Avonmouth House, London Borough of Southwark

Energy Strategy

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JAW Sustainability

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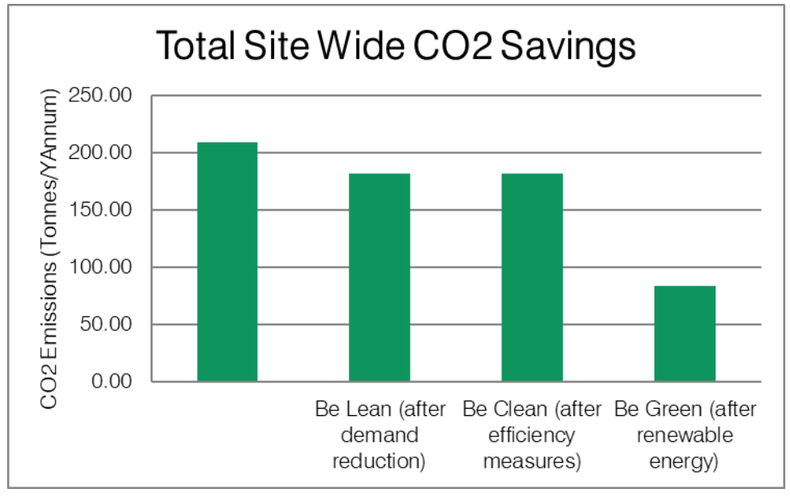
Executive Summary

This energy strategy has been prepared for the proposed development of Avonmouth House. The proposed development consists of the demolition of existing building and structures and erection of a part 2, part 7, part 14, part 16 storey plus basement mixed-use development comprising 1733sqm (GIA) of space for Class E employment use and/or community health hub and/or Class F1(a) education use and 233 purpose-built student residential rooms with associated amenity space and public realm works, car and cycle parking, and ancillary infrastructure.

This report demonstrates how the proposed development addresses local planning policies relating to energy.

Following the energy hierarchy, passive design measures, energy efficient equipment have been proposed, resulting in achieved a 58.9% saving for the development as a whole. The heating and cooling hierarchies have also been followed. An offset payment is proposed to achieve zero carbon overall.

The design team have made all reasonable endeavours to achieve the maximum carbon savings. The fabric performs significantly better than building regulations minimum standards, highly efficient systems are specified, including an ASHP for providing low carbon heating and hot water and the PV system utilises all available roof space.



1 Introduction

This energy strategy has been prepared for the proposed development at Avonmouth House in order to meet the sustainability requirements of the London Plan and the London Borough of Southwark

The site is situated in London Borough of Southwark. The proposed development consists of the demolition of existing building and structures and erection of a part 2, part 7, part 14, part 16 storey plus basement mixed-use development comprising 1733sqm (GIA) of space for Class E employment use and/or community health hub and/or Class F1(a) education use and 233 purpose-built student residential rooms with associated amenity space and public realm works, car and cycle parking, and ancillary infrastructure. The site area is shown in Figure 1-1 below.

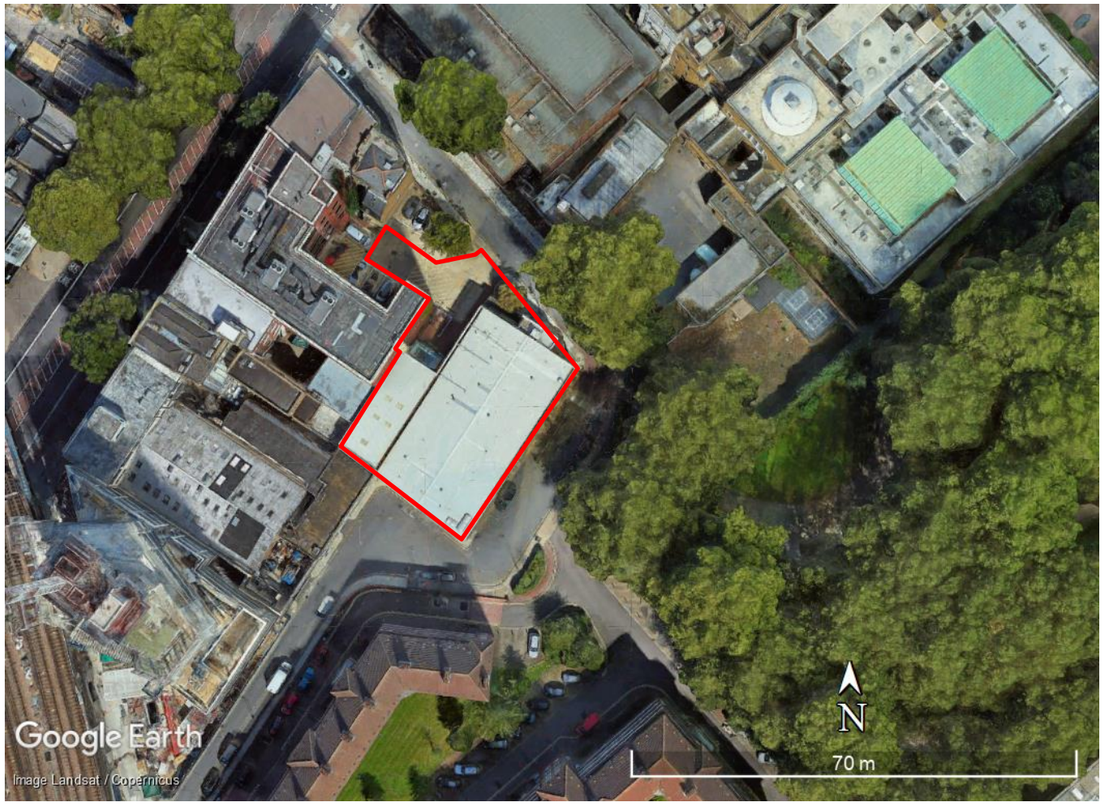


Figure 1-1 – Avonmouth House Site location

1.1 Assessment approach

This report summarises the work undertaken to support the development of an energy strategy for the new development, following the energy hierarchy 'Be Lean, Be Clean, Be Green, Be Seen'.

Energy calculations have been carried out using IES VE Apache tool to produce separate BRUKLS for the employment and student sections of the development. These are used to assess the impact on energy demand and CO_2 emissions of improvements through the hierarchy and demonstrate the most appropriate solution for the development to meet the relevant planning requirements. The SAP 10 carbon factors have been used to calculate the carbon emissions for the development.

2 Policy

2.1 Southwark Core Strategy 2011

Strategic Policy 13 – High environmental standards

Our approach is:
Development will help us live and work in a way that respects the limits of the planet's natural resources, reduces pollution and damage to the environment and helps us adapt to climate change.

We will do this by:

1. Requiring development to meet the highest possible environmental standards, including targets based on the Code for Sustainable Homes and BREEAM.

2. Requiring all new development to be designed and built to minimise greenhouse gas emissions across its lifetime. This will be achieved by applying the energy hierarchy:
    - Designing all developments so that they require as little energy as possible to build and use.
    - