively shift in the profession towards outcome orientated design approaches.

The RIBA joined the global 'declare' movement in June 2019 and, to ensure that the strong words of the declaration of a climate emergency are matched by actions, they set RIBA Chartered Practices a challenge of achieving the following reductions as soon as possible but as a minimum for projects in operation in 2030:

1. Reduce operational energy demand by at least 60% from current business as usual baseline figures, before offsetting.
2. Reduce embodied carbon by at least 40% from current business as usual baseline figures, before offsetting.
3. Reduce potable water use by at least 40% from CIRIA benchmark/ Building Regulation figures.
4. Achieve all core health and wellbeing metrics, as detailed in Table 3.

Table 3: RIBA 2030 Climate Challenge best practice health metrics

Best Practice Health Metrics	Requirement	References
Overheating	25 - 28°C maximum for 1% of occupied hours	CIBSE TM52, CIBSE TM59
Daylighting	<2% average daylight factor, 0.4 uniformity	CIBSE LG10
CO2 levels	<900ppm	CIBSE TM40
Total VOCs	<0.3mg/m ³	Approved Document F
Formaldehyde	<0.1mg/m ³	BREEAM

MEMORANDUM CONT.

The guidance then also goes on to stipulate the following additional requirements:

- Use of on-site renewables must be maximised.
- No new connections to the gas grid.
- Use low carbon heating, for example heat pumps or connections to non-fossil fuel district heat networks.
- Design using realistic predictions of the operational energy targets to avoid the performance gap and report the energy use by fuel type. The RIBA recommends the use of rigorous design for performance methods such as CIBSE TM54.
- Disclosure of the full breakdown of regulated and unregulated energy use.
- Use of offsetting as a last resort, and use of a recognised offsetting framework, in line with UKBC guidance.
- Significant enhancement of the project site's biodiversity net gain and green cover compared to pre-development levels.
- Plan for ongoing maintenance and management of green/blue infrastructure on site, to ensure biodiversity net gain is remains a continued legacy.
- Undertake at least a light touch post occupancy evaluation.

The voluntary operational energy and water use and embodied carbon performance targets that are set out in the 2030 Climate Challenge have been developed by the RIBA through consultation with experts across the industry. The targets take into account the latest recommendations from the Green Construction Board and are aligned with other built environment professional bodies. The Climate Challenge presents ambitious but achievable forward-facing performance outcomes, set against business-as-usual compliance approaches. As the targets are for performance outcomes of buildings in operation, the RIBA advocates that buildings in design today should, as a minimum, adopt the 2025 targets. As these targets are based on domestic and commercial buildings, the RIBA recognises that there may need to be further refinement by sector and building type in the future.

The 2030 Climate Challenge is currently only open to all RIBA Chartered Practices, however it is the intention of the College to adhere to the requirements to demonstrate their commitment to sustainable development and in supporting Manchester Council's NZC agenda.

4. Project Approach to Net Zero Operational Carbon

As previously discussed, benchmarks are currently only available for new build office, school and residential developments. The energy demands, occupancies and general activities required of the College are substantially different to those of a typical office or school environment, and, therefore, it is highly unlikely that an EUI value of <55 kWh/m²/year is realistically achievable. As such, it is proposed that typical energy benchmarks of offices are compared to those of further / higher education establishments, and the difference apportioned to the RIBA EUI target.

CIBSE TM46 offers a comprehensive outline of building energy benchmarks for different building types. Of the available building types, "university campus buildings" are the most closely aligned to Phase 2. The typical energy benchmarks for the two building types are:

- General office: 215 kWh/m²/year
- University campus: 320 kWh/m²/year

It should be noted that benchmarks for offices have been selected, as opposed to those for schools, as these are more stringent and therefore align with the College's high sustainability aspirations.

Based on the CIBSE TM46 data above, a university campus building typically uses 1.49 times more energy than an office. The proposed net zero operational energy EUI benchmarks, based on this and the RIBA benchmarks, are summarised in Table 4.

Table 4: Proposed energy use intensity benchmarks

Target	RIBA 2030 Climate Challenge	Proposed EUI
RIBA 2025 interim	<75 kWh/m ² /yr	<111.75 kWh/m ² /yr
RIBA 2030 stretch	<55 kWh/m ² /yr	<81.95 kWh/m ² /yr

Early-stage energy modelling of the current design confirms that an EUI of circa 80 kWh/m²/yr is achieved, thereby performing better than the proposed 2025 interim target and slightly better than the RIBA 2030 stretch target.

MEMORANDUM CONT.

With regards to the remaining requirements of the Climate Challenge, as set out in Table 3 of this document, the BDP design team have confirmed that the minimum requirements for daylighting (<2% average daylight factor, 0.4 uniformity) cannot be achieved for all spaces. It should be noted that, as per the comments provided within the Climate Challenge documentation, targets are based on domestic and commercial buildings, and the RIBA recognises that there may need to be further refinement by sector and building type in the future. In addition, the targets themselves may need further revision in the coming years as more detailed data and further work in sectoral contributions to carbon emissions in line with science-based targets is undertaken by the industry. The RIBA therefore acknowledges the imperfect nature of the targets but give the urgency for action on carbon emissions, there is no time to wait for the perfect set of figures to be developed.

The College will remain committed to achieving the key environmental sustainability outcomes of the Challenge relevant to operational energy. Although the targets for daylight factor cannot be met, they will endeavour to ensure the design promotes natural light ingress as far as practicable within the design, as well as meet the remaining sustainability criteria listed within Table 3.

5. NZC vs BREEAM accreditation

In light of the Climate Emergency and Manchester City Council's net zero carbon agenda, the approach for the Manchester College Phase 2 development is to focus on exceeding Planning requirements relevant to carbon and energy and maximising the NZC investment, whilst also considering the wider sustainability features required by RIBA 2030 and MCC Planning requirements, e.g. biodiversity net gain, health and wellbeing, waste and surface water runoff. This approach may subsequently allow the project to become an exemplar in terms of carbon reductions, whilst still addressing wider sustainability issues around the topics covered by BREEAM.

Furthermore, the College propose shifting the focus away from BREEAM as to allow the project team to assign a greater level of resource to the additional works required to achieve net zero carbon, rather than additional BREEAM workshops and 'add-ons' which may be of little value but provided solely to secure BREEAM credits.

6. Conclusion

To demonstrate their commitment to net zero carbon and to Manchester Council's 2038 NZC targets, the project team have proposed applying RIBA 2030 Climate Challenge sustainability benchmarks relevant to operational carbon to the City Centre Phase 2 development. The UKGBC and LETI frameworks have been considered, however RIBA 2030 has been adopted as, not only are the targets largely in line with the two other schemes, but RIBA 2030 proposes additional and non-energy related benchmarks for issues such as water consumption, daylight, biodiversity, and health and wellbeing, therefore adopting a broader and more holistic approach to sustainable development. Although early stage calculations indicate the daylight factor thresholds are not met for all spaces, the College will endeavour to ensure natural light ingress is promoted (whilst ensuring there are no negative implications on energy performance). The College will further commit to ensuring the remaining targets are achieved, as far as possible. As previously noted, the RIBA have stipulated that the targets have been developed based on commercial and domestic developments and are likely to require revision as they are implemented in different sectors.

Bespoke energy use intensity targets have been derived using CIBSE TM46 energy benchmarks. Calculations undertaken by BDP, prior to the introduction of the new building regulations, demonstrate that the current design will achieve the proposed 2025 interim EUI of <111.75 kWh/m²/yr and the proposed stretch target of 81.95 kWh/m²/yr, as the EUI is currently 80 kWh/m²/yr..

It is currently proposed that, in lieu of formal BREEAM certification, investment in the NZC carbon approach will be maximised to allow the College to deliver an exemplar net zero operational carbon building. Application of the RIBA 2030 Climate Challenge framework will also ensure wider sustainable features are promoted, alongside addressing the wider MCC environmental targets, e.g. those relevant to surface water runoff and waste, will ensure the approach to sustainable design remains holistic.

Appendix 4: CIBSE TM54 Report – Prediction of Operational Energy Consumption

The Manchester College City Centre Campus Phase 2

CIBSE TM54 – Prediction of Operational Energy Consumption

Doc No: CC-BDP-PH2-XX-RP-MEP-0001

Issue: Stage 4

Rev: P03

Date: 27/07/2023

BDP.

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Revision	Date	Description	By	Approved
P01	19 th April 2023	For Information – Stage 4	RAB	AR
P02	10 th July 2023	Stage 4 – typo in Table 2 amended	RAB	AR
P03	27 th July 2023	TM54 updated to reflect VE & design progress; references to BREEAM removed as no longer needed	RAB	AR

1.0 Project Summary

This report summarises the calculation undertaken using the CIBSE TM54 operational energy calculation methodology for Phase 2 of The Manchester College City Centre Campus.

The TM54 model and results are intended to be developed as the project progresses, therefore results presented in this report represent a snapshot in time and will be further refined during the next design stages.

The level of model confidence for each section is described within the Implementation Matrix in Section 0 on p.60.

The structure of this report follows the steps outlined within CIBSE TM54 (2022) – *Evaluating Operational Energy Performance of Buildings at The Design Stage*.

Section 7.17 of CIBSE TM54 states that estimates of energy use can be made at key points in the design and construction process. The Energy Use Intensity (EUI) may be reduced from the wide range at earlier stages to narrow down the actual building energy use as the design progresses, plant and equipment sizes selected, and calculations are refined. In line with CIBSE TM54, the energy model has been revisited following agreement on equipment utilisation. Figure 1 gives an example of how the CIBSE TM54 process works across the RIBA stages through to building operation.

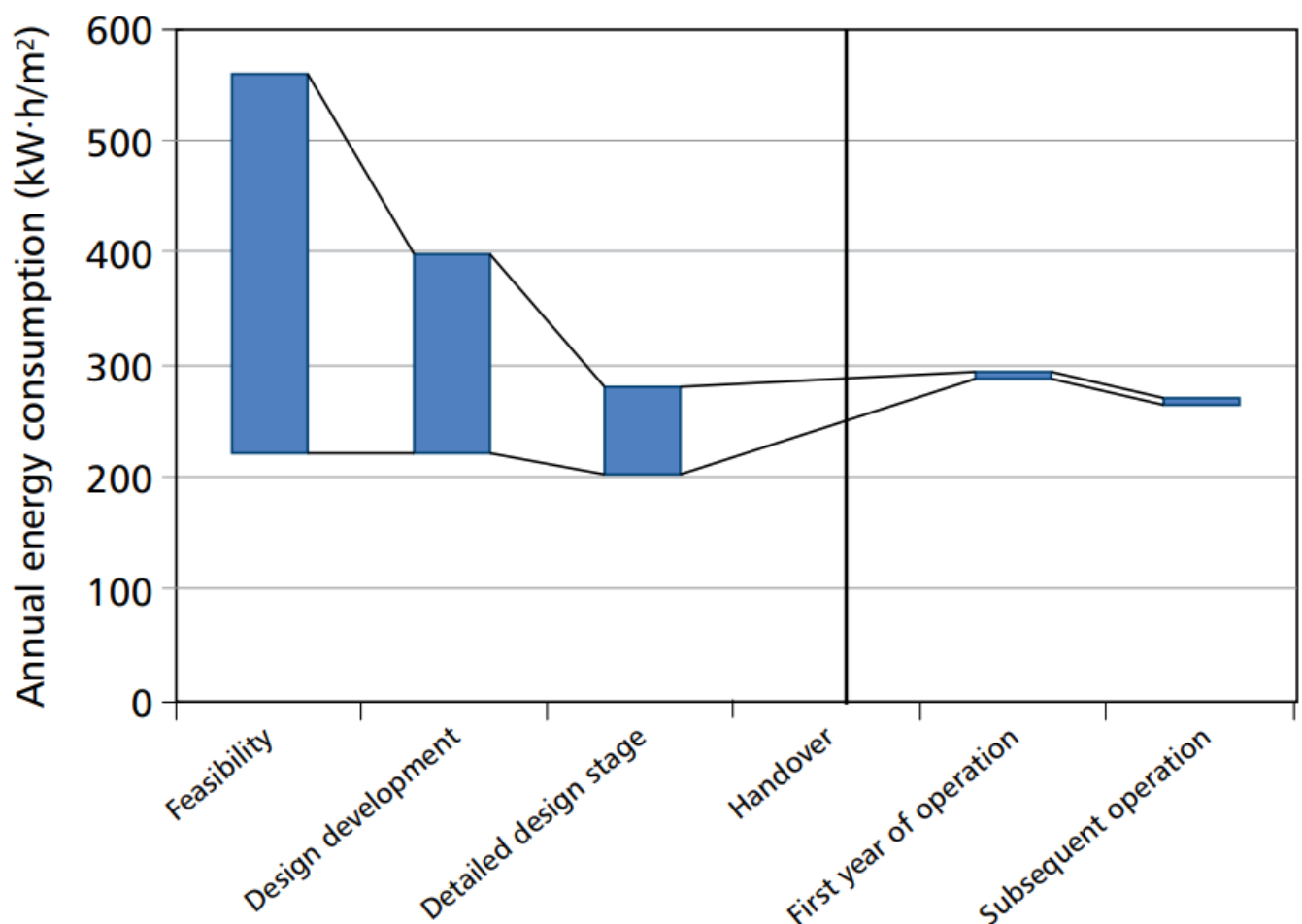


Figure 1 - Sample extract from CIBSE TM54 illustrating the intention of revisiting operational energy models to refine calculations

1.1 CIBSE TM54

Most of the report follows the prescribed steps seen in CIBSE TM54 (2022).

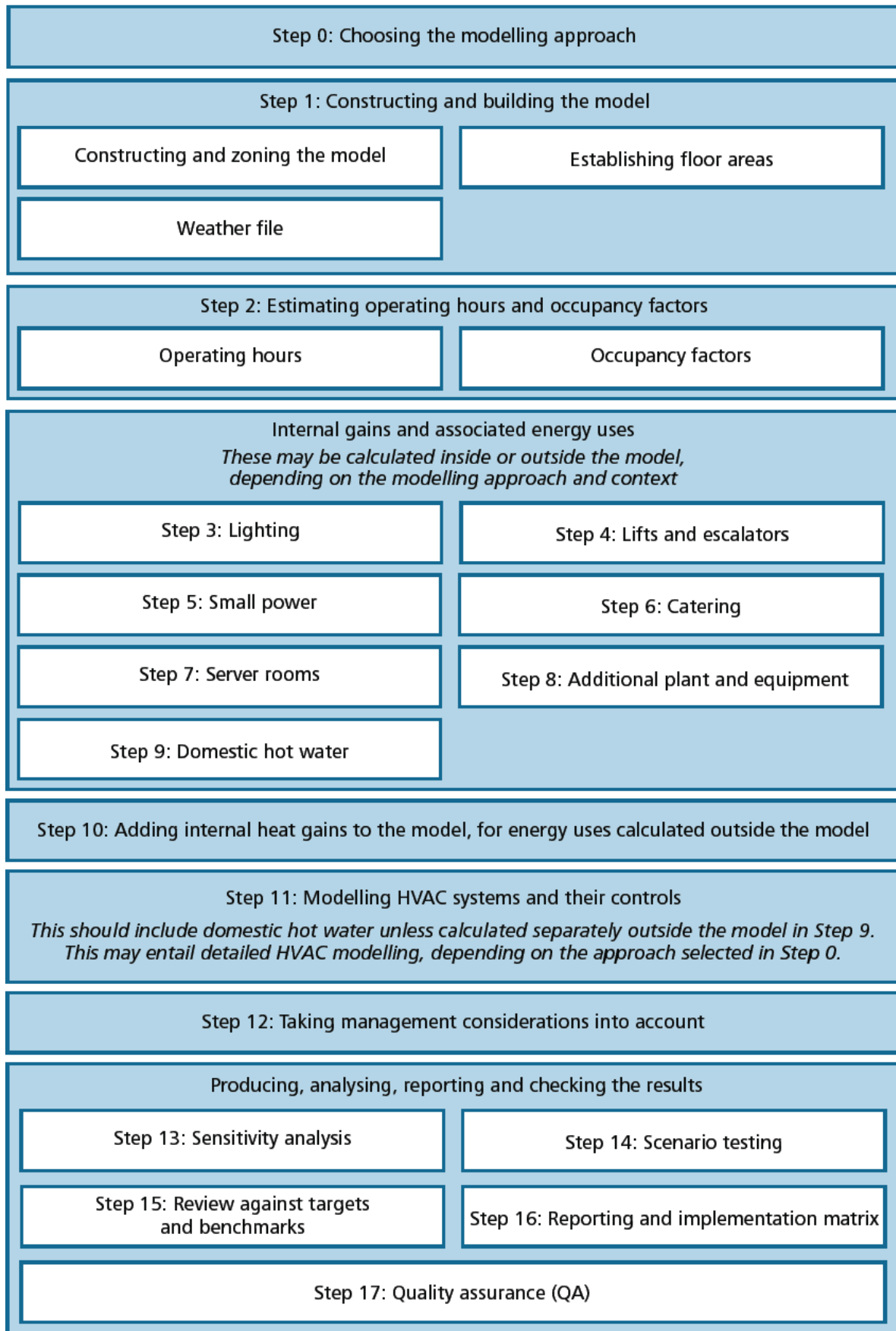


Figure 2 - TM54 procedure steps

1.2 Choice of modelling tool and approach (Step 0)

A Dynamic thermal model, using IES Virtual Environment 2022.2.0, has been developed for the TM54 assessment. This has been deemed to be the appropriate modelling tool at this stage and HVAC systems have been modelled using a simplified approach (ApacheSim). This approach considers an idealised plant model and therefore presents some limitations compared to the more detailed ApacheHVAC method where system components are modelled explicitly.

1.3 Floor areas (Step 1)

At 6364.6m², the total floor area represented within the thermal model presents a slight variance compared to the architectural area schedule. This discrepancy is due to modelling simplifications and Revit model used as reference for the TM54 modelling. This variance has been deemed to be minimal compared to the scale of the building and therefore considered acceptable.

The treated Floor area (TFA), which consists of the GIA minus plants and other spaces not directly heated (e.g., stores, risers) has been considered as metric to establish the Energy Use Intensity (EUI) of 80kW/m²/year.

1.4 Weather file (Step 1)

The weather file used for the assessment is CIBSE Manchester TRY 2020, High Emissions Scenario, 50th Percentile. This is the closest CIBSE weather file to the area.

Sensitivity analysis has been run on the weather variable to test the impact of a warmer summer on energy consumption. A more onerous weather file, the Manchester DSY, has been used for this purpose.

1.5 QA statement (Step 17)

QA was carried out by associate Andrew Rennox before issue to project team. This QA included consistency with the project information (design proposals, control strategy, project brief etc), and the modelling report. QA procedures were in line with CIBSE AM11:2015 – *Building Performance Modelling*, Chapter 2 – *Quality Assurance*.

Per P01 of this report, the QA review concluded that the model and report were satisfactory for Stage 4 but would need to address the recommendations listed in this report at the next stage, particularly the inclusion of information from the client to tie into M&E small power allowances.

Some further information has now arrived in the form of utilisation figures, assumed to be 48% of maximum usage. The report therefore now requires a P03.

2.0 3D Model (Step1)

2.1 Model geometry

The model geometry has been constructed from the architects' Revit model.

The building orientation and project north has been based on architects' layouts and adjacent buildings have been included based on Google maps and 3D model information.

External shading elements, like balconies, fins, overhangs, and planters have been included in the simulation, to provide a more realistic representation of the building as designed.

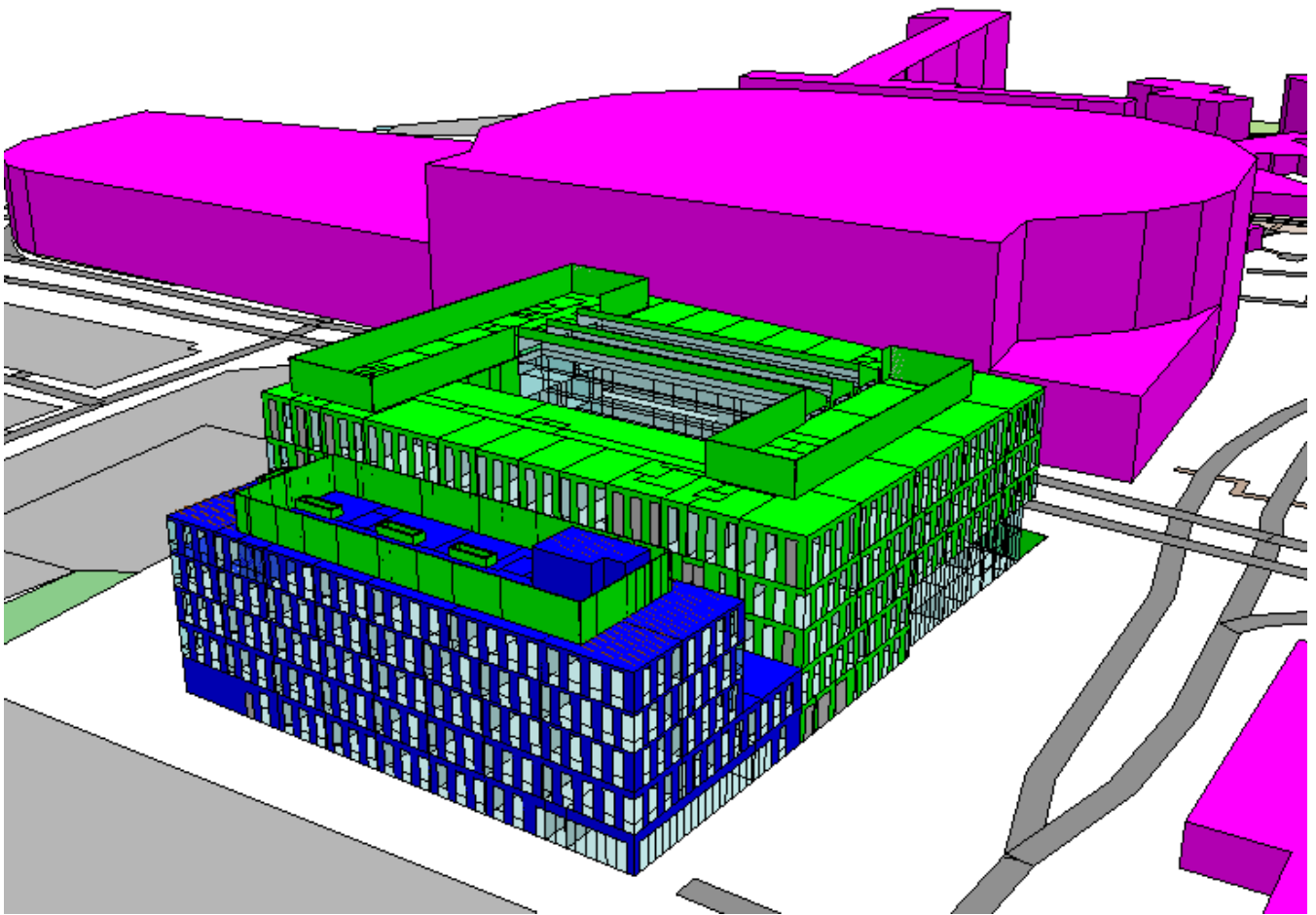


Figure 3 - Proposed building as seen in energy modelling software

2.2 Envelope and constructions

Fabric parameters

Table 1 - Fabric parameters

Fabric Element	U-value (W/m ² K)
Ground Floor	0.15
Roof	0.15
External walls	0.15
External Glazing	1.32
Rooflight	1.75
g-value	0.4 glazing, 0.55 rooflight
Air Permeability	3m ³ /h/m ² @ 50Pa

Internal Blinds

Blinds have not been included in the simulation since occupants cannot be relied upon to operate them as intended.

Internal zone layouts

The building has been divided into thermally similar zones based on similar usage, environmental conditions, and servicing strategy. The complete list of the thermal zones considered within the building is reported in Table 2.

It must be noted that this list represents a simplification of the real zoning and servicing strategy proposed for the actual building, for modelling purposes.

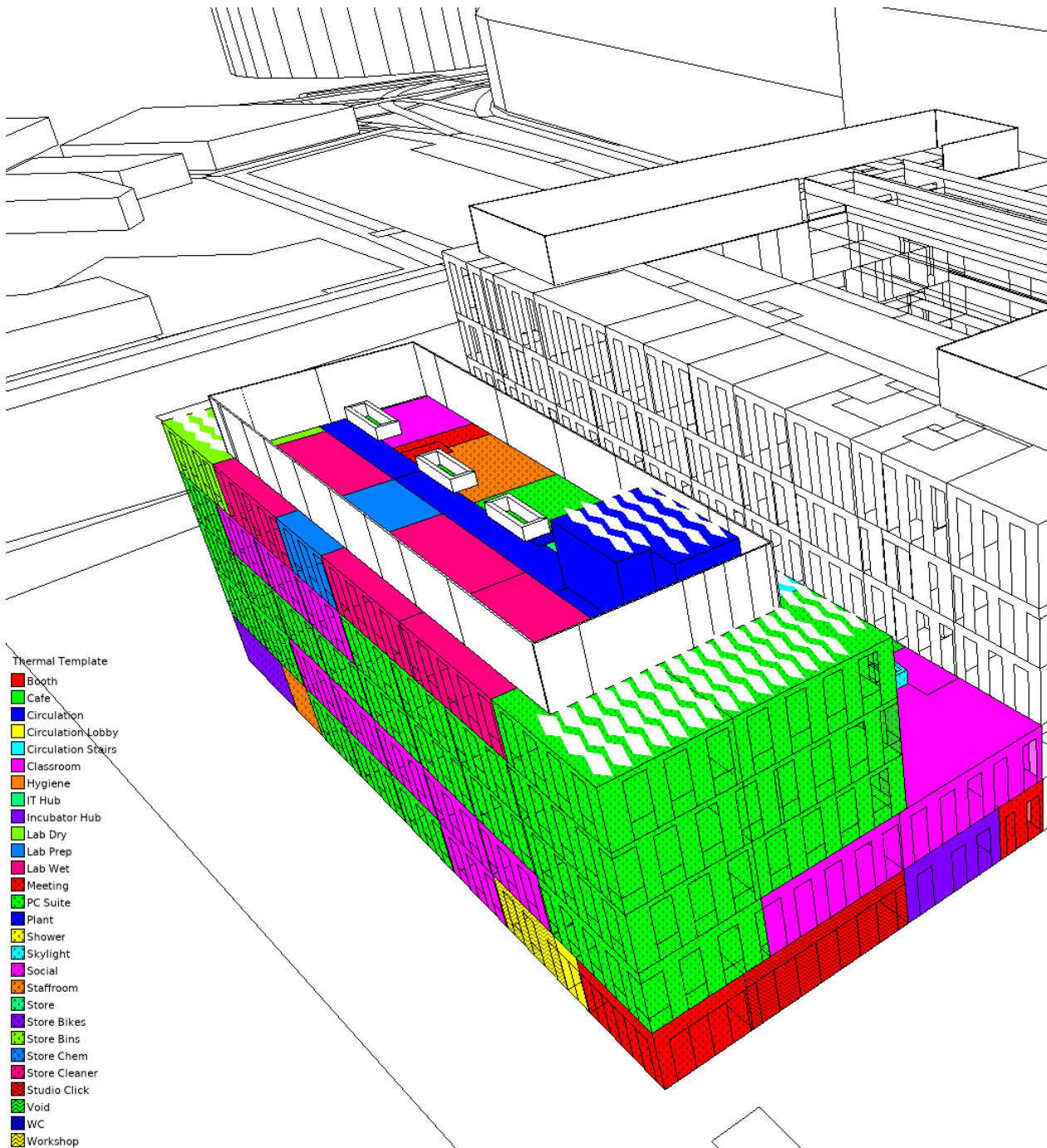


Figure 4 - Zone activities as seen in model

Table 2 - Zone areas by activity

Room Type	Area (m ²)
Booth	15.1
Cafe	25.8
Circulation	688.4
Circulation Lobby	232.9
Circulation Stairs	418.3
Classroom	1074.0
Hygiene	13.2
Incubator Hub	130.3
IT Hub	43.5
Lab Dry	40.0
Lab Prep	54.3
Lab Wet	134.0
Meeting	248.9
PC Suite	1646.0
Plant	75.3
Shower	3.4
Social	343.7
Staffroom	400.2
Store	45.0
Store Bikes	106.0
Store Bins	90.6
Store Chem	15.7
Store Cleaner	16.0
Studio Click	84.5
Void	212.1
WC	209.8
Workshop	55.2

3.0 Internal gains and associated energy use (Step 1)

3.1 Internal gains and associated energy use

The different energy uses of the building have been estimated using the calculation methodology described within TM54.

End uses presented in this section have been calculated outside the Dynamic Thermal Model, using calculation spreadsheets, then entered into the model.

Energy used for Heating, Cooling and Ventilation, reported in section 4 and 5, has instead been estimated using the Dynamic Thermal Model (IES VE), as recommended by TM54, to take into account the transient effect of the variables involved.

3.2 Occupancy factors and operating hours (Step 2)

Occupied hours of the building and intended hours of operation of plant and equipment have been estimated based on design team calculations and information provided by the client.

Main operating hours are based on the M&E heating & cooling calculations.

The energy workshop confirmed the client's expected occupancy variation; a sample for classrooms is seen in Figure 5.

The client provided maximum occupancy and expected continuous occupancy for the building. Weekly and annual occupancy profiles have been applied based on activity, to account for occupant movement around the building and occupancy variation. Additionally, the VE schedule from 19th of July 2023 suggests room utilisation at 48% which has been applied to the occupancy.

The client expects core hours to be 9am-5pm, with occupancy trailing off in the afternoon and evening. Cleaning is set to take place in the morning, when the building is operation, but prior to the building core hours.

The client expects occupancy to decrease to about 10% of typical during the summer months.

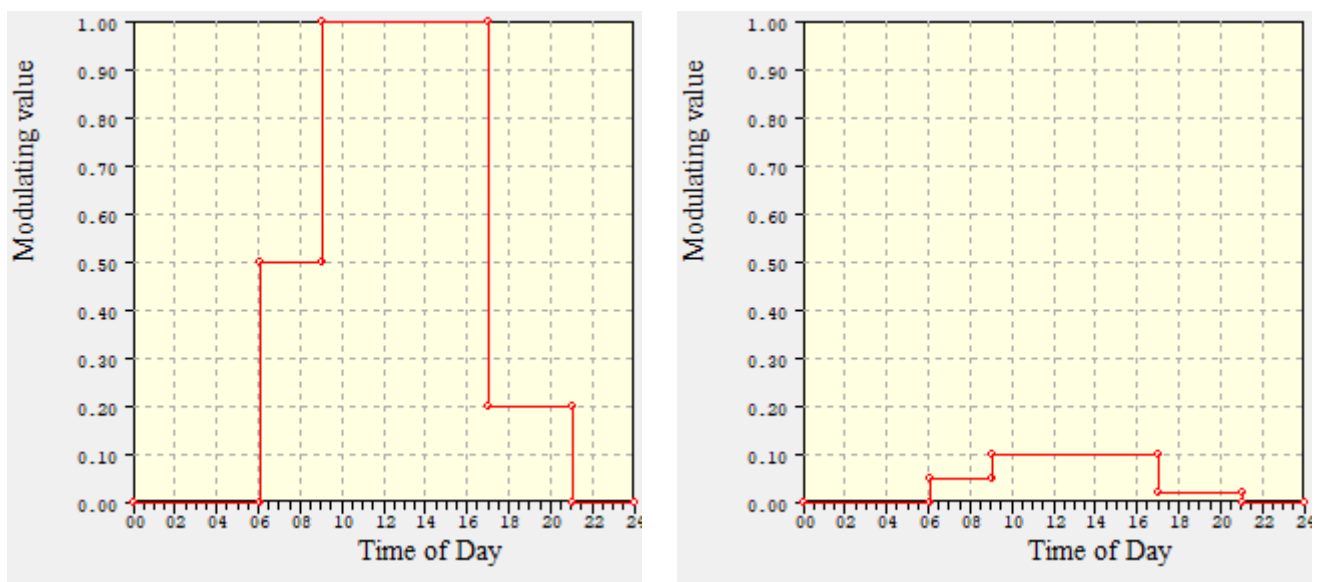


Figure 5 - Typical and summer occupancy

Table 3 - Occupancy by room

Room Type	Occupancy (People)	Occupant Density (People/m ²)	Occupancy Profile	Diversity Factor
L00 CCA 0.03 Click	30	2.816	Variable per energy workshop	Down to 10% in summer term
L00 CCA 0.29 Social	65	5.287	Variable per energy workshop	Down to 10% in summer term
L00 CCA.0.20 Meeting	4	2.373	Variable per energy workshop	Down to 10% in summer term
L00 CCA-0.01 Incubator Hub	30	4.343	Variable per energy workshop	Down to 10% in summer term
L00 CCA-0.01a Meeting	24	0.709	Variable per energy workshop	Down to 10% in summer term
L00 CCA-0.01b Meeting	24	0.602	Variable per energy workshop	Down to 10% in summer term
L00 CCA-0.05 Workshop	24	2.298	Variable per energy workshop	Down to 10% in summer term
L00 CCA-0.10 Classroom	24	2.261	Variable per energy workshop	Down to 10% in summer term
L00 CCA-0.11 PC Suite	24	2.266	Variable per energy workshop	Down to 10% in summer term
L00 CCA-0.13 Kitchen CAFE	3	8.587	Variable per energy workshop	Down to 10% in summer term
L00 CCA-0.15 PC Suite	24	2.263	Variable per energy workshop	Down to 10% in summer term
L00 CCA-0.17 PC Suite	24	2.227	Variable per energy workshop	Down to 10% in summer term
L00 CCA-0.18 FM Staff	24	1.513	Variable per energy workshop	Down to 10% in summer term
L00 CCA-0.21 1-2-1	4	2.254	Variable per energy workshop	Down to 10% in summer term
L00 CCA-0.27a Booth	4	0.824	Variable per energy workshop	Down to 10% in summer term
L00 CCA-0.27b Booth	4	0.585	Variable per energy workshop	Down to 10% in summer term
L00 CCA-0.27c Booth	4	0.898	Variable per energy workshop	Down to 10% in summer term
L00 CCA-0.27d Booth	4	0.522	Variable per energy workshop	Down to 10% in summer term
L00 CCA-0.27e Booth	4	0.954	Variable per energy workshop	Down to 10% in summer term
L00 Gaming CCA-0.16	20	2.548	Variable per energy workshop	Down to 10% in summer term
L00 Meeting CCA-0.04	24	1.898	Variable per energy workshop	Down to 10% in summer term
L01 CCA-1.01 Support Room	30	0.525	Variable per energy workshop	Down to 10% in summer term
L01 CCA-1.02 Staff Room	24	1.299	Variable per energy workshop	Down to 10% in summer term
L01 CCA-1.03 Exam Room	30	3.794	Variable per energy workshop	Down to 10% in summer term
L01 CCA-1.04 Large Classroom	30	2.582	Variable per energy workshop	Down to 10% in summer term
L01 CCA-1.22 Meeting	24	1.913	Variable per energy workshop	Down to 10% in summer term
L01 Classroom 1.06	24	2.267	Variable per energy workshop	Down to 10% in summer term
L01 Classroom CCA 1.13	24	2.266	Variable per energy workshop	Down to 10% in summer term
L01 Classroom CCA-1.15	24	2.263	Variable per energy workshop	Down to 10% in summer term
L01 Classroom CCA-1.18	24	2.276	Variable per energy workshop	Down to 10% in summer term
L01 Classroom-CCA-1.12	24	2.261	Variable per energy workshop	Down to 10% in summer term
L01 Classroom-CCA-1.14	24	2.051	Variable per energy workshop	Down to 10% in summer term

Room Type	Occupancy (People)	Occupant Density (People/m ²)	Occupancy Profile	Diversity Factor
L01 Classroom-CCA-1.17	24	2.227	Variable per energy workshop	Down to 10% in summer term
L01 Film Classroom CCA-1.25	24	2.527	Variable per energy workshop	Down to 10% in summer term
L01 Meeting 1-to-1 CCA 1.21	4	1.623	Variable per energy workshop	Down to 10% in summer term
L01 PC 1.19	24	2.299	Variable per energy workshop	Down to 10% in summer term
L01 PC Suite 1.05	26	3.056	Variable per energy workshop	Down to 10% in summer term
L01 PC Suite-CCA-1.20	26	2.755	Variable per energy workshop	Down to 10% in summer term
L01 Staffroom 1.16	16	3.186	Variable per energy workshop	Down to 10% in summer term
L01 Staffroom CCA.1.24	15	3.263	Variable per energy workshop	Down to 10% in summer term
L01 Staffroom CCA-1.23	10	2.787	Variable per energy workshop	Down to 10% in summer term
L02 CCA-2.13 Staffroom	24	2.864	Variable per energy workshop	Down to 10% in summer term
L02 CCA-2.13A Meeting	24	0.853	Variable per energy workshop	Down to 10% in summer term
L02 CCA-2.14 Meeting	24	0.261	Variable per energy workshop	Down to 10% in summer term
L02 Meeting 1-to-1-2.19	24	0.27	Variable per energy workshop	Down to 10% in summer term
L02 PC Suite 2.08	24	2.261	Variable per energy workshop	Down to 10% in summer term
L02 PC Suite 2.11	24	2.224	Variable per energy workshop	Down to 10% in summer term
L02 PC Suite 2.12	24	2.263	Variable per energy workshop	Down to 10% in summer term
L02 PC Suite 2.16	24	2.296	Variable per energy workshop	Down to 10% in summer term
L02 PC Suite 2.17	24	2.299	Variable per energy workshop	Down to 10% in summer term
L02 PC Suite-2.01	26	3.157	Variable per energy workshop	Down to 10% in summer term
L02 PC Suite-2.02	24	3.31	Variable per energy workshop	Down to 10% in summer term
L02 PC Suite-2.03	24	2.267	Variable per energy workshop	Down to 10% in summer term
L02 PC Suite-2.10	24	2.266	Variable per energy workshop	Down to 10% in summer term
L02 PC Suite-2.15	24	2.227	Variable per energy workshop	Down to 10% in summer term
L02 PC Suite-2.18	26	2.755	Variable per energy workshop	Down to 10% in summer term
L03 CCA3.13 Staffroom	24	2.727	Variable per energy workshop	Down to 10% in summer term
L03 CCA3.13A Meeting	24	1.001	Variable per energy workshop	Down to 10% in summer term
L03 CCA3.14 Meeting	24	0.25	Variable per energy workshop	Down to 10% in summer term
L03 Classroom 3.15	30	1.782	Variable per energy workshop	Down to 10% in summer term
L03 Classroom -3.16	30	1.837	Variable per energy workshop	Down to 10% in summer term
L03 Classroom+PC-3.17	30	1.839	Variable per energy workshop	Down to 10% in summer term
L03 Classroom-3.11	30	1.779	Variable per energy workshop	Down to 10% in summer term
L03 Classroom-3.12	30	1.81	Variable per energy workshop	Down to 10% in summer term
L03 Meeting 1-to-1-3.19	24	0.27	Variable per energy workshop	Down to 10% in summer term

Room Type	Occupancy (People)	Occupant Density (People/m ²)	Occupancy Profile	Diversity Factor
L03 PC Suite 3.08	24	2.261	Variable per energy workshop	Down to 10% in summer term
L03 PC Suite-3.01	26	3.157	Variable per energy workshop	Down to 10% in summer term
L03 PC Suite-3.02	26	3.056	Variable per energy workshop	Down to 10% in summer term
L03 PC Suite-3.03	24	2.267	Variable per energy workshop	Down to 10% in summer term
L03 PC Suite-3.10	24	2.266	Variable per energy workshop	Down to 10% in summer term
L03 PC Suite-3.18	24	2.985	Variable per energy workshop	Down to 10% in summer term
L04 AAT-4.01	26	3.157	Variable per energy workshop	Down to 10% in summer term
L04 CCA-4.12 Staffroom	24	2.947	Variable per energy workshop	Down to 10% in summer term
L04 CCA-4.12A Meeting	24	0.763	Variable per energy workshop	Down to 10% in summer term
L04 CCA-4.13 Meeting	24	0.268	Variable per energy workshop	Down to 10% in summer term
L04 CCA-4.16 Dry Lab	24	3.295	Variable per energy workshop	Down to 10% in summer term
L04 CCA-4.19 Meeting 1-to-1	24	0.27	Variable per energy workshop	Down to 10% in summer term
L04 Classroom CCA-4.15	30	1.837	Variable per energy workshop	Down to 10% in summer term
L04 Lab Wet-4.03	24	3.419	Variable per energy workshop	Down to 10% in summer term
L04 Lab Wet-4.09	24	3.421	Variable per energy workshop	Down to 10% in summer term
L04 PC Suite-4.02	26	3.013	Variable per energy workshop	Down to 10% in summer term
L04 PC Suite-4.10	24	2.224	Variable per energy workshop	Down to 10% in summer term
L04 Prep-4.11	5	10.861	Variable per energy workshop	Down to 10% in summer term
L04 Wet Lab 4.14	24	3.562	Variable per energy workshop	Down to 10% in summer term

3.3 Lighting gains and controls (Step 3)

Table 4 reports lighting gains and controls that have been assumed for each space, based on M&E allowances, lighting automatic controls specification, and some daylight linking required to achieve Part L2A compliance.

Per CIBSE TM54, section 7.4.1, lighting energy consumption and associated heat gains have been calculated automatically via software package, with some adjustments for lighting controls and parasitic loads.

Lighting gains for specialist lighting (e.g., task lighting, etc) have been included within the W/m^2 allowance for each room reported in Table 4 and individual lighting usage patterns will be refined during the next design stage.

Energy used for external lighting has been taken into account separately and is described in section 6.1. Total figures reported in the results section consider all lighting figures combined.

General lighting is on during operational hours, whereas emergency lighting is always on.

Daylight linking is assumed to be capable of dimming down to 300lux, according to CIBSE Guide A, Table 1.5.

P03 of this report now includes an assumed 48% diversity based on the VE schedule. Not all lights would be in use at the same time therefore some reduction is possible.

Table 4 - Lighting gains and controls by room

Room Type	General Lighting (W/m^2)	Emergency Lighting (W/m^2)	Automatic Controls for General Lighting
FM Store CCA-0.23	12	0.5	-
L00 CCA 0.03 Click	12	0.5	-
L00 CCA 0.19 Hygiene	12	0.5	Presence
L00 CCA 0.29 Social	12	0.5	-
L00 CCA CD02 Circ	12	0.5	-
L00 CCA CD03 Circ	12	0.5	-
L00 CCA.0.20 Meeting	12	0.5	Presence
L00 CCA.0.CD04 Lobby	12	0.5	Presence
L00 CCA.0.CD07 Circ	12	0.5	Presence
L00 CCA.0.ST.01 Circ Stair	12	0.5	Presence
L00 CCA.0.ST02 Circ Stair	12	0.5	Presence
L00 CCA-0.01 Incubator Hub	12	0.5	-
L00 CCA-0.01a Meeting	12	0.5	-
L00 CCA-0.01b Meeting	12	0.5	-
L00 CCA-0.02 Store	12	0.5	-
L00 CCA-0.05 Workshop	12	0.5	Presence + Dimming
L00 CCA-0.06 Male W/C	12	0.5	Presence
L00 CCA-0.07 Acc. WC	12	0.5	Presence
L00 CCA-0.08 CIn	12	0.5	Presence

Room Type	General Lighting (W/m ²)	Emergency Lighting (W/m ²)	Automatic Controls for General Lighting
L00 CCA-0.09 Female W/C	12	0.5	Presence
L00 CCA-0.10 Classroom	12	0.5	Presence + Dimming
L00 CCA-0.11 PC Suite	12	0.5	Presence + Dimming
L00 CCA-0.12 Store	12	0.5	Presence
L00 CCA-0.13 Kitchen CAFE	12	0.5	-
L00 CCA-0.14 Store	12	0.5	-
L00 CCA-0.15 PC Suite	12	0.5	Presence + Dimming
L00 CCA-0.17 PC Suite	12	0.5	Presence + Dimming
L00 CCA-0.18 FM Staff	12	0.5	-
L00 CCA-0.21 1-2-1	12	0.5	Presence
L00 CCA-0.22 Plant LV	12	0.5	Presence
L00 CCA-0.24 Shower	12	0.5	-
L00 CCA-0.25 Shower	12	0.5	-
L00 CCA-0.26 Plant Water	12	0.5	Presence
L00 CCA-0.27a Booth	12	0.5	Presence
L00 CCA-0.27b Booth	12	0.5	Presence
L00 CCA-0.27c Booth	12	0.5	Presence
L00 CCA-0.27d Booth	12	0.5	Presence
L00 CCA-0.27e Booth	12	0.5	Presence
L00 CCA-0.CD05 Circ	12	n/a	-
L00 CCA-0.CD09 Circ	12	0.5	-
L00 CCA-0.CD10 Lobby	12	0.5	-
L00 CCA-0.CD12 Lobby	12	0.5	-
L00 CCA-EX0.01 Bike Store	12	0.5	-
L00 CCA-EX0.03 Plant Extract	12	0.5	Presence
L00 Gaming CCA-0.16	12	0.5	Presence
L00 Lobby CCA-0.CD11	12	0.5	Presence
L00 Meeting CCA-0.04	12	0.5	Presence + Dimming
L00 Store Bin CCA-EX0.02	12	0.5	Presence
L01 CCA-1 CD02 Circ	12	0.5	-
L01 CCA-1.01 Support Room	12	0.5	-
L01 CCA-1.02 Staff Room	12	0.5	-
L01 CCA-1.03 Exam Room	12	0.5	-

Room Type	General Lighting (W/m ²)	Emergency Lighting (W/m ²)	Automatic Controls for General Lighting
L01 CCA-1.04 Large Classroom	12	0.5	-
L01 CCA-1.22 Meeting	12	0.5	-
L01 CCA-1.CD01 Lobby	12	0.5	-
L01 Circ 1.CD.04	12	0.5	Presence
L01 Circ 1.CD.05	12	0.5	Presence
L01 Circ 1.CD.06	12	0.5	Presence
L01 Circ 1.CD.08	12	0.5	Presence
L01 Circ Lobby 1.CD.03	12	0.5	Presence
L01 Circ Lobby 1.CD.07	12	0.5	Presence
L01 Circ Stairs 1.ST.01	12	0.5	Presence
L01 Circ Stairs 1.ST.02	12	0.5	Presence
L01 Classroom 1.06	12	0.5	Presence + Dimming
L01 Classroom CCA 1.13	12	0.5	Presence + Dimming
L01 Classroom CCA-1.15	12	0.5	Presence + Dimming
L01 Classroom CCA-1.18	12	0.5	Presence + Dimming
L01 Classroom-CCA-1.12	12	0.5	Presence + Dimming
L01 Classroom-CCA-1.14	12	0.5	Presence + Dimming
L01 Classroom-CCA-1.17	12	0.5	Presence + Dimming
L01 Film Classroom CCA-1.25	12	0.5	Presence + Dimming
L01 IT Hub 1.10	12	0.5	Presence
L01 Meeting 1-to-1 CCA 1.21	12	0.5	Presence
L01 PC 1.19	12	0.5	Presence + Dimming
L01 PC Suite 1.05	12	0.5	Presence + Dimming
L01 PC Suite-CCA-1.20	12	0.5	Presence + Dimming
L01 Staffroom 1.16	12	0.5	Presence + Dimming
L01 Staffroom CCA.1.24	12	0.5	Presence + Dimming
L01 Staffroom CCA-1.23	12	0.5	Presence + Dimming
L01 Store Cleaner 1.09	12	0.5	Presence
L01 WC Acc 1.07	12	0.5	Presence
L01 WC F 1.11	12	0.5	Presence
L01 WC M 1.08	12	0.5	Presence
L02 CCA-2.13 Staffroom	12	0.5	-
L02 CCA-2.13A Meeting	12	0.5	-

Room Type	General Lighting (W/m ²)	Emergency Lighting (W/m ²)	Automatic Controls for General Lighting
L02 CCA-2.14 Meeting	12	0.5	-
L02 Circ Lobby-CD02	12	0.5	Presence
L02 Circ Lobby-CD05	12	0.5	Presence
L02 Circ Stairs-ST01	12	0.5	Presence
L02 Circ Stairs-ST02	12	0.5	Presence
L02 Circ-CD01	12	0.5	Presence
L02 Circ-CD04	12	0.5	Presence
L02 Circ-CD04	12	0.5	Presence
L02 IT Hub-2.07	12	0.5	Presence
L02 Meeting 1-to-1-2.19	12	0.5	Presence
L02 PC Suite 2.08	12	0.5	Presence + Dimming
L02 PC Suite 2.11	12	0.5	Presence + Dimming
L02 PC Suite 2.12	12	0.5	Presence + Dimming
L02 PC Suite 2.16	12	0.5	Presence + Dimming
L02 PC Suite 2.17	12	0.5	Presence + Dimming
L02 PC Suite-2.01	12	0.5	Presence + Dimming
L02 PC Suite-2.02	12	0.5	Presence + Dimming
L02 PC Suite-2.03	12	0.5	Presence + Dimming
L02 PC Suite-2.10	12	0.5	Presence + Dimming
L02 PC Suite-2.15	12	0.5	Presence + Dimming
L02 PC Suite-2.18	12	0.5	Presence + Dimming
L02 Store Cleaner-2.06	12	0.5	Presence
L02 WC Acc-2.04	12	0.5	Presence
L02 WC F-2.09	12	0.5	Presence
L02 WC M-2.05	12	0.5	Presence
L03 CCA3.13 Staffroom	12	0.5	-
L03 CCA3.13A Meeting	12	0.5	-
L03 CCA3.14 Meeting	12	0.5	-
L03 Circ Lobby-CD01	12	0.5	Presence
L03 Circ Lobby-CD05	12	0.5	Presence
L03 Circ Stairs-ST01	12	0.5	Presence
L03 Circ Stairs-ST02	12	0.5	Presence
L03 Circ-CD02	12	0.5	Presence

Room Type	General Lighting (W/m ²)	Emergency Lighting (W/m ²)	Automatic Controls for General Lighting
L03 Circ-CD03	12	0.5	Presence
L03 Circ-CD04	12	0.5	Presence
L03 Classroom 3.15	12	0.5	Presence + Dimming
L03 Classroom -3.16	12	0.5	Presence + Dimming
L03 Classroom+PC-3.17	12	0.5	Presence + Dimming
L03 Classroom-3.11	12	0.5	Presence + Dimming
L03 Classroom-3.12	12	0.5	Presence + Dimming
L03 IT Hub-3.07	12	0.5	Presence
L03 Meeting 1-to-1-3.19	12	0.5	Presence
L03 PC Suite 3.08	12	0.5	Presence + Dimming
L03 PC Suite-3.01	12	0.5	Presence + Dimming
L03 PC Suite-3.02	12	0.5	Presence + Dimming
L03 PC Suite-3.03	12	0.5	Presence + Dimming
L03 PC Suite-3.10	12	0.5	Presence + Dimming
L03 PC Suite-3.18	12	0.5	Presence + Dimming
L03 Store Cleaner-3.06	12	0.5	Presence
L03 WC Acc-3.04	12	0.5	Presence
L03 WC F-3.09	12	0.5	Presence
L03 WC M-3.05	12	0.5	Presence
L04 AAT-4.01	12	0.5	Presence + Dimming
L04 CCA.4.ST02 Circ Stairs	12	0.5	Presence
L04 CCA-4.12 Staffroom	12	0.5	-
L04 CCA-4.12A Meeting	12	0.5	-
L04 CCA-4.13 Meeting	12	0.5	-
L04 CCA-4.16 Dry Lab	12	0.5	-
L04 CCA-4.17 Store Chem	12	0.5	Presence
L04 CCA-4.18 Store Chem	12	0.5	Presence
L04 CCA-4.19 Meeting 1-to-1	12	0.5	Presence
L04 CCA-4.CD05 Circ Lobby	12	0.5	Presence
L04 Circ CCA-4.CD04	12	0.5	Presence
L04 Circ Lobby-CD01	12	0.5	Presence
L04 Circ Stairs-ST01	12	0.5	Presence
L04 Circ-CD02	12	0.5	Presence

Room Type	General Lighting (W/m ²)	Emergency Lighting (W/m ²)	Automatic Controls for General Lighting
L04 Circ-CD03	12	0.5	Presence
L04 Classroom CCA-4.15	12	0.5	Presence + Dimming
L04 IT Hub-4.07	12	0.5	Presence
L04 Lab Wet-4.03	12	0.5	Presence + Dimming
L04 Lab Wet-4.09	12	0.5	Presence + Dimming
L04 PC Suite-4.02	12	0.5	Presence + Dimming
L04 PC Suite-4.10	12	0.5	Presence + Dimming
L04 Prep-4.11	12	0.5	Presence + Dimming
L04 Store Cleaner-4.06	12	0.5	Presence
L04 WC Acc-4.04	12	0.5	Presence
L04 WC F-4.08	12	0.5	Presence
L04 WC M-4.05	12	0.5	Presence
L04 Wet Lab 4.14	12	0.5	-
L05 CCA.5.ST01 Circ Stairs	12	0.5	Presence

3.4 Lifts and escalators (Step 4)

There are 2no. lift in the building and no escalators present. No lift traffic analysis has been undertaken by the design team at this stage.

An assumed calculation for lift energy consumption is presented in Table 5 and has been developed according to TM54 methodology.

Table 5 - Lifts energy calculation

Parameter	Description	Value	Notes/Comments
	Number of starts per day	300	Medium usage intensity, from CIBSE TM54 Table 6 Category 3, from CIBSE TM54, Table 7, weekdays only
	Occupancy factor-weekday	1	
	Occupancy factor-weekend	1	
S	Number of starts per year,	109200	
P	Drive Motor Power (kW)	54.13	From similar project
	Standby Motor Power/ Drive Motor Power	7.5%	5%-10% of running power suggested by lift manufacturer on similar project
P _s	Standby Motor Power, P	4.1	
	Assumed lift speed (m/s)	1.6	
	Travel distance (m)	16.95	Ground to fourth floor
t _h	Time to travel between the main entrance floor and the highest served floor from the instant the doors have closed to the instant they start to open (h)	0.003	
E _{active}	Active energy used by a single lift in one year (kWh)	3727	
E _{standby}	Standby energy used by a single lift in one year (kWh)	34445	
Lifts Totals			
E _L	Energy used by one lift (kWh)	38173	
n	number of lifts	2	
E _{tot}	Energy used by all lifts (kWh)	76345	
E _{tot} /m ²	Energy used by all lifts (kWh/m ²)	12.0	

3.5 Small power gains and profiles (Step 5)

Small power and equipment gains assumed in the model are reported in Table 6, based on the M&E load assumptions. Please note that as of this writing, M&E small power allowances do not necessarily match small power energy uses from room data sheets. The post-construction iteration of the model will be refined to address this.

Internal gains for special equipment have been included within the W/m^2 allowance for each room reported in Table 6. P01 of this report stated that individual equipment usage patterns will be refined. The VE schedule from 19th of July 2023 suggests room utilisation at 48%, and a corresponding diversity figure has been applied to the equipment.

Unless otherwise noted, equipment energy use is also assumed to decrease to 10% of typical during the summer, in line with lower expected occupancy during this period.

Table 6 - Small power calculation

Room Types	Small power and Equipment Load (W)	Small power and Equipment Load (W/m^2)	Equipment Profile
L00 CCA 0.03 Click	1.184	100	Annual 6am-9pm Mon-Thurs; 6am-8pm Fri
L00 CCA 0.19 Hygiene	7.584	100	Annual 6am-9pm Mon-Thurs; 6am-8pm Fri
L00 CCA 0.29 Social	0.291	100	Annual 6am-9pm Mon-Thurs; 6am-8pm Fri
L00 CCA.0.20 Meeting	12	113.883	Annual 6am-9pm Mon-Thurs; 6am-8pm Fri
L00 CCA-0.01 Incubator Hub	0.767	100	Annual 6am-9pm Mon-Thurs; 6am-8pm Fri
L00 CCA-0.01a Meeting	5.878	100	Annual 6am-9pm Mon-Thurs; 6am-8pm Fri
L00 CCA-0.01b Meeting	6.922	100	Annual 6am-9pm Mon-Thurs; 6am-8pm Fri
L00 CCA-0.05 Workshop	1.813	100	Annual 6am-9pm Mon-Thurs; 6am-8pm Fri
L00 CCA-0.06 Male W/C	4.515	100	Annual 6am-9pm Mon-Thurs; 6am-8pm Fri
L00 CCA-0.07 Acc. WC	19.397	100	Annual 6am-9pm Mon-Thurs; 6am-8pm Fri
L00 CCA-0.09 Female W/C	4.257	100	Annual 6am-9pm Mon-Thurs; 6am-8pm Fri
L00 CCA-0.10 Classroom	1.843	100	Annual 6am-9pm Mon-Thurs; 6am-8pm Fri
L00 CCA-0.11 PC Suite	12	652.626	Annual 6am-9pm Mon-Thurs; 6am-8pm Fri
L00 CCA-0.15 PC Suite	12	651.667	Annual 6am-9pm Mon-Thurs; 6am-8pm Fri
L00 CCA-0.17 PC Suite	48.644	2600	Annual 6am-9pm Mon-Thurs; 6am-8pm Fri
L00 CCA-0.18 FM Staff	55.068	2000	Annual 6am-9pm Mon-Thurs; 6am-8pm Fri
L00 CCA-0.21 1-2-1	11.09	100	Annual 6am-9pm Mon-Thurs; 6am-8pm Fri
L00 Gaming CCA-0.16	9.81	500	Annual 6am-9pm Mon-Thurs; 6am-8pm Fri
L00 Meeting CCA-0.04	2.196	100	Annual 6am-9pm Mon-Thurs; 6am-8pm Fri
L01 CCA-1.01 Support Room	6.353	100	Annual 6am-9pm Mon-Thurs; 6am-8pm Fri
L01 CCA-1.02 Staff Room	64.155	2000	Annual 6am-9pm Mon-Thurs; 6am-8pm Fri
L01 CCA-1.03 Exam Room	26.354	3000	Annual 6am-9pm Mon-Thurs; 6am-8pm Fri
L01 CCA-1.04 Large Classroom	1.291	100	Annual 6am-9pm Mon-Thurs; 6am-8pm Fri

Room Types	Small power and Equipment Load (W)	Small power and Equipment Load (W/m ²)	Equipment Profile
L01 CCA-1.22 Meeting	4.355	200	Annual 6am-9pm Mon-Thurs; 6am-8pm Fri
L01 Classroom 1.06	1.838	100	Annual 6am-9pm Mon-Thurs; 6am-8pm Fri
L01 Classroom CCA 1.13	1.839	100	Annual 6am-9pm Mon-Thurs; 6am-8pm Fri
L01 Classroom CCA-1.15	1.841	100	Annual 6am-9pm Mon-Thurs; 6am-8pm Fri
L01 Classroom CCA-1.18	1.83	100	Annual 6am-9pm Mon-Thurs; 6am-8pm Fri
L01 Classroom-CCA-1.12	1.843	100	Annual 6am-9pm Mon-Thurs; 6am-8pm Fri
L01 Classroom-CCA-1.14	2.031	100	Annual 6am-9pm Mon-Thurs; 6am-8pm Fri
L01 Classroom-CCA-1.17	1.871	100	Annual 6am-9pm Mon-Thurs; 6am-8pm Fri
L01 Film Classroom CCA-1.25	1.649	100	Annual 6am-9pm Mon-Thurs; 6am-8pm Fri
L01 Meeting 1-to-1 CCA 1.21	15.406	100	Annual 6am-9pm Mon-Thurs; 6am-8pm Fri
L01 PC 1.19	47.115	2600	Annual 6am-9pm Mon-Thurs; 6am-8pm Fri
L01 PC Suite 1.05	32.727	2600	Annual 6am-9pm Mon-Thurs; 6am-8pm Fri
L01 PC Suite-CCA-1.20	36.297	2600	Annual 6am-9pm Mon-Thurs; 6am-8pm Fri
L01 Staffroom 1.16	13.734	700	Annual 6am-9pm Mon-Thurs; 6am-8pm Fri
L01 Staffroom CCA.1.24	14.302	700	Annual 6am-9pm Mon-Thurs; 6am-8pm Fri
L01 Staffroom CCA-1.23	71.754	2000	Annual 6am-9pm Mon-Thurs; 6am-8pm Fri
L01 WC Acc 1.07	19.084	100	Annual 6am-9pm Mon-Thurs; 6am-8pm Fri
L01 WC F 1.11	5.224	100	Annual 6am-9pm Mon-Thurs; 6am-8pm Fri
L01 WC M 1.08	8.274	100	Annual 6am-9pm Mon-Thurs; 6am-8pm Fri
L02 CCA-2.13 Staffroom	29.098	2000	Annual 6am-9pm Mon-Thurs; 6am-8pm Fri
L02 CCA-2.13A Meeting	9.773	200	Annual 6am-9pm Mon-Thurs; 6am-8pm Fri
L02 CCA-2.14 Meeting	31.896	200	Annual 6am-9pm Mon-Thurs; 6am-8pm Fri
L02 Meeting 1-to-1-2.19	15.406	100	Annual 6am-9pm Mon-Thurs; 6am-8pm Fri
L02 PC Suite 2.08	47.921	2600	Annual 6am-9pm Mon-Thurs; 6am-8pm Fri
L02 PC Suite 2.11	48.72	2600	Annual 6am-9pm Mon-Thurs; 6am-8pm Fri
L02 PC Suite 2.12	47.877	2600	Annual 6am-9pm Mon-Thurs; 6am-8pm Fri
L02 PC Suite 2.16	47.189	2600	Annual 6am-9pm Mon-Thurs; 6am-8pm Fri
L02 PC Suite 2.17	47.115	2600	Annual 6am-9pm Mon-Thurs; 6am-8pm Fri
L02 PC Suite-2.01	31.68	2600	Annual 6am-9pm Mon-Thurs; 6am-8pm Fri
L02 PC Suite-2.02	32.727	2600	Annual 6am-9pm Mon-Thurs; 6am-8pm Fri
L02 PC Suite-2.03	47.788	2600	Annual 6am-9pm Mon-Thurs; 6am-8pm Fri
L02 PC Suite-2.10	47.807	2600	Annual 6am-9pm Mon-Thurs; 6am-8pm Fri
L02 PC Suite-2.15	48.644	2600	Annual 6am-9pm Mon-Thurs; 6am-8pm Fri

Room Types	Small power and Equipment Load (W)	Small power and Equipment Load (W/m ²)	Equipment Profile
L02 PC Suite-2.18	36.297	2600	Annual 6am-9pm Mon-Thurs; 6am-8pm Fri
L02 WC Acc-2.04	19.084	100	Annual 6am-9pm Mon-Thurs; 6am-8pm Fri
L02 WC F-2.09	4.708	100	Annual 6am-9pm Mon-Thurs; 6am-8pm Fri
L02 WC M-2.05	6.966	100	Annual 6am-9pm Mon-Thurs; 6am-8pm Fri
L03 CCA3.13 Staffroom	30.56	2000	Annual 6am-9pm Mon-Thurs; 6am-8pm Fri
L03 CCA3.13A Meeting	8.326	200	Annual 6am-9pm Mon-Thurs; 6am-8pm Fri
L03 CCA3.14 Meeting	33.342	200	Annual 6am-9pm Mon-Thurs; 6am-8pm Fri
L03 Classroom 3.15	1.871	100	Annual 6am-9pm Mon-Thurs; 6am-8pm Fri
L03 Classroom -3.16	1.815	100	Annual 6am-9pm Mon-Thurs; 6am-8pm Fri
L03 Classroom+PC-3.17	1.812	100	Annual 6am-9pm Mon-Thurs; 6am-8pm Fri
L03 Classroom-3.11	1.874	100	Annual 6am-9pm Mon-Thurs; 6am-8pm Fri
L03 Classroom-3.12	1.841	100	Annual 6am-9pm Mon-Thurs; 6am-8pm Fri
L03 Meeting 1-to-1-3.19	15.406	100	Annual 6am-9pm Mon-Thurs; 6am-8pm Fri
L03 PC Suite 3.08	1.843	100	Annual 6am-9pm Mon-Thurs; 6am-8pm Fri
L03 PC Suite-3.01	31.68	2600	Annual 6am-9pm Mon-Thurs; 6am-8pm Fri
L03 PC Suite-3.02	32.727	2600	Annual 6am-9pm Mon-Thurs; 6am-8pm Fri
L03 PC Suite-3.03	47.788	2600	Annual 6am-9pm Mon-Thurs; 6am-8pm Fri
L03 PC Suite-3.10	47.807	2600	Annual 6am-9pm Mon-Thurs; 6am-8pm Fri
L03 PC Suite-3.18	36.297	2600	Annual 6am-9pm Mon-Thurs; 6am-8pm Fri
L03 WC Acc-3.04	19.084	100	Annual 6am-9pm Mon-Thurs; 6am-8pm Fri
L03 WC F-3.09	4.708	100	Annual 6am-9pm Mon-Thurs; 6am-8pm Fri
L03 WC M-3.05	6.966	100	Annual 6am-9pm Mon-Thurs; 6am-8pm Fri
L04 AAT-4.01	1.218	100	Annual 6am-9pm Mon-Thurs; 6am-8pm Fri
L04 CCA-4.12 Staffroom	28.279	2000	Annual 6am-9pm Mon-Thurs; 6am-8pm Fri
L04 CCA-4.12A Meeting	10.926	200	Annual 6am-9pm Mon-Thurs; 6am-8pm Fri
L04 CCA-4.13 Meeting	31.063	200	Annual 6am-9pm Mon-Thurs; 6am-8pm Fri
L04 CCA-4.16 Dry Lab	1.265	100	Annual 6am-9pm Mon-Thurs; 6am-8pm Fri
L04 CCA-4.17 Store Chem	13.638	100	Annual 6am-9pm Mon-Thurs; 6am-8pm Fri
L04 CCA-4.18 Store Chem	11.961	100	Annual 6am-9pm Mon-Thurs; 6am-8pm Fri
L04 CCA-4.19 Meeting 1-to-1	15.406	100	Annual 6am-9pm Mon-Thurs; 6am-8pm Fri
L04 Classroom CCA-4.15	1.815	100	Annual 6am-9pm Mon-Thurs; 6am-8pm Fri
L04 Lab Wet-4.03	29.246	2400	Annual 6am-9pm Mon-Thurs; 6am-8pm Fri
L04 Lab Wet-4.09	1.218	100	Annual 6am-9pm Mon-Thurs; 6am-8pm Fri

Room Types	Small power and Equipment Load (W)	Small power and Equipment Load (W/m ²)	Equipment Profile
L04 PC Suite-4.02	30.641	2400	Annual 6am-9pm Mon-Thurs; 6am-8pm Fri
L04 PC Suite-4.10	48.72	2600	Annual 6am-9pm Mon-Thurs; 6am-8pm Fri
L04 Prep-4.11	1.841	100	Annual 6am-9pm Mon-Thurs; 6am-8pm Fri
L04 WC Acc-4.04	19.084	100	Annual 6am-9pm Mon-Thurs; 6am-8pm Fri
L04 WC F-4.08	4.708	100	Annual 6am-9pm Mon-Thurs; 6am-8pm Fri
L04 WC M-4.05	6.966	100	Annual 6am-9pm Mon-Thurs; 6am-8pm Fri
L04 Wet Lab 4.14	1.17	100	Annual 6am-9pm Mon-Thurs; 6am-8pm Fri

3.6 Catering (Step 6)

Small power and equipment gains assumed in the model are reported in Table 7, based on the M&E load assumptions.

Table 7 - Catering calculation

Room Types	Catering Equipment Load (W)	Catering Equipment Load (W/m ²)	Equipment Profile
L00 CCA-0.13 Kitchen Cafe	100	3.882	Annual 6am-9pm Mon-Thurs; 6am-8pm Fri

3.7 Server rooms (Step 7)

Table 8 shows the calculations used to estimate the energy use of the server room within the building.

Table 8 - IT hub energy calculation

Parameter	Value	Notes/Comments
number of server rooms	4	
Rated power demand of servers (kW)	5100	From M&E data for 5 server racks
Ratio of rated to operational demand	67%	From TM54 worked example
Hours of operation (h)	8760	Always on - 24 hours × 7 days × 52 weeks
Cooling power consumption	100%	70% of server power consumption (x chilled water) - if DX system used 100% peak load required
Totals		
Annual energy consumption for large server rooms w cooling (kWh/year)	117384	
Annual energy consumption for small server rooms (kWh/m ² /year)	18	

3.8 Additional plant and equipment (Step 8)

Table 9 reports the calculations for the additional plant and equipment electrical consumption, based on discussions arising from the energy workshop.

The client expects there to be tea points and similar equipment per staff room. It is assumed that there are 50 security cameras around the building.

The post-construction iteration of the model will clarify additional plant & equipment loads once these are selected.

Table 9 - Miscellaneous plant and equipment energy calculations

Equipment	Quantity	Equipment Power consumption (W)	Equipment Sleep mode consumption (W)	Average Power consumption tot (W)	Sleep mode consumption tot (W)	Hours of operation
Security systems	50	50	5	2500	250	8736
Local tea points	8	1200	120	9600	960	2912
Microwaves	8	1200	120	9600	960	2912
Toasters	8	1200	120	9600	960	2912
Refrigerators	8	150	15	1200	120	8736
Vending machines	8	50	5	400	40	2912

4.0 Ventilation provision

4.1 Infiltration (Step 1)

The CIBSE Guide A air permeability table for schools has been used to estimate the Infiltration rate of the building. A value of 0.1ach has been assumed throughout the building at this stage, based on the air permeability target of 3m³/h/m² @ 50Pa and CIBSE Guide A, Table 4.23ⁱ.

4.2 Natural ventilation (Step 11)

The building will be fully mechanically ventilated; therefore, no natural ventilation has been considered in the model and all windows have been assumed to be fixed shut.

4.3 Mechanical ventilation (Step 11)

Mechanical ventilation has been included within the thermal model as per information provided by the mechanical team. Ventilation rates, operational profiles, and tempered air supply conditions for each space are reported in Table 10. Ventilation profiles are longer than the operational hours of the building, to allow for the building to reach thermal equilibrium prior to occupancy. Ventilation is variable based on occupancy.

Table 10 - Ventilation rates by space

Room Type	Peak ventilation rate (ACH)	Peak ventilation rate (l/s)	Ventilation Profile
FM Store CCA-0.23	6	63.8429	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA 0.03 Click	3.4668	360	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA 0.29 Social	0.9233	780	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA.0.20 Meeting	4.1149	48	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA-0.01 Incubator Hub	2.2478	360	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA-0.01a Meeting	13.7727	288	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA-0.01b Meeting	16.219	288	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA-0.02 Store	6	94.8754	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA-0.05 Workshop	10	677.9774	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA-0.06 Male W/C	6	163.3329	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA-0.07 Acc. WC	6	38.0209	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA-0.08 CIn	10	51.2516	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA-0.09 Female W/C	6	173.2354	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA-0.10 Classroom	4.3185	288	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA-0.11 PC Suite	4.3082	288	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA-0.12 Store	6	70.0973	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA-0.13 Kitchen CAFE	10	316.6605	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA-0.14 Store	6	103.0092	5am-9pm Mon-Thu; 5am-8pm Fri

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

Room Type	Peak ventilation rate (ACH)	Peak ventilation rate (l/s)	Ventilation Profile
L00 CCA-0.15 PC Suite	4.3146	288	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA-0.17 PC Suite	4.3836	288	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA-0.18 FM Staff	6.4514	288	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA-0.21 1-2-1	4.3309	48	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA-0.24 Shower	10	20.7712	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA-0.25 Shower	10	20.7553	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA-0.27a Booth	11.8462	48	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA-0.27b Booth	16.6833	48	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA-0.27c Booth	10.8716	48	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA-0.27d Booth	18.706	48	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA-0.27e Booth	10.2317	48	5am-9pm Mon-Thu; 5am-8pm Fri
L00 Gaming CCA-0.16	3.8309	240	5am-9pm Mon-Thu; 5am-8pm Fri
L00 Meeting CCA-0.04	5.1449	288	5am-9pm Mon-Thu; 5am-8pm Fri
L00 Store Bin CCA-EX0.02	6	668.2896	5am-9pm Mon-Thu; 5am-8pm Fri
L01 CCA-1.01 Support Room	18.6075	360	5am-9pm Mon-Thu; 5am-8pm Fri
L01 CCA-1.02 Staff Room	7.5159	288	5am-9pm Mon-Thu; 5am-8pm Fri
L01 CCA-1.03 Exam Room	2.5729	360	5am-9pm Mon-Thu; 5am-8pm Fri
L01 CCA-1.04 Large Classroom	3.7809	360	5am-9pm Mon-Thu; 5am-8pm Fri
L01 CCA-1.22 Meeting	5.1024	288	5am-9pm Mon-Thu; 5am-8pm Fri
L01 Classroom 1.06	4.3066	288	5am-9pm Mon-Thu; 5am-8pm Fri
L01 Classroom CCA 1.13	4.3082	288	5am-9pm Mon-Thu; 5am-8pm Fri
L01 Classroom CCA-1.15	4.3146	288	5am-9pm Mon-Thu; 5am-8pm Fri
L01 Classroom CCA-1.18	4.2889	288	5am-9pm Mon-Thu; 5am-8pm Fri
L01 Classroom-CCA-1.12	4.3185	288	5am-9pm Mon-Thu; 5am-8pm Fri
L01 Classroom-CCA-1.14	4.759	288	5am-9pm Mon-Thu; 5am-8pm Fri
L01 Classroom-CCA-1.17	4.3836	288	5am-9pm Mon-Thu; 5am-8pm Fri
L01 Film Classroom CCA-1.25	3.8636	288	5am-9pm Mon-Thu; 5am-8pm Fri
L01 Meeting 1-to-1 CCA 1.21	6.0161	48	5am-9pm Mon-Thu; 5am-8pm Fri
L01 PC 1.19	4.2459	288	5am-9pm Mon-Thu; 5am-8pm Fri
L01 PC Suite 1.05	3.1951	312	5am-9pm Mon-Thu; 5am-8pm Fri
L01 PC Suite-CCA-1.20	3.5435	312	5am-9pm Mon-Thu; 5am-8pm Fri
L01 Staffroom 1.16	3.0647	192	5am-9pm Mon-Thu; 5am-8pm Fri
L01 Staffroom CCA.1.24	2.992	180	5am-9pm Mon-Thu; 5am-8pm Fri

Room Type	Peak ventilation rate (ACH)	Peak ventilation rate (l/s)	Ventilation Profile
L01 Staffroom CCA-1.23	3.5026	120	5am-9pm Mon-Thu; 5am-8pm Fri
L01 Store Cleaner 1.09	10	36.4211	5am-9pm Mon-Thu; 5am-8pm Fri
L01 WC Acc 1.07	6	38.644	5am-9pm Mon-Thu; 5am-8pm Fri
L01 WC F 1.11	6	141.1658	5am-9pm Mon-Thu; 5am-8pm Fri
L01 WC M 1.08	6	89.1357	5am-9pm Mon-Thu; 5am-8pm Fri
L02 CCA-2.13 Staffroom	3.7246	288	5am-9pm Mon-Thu; 5am-8pm Fri
L02 CCA-2.13A Meeting	12.5098	288	5am-9pm Mon-Thu; 5am-8pm Fri
L02 CCA-2.14 Meeting	40.8272	288	5am-9pm Mon-Thu; 5am-8pm Fri
L02 Meeting 1-to-1-2.19	39.4391	288	5am-9pm Mon-Thu; 5am-8pm Fri
L02 PC Suite 2.08	4.7184	288	5am-9pm Mon-Thu; 5am-8pm Fri
L02 PC Suite 2.11	4.7971	288	5am-9pm Mon-Thu; 5am-8pm Fri
L02 PC Suite 2.12	4.7141	288	5am-9pm Mon-Thu; 5am-8pm Fri
L02 PC Suite 2.16	4.6463	288	5am-9pm Mon-Thu; 5am-8pm Fri
L02 PC Suite 2.17	4.639	288	5am-9pm Mon-Thu; 5am-8pm Fri
L02 PC Suite-2.01	3.3792	312	5am-9pm Mon-Thu; 5am-8pm Fri
L02 PC Suite-2.02	3.2224	288	5am-9pm Mon-Thu; 5am-8pm Fri
L02 PC Suite-2.03	4.7053	288	5am-9pm Mon-Thu; 5am-8pm Fri
L02 PC Suite-2.10	4.7071	288	5am-9pm Mon-Thu; 5am-8pm Fri
L02 PC Suite-2.15	4.7895	288	5am-9pm Mon-Thu; 5am-8pm Fri
L02 PC Suite-2.18	3.8716	312	5am-9pm Mon-Thu; 5am-8pm Fri
L02 Store Cleaner-2.06	10	33.3346	5am-9pm Mon-Thu; 5am-8pm Fri
L02 WC Acc-2.04	6	35.3691	5am-9pm Mon-Thu; 5am-8pm Fri
L02 WC F-2.09	6	143.3703	5am-9pm Mon-Thu; 5am-8pm Fri
L02 WC M-2.05	6	96.8943	5am-9pm Mon-Thu; 5am-8pm Fri
L03 CCA3.13 Staffroom	3.9116	288	5am-9pm Mon-Thu; 5am-8pm Fri
L03 CCA3.13A Meeting	10.6567	288	5am-9pm Mon-Thu; 5am-8pm Fri
L03 CCA3.14 Meeting	42.6776	288	5am-9pm Mon-Thu; 5am-8pm Fri
L03 Classroom 3.15	5.9869	360	5am-9pm Mon-Thu; 5am-8pm Fri
L03 Classroom -3.16	5.8078	360	5am-9pm Mon-Thu; 5am-8pm Fri
L03 Classroom+PC-3.17	5.7988	360	5am-9pm Mon-Thu; 5am-8pm Fri
L03 Classroom-3.11	5.9963	360	5am-9pm Mon-Thu; 5am-8pm Fri
L03 Classroom-3.12	5.8926	360	5am-9pm Mon-Thu; 5am-8pm Fri
L03 Meeting 1-to-1-3.19	39.4391	288	5am-9pm Mon-Thu; 5am-8pm Fri

Room Type	Peak ventilation rate (ACH)	Peak ventilation rate (l/s)	Ventilation Profile
L03 PC Suite 3.08	4.7184	288	5am-9pm Mon-Thu; 5am-8pm Fri
L03 PC Suite-3.01	3.3792	312	5am-9pm Mon-Thu; 5am-8pm Fri
L03 PC Suite-3.02	3.4909	312	5am-9pm Mon-Thu; 5am-8pm Fri
L03 PC Suite-3.03	4.7053	288	5am-9pm Mon-Thu; 5am-8pm Fri
L03 PC Suite-3.10	4.7071	288	5am-9pm Mon-Thu; 5am-8pm Fri
L03 PC Suite-3.18	3.5738	288	5am-9pm Mon-Thu; 5am-8pm Fri
L03 Store Cleaner-3.06	10	33.3346	5am-9pm Mon-Thu; 5am-8pm Fri
L03 WC Acc-3.04	6	35.3691	5am-9pm Mon-Thu; 5am-8pm Fri
L03 WC F-3.09	6	143.3703	5am-9pm Mon-Thu; 5am-8pm Fri
L03 WC M-3.05	6	96.8943	5am-9pm Mon-Thu; 5am-8pm Fri
L04 AAT-4.01	3.3792	312	5am-9pm Mon-Thu; 5am-8pm Fri
L04 CCA-4.12 Staffroom	3.6197	288	5am-9pm Mon-Thu; 5am-8pm Fri
L04 CCA-4.12A Meeting	13.9857	288	5am-9pm Mon-Thu; 5am-8pm Fri
L04 CCA-4.13 Meeting	39.7603	288	5am-9pm Mon-Thu; 5am-8pm Fri
L04 CCA-4.16 Dry Lab	3.2375	288	5am-9pm Mon-Thu; 5am-8pm Fri
L04 CCA-4.17 Store Chem	2	16.4985	5am-9pm Mon-Thu; 5am-8pm Fri
L04 CCA-4.18 Store Chem	2	18.8115	5am-9pm Mon-Thu; 5am-8pm Fri
L04 CCA-4.19 Meeting 1-to-1	39.4391	288	5am-9pm Mon-Thu; 5am-8pm Fri
L04 Classroom CCA-4.15	5.8078	360	5am-9pm Mon-Thu; 5am-8pm Fri
L04 Lab Wet-4.03	3.1196	288	5am-9pm Mon-Thu; 5am-8pm Fri
L04 Lab Wet-4.09	3.1181	288	5am-9pm Mon-Thu; 5am-8pm Fri
L04 PC Suite-4.02	3.5407	312	5am-9pm Mon-Thu; 5am-8pm Fri
L04 PC Suite-4.10	4.7971	288	5am-9pm Mon-Thu; 5am-8pm Fri
L04 Prep-4.11	0.9821	60	5am-9pm Mon-Thu; 5am-8pm Fri
L04 Store Cleaner-4.06	10	33.3346	5am-9pm Mon-Thu; 5am-8pm Fri
L04 WC Acc-4.04	6	35.3691	5am-9pm Mon-Thu; 5am-8pm Fri
L04 WC F-4.08	6	143.3703	5am-9pm Mon-Thu; 5am-8pm Fri
L04 WC M-4.05	6	96.8943	5am-9pm Mon-Thu; 5am-8pm Fri
L04 Wet Lab 4.14	2.9942	288	5am-9pm Mon-Thu; 5am-8pm Fri

5.0 Heating and cooling

Table 11 lists environmental strategies for each space. Systems have been modelled using a simplified approach and no detailed HVAC modelling has been undertaken at this stage.

Table 11 - Heating strategy by space

Room Type	Environmental Strategy
FM Store CCA-0.23	ASHP Heating + VAV
L00 CCA 0.03 Click	VRF + VAV
L00 CCA 0.19 Hygiene	ASHP Heating + VAV
L00 CCA 0.29 Social	VRF + VAV
L00 CCA CD02 Circ	VRF + Nat Vent
L00 CCA CD03 Circ	VRF + Nat Vent
L00 CCA.0.20 Meeting	VRF + VAV
L00 CCA.0.CD04 Lobby	VRF + Nat Vent
L00 CCA.0.CD07 Circ	VRF + Nat Vent
L00 CCA.0.ST.01 Circ Stair	VRF + Nat Vent
L00 CCA.0.ST02 Circ Stair	VRF + Nat Vent
L00 CCA-0.01 Incubator Hub	VRF + VAV
L00 CCA-0.01a Meeting	VRF + VAV
L00 CCA-0.01b Meeting	VRF + VAV
L00 CCA-0.02 Store	ASHP Heating + VAV
L00 CCA-0.05 Workshop	VRF + VAV
L00 CCA-0.06 Male W/C	ASHP Heating + VAV
L00 CCA-0.07 Acc. WC	ASHP Heating + VAV
L00 CCA-0.08 Cln	ASHP Heating + VAV
L00 CCA-0.09 Female W/C	ASHP Heating + VAV
L00 CCA-0.10 Classroom	VRF + VAV
L00 CCA-0.11 PC Suite	VRF + VAV
L00 CCA-0.12 Store	ASHP Heating + VAV
L00 CCA-0.13 Kitchen CAFE	VRF + VAV
L00 CCA-0.14 Store	ASHP Heating + VAV
L00 CCA-0.15 PC Suite	VRF + VAV
L00 CCA-0.17 PC Suite	VRF + VAV
L00 CCA-0.18 FM Staff	VRF + VAV
L00 CCA-0.21 1-2-1	VRF + VAV

Room Type	Environmental Strategy
L00 CCA-0.22 Plant LV	VRF + Nat Vent
L00 CCA-0.24 Shower	ASHP Heating + VAV
L00 CCA-0.25 Shower	ASHP Heating + VAV
L00 CCA-0.26 Plant Water	VRF + Nat Vent
L00 CCA-0.27a Booth	VRF + VAV
L00 CCA-0.27b Booth	VRF + VAV
L00 CCA-0.27c Booth	VRF + VAV
L00 CCA-0.27d Booth	VRF + VAV
L00 CCA-0.27e Booth	VRF + VAV
L00 CCA-0.CD05 Circ	VRF + Nat Vent
L00 CCA-0.CD09 Circ	VRF + Nat Vent
L00 CCA-0.CD10 Lobby	VRF + Nat Vent
L00 CCA-0.CD12 Lobby	VRF + Nat Vent
L00 CCA-EX0.03 Plant Extract	VRF + Nat Vent
L00 Gaming CCA-0.16	VRF + VAV
L00 Lobby CCA-0.CD11	VRF + Nat Vent
L00 Meeting CCA-0.04	VRF + VAV
L00 Store Bin CCA-EX0.02	ASHP Heating + Extract
L01 CCA-1 CD02 Circ	VRF + Nat Vent
L01 CCA-1.01 Support Room	VRF + VAV
L01 CCA-1.02 Staff Room	VRF + VAV
L01 CCA-1.03 Exam Room	VRF + VAV
L01 CCA-1.04 Large Classroom	VRF + VAV
L01 CCA-1.22 Meeting	VRF + VAV
L01 CCA-1.CD01 Lobby	VRF + Nat Vent
L01 Circ 1.CD.04	VRF + Nat Vent
L01 Circ 1.CD.05	VRF + Nat Vent
L01 Circ 1.CD.06	VRF + Nat Vent
L01 Circ 1.CD.08	VRF + Nat Vent
L01 Circ Lobby 1.CD.03	VRF + Nat Vent
L01 Circ Lobby 1.CD.07	VRF + Nat Vent
L01 Circ Stairs 1.ST.01	VRF + Nat Vent
L01 Circ Stairs 1.ST.02	VRF + Nat Vent

Room Type	Environmental Strategy
L01 Classroom 1.06	VRF + VAV
L01 Classroom CCA 1.13	VRF + VAV
L01 Classroom CCA-1.15	VRF + VAV
L01 Classroom CCA-1.18	VRF + VAV
L01 Classroom-CCA-1.12	VRF + VAV
L01 Classroom-CCA-1.14	VRF + VAV
L01 Classroom-CCA-1.17	VRF + VAV
L01 Film Classroom CCA-1.25	VRF + VAV
L01 IT Hub 1.10	DX
L01 Meeting 1-to-1 CCA 1.21	VRF + VAV
L01 PC 1.19	VRF + VAV
L01 PC Suite 1.05	VRF + VAV
L01 PC Suite-CCA-1.20	VRF + VAV
L01 Staffroom 1.16	VRF + VAV
L01 Staffroom CCA.1.24	VRF + VAV
L01 Staffroom CCA-1.23	VRF + VAV
L01 Store Cleaner 1.09	ASHP Heating + VAV
L01 WC Acc 1.07	ASHP Heating + VAV
L01 WC F 1.11	ASHP Heating + VAV
L01 WC M 1.08	ASHP Heating + VAV
L02 CCA-2.13 Staffroom	VRF + VAV
L02 CCA-2.13A Meeting	VRF + VAV
L02 CCA-2.14 Meeting	VRF + VAV
L02 Circ Lobby-CD02	VRF + Nat Vent
L02 Circ Lobby-CD05	VRF + Nat Vent
L02 Circ Stairs-ST01	VRF + Nat Vent
L02 Circ Stairs-ST02	VRF + Nat Vent
L02 Circ-CD01	VRF + Nat Vent
L02 Circ-CD04	VRF + Nat Vent
L02 Circ-CD04	VRF + Nat Vent
L02 IT Hub-2.07	DX
L02 Meeting 1-to-1-2.19	VRF + VAV
L02 PC Suite 2.08	VRF + VAV

Room Type	Environmental Strategy
L02 PC Suite 2.11	VRF + VAV
L02 PC Suite 2.12	VRF + VAV
L02 PC Suite 2.16	VRF + VAV
L02 PC Suite 2.17	VRF + VAV
L02 PC Suite-2.01	VRF + VAV
L02 PC Suite-2.02	VRF + VAV
L02 PC Suite-2.03	VRF + VAV
L02 PC Suite-2.10	VRF + VAV
L02 PC Suite-2.15	VRF + VAV
L02 PC Suite-2.18	VRF + VAV
L02 Store Cleaner-2.06	ASHP Heating + VAV
L02 WC Acc-2.04	ASHP Heating + VAV
L02 WC F-2.09	ASHP Heating + VAV
L02 WC M-2.05	ASHP Heating + VAV
L03 CCA3.13 Staffroom	VRF + VAV
L03 CCA3.13A Meeting	VRF + VAV
L03 CCA3.14 Meeting	VRF + VAV
L03 Circ Lobby-CD01	VRF + Nat Vent
L03 Circ Lobby-CD05	VRF + Nat Vent
L03 Circ Stairs-ST01	VRF + Nat Vent
L03 Circ Stairs-ST02	VRF + Nat Vent
L03 Circ-CD02	VRF + Nat Vent
L03 Circ-CD03	VRF + Nat Vent
L03 Circ-CD04	VRF + Nat Vent
L03 Classroom 3.15	VRF + VAV
L03 Classroom -3.16	VRF + VAV
L03 Classroom+PC-3.17	VRF + VAV
L03 Classroom-3.11	VRF + VAV
L03 Classroom-3.12	VRF + VAV
L03 IT Hub-3.07	DX
L03 Meeting 1-to-1-3.19	VRF + VAV
L03 PC Suite 3.08	VRF + VAV
L03 PC Suite-3.01	VRF + VAV

Room Type	Environmental Strategy
L03 PC Suite-3.02	VRF + VAV
L03 PC Suite-3.03	VRF + VAV
L03 PC Suite-3.10	VRF + VAV
L03 PC Suite-3.18	VRF + VAV
L03 Store Cleaner-3.06	ASHP Heating + VAV
L03 WC Acc-3.04	ASHP Heating + VAV
L03 WC F-3.09	ASHP Heating + VAV
L03 WC M-3.05	ASHP Heating + VAV
L04 AAT-4.01	VRF + VAV
L04 CCA.4.ST02 Circ Stairs	VRF + Nat Vent
L04 CCA-4.12 Staffroom	VRF + VAV
L04 CCA-4.12A Meeting	VRF + VAV
L04 CCA-4.13 Meeting	VRF + VAV
L04 CCA-4.16 Dry Lab	VRF + VAV
L04 CCA-4.17 Store Chem	ASHP Heating + VAV
L04 CCA-4.18 Store Chem	ASHP Heating + VAV
L04 CCA-4.19 Meeting 1-to-1	VRF + VAV
L04 CCA-4.CD05 Circ Lobby	VRF + Nat Vent
L04 Circ CCA-4.CD04	VRF + Nat Vent
L04 Circ Lobby-CD01	VRF + Nat Vent
L04 Circ Stairs-ST01	VRF + Nat Vent
L04 Circ-CD02	VRF + Nat Vent
L04 Circ-CD03	VRF + Nat Vent
L04 Classroom CCA-4.15	VRF + VAV
L04 IT Hub-4.07	DX
L04 Lab Wet-4.03	VRF + VAV
L04 Lab Wet-4.09	VRF + VAV
L04 PC Suite-4.02	VRF + VAV
L04 PC Suite-4.10	VRF + VAV
L04 Prep-4.11	VRF + VAV
L04 Store Cleaner-4.06	ASHP Heating + VAV
L04 WC Acc-4.04	ASHP Heating + VAV
L04 WC F-4.08	ASHP Heating + VAV

Room Type	Environmental Strategy
L04 WC M-4.05	ASHP Heating + VAV
L04 Wet Lab 4.14	VRF + VAV
L05 CCA.5.ST01 Circ Stairs	VRF + Nat Vent

5.1 Space heating: setpoints, controls, generation, and distribution (Step 11)

Table 12 lists the rooms heating setpoints and operational profiles.

Heating profiles are longer than the operational hours of the building, to account for early arrivals and morning cleaning.

Table 12 - Heating setpoints and profiles

Room Type	Heating set-point (°C)	Heating Profile
FM Store CCA-0.23	19	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA 0.03 Click	19	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA 0.19 Hygiene	19	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA 0.29 Social	19	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA CD02 Circ	19	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA CD03 Circ	19	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA.0.20 Meeting	22	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA.0.CD.08 Lockers	21	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA.0.CD04 Lobby	21	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA.0.CD07 Circ	21	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA.0.ST.01 Circ Stair	21	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA.0.ST02 Circ Stair	21	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA-0.01 Incubator Hub	19	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA-0.01a Meeting	19	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA-0.01b Meeting	19	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA-0.02 Store	19	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA-0.05 Workshop	19	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA-0.06 Male W/C	21	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA-0.07 Acc. WC	19	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA-0.08 Cln	19	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA-0.09 Female W/C	21	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA-0.10 Classroom	21	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA-0.11 PC Suite	19	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA-0.12 Store	19	5am-9pm Mon-Thu; 5am-8pm Fri

Room Type	Heating set-point (°C)	Heating Profile
L00 CCA-0.13 Kitchen CAFE	19	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA-0.14 Store	19	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA-0.15 PC Suite	19	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA-0.17 PC Suite	19	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA-0.18 FM Staff	19	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA-0.21 1-2-1	19	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA-0.22 Plant LV	21	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA-0.24 Shower	19	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA-0.25 Shower	19	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA-0.26 Plant Water	21	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA-0.27a Booth	19	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA-0.27b Booth	19	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA-0.27c Booth	19	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA-0.27d Booth	19	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA-0.27e Booth	19	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA-0.CD05 Circ	19	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA-0.CD08 Lockers	19	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA-0.CD09 Circ	19	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA-0.CD10 Lobby	19	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA-0.CD12 Lobby	19	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA-EX0.01 Bike Store	19	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA-EX0.03 Plant Extract	21	5am-9pm Mon-Thu; 5am-8pm Fri
L00 Gaming CCA-0.16	21	5am-9pm Mon-Thu; 5am-8pm Fri
L00 Lobby CCA-0.CD11	19	5am-9pm Mon-Thu; 5am-8pm Fri
L00 Meeting CCA-0.04	19	5am-9pm Mon-Thu; 5am-8pm Fri
L00 Store Bin CCA-EX0.02	21	5am-9pm Mon-Thu; 5am-8pm Fri
L01 CCA-1 CD02 Circ	19	5am-9pm Mon-Thu; 5am-8pm Fri
L01 CCA-1.01 Support Room	21	5am-9pm Mon-Thu; 5am-8pm Fri
L01 CCA-1.02 Staff Room	19	5am-9pm Mon-Thu; 5am-8pm Fri
L01 CCA-1.03 Exam Room	21	5am-9pm Mon-Thu; 5am-8pm Fri
L01 CCA-1.04 Large Classroom	21	5am-9pm Mon-Thu; 5am-8pm Fri
L01 CCA-1.22 Meeting	19	5am-9pm Mon-Thu; 5am-8pm Fri
L01 CCA-1.CD01 Lobby	19	5am-9pm Mon-Thu; 5am-8pm Fri

Room Type	Heating set-point (°C)	Heating Profile
L01 CCA-1.RS05 Syph	19	5am-9pm Mon-Thu; 5am-8pm Fri
L01 Circ 1.CD.04	21	5am-9pm Mon-Thu; 5am-8pm Fri
L01 Circ 1.CD.05	21	5am-9pm Mon-Thu; 5am-8pm Fri
L01 Circ 1.CD.06	21	5am-9pm Mon-Thu; 5am-8pm Fri
L01 Circ 1.CD.08	21	5am-9pm Mon-Thu; 5am-8pm Fri
L01 Circ Lobby 1.CD.03	21	5am-9pm Mon-Thu; 5am-8pm Fri
L01 Circ Lobby 1.CD.07	21	5am-9pm Mon-Thu; 5am-8pm Fri
L01 Circ Stairs 1.ST.01	21	5am-9pm Mon-Thu; 5am-8pm Fri
L01 Circ Stairs 1.ST.02	21	5am-9pm Mon-Thu; 5am-8pm Fri
L01 Classroom 1.06	21	5am-9pm Mon-Thu; 5am-8pm Fri
L01 Classroom CCA 1.13	21	5am-9pm Mon-Thu; 5am-8pm Fri
L01 Classroom CCA-1.15	21	5am-9pm Mon-Thu; 5am-8pm Fri
L01 Classroom CCA-1.18	21	5am-9pm Mon-Thu; 5am-8pm Fri
L01 Classroom-CCA-1.12	21	5am-9pm Mon-Thu; 5am-8pm Fri
L01 Classroom-CCA-1.14	21	5am-9pm Mon-Thu; 5am-8pm Fri
L01 Classroom-CCA-1.17	21	5am-9pm Mon-Thu; 5am-8pm Fri
L01 Film Classroom CCA-1.25	21	5am-9pm Mon-Thu; 5am-8pm Fri
L01 IT Hub 1.10	21	on continuously
L01 Meeting 1-to-1 CCA 1.21	22	5am-9pm Mon-Thu; 5am-8pm Fri
L01 PC 1.19	19	5am-9pm Mon-Thu; 5am-8pm Fri
L01 PC Suite 1.05	21	5am-9pm Mon-Thu; 5am-8pm Fri
L01 PC Suite-CCA-1.20	21	5am-9pm Mon-Thu; 5am-8pm Fri
L01 Staffroom 1.16	19	5am-9pm Mon-Thu; 5am-8pm Fri
L01 Staffroom CCA.1.24	19	5am-9pm Mon-Thu; 5am-8pm Fri
L01 Staffroom CCA-1.23	19	5am-9pm Mon-Thu; 5am-8pm Fri
L01 Store Cleaner 1.09	21	5am-9pm Mon-Thu; 5am-8pm Fri
L01 WC Acc 1.07	21	5am-9pm Mon-Thu; 5am-8pm Fri
L01 WC F 1.11	21	5am-9pm Mon-Thu; 5am-8pm Fri
L01 WC M 1.08	21	5am-9pm Mon-Thu; 5am-8pm Fri
L02 CCA-2 RS03 Riser 03	19	5am-9pm Mon-Thu; 5am-8pm Fri
L02 CCA-2.13 Staffroom	19	5am-9pm Mon-Thu; 5am-8pm Fri
L02 CCA-2.13A Meeting	19	5am-9pm Mon-Thu; 5am-8pm Fri
L02 CCA-2.14 Meeting	19	5am-9pm Mon-Thu; 5am-8pm Fri

Room Type	Heating set-point (°C)	Heating Profile
L02 Circ Lobby-CD02	21	5am-9pm Mon-Thu; 5am-8pm Fri
L02 Circ Lobby-CD05	21	5am-9pm Mon-Thu; 5am-8pm Fri
L02 Circ Stairs-ST01	21	5am-9pm Mon-Thu; 5am-8pm Fri
L02 Circ Stairs-ST02	21	5am-9pm Mon-Thu; 5am-8pm Fri
L02 Circ-CD01	21	5am-9pm Mon-Thu; 5am-8pm Fri
L02 Circ-CD04	21	5am-9pm Mon-Thu; 5am-8pm Fri
L02 Circ-CD04	21	5am-9pm Mon-Thu; 5am-8pm Fri
L02 IT Hub-2.07	21	on continuously
L02 Meeting 1-to-1-2.19	22	5am-9pm Mon-Thu; 5am-8pm Fri
L02 PC Suite 2.08	19	5am-9pm Mon-Thu; 5am-8pm Fri
L02 PC Suite 2.11	19	5am-9pm Mon-Thu; 5am-8pm Fri
L02 PC Suite 2.12	19	5am-9pm Mon-Thu; 5am-8pm Fri
L02 PC Suite 2.16	19	5am-9pm Mon-Thu; 5am-8pm Fri
L02 PC Suite 2.17	19	5am-9pm Mon-Thu; 5am-8pm Fri
L02 PC Suite-2.01	21	5am-9pm Mon-Thu; 5am-8pm Fri
L02 PC Suite-2.02	21	5am-9pm Mon-Thu; 5am-8pm Fri
L02 PC Suite-2.03	21	5am-9pm Mon-Thu; 5am-8pm Fri
L02 PC Suite-2.10	21	5am-9pm Mon-Thu; 5am-8pm Fri
L02 PC Suite-2.15	21	5am-9pm Mon-Thu; 5am-8pm Fri
L02 PC Suite-2.18	21	5am-9pm Mon-Thu; 5am-8pm Fri
L02 Store Cleaner-2.06	21	5am-9pm Mon-Thu; 5am-8pm Fri
L02 WC Acc-2.04	21	5am-9pm Mon-Thu; 5am-8pm Fri
L02 WC F-2.09	21	5am-9pm Mon-Thu; 5am-8pm Fri
L02 WC M-2.05	21	5am-9pm Mon-Thu; 5am-8pm Fri
L03 CCA3.13 Staffroom	19	5am-9pm Mon-Thu; 5am-8pm Fri
L03 CCA3.13A Meeting	19	5am-9pm Mon-Thu; 5am-8pm Fri
L03 CCA3.14 Meeting	19	5am-9pm Mon-Thu; 5am-8pm Fri
L03 CCA3.RS01 Riser	19	5am-9pm Mon-Thu; 5am-8pm Fri
L03 Circ Lobby-CD01	21	5am-9pm Mon-Thu; 5am-8pm Fri
L03 Circ Lobby-CD05	21	5am-9pm Mon-Thu; 5am-8pm Fri
L03 Circ Stairs-ST01	21	5am-9pm Mon-Thu; 5am-8pm Fri
L03 Circ Stairs-ST02	21	5am-9pm Mon-Thu; 5am-8pm Fri
L03 Circ-CD02	21	5am-9pm Mon-Thu; 5am-8pm Fri

Room Type	Heating set-point (°C)	Heating Profile
L03 Circ-CD03	21	5am-9pm Mon-Thu; 5am-8pm Fri
L03 Circ-CD04	21	5am-9pm Mon-Thu; 5am-8pm Fri
L03 Classroom 3.15	21	5am-9pm Mon-Thu; 5am-8pm Fri
L03 Classroom -3.16	21	5am-9pm Mon-Thu; 5am-8pm Fri
L03 Classroom+PC-3.17	21	5am-9pm Mon-Thu; 5am-8pm Fri
L03 Classroom-3.11	21	5am-9pm Mon-Thu; 5am-8pm Fri
L03 Classroom-3.12	21	5am-9pm Mon-Thu; 5am-8pm Fri
L03 IT Hub-3.07	21	on continuously
L03 Meeting 1-to-1-3.19	22	5am-9pm Mon-Thu; 5am-8pm Fri
L03 PC Suite 3.08	19	5am-9pm Mon-Thu; 5am-8pm Fri
L03 PC Suite-3.01	21	5am-9pm Mon-Thu; 5am-8pm Fri
L03 PC Suite-3.02	21	5am-9pm Mon-Thu; 5am-8pm Fri
L03 PC Suite-3.03	21	5am-9pm Mon-Thu; 5am-8pm Fri
L03 PC Suite-3.10	21	5am-9pm Mon-Thu; 5am-8pm Fri
L03 PC Suite-3.18	21	5am-9pm Mon-Thu; 5am-8pm Fri
L03 Store Cleaner-3.06	21	5am-9pm Mon-Thu; 5am-8pm Fri
L03 WC Acc-3.04	21	5am-9pm Mon-Thu; 5am-8pm Fri
L03 WC F-3.09	21	5am-9pm Mon-Thu; 5am-8pm Fri
L03 WC M-3.05	21	5am-9pm Mon-Thu; 5am-8pm Fri
L04 AAT-4.01	21	5am-9pm Mon-Thu; 5am-8pm Fri
L04 CCA.4.ST02 Circ Stairs	21	5am-9pm Mon-Thu; 5am-8pm Fri
L04 CCA-4 RS01 Riser 1	19	5am-9pm Mon-Thu; 5am-8pm Fri
L04 CCA-4.12 Staffroom	19	5am-9pm Mon-Thu; 5am-8pm Fri
L04 CCA-4.12A Meeting	19	5am-9pm Mon-Thu; 5am-8pm Fri
L04 CCA-4.13 Meeting	19	5am-9pm Mon-Thu; 5am-8pm Fri
L04 CCA-4.16 Dry Lab	19	5am-9pm Mon-Thu; 5am-8pm Fri
L04 CCA-4.17 Store Chem	21	5am-9pm Mon-Thu; 5am-8pm Fri
L04 CCA-4.18 Store Chem	21	5am-9pm Mon-Thu; 5am-8pm Fri
L04 CCA-4.19 Meeting 1-to-1	22	5am-9pm Mon-Thu; 5am-8pm Fri
L04 CCA-4.CD05 Circ Lobby	21	5am-9pm Mon-Thu; 5am-8pm Fri
L04 Circ CCA-4.CD04	21	5am-9pm Mon-Thu; 5am-8pm Fri
L04 Circ Lobby-CD01	21	5am-9pm Mon-Thu; 5am-8pm Fri
L04 Circ Stairs-ST01	21	5am-9pm Mon-Thu; 5am-8pm Fri

Room Type	Heating set-point (°C)	Heating Profile
L04 Circ-CD02	21	5am-9pm Mon-Thu; 5am-8pm Fri
L04 Circ-CD03	21	5am-9pm Mon-Thu; 5am-8pm Fri
L04 Classroom CCA-4.15	21	5am-9pm Mon-Thu; 5am-8pm Fri
L04 IT Hub-4.07	21	on continuously
L04 Lab Wet-4.03	21	5am-9pm Mon-Thu; 5am-8pm Fri
L04 Lab Wet-4.09	21	5am-9pm Mon-Thu; 5am-8pm Fri
L04 PC Suite-4.02	21	5am-9pm Mon-Thu; 5am-8pm Fri
L04 PC Suite-4.10	19	5am-9pm Mon-Thu; 5am-8pm Fri
L04 Prep-4.11	21	5am-9pm Mon-Thu; 5am-8pm Fri
L04 Store Cleaner-4.06	21	5am-9pm Mon-Thu; 5am-8pm Fri
L04 WC Acc-4.04	21	5am-9pm Mon-Thu; 5am-8pm Fri
L04 WC F-4.08	21	5am-9pm Mon-Thu; 5am-8pm Fri
L04 WC M-4.05	21	5am-9pm Mon-Thu; 5am-8pm Fri
L04 Wet Lab 4.14	19	5am-9pm Mon-Thu; 5am-8pm Fri
L05 CCA.5.ST01 Circ Stairs	21	5am-9pm Mon-Thu; 5am-8pm Fri

5.2 Domestic hot water: expected usage, profile, controls, generation, and distribution (Step 9, or within Step 11)'

Domestic Hot Water consumption has been estimated according to TM54 methodology, and CIBSE Guide G has been used as reference to estimate the domestic hot water consumption. 15l/person/day has been assumed at this stage, based on CIBSE Guide G benchmarksⁱⁱ for a day college. This translates to 1l/person/hour.

5% delivery losses are estimated for the domestic hot water provision. This will be clarified in the next iteration of the model.

ⁱⁱ CIBSE Guide G, Table 2.11: Daily Hot Water Demands.

5.3 Space cooling: setpoints, controls, generation, and distribution (Step 11)

Space cooling has been considered in the spaces listed in Table 13, according to the mechanical design.

Cooling profiles are longer than the operational hours of the building, to account for early arrivals and morning cleaning.

Table 13 - Cooling setpoints and profiles

Room Type	Cooling set-point (°C)	Cooling Profile
L00 CCA 0.03 Click	21	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA 0.29 Social	21	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA.0.20 Meeting	23	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA.0.CD.08 Lockers	23	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA-0.01 Incubator Hub	21	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA-0.01a Meeting	21	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA-0.01b Meeting	21	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA-0.05 Workshop	23	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA-0.10 Classroom	23	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA-0.11 PC Suite	21	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA-0.13 Kitchen CAFE	21	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA-0.15 PC Suite	21	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA-0.17 PC Suite	23	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA-0.18 FM Staff	21	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA-0.21 1-2-1	21	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA-0.27a Booth	23	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA-0.27b Booth	23	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA-0.27c Booth	23	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA-0.27d Booth	23	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA-0.27e Booth	23	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA-EX0.01 Bike Store	21	5am-9pm Mon-Thu; 5am-8pm Fri
L00 Gaming CCA-0.16	23	5am-9pm Mon-Thu; 5am-8pm Fri
L00 Meeting CCA-0.04	21	5am-9pm Mon-Thu; 5am-8pm Fri
L01 CCA-1.01 Support Room	23	5am-9pm Mon-Thu; 5am-8pm Fri
L01 CCA-1.02 Staff Room	21	5am-9pm Mon-Thu; 5am-8pm Fri
L01 CCA-1.03 Exam Room	23	5am-9pm Mon-Thu; 5am-8pm Fri
L01 CCA-1.04 Large Classroom	23	5am-9pm Mon-Thu; 5am-8pm Fri
L01 CCA-1.22 Meeting	21	5am-9pm Mon-Thu; 5am-8pm Fri

Room Type	Cooling set-point (°C)	Cooling Profile
L01 Classroom 1.06	23	5am-9pm Mon-Thu; 5am-8pm Fri
L01 Classroom CCA 1.13	23	5am-9pm Mon-Thu; 5am-8pm Fri
L01 Classroom CCA-1.15	23	5am-9pm Mon-Thu; 5am-8pm Fri
L01 Classroom CCA-1.18	23	5am-9pm Mon-Thu; 5am-8pm Fri
L01 Classroom-CCA-1.12	23	5am-9pm Mon-Thu; 5am-8pm Fri
L01 Classroom-CCA-1.14	23	5am-9pm Mon-Thu; 5am-8pm Fri
L01 Classroom-CCA-1.17	23	5am-9pm Mon-Thu; 5am-8pm Fri
L01 Film Classroom CCA-1.25	23	5am-9pm Mon-Thu; 5am-8pm Fri
L01 IT Hub 1.10	23	5am-9pm Mon-Thu; 5am-8pm Fri
L01 Meeting 1-to-1 CCA 1.21	23	5am-9pm Mon-Thu; 5am-8pm Fri
L01 PC 1.19	21	5am-9pm Mon-Thu; 5am-8pm Fri
L01 PC Suite 1.05	23	5am-9pm Mon-Thu; 5am-8pm Fri
L01 PC Suite-CCA-1.20	23	5am-9pm Mon-Thu; 5am-8pm Fri
L01 Staffroom 1.16	21	5am-9pm Mon-Thu; 5am-8pm Fri
L01 Staffroom CCA.1.24	21	5am-9pm Mon-Thu; 5am-8pm Fri
L01 Staffroom CCA-1.23	21	5am-9pm Mon-Thu; 5am-8pm Fri
L02 CCA-2.13 Staffroom	21	5am-9pm Mon-Thu; 5am-8pm Fri
L02 CCA-2.13A Meeting	21	5am-9pm Mon-Thu; 5am-8pm Fri
L02 CCA-2.14 Meeting	21	5am-9pm Mon-Thu; 5am-8pm Fri
L02 IT Hub-2.07	23	5am-9pm Mon-Thu; 5am-8pm Fri
L02 Meeting 1-to-1-2.19	23	5am-9pm Mon-Thu; 5am-8pm Fri
L02 PC Suite 2.08	21	5am-9pm Mon-Thu; 5am-8pm Fri
L02 PC Suite 2.11	21	5am-9pm Mon-Thu; 5am-8pm Fri
L02 PC Suite 2.12	21	5am-9pm Mon-Thu; 5am-8pm Fri
L02 PC Suite 2.16	21	5am-9pm Mon-Thu; 5am-8pm Fri
L02 PC Suite 2.17	21	5am-9pm Mon-Thu; 5am-8pm Fri
L02 PC Suite-2.01	23	5am-9pm Mon-Thu; 5am-8pm Fri
L02 PC Suite-2.02	23	5am-9pm Mon-Thu; 5am-8pm Fri
L02 PC Suite-2.03	23	5am-9pm Mon-Thu; 5am-8pm Fri
L02 PC Suite-2.10	23	5am-9pm Mon-Thu; 5am-8pm Fri
L02 PC Suite-2.15	23	5am-9pm Mon-Thu; 5am-8pm Fri
L02 PC Suite-2.18	23	5am-9pm Mon-Thu; 5am-8pm Fri
L03 CCA3.13 Staffroom	21	5am-9pm Mon-Thu; 5am-8pm Fri

Room Type	Cooling set-point (°C)	Cooling Profile
L03 CCA3.13A Meeting	21	5am-9pm Mon-Thu; 5am-8pm Fri
L03 CCA3.14 Meeting	21	5am-9pm Mon-Thu; 5am-8pm Fri
L03 Classroom 3.15	23	5am-9pm Mon-Thu; 5am-8pm Fri
L03 Classroom -3.16	23	5am-9pm Mon-Thu; 5am-8pm Fri
L03 Classroom+PC-3.17	23	5am-9pm Mon-Thu; 5am-8pm Fri
L03 Classroom-3.11	23	5am-9pm Mon-Thu; 5am-8pm Fri
L03 Classroom-3.12	23	5am-9pm Mon-Thu; 5am-8pm Fri
L03 IT Hub-3.07	23	5am-9pm Mon-Thu; 5am-8pm Fri
L03 Meeting 1-to-1-3.19	23	5am-9pm Mon-Thu; 5am-8pm Fri
L03 PC Suite 3.08	21	5am-9pm Mon-Thu; 5am-8pm Fri
L03 PC Suite-3.01	23	5am-9pm Mon-Thu; 5am-8pm Fri
L03 PC Suite-3.02	23	5am-9pm Mon-Thu; 5am-8pm Fri
L03 PC Suite-3.03	23	5am-9pm Mon-Thu; 5am-8pm Fri
L03 PC Suite-3.10	23	5am-9pm Mon-Thu; 5am-8pm Fri
L03 PC Suite-3.18	23	5am-9pm Mon-Thu; 5am-8pm Fri
L04 AAT-4.01	23	5am-9pm Mon-Thu; 5am-8pm Fri
L04 CCA-4.12 Staffroom	21	5am-9pm Mon-Thu; 5am-8pm Fri
L04 CCA-4.12A Meeting	21	5am-9pm Mon-Thu; 5am-8pm Fri
L04 CCA-4.13 Meeting	21	5am-9pm Mon-Thu; 5am-8pm Fri
L04 CCA-4.16 Dry Lab	21	5am-9pm Mon-Thu; 5am-8pm Fri
L04 CCA-4.19 Meeting 1-to-1	23	5am-9pm Mon-Thu; 5am-8pm Fri
L04 Classroom CCA-4.15	23	5am-9pm Mon-Thu; 5am-8pm Fri
L04 IT Hub-4.07	23	5am-9pm Mon-Thu; 5am-8pm Fri
L04 Lab Wet-4.03	23	5am-9pm Mon-Thu; 5am-8pm Fri
L04 Lab Wet-4.09	23	5am-9pm Mon-Thu; 5am-8pm Fri
L04 PC Suite-4.02	23	5am-9pm Mon-Thu; 5am-8pm Fri
L04 PC Suite-4.10	21	5am-9pm Mon-Thu; 5am-8pm Fri
L04 Prep-4.11	23	5am-9pm Mon-Thu; 5am-8pm Fri
L04 Wet Lab 4.14	21	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA 0.03 Click	21	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA 0.29 Social	21	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA.0.20 Meeting	23	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA.0.CD.08 Lockers	23	5am-9pm Mon-Thu; 5am-8pm Fri

Room Type	Cooling set-point (°C)	Cooling Profile
L00 CCA-0.01 Incubator Hub	21	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA-0.01a Meeting	21	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA-0.01b Meeting	21	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA-0.05 Workshop	23	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA-0.10 Classroom	23	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA-0.11 PC Suite	21	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA-0.13 Kitchen CAFE	21	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA-0.15 PC Suite	21	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA-0.17 PC Suite	23	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA-0.18 FM Staff	21	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA-0.21 1-2-1	21	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA-0.27a Booth	23	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA-0.27b Booth	23	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA-0.27c Booth	23	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA-0.27d Booth	23	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA-0.27e Booth	23	5am-9pm Mon-Thu; 5am-8pm Fri
L00 CCA-EX0.01 Bike Store	21	5am-9pm Mon-Thu; 5am-8pm Fri
L00 Gaming CCA-0.16	23	5am-9pm Mon-Thu; 5am-8pm Fri
L00 Meeting CCA-0.04	21	5am-9pm Mon-Thu; 5am-8pm Fri
L01 CCA-1.01 Support Room	23	5am-9pm Mon-Thu; 5am-8pm Fri
L01 CCA-1.02 Staff Room	21	5am-9pm Mon-Thu; 5am-8pm Fri
L01 CCA-1.03 Exam Room	23	5am-9pm Mon-Thu; 5am-8pm Fri
L01 CCA-1.04 Large Classroom	23	5am-9pm Mon-Thu; 5am-8pm Fri
L01 CCA-1.22 Meeting	21	5am-9pm Mon-Thu; 5am-8pm Fri
L01 Classroom 1.06	23	5am-9pm Mon-Thu; 5am-8pm Fri
L01 Classroom CCA 1.13	23	5am-9pm Mon-Thu; 5am-8pm Fri
L01 Classroom CCA-1.15	23	5am-9pm Mon-Thu; 5am-8pm Fri
L01 Classroom CCA-1.18	23	5am-9pm Mon-Thu; 5am-8pm Fri
L01 Classroom-CCA-1.12	23	5am-9pm Mon-Thu; 5am-8pm Fri
L01 Classroom-CCA-1.14	23	5am-9pm Mon-Thu; 5am-8pm Fri
L01 Classroom-CCA-1.17	23	5am-9pm Mon-Thu; 5am-8pm Fri
L01 Film Classroom CCA-1.25	23	5am-9pm Mon-Thu; 5am-8pm Fri
L01 IT Hub 1.10	23	5am-9pm Mon-Thu; 5am-8pm Fri

Room Type	Cooling set-point (°C)	Cooling Profile
L01 Meeting 1-to-1 CCA 1.21	23	5am-9pm Mon-Thu; 5am-8pm Fri
L01 PC 1.19	21	5am-9pm Mon-Thu; 5am-8pm Fri
L01 PC Suite 1.05	23	5am-9pm Mon-Thu; 5am-8pm Fri
L01 PC Suite-CCA-1.20	23	5am-9pm Mon-Thu; 5am-8pm Fri
L01 Staffroom 1.16	21	5am-9pm Mon-Thu; 5am-8pm Fri
L01 Staffroom CCA.1.24	21	5am-9pm Mon-Thu; 5am-8pm Fri
L01 Staffroom CCA-1.23	21	5am-9pm Mon-Thu; 5am-8pm Fri
L02 CCA-2.13 Staffroom	21	5am-9pm Mon-Thu; 5am-8pm Fri
L02 CCA-2.13A Meeting	21	5am-9pm Mon-Thu; 5am-8pm Fri
L02 CCA-2.14 Meeting	21	5am-9pm Mon-Thu; 5am-8pm Fri
L02 IT Hub-2.07	23	5am-9pm Mon-Thu; 5am-8pm Fri
L02 Meeting 1-to-1-2.19	23	5am-9pm Mon-Thu; 5am-8pm Fri
L02 PC Suite 2.08	21	5am-9pm Mon-Thu; 5am-8pm Fri
L02 PC Suite 2.11	21	5am-9pm Mon-Thu; 5am-8pm Fri
L02 PC Suite 2.12	21	5am-9pm Mon-Thu; 5am-8pm Fri
L02 PC Suite 2.16	21	5am-9pm Mon-Thu; 5am-8pm Fri
L02 PC Suite 2.17	21	5am-9pm Mon-Thu; 5am-8pm Fri
L02 PC Suite-2.01	23	5am-9pm Mon-Thu; 5am-8pm Fri
L02 PC Suite-2.02	23	5am-9pm Mon-Thu; 5am-8pm Fri
L02 PC Suite-2.03	23	5am-9pm Mon-Thu; 5am-8pm Fri
L02 PC Suite-2.10	23	5am-9pm Mon-Thu; 5am-8pm Fri
L02 PC Suite-2.15	23	5am-9pm Mon-Thu; 5am-8pm Fri
L02 PC Suite-2.18	23	5am-9pm Mon-Thu; 5am-8pm Fri
L03 CCA3.13 Staffroom	21	5am-9pm Mon-Thu; 5am-8pm Fri
L03 CCA3.13A Meeting	21	5am-9pm Mon-Thu; 5am-8pm Fri
L03 CCA3.14 Meeting	21	5am-9pm Mon-Thu; 5am-8pm Fri
L03 Classroom 3.15	23	5am-9pm Mon-Thu; 5am-8pm Fri
L03 Classroom -3.16	23	5am-9pm Mon-Thu; 5am-8pm Fri
L03 Classroom+PC-3.17	23	5am-9pm Mon-Thu; 5am-8pm Fri
L03 Classroom-3.11	23	5am-9pm Mon-Thu; 5am-8pm Fri
L03 Classroom-3.12	23	5am-9pm Mon-Thu; 5am-8pm Fri
L03 IT Hub-3.07	23	5am-9pm Mon-Thu; 5am-8pm Fri
L03 Meeting 1-to-1-3.19	23	5am-9pm Mon-Thu; 5am-8pm Fri

Room Type	Cooling set-point (°C)	Cooling Profile
L03 PC Suite 3.08	21	5am-9pm Mon-Thu; 5am-8pm Fri
L03 PC Suite-3.01	23	5am-9pm Mon-Thu; 5am-8pm Fri
L03 PC Suite-3.02	23	5am-9pm Mon-Thu; 5am-8pm Fri
L03 PC Suite-3.03	23	5am-9pm Mon-Thu; 5am-8pm Fri
L03 PC Suite-3.10	23	5am-9pm Mon-Thu; 5am-8pm Fri
L03 PC Suite-3.18	23	5am-9pm Mon-Thu; 5am-8pm Fri
L04 AAT-4.01	23	5am-9pm Mon-Thu; 5am-8pm Fri
L04 CCA-4.12 Staffroom	21	5am-9pm Mon-Thu; 5am-8pm Fri
L04 CCA-4.12A Meeting	21	5am-9pm Mon-Thu; 5am-8pm Fri
L04 CCA-4.13 Meeting	21	5am-9pm Mon-Thu; 5am-8pm Fri
L04 CCA-4.16 Dry Lab	21	5am-9pm Mon-Thu; 5am-8pm Fri
L04 CCA-4.19 Meeting 1-to-1	23	5am-9pm Mon-Thu; 5am-8pm Fri
L04 Classroom CCA-4.15	23	5am-9pm Mon-Thu; 5am-8pm Fri
L04 IT Hub-4.07	23	5am-9pm Mon-Thu; 5am-8pm Fri
L04 Lab Wet-4.03	23	5am-9pm Mon-Thu; 5am-8pm Fri
L04 Lab Wet-4.09	23	5am-9pm Mon-Thu; 5am-8pm Fri
L04 PC Suite-4.02	23	5am-9pm Mon-Thu; 5am-8pm Fri
L04 PC Suite-4.10	21	5am-9pm Mon-Thu; 5am-8pm Fri
L04 Prep-4.11	23	5am-9pm Mon-Thu; 5am-8pm Fri
L04 Wet Lab 4.14	21	5am-9pm Mon-Thu; 5am-8pm Fri

6.0 Other energy uses (not contributing to internal gains)

6.1 External lighting (Step 3)

Energy consumption for external lighting has been derived from external lighting drawings is reported in Table 14.

Table 14 - External lighting energy calculation

Lighting type	Total installed power (W)	Hours of utilisation (h)	Total Energy consumption (kWh)
External lighting	315	5824	1835
			0.29 (kWh/m ² /year)

7.0 Management considerations and operational risks (Step 12)

Generally, energy calculations and modelling typically assume a well-managed building, with systems being well maintained, energy saving features being applied, and the energy use being monitored and managed. However, this represents a very high uncertainty and can lead to a consistent increase of the energy used within the building.

Management scenarios have been assumed based on answers provided by the team during the energy design workshop. The resulting best, mid-range, and worst-case energy consumption scenarios are then developed. The more management strategies are adopted, the smaller the difference between best and mid-range (actual) scenarios.

Previous versions of TM54 awarded points based on management answers. This has since been withdrawn in the 2022 revision of TM54 in favour of more scenario testing. Nonetheless, management considerations remain an important parameter in operational energy analyses.

Table 15 - Energy workshop questionnaire answers

Issue	Question	Design Team Answer
Energy use	Will the operator be incentivised to reduce energy use?	No
Energy saving responsible	Will there be anyone responsible for employing energy saving measures (e.g., switching off unnecessary lights during the day or turning off equipment at night, etc.)?	No
Maintenance programme	Will the building be maintained regularly through a planned preventive maintenance programme?	Yes
Sub-meters	Will there be properly commissioned sub-meters to help to identify where energy is being used?	Yes
Automatic metering reading	Will automatic meter reading (AMR) be installed?	Yes
Building energy management software	Will there be a building energy management software provided as part of the BMS to enable the building manager to monitor energy use and target energy saving measures?	Yes
Energy targets/budgets	Will energy targets /budgets be set and monitored monthly?	Yes
Energy management budget	Is there a budget for energy management?	Yes

8.0 Sensitivity analysis (Step 13)

Figure 6 shows the sensitivity analysis that has been undertaken to test the impact of the variation of some variables on the energy use breakdown within the building. The variables that have been considered are:

- Design Summer Year – DSY 1, the third warmest summer out of a sample of twenty years
- Automatic lighting controls removed
- Increased ventilation rate, to 12l/person/second
- Assumed full annual occupancy, with no occupant diversity in the summer
- New for P03 of this report, 48% utilisation based on the VE schedule

There is little difference between the Test Reference Year and the Design Summer year. Since the building is less occupied in the summer, increased solar gain is balanced by reduced internal gain.

The biggest overall energy demand is small power, followed by lighting. The variables that are deemed to be the most sensitive are the occupancy and the lighting controls; the former because occupancy determines equipment demand and the latter because tight controls have a significant effect on lighting. Introducing 48% utilisation reduces overall energy consumption by 33.5%, with cooling energy demand reducing by 57.3%, though heating demand increases by 37%.

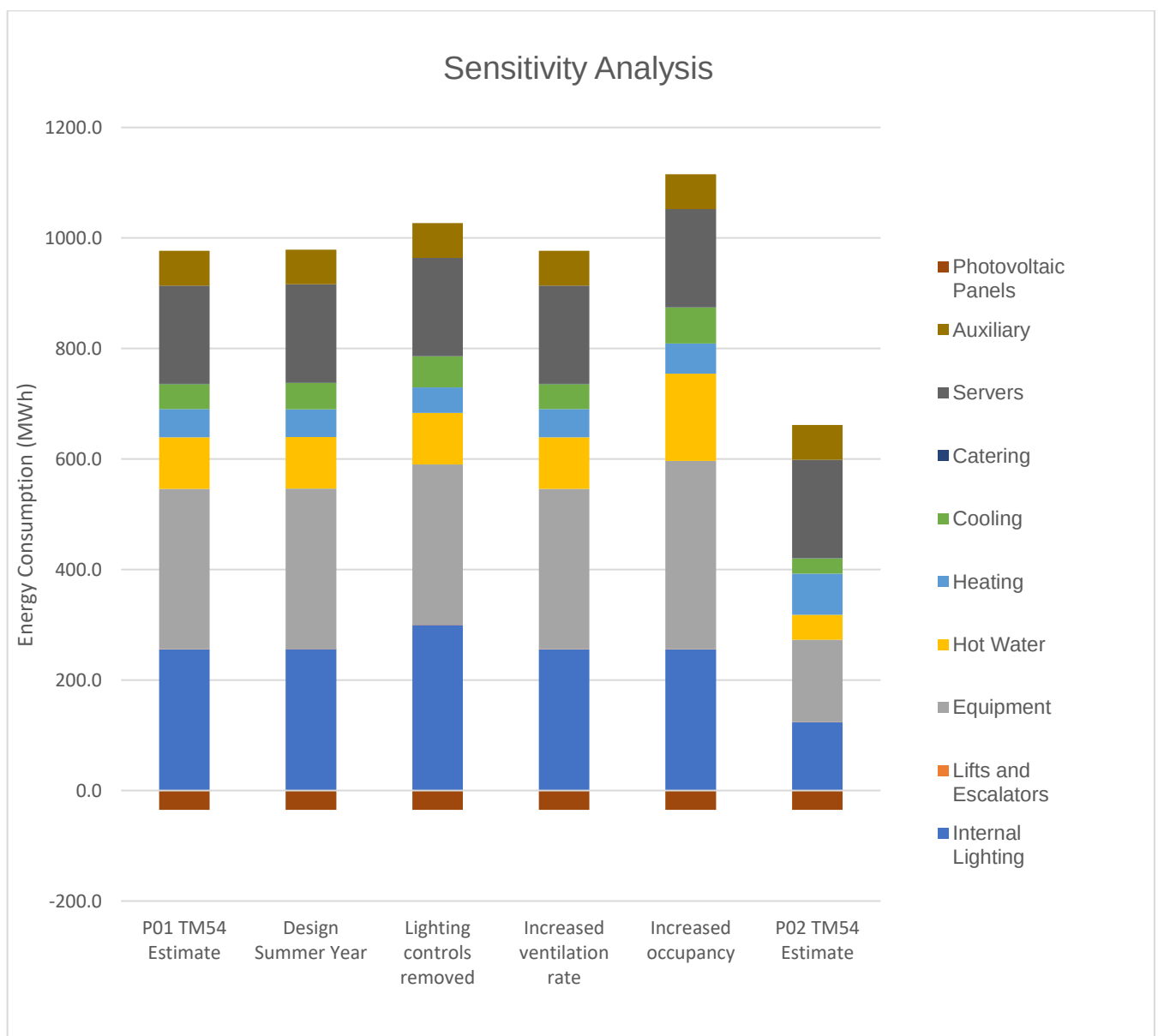


Figure 6 - Sensitivity analysis

9.0 Scenario testing: low-end, mid-range and high-end (Step 14)

Modelling results are presented below as a range to demonstrate the level of uncertainty of the different inputs.

The following scenarios have been generated:

- A mid-range scenario (to be used as baseline case) is an estimate of energy use, based on the occupancy estimates and the most reasonable assumptions for the building's systems efficiencies, controls and management regimes.
- High-end and low-end scenarios generated by taking into account uncertainties for key parameters.
- A 'worst-case' scenario has also been generated, assuming a poorly managed building with extended running hours and other key factors set at above-average values.

As the design progresses and more key assumptions are agreed upon, the previous low-end best-case scenario involves further reduction in energy consumption, because it is still based on an assumption of building occupancy that won't truly be confirmed until the building is operation. At a later stage, the low-end may become the mid-range as more assumptions are confirmed.

Parameters involved in the scenario testing have been divided into the following categories according to their influence:

Asset (designer influence)
Management (operator influence)
Both

Table 16 - Scenario results for whole building

	Low- End	Mid-Range	High-End
Scenario	Excellent management with low internal gains. Standard hours of operations	Average management with average internal gains. Extended hours of operation for plant and equipment	Poor management with high internal gains and extended hours of operation for plant and equipment
Occupancy Diversity	0.48	0.8	1
Operating Hours	Hours of operation as per client brief, with equipment switched off at night	Hours of operation as per client brief, with lighting and equipment switched off an hour later	Hours of operation as per client brief, with lighting and equipment never switched off

The following pages report scenario results by major energy use.

Table 17 - Scenario results for internal lighting

Lighting (kWh/m ²)			
	Low- End	Mid-Range	High-End
	1.8	25.3	27.8
	↑	↑	↑
Scenario	Low- End	Mid-Range	High-End
	Excellent management with fully functional controls. Standard hours of operations	Average management with partially functional controls. Extended hours of operation for plant and equipment	Poor management with non-functional controls. Extended hours of operation for plant and equipment
Total installed power	7079	7079	7079
Constant illuminance factor	1	1	1
Occupancy dependency factor	0.48	0.95	1
Daylight dependency factor	0.9	0.95	1
Operating Hours	Hours of operation as per client brief	Hours of operation as per client brief, with lighting switched off late at 6pm	Lighting not switched off

Table 18 - Scenario results for small power

Small Power (kWh/m ²)			
	Low- End	Mid-Range	High-End
	6.2	49.5	54.5
	↑	↑	↑
Scenario	Low- End	Mid-Range	High-End
	Excellent management with low internal gains. Standard hours of operations	Average management with average internal gains. Extended hours of operation for plant and equipment	Poor management with high internal gains and extended hours of operation for plant and equipment
Operating Hours	Hours of operation as per client brief, all equipment fully switched off at the mains when not in use	Extended hours of operation including weekends, with equipment switched off two hours later then left on standby overnight	Equipment not switched off, always left on standby

Table 19 - Scenario results for hot water

Hot Water (kWh/m ²)			
	Low- End	Mid-Range	High-End
	5.0	5.4	7.5
	↑	↑	↑
Scenario	Low- End	Mid-Range	High-End
	Excellent management with waste heat energy. Standard hours of operations	Average management with average waste heat energy. Extended hours of operation for plant and equipment	Poor management with high delivery losses and extended hours of operation for plant and equipment
Occupancy Diversity	48%	70%	80%
Operating Hours	Hours of operation as per client brief	Hours of operation as per client brief	Hours of operation as per client brief

Table 20 - Scenario results for auxiliary energy

Auxiliary (kWh/m ²)			
	Low- End	Mid-Range	High-End
	9.9	9.9	9.9
	↑	↑	↑
Scenario	Low- End	Mid-Range	High-End
	Excellent management with low internal gains. Standard hours of operations	Average management with average internal gains. Extended hours of operation for plant and equipment	Poor management with high internal gains and extended hours of operation for plant and equipment
SFP	1.9 W/l/s	1.9 W/l/s	1.9 W/l/s
Operating Hours	Hours of operation as per client brief	Extended hours of operation	Vent never off

Table 21 - Scenario results for catering

Catering (kWh/m ²)			
	Low- End	Mid-Range	High-End
	0.7	0.8	0.8
	↑	↑	↑
Scenario	Low- End	Mid-Range	High-End
	Excellent management. Standard hours of operations	Average management. Extended hours of operation for plant and equipment	Poor management. Extended hours of operation for plant and equipment
Operating Hours	Hours of operation as per client brief, all equipment fully switched off at the mains when not in use	Hours of operation as per client brief, with kitchen open two hours earlier	Hours of operation as per client brief, with full occupancy all day

Table 22 - Scenario results for lifts

Lifts (kWh/m ²)			
	Low- End	Mid-Range	High-End
	12.0	12.1	13.2
	↑	↑	↑
Scenario	Low- End	Mid-Range	High-End
	Excellent management. Standard hours of operations	Average management. Extended hours of operation for plant and equipment	Poor management. Extended hours of operation for plant and equipment
Operating Hours	Hours of operation as per client brief	Extended hours of operation with increased lift demand	Always on with increased lift demand

Table 23 - Scenario results for IT hubs

IT Hubs (kWh/m ²)			
	Low- End	Mid-Range	High-End
	18.4	34.3	55.3
	↑	↑	↑
Scenario	Low- End	Mid-Range	High-End
	1kW per rack	2kW per rack	3kW per rack
Operating Hours	Always on	Always on	Always on

Table 24 - Scenario results for space heating

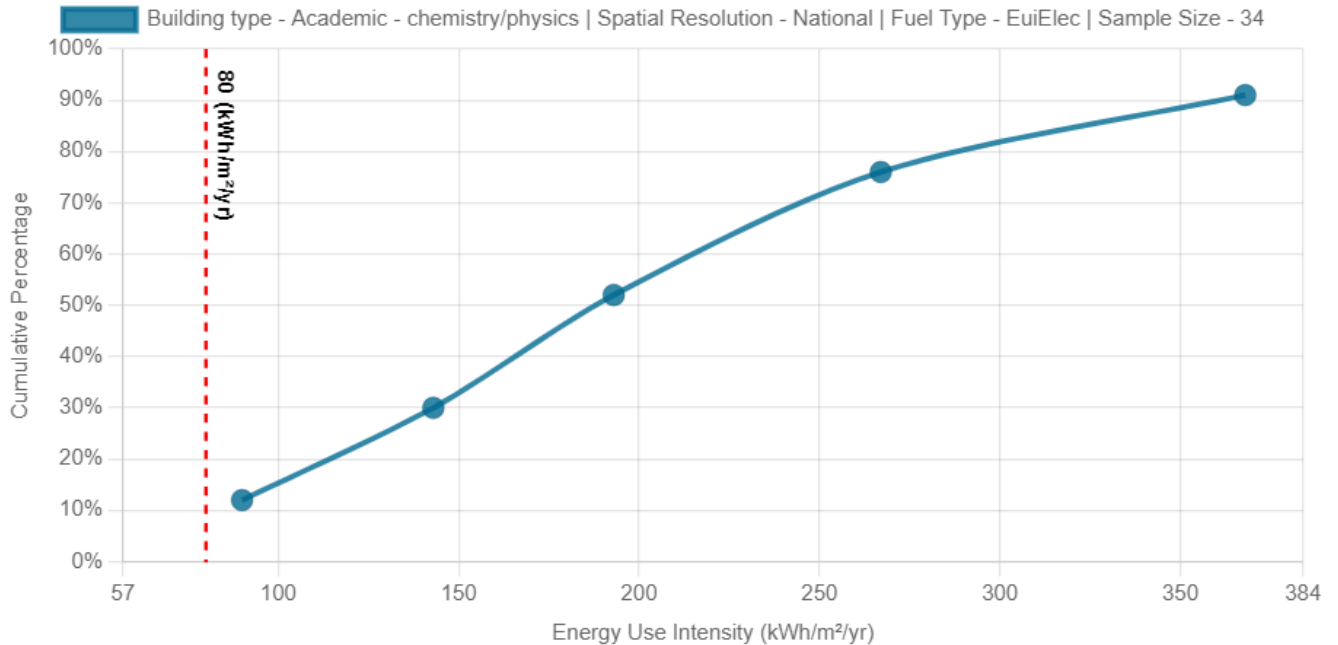
Space Heating (kWh/m ²)			
	Low- End	Mid-Range	High-End
	8.0	8.3	8.6
	↑	↑	↑
Scenario	Low- End	Mid-Range	High-End
	Excellent management with low internal gains. Standard hours of operations	Average management with average internal gains. Extended hours of operation for plant and equipment	Poor management with high internal gains and Extended hours of operation for plant and equipment
Occupancy Diversity	0.48	1	1
SCOP	Varies from 3.5 to 4.4	Varies from 3.5 to 4.4	Varies from 3.5 to 4.4
Operating Hours	Hours of operation as per client brief	Extended hours of operation	Heating never off

Table 25 - Scenario results for space cooling

Space Cooling (kWh/m ²)			
	Low- End	Mid-Range	High-End
	7.1	8.7	10.2
	↑	↑	↑
Scenario	Low- End	Mid-Range	High-End
	Excellent management with low internal gains. Standard hours of operations	Average management with average internal gains. Extended hours of operation for plant and equipment	Poor management with high internal gains and Extended hours of operation for plant and equipment
Occupancy Diversity	0.48	1	1
SEER	Varies from 5.9 to 6.5	Varies from 5.9 to 6.5	Varies from 5.9 to 6.5
Operating Hours	Hours of operation as per client brief	Extended hours of operation	Cooling never off

10.0 Results and comparison with targets (Step 15)

Figure 7 displays energy benchmarks for the closest building type, namely an academic institution with chemistry and physics courses, to reflect the proposed STEM subjects to be taught at the Phase 2 building. The results show that building energy use of 80kW/m²/year would put it within the 10% lowest electrical demand for its building type, based on nationwide data from 2021.



Building Type	Good practice electricity	Typical practice electricity	Source
Academic - chemistry/physics	131	193	DEC

Figure 7 - Electricity benchmarks

Heating and cooling demand has some balance, with cooling demand rising in the summer as heating demand reduces. There is a dip in cooling demand during the summer term when occupancy is low.

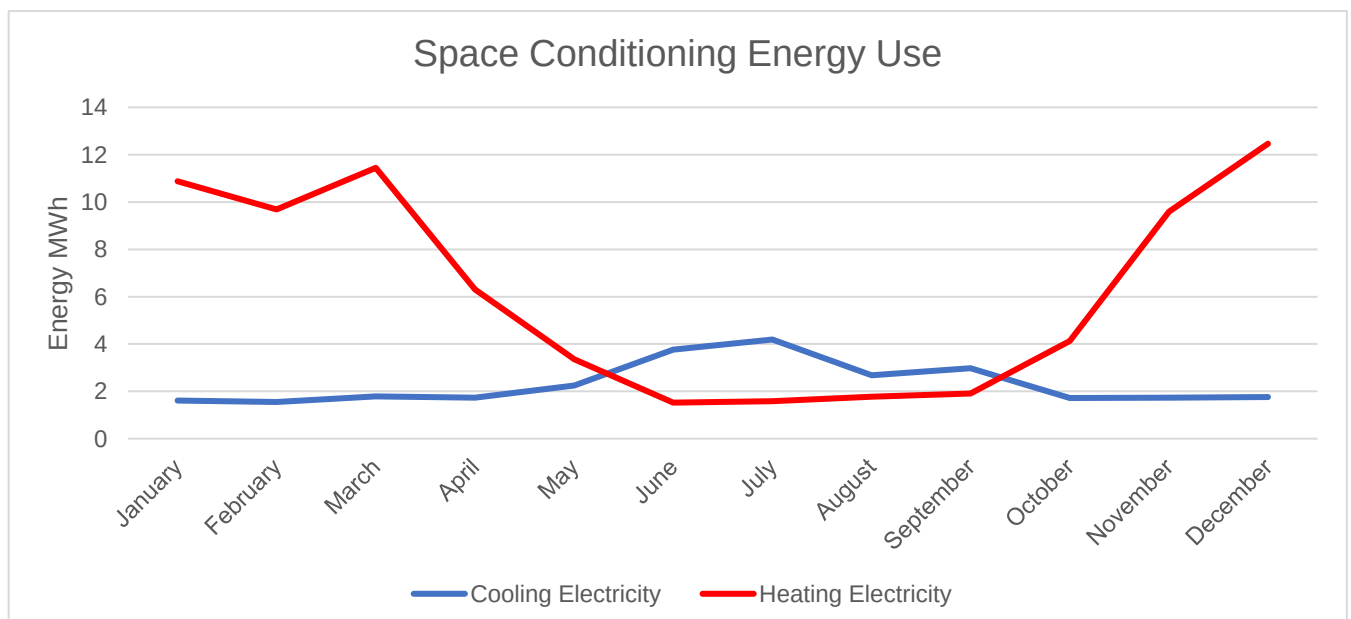


Figure 8 - Heating and cooling energy use

Energy use breakdown results for all scenarios are shown in Table 26 and Figure 9. It can be seen that regulated HVAC energy is in fact a very small component of the total building energy use. Management and changes in usage can result in a worst-case scenario with more than three times the energy demand of the best-case scenario.

While server rooms constitute the single largest design energy demand, the small power represents the largest variance. The worst-case scenario for small power is 10 times more energy intensive than the diversified low-end best-case scenario.

Table 26 - Energy use breakdown

Energy consumption (kWh/m ² /year)	Low-End	Worst-Case	High-End	Mid-Range
Lighting	2.6	32.0	27.8	25.3
Lifts and Escalators	12.0	15.2	13.2	12.1
Small Power	6.2	62.7	54.5	49.5
Catering	0.7	0.9	0.8	0.8
Server Rooms	18	63.6	55.3	34.3
Other Equipment	10.1	57.1	49.7	32.0
DHW consumption	5	8.7	7.5	5.5
Heating	8.0	9.8	8.6	8.3
Cooling	7.1	11.8	10.2	8.7
Auxiliary	9.9	11.3	9.9	7.8
Totals				
Total Gas used (kWh/m²/year)	0	0	0	0
Total Electricity used (kWh/m²/year)	80	273	237	184
TOTAL EUI	80	273	237	184

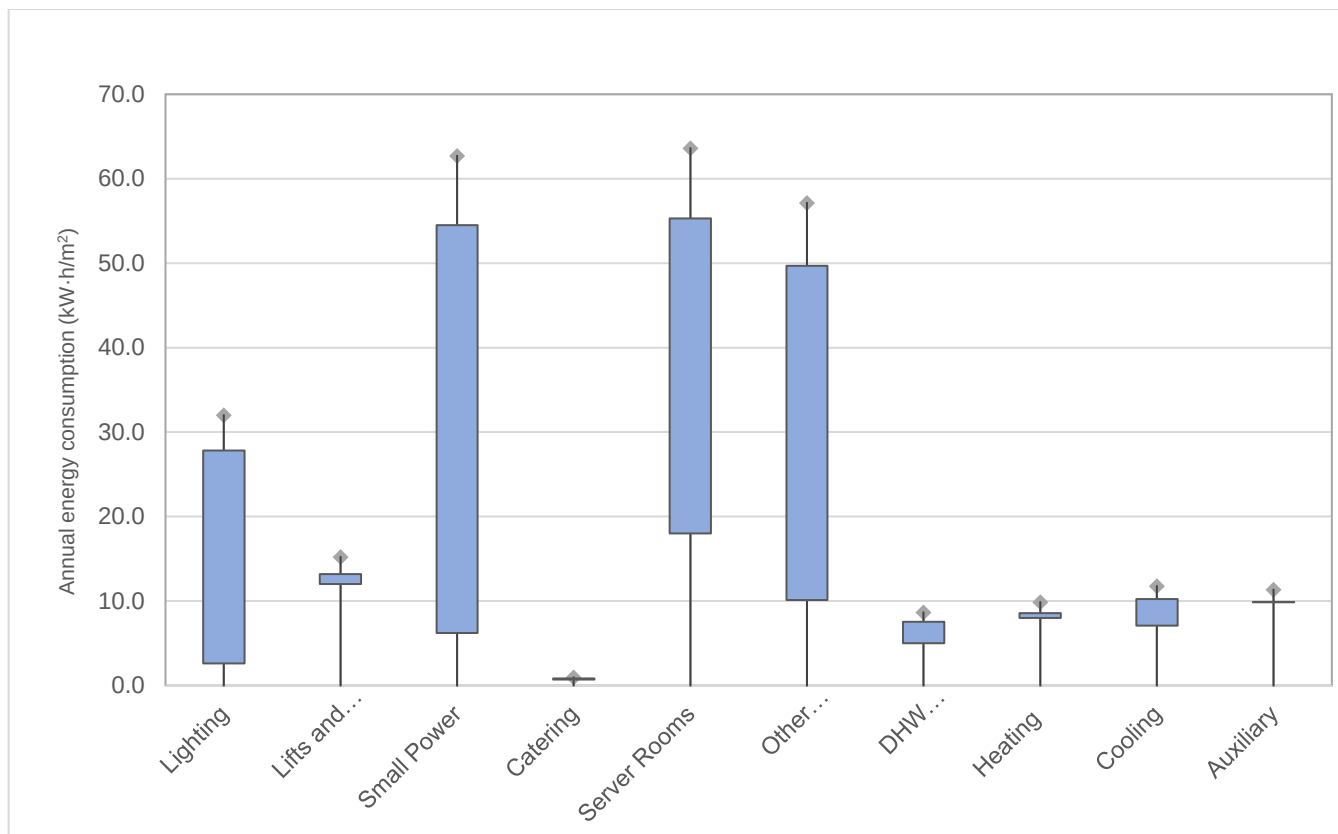


Figure 9 - Energy use ranges

Predicted annual energy costs for each EUI

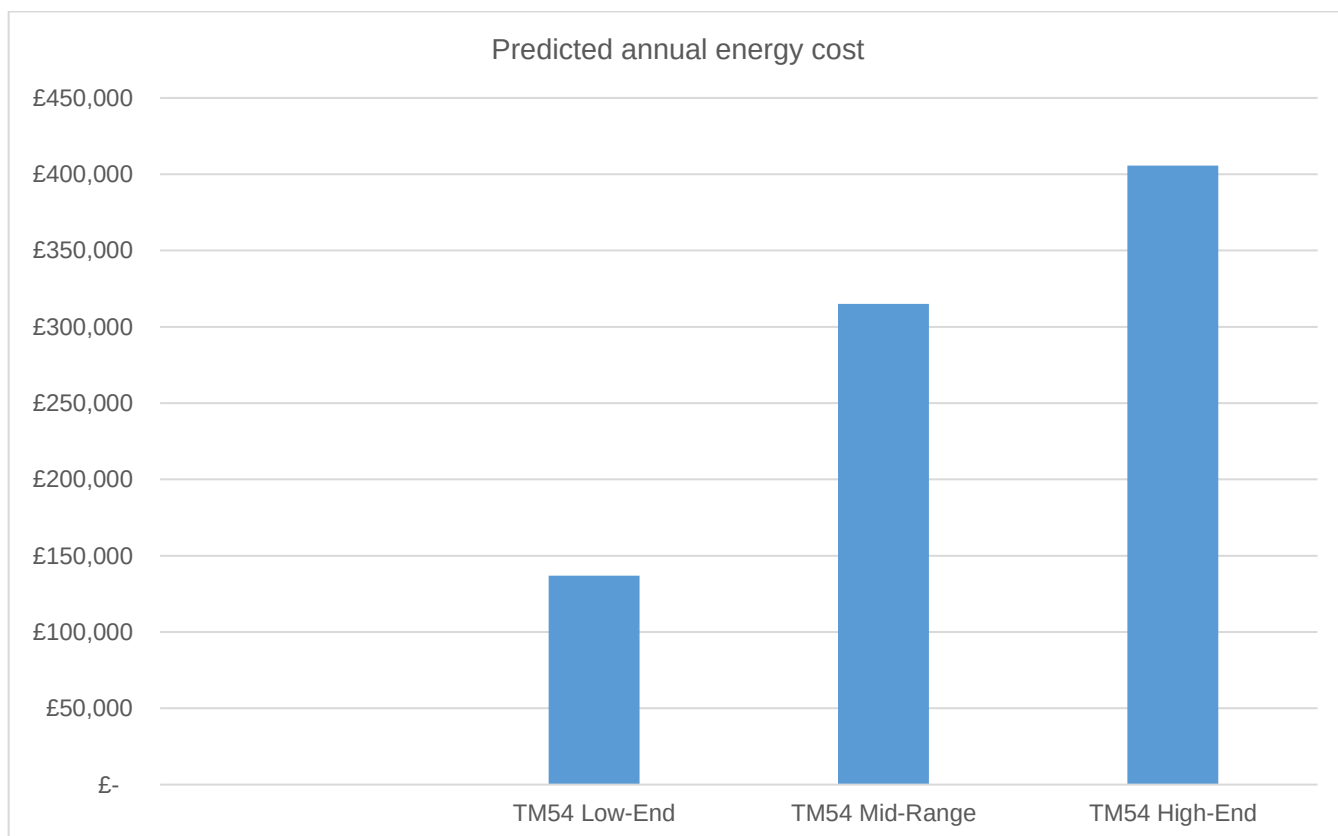


Figure 10 - Predicted annual energy costs for each TM54 EUI, based on 26.9 p/kWh from [Quarterly Energy Prices June 2023 \(publishing.service.gov.uk\)](https://www.gov.uk/publishing.service.gov.uk) 500-1999 MWh/yr consumption band

Route to Net Zero

This section originally appeared in the Energy Statement Ref: MCC2-BDP-XX-XX-RP-MEP-ZZ-ER-0001 as a placeholder, to give an indication of the feasibility of Net Zero whilst BDP was yet to be appointed for TM54.

The conclusion of the Energy Statement affirmed that a CIBSE TM54 operational energy analysis would need to be performed in order to provide a more detailed energy consumption profile and verify the feasibility of Net Zero. Following design development, the EUI has been further progressed, so the Route to Net Zero section has been moved over to this report.

Per the BDP document P3000166 Manchester College Ph2 NZC technical note, to demonstrate their commitment to net zero carbon and to Manchester Council's 2038 NZC targets, the project team have proposed applying RIBA 2030 Climate Challenge sustainability benchmarks relevant to operational carbon to the City Centre Phase 2 development.

Bespoke energy use intensity targets have been derived using CIBSE TM46 energy benchmarks. P01 & P02 of this report confirmed an EUI of 133kWh/m²/yr largely based on undiversified energy demands. As it stood then, the model did not meet the proposed 2025 interim EUI of <111.75kWh/m²/yr, however it was a reasonable assumption that diversity would reduce overall energy demand once a figure was agreed upon.

The technical memo had previously advised a proposed stretch target of 81.95kWh/m²/yr. The design as it stands, in P03 of this report, has an EUI of 80kWh/m²/yr, achieving the stretch target.

Photovoltaic panels are estimated to produce about 35MWh of electricity annually, which is not enough to cover the entire building carbon emissions. There would need to be some form of carbon offsetting for the shortfall. Following carbon offset by onsite PV, the client may choose to offset the remaining 87.1 tonnes of carbon. As of this writing, Manchester City Council does not have a specific carbon offset policy.

Based on a quote obtained from a carbon offsetting company, this equates to about £565.50 per year to offset the building carbon emissions based on £6.50 per tonne per year. This is however on the cheaper end of the scale. The UK Gov Green Book 2022 values carbon emissions at around £250 per tonne CO₂ (i.e. £21,750 per year). Some councils such as those within the Greater London Authority charge £95 per tonne per year, for 30 years up front (i.e. £247,950 one-time).

Since Manchester has no specific policy regarding carbon offset contribution, any offsetting cost would likely be based on the commercial market. As can be seen, the final offsetting cost can vary greatly. It is unclear whether the driver for Net Zero is voluntary or a council requirement, and if so, what the enforcement mechanism would be for any offsetting cost.

Table 27 - Annual carbon emissions

Date	Carbon Emissions (Tonnes CO ₂)	PV Offset Emissions (Tonnes CO ₂)	Total Carbon Emissions (Tonnes CO ₂)
Jan 01-31	10.05	-0.319	9.731
Feb 01-28	9.147	-0.525	8.622
Mar 01-31	9.974	-0.697	9.277
Apr 01-30	8.2	-0.755	7.445
May 01-31	7.061	-0.83	6.231
Jun 01-30	6.48	-0.636	5.844
Jul 01-31	4.258	-0.613	3.645
Aug 01-31	4.106	-0.547	3.559
Sep 01-30	6.637	-0.526	6.111
Oct 01-31	7.436	-0.464	6.972
Nov 01-30	9.315	-0.278	9.037
Dec 01-31	10.866	-0.275	10.591
Summed total	93.532	-6.468	87.064

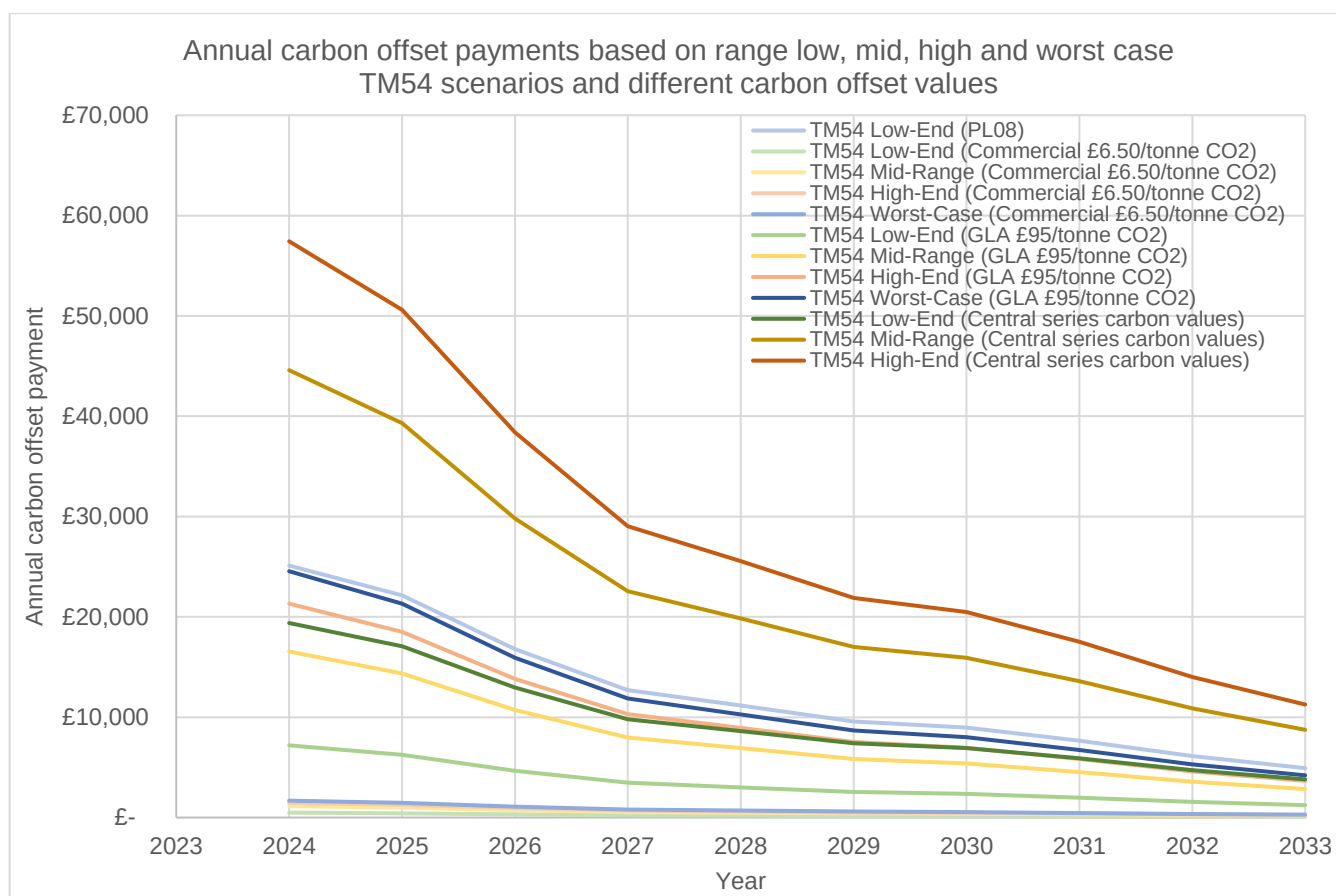


Figure 11 - Annual carbon offset payment based on range of TM54 scenarios and range of carbon offsetting prices

Table 28 - Assumed electricity grid emission factors and carbon costs ([Green Book supplementary guidance: valuation of energy use and greenhouse gas emissions for appraisal - GOV.UK \(www.gov.uk\)](#))

Year	Electricity grid emissions factor (kgCO ₂ e/kWh)	Carbon prices (/tonne CO ₂)
		Central series
2024	0.149	£256
2025	0.129	£260
2026	0.096	£264
2027	0.072	£268
2028	0.062	£272
2029	0.053	£276
2030	0.049	£280
2031	0.040	£285
2032	0.032	£289
2033	0.025	£293

11.0 Implementation matrix (Step 16)

Table 29 - Implementation matrix

TM54 steps	Recommendation	Modelling approach (summary)	Probable range	Confidence level (L/M/H)	QA check
Simplifications and assumptions	They should be used appropriately and judiciously, and detailed in the report	<i>IES Model based on architects' Revit model and GAs.</i>	<i>n/a</i>	<i>n/a</i>	<i>✓</i>
Use of benchmarks and targets	Benchmarks should not replace a dedicated calculation of energy use. Targets that can be verified in use are recommended to be set for the project from the early stages and should be reported alongside the modelling results. The aim of the modelling will be to test whether the targets are achievable and inform the design proposals to meet the targets.	<i>Building fabric parameters have been provided by the design team. CIBSE Benchmarking tool has been used instead for energy use targets.</i>	<i>n/a</i>	<i>n/a</i>	<i>✓</i>
Step 0: Choosing the right level of modelling	The project team should establish early in the project, in discussion with the client, the right level of modelling for the project. This should consider multiple factors including the complexity of the building and its systems, the resources available for the modelling, and the level of accuracy and certainty needed from the results. The discussions should also determine whether some steps in this methodology should be carried out within or outside the model, e.g., Step 3 (Lighting), Step 9 (Domestic hot water).	<i>The building is a large extension of the Manchester College's City Campus. A dynamic thermal modelling approach has been chosen. The model has also been used for additional tasks such as thermal comfort analysis and Part L building regulations compliance. HVAC systems have been modelled using a simplified approach. Energy use associated with hot water has been calculated inside the DTM (Dynamic Thermal Model) using CIBSE guidelines. DHW volumes have been based on anticipated usage data provided by industry benchmarks. Resultant internal lighting gains have been included within the DTM based on M&E lighting allowances.</i>	<i>n/a</i>	<i>n/a</i>	<i>✓</i>

TM54 steps	Recommendation	Modelling approach (summary)	Probable range	Confidence level (L/M/H)	QA check
Step 1: Constructing and building the model	Constructing and zoning: Consider the level of detail needed for the model to be accurate and robust. Always check the North arrow. Check the modelled envelope properties against information provided by design team members (engineer, façade consultant, architect etc). Carry out simple checks at the end of this stage, with default settings, to ensure the model operates as expected.	<i>The thermal model used information provided by the design team including architect, building services engineer and sustainability consultants. Geometry is based on architectural information. Simplifications and assumptions are listed in section 2.1 of the modelling report. Notable simplifications include the zoning, which are detailed in section 2.2, and the way the façade is represented; geometry has been checked with the Revit model. The nearest neighbouring building has been included in the model. An infiltration rate of 0.1ach has been used at this stage based on empiric values reported in CIBSE Guide A. A more detailed calculation is to be performed for the specific building in the next stage.</i>	±20%	H	
	Establishing floor areas: Identify or estimate NIA, GIA, or TFA for the building, as required for the calculations and in line with the floor area used in targets and benchmarks for the project, and include this in the report	<i>The total floor area of the thermal model presents a slight variance compared to the Revit model, this variance is due to modelling simplifications, i.e. lack of wall thicknesses. TFA has been used to provide Energy consumption figures (kWh/m²)</i>	n/a	n/a	
	The weather data used for the model should be clearly stated in the report, and appropriate for the purpose of the modelling. Where the site location is not close to any of the CIBSE weather file locations, the best match should be used based on the local climate.	<ul style="list-style-type: none"> • Design Summer Year – DSY 1 • Automatic lighting controls removed • Increased ventilation rate, to 12l/p/s • Assumed full annual occupancy, with no occupant diversity in the summer • Introduction of occupant diversity 	n/a	n/a	

TM54 steps	Recommendation	Modelling approach (summary)	Probable range	Confidence level (L/M/H)	QA check
Step 2: Estimating operating hours and occupancy factors	Request anticipated operational profiles from the client, for example through structured interview.	<i>Operating hours have been confirmed by the client during the energy workshop which took place on the 14th of February 2023. The operating hours are unlikely to change. As of P03 of this report, the VE schedule now includes occupancy factors which have been applied to the model.</i>	±20%	H	
Step 3: Evaluating lighting energy use	Assess the energy use for each element, as per guidance provided in each step. Where steps are omitted, state and justify (e.g., Step 4 omitted if the building has no lifts). Make a note of instances where benchmarks or assumptions have been used, rather than project-specific and confirmed information. Identify likely variability and uncertainty, to take account of it in the scenario testing and sensitivity analysis.	<i>M&E allowances have been used for general lighting. External lighting is based on the lighting engineer's specific calculation. Benchmarks for emergency lighting have been used.</i>	±20%	M	
Step 4: Evaluating energy use for lifts and escalators		<i>The building has one lift, not expected to be used heavily, therefore the lift motor is unknown, and no specialist lift traffic calculation will be carried out. TM54 formula has been used for the calculation and lifts motor power is based on data from other similar sized projects.</i>	±30%	L	
Step 5: Evaluating energy use for small power		<i>Appliances based on M&E allowances. Rated outputs for individual equipment advised by M&E, however assumptions sometimes differ. Diversity figures have recently been included in the calculation based on new documentation. Post-construction modelling will address this.</i>	±30%	L	

TM54 steps	Recommendation	Modelling approach (summary)	Probable range	Confidence level (L/M/H)	QA check
Step 6: Evaluating energy use for catering		<i>Catering based on M&E allowances. Rated outputs for individual equipment advised by M&E, however catering specialist needs to confirm. Post-construction modelling will address this.</i>	±50%	M	
Step 7: Evaluating energy use for server rooms		<i>Information on server rooms consumption based on TM54 worked example. Server racks based on M&E allowances, however variance may result in large swings in EUI.</i>	±50%	L	
Step 8: Evaluating energy use of additional plant and equipment		<i>Additional equipment electrical loads and gains have been included as W/m² allowance for the specific rooms. More detailed usage profiles to have included, to be further refined in the next stage.</i>	±20%	M	
Step 9: Evaluating energy use of domestic hot water		<i>DHW consumption has been based on CIBSE Guide G standard values and a steady state calculation has been performed at this stage. The actual DHW consumption may vary.</i>	±40%	M	
Step 10: Evaluating internal heat gains		<i>Internal gains have been based on information provided by the design team, including heating and cooling loads, and the energy workshop where the client confirmed occupancy variation. Newer documentation for diversity further refines the heat gains.</i>	±10%	H	
Step 11: Modelling HVAC systems and their controls	Assess the energy use with the appropriate modelling method, as determined in Step 0. Report separately for heating, hot water, cooling, and fans and pumps. Model controls carefully and use this to inform the control strategy and design.	<i>Apache systems methodology used to model HVAC systems within the dynamic thermal model. HVAC Systems to be modelled in more detail during the next stage.</i>	±40%	L	
	Evaluating energy use for humidification and dehumidification: Active (de) humidification systems should be modelled using detailed HVAC simulation.	<i>Humidification has not been considered at this stage.</i>	±100%	L	

TM54 steps	Recommendation	Modelling approach (summary)	Probable range	Confidence level (L/M/H)	QA check
Step 12: Taking management considerations into account	Review management considerations, ideally through structured interview/information request with future occupants. This should determine variability in the inputs due to management considerations. Blanket management factors should not be used.	<i>Management factors are no longer required under TM54.</i>	<i>n/a</i>	<i>n/a</i>	
Step 13: Sensitivity analysis	At the minimum, run basic sensitivity tests on the impact of individual inputs, to identify the most influential and inform scenario testing. The range of factors to include in the sensitivity tests will vary for different building types, but typically would include: <ul style="list-style-type: none"> weather and climate heat gain scenarios, including occupancy density and hours (and associated loads) management and occupant behaviour. Discuss with the client whether a proper sensitivity analysis (beyond these basic tests) is required and record the justification and decision.	<i>The following variables have been included in the sensitivity analysis:</i> <ul style="list-style-type: none"> <i>Future Weather File – CIBSE Manchester TRY 2020, High Emissions Scenario, 50th Percentile</i> <i>Automatic lighting controls removed</i> <i>Increased DHW consumption up by 30%</i> <i>Assumed full occupancy throughout the year, with no occupant diversity</i> <i>48% utilisation per the VE schedule</i> 	<i>n/a</i>	<i>n/a</i>	

TM54 steps	Recommendation	Modelling approach (summary)	Probable range	Confidence level (L/M/H)	QA check
Step 14: Scenario testing	<p>Produce mid-range, low-end and high-end scenarios.</p> <p>As an additional option, run a 'worst case' scenario, with caveats as noted in section 7.15. This should take account of variability in inputs established in each of the previous steps. Scenarios will vary per project, but typically would include variations in the following inputs:</p> <ul style="list-style-type: none"> • controls • hours of operation of plant and equipment • heat gain scenarios, including occupancy density and hours (and associated loads) • design efficiencies of key plant and equipment items • weather scenarios, including future climate change • management considerations, as examined in Step 13 • occupant behaviour. 	<p><i>Additional scenarios have been run to test the impact of design assets. Low, medium, and high usage scenarios have been identified.</i></p> <p><i>A worst-case scenario has also been reported.</i></p>	n/a	n/a	

TM54 steps	Recommendation	Modelling approach (summary)	Probable range	Confidence level (L/M/H)	QA check
Step 15: Reviewing the results against benchmarks and targets	<p>Compare results with the project targets and, if relevant, benchmarks. If using benchmarks, provide context on their relevance to the project. Use the comparison to check whether the design proposals are on track to achieve the target, and inform any change required. If the comparison and iterative review of design options and modelling concludes that the initial target is not achievable, this should be carefully recorded and justified, along with a recommendation for alternative target and design proposals to achieve it. If the range for the low-mid-high scenarios for the project is higher than acceptable levels for a project, then the project team should seek to refine the variability of the input factors, including further discussions with the client on likely operation of the building; design measures may also need to be implemented, if variability is expected to remain, and safeguards should be put in place to keep them in check through construction and into operation.</p>	<p><i>Project is based CIBSE benchmarking for academic buildings that teach STEM subjects.</i></p>	n/a	n/a	

TM54 steps	Recommendation	Modelling approach (summary)	Probable range	Confidence level (L/M/H)	QA check
Step 17: QA	QA should be carried out by an experienced modeller, at least at each stage before the results and report are issued to external parties. It should be recorded, with clear recommendations to be acted upon before issue, or for the next stage. It should encompass the model, the report, and their consistency with each other and with the project information. Intermediate QAs may also be carried out, e.g. at the end of Step 1, rather than waiting for the whole model and report to be available.	<i>QA was carried out by Associate Andrew Rennox before issue to project team. This QA included consistency with the project information (design proposals, control strategy, project brief etc), and the modelling report. QA procedures were in line with CIBSE AM11:2015 – Building Performance Modelling, Chapter 2 – Quality Assurance. Overall, the QA review concludes that the model and report are satisfactory for this stage but will need to address the recommendations listed in this report at the next stage, particularly the inclusion of information from the client to tie into M&E small power allowances.</i>	<i>n/a</i>	<i>n/a</i>	<i>n/a</i>

12.0 Energy workshop

TM54 Energy Workshop Questionnaire / Meeting Minutes

Project Number:	P3000166	BDP.
Project Name	Manchester College Phase 2	
Engineer:	RB	
Date:	14/02/2023	

Attendees:	Daniel Goodwin	Client - Manchester College
	Niall Wright	Client - Manchester College
	Nick Ince	Client - Manchester College
	Steven Pickard	Client - Manchester College
	Andrew Rennox	Associate - BDP
	Danny Ingham	MEP Engineer - BDP
	Robin Beatson	Building Physics - BDP

1. USERS		
1.1 - BUILDING USERS		
Maximum occupancy	How many occupants are you expecting to have?	From Bond Bryan; use maximum and for diversity for fire
1.2 - OPERATING HOURS		
Hours of operation	What are the intended hours of operation of the building? Does this vary in different parts?	9-9, core hours are 9-5, after which utilisation drops off
Occupancy profiles	Are existing occupancy profiles available from previous/equivalent buildings?	Similar to Phase 1 with some updating required
Night-time operation	Will there be requests for extended hours of operation? are there any out of hours operational requirements?	Cleaning, events, etc. Assume one event per month?
Night-time operation	Can the energy use be reduced during out-of-hours operation (e.g., night set-back, turning-off display lighting when shelf-stacking etc.)	Not too much display lighting
Holidays operation	What happens on long holidays (e.g. Easter, Christmas, etc.), bank holidays, Weekends?	Phase 2 would have limited use around summer and holidays. Assume reduction to 10%
Cleaning operations	When will the building be cleaned (how often, for how long?)	Monday to Friday cleaning every morning, perhaps 1 hour
Cleaning operations	How will cleaning operations be managed? When will the building be cleaned? If the building is cleaned in the evening, will the cleaners be responsible for turning the lights off?	Automatic lighting, so cleaners don't need to be responsible for turning off lights.
Winter temperature set points	Which will be the winter core hours temperature set points?	Per BDP heating & cooling loads
Winter temperature setback	Which will be the winter setback temperature (ie the out of core hours temperature set points)?	As low as possible to be controlled up to two hours before occupation
Summer temperature set points	Which will be the summer core hours temperature set points?	Per BDP heating & cooling loads
Security arrangements	Will the security arrangements require lights or equipment (i.e., CCTV monitors, security lighting, etc) to be running?	No active monitoring, external CCTV, fire lighting assumptions per BDP
Process Equipment	Will process equipment that is not required (e.g. it equipment) be switched off outside of occupancy hours?	Everything can shut out of hours except heating & cooling setback.

1. USERS		
Hosting events	Will the rooms be used for hosting events etc., which would require the spaces to be used outside core occupancy hours? If so, are there any special requirements? Will the building use require re-stocking, preparation for catering, maintenance etc., which would require plant to be running outside regular occupancy hours?	Most events in Phase 1. Open space could possibly be used in Phase 2 for events, but unlikely.
1.3 - OCCUPANCY FACTORS		
Occupancy Density	What is the intended occupancy density?	Assume based on Bond Bryan occupancy
Occupancy Density	Will the intended occupancy density vary across the day, the week or over the year?	Unused for weekends, variable during the day and trailing off late afternoons.
Occupants' activity	Will the occupants be active, standing, seated etc?	Seated at desk work; exceptions include labs.
Windows actuation	Will the windows be openable, and if so, will they be locked, or will occupants be allowed to open them?	Windows are not openable.

2.ELECTRICITY USAGE		
2.1 - LIGHTING		
Lighting levels	What are the lighting levels in the building?	Per BDP design; British standard illuminance
Lighting controls	What is the lighting controls strategy in the building?	Per BDP design; British standard illuminance
Lighting operation	What are the lighting operational hours in the building?	Per BDP design; British standard illuminance
Task and special lighting	Is there a requirement for desk lighting/stage lighting/display lighting?	Not much task lighting; main lights only; no separate signage or external lighting
Occupant lighting	Are occupants intended to install additional lighting as part of the fit-out?	n/a
2.2 - SMALL POWER EQUIPMENT		
Equipment	What devices/equipment are expected in the building? Equipment list (including laptops and plug-in devices)	Laptops, computer rooms, standard (take assumptions from CIBSE unless otherwise noted)
Equipment usage	Will the occupants be using the equipment in the building intensely, or intermittently?	Intention to switch off entirely by policy; perhaps scenario test standby vs switching at mains
Personal devices	Which type of personal devices are expected to be used? How are expected to be used and where are they expected to be charged?	Mobile chargers may be available in the atrium but not much elsewhere.
Kitchen equipment	What is expected equipment provided in kitchen?	Café deli rather than commercial kitchen
Kitchen equipment use	How is equipment expected to be used?	See above, base on M&E allowances
Other equipment	Is there any other equipment? And how is expected to be used? (including tea points, microwaves, toasters, refrigerators, vending machines, laundry equipment, security systems etc)	Tea points, microwave, standard equipment for staff rooms
Occupant lighting	If occupants are intended to install additional lighting, will this be on a separate circuit?	n/a

3. MANAGEMENT		
3.1 - MANAGEMENT FACTORS		
Energy use	Will the operator be incentivised to reduce energy use?	No
Energy saving responsible	Will there be anyone responsible for employing energy saving measures (e.g., switching off unnecessary lights during the day or turning off equipment during unoccupied hours etc.)?	No
Maintenance programme	Will the building be maintained regularly through a planned preventive maintenance programme?	Yes
Sub-meters	Will there be properly commissioned sub-meters to help to identify where energy is being used?	Yes
Automatic metering reading	Will automatic metering reading (AMR) be installed?	Yes
Building energy management software	Will there be a building energy management software provided as part of the BMS to enable the building manager to monitor energy use and target energy saving measures?	Yes
Energy targets/budgets	Will energy targets /budgets be set and monitored monthly?	Yes
Energy management budget	Is there a budget for energy management?	Yes
Occupants' role	Will occupants be made aware of their role in energy efficiency through regular awareness campaigns etc?	No

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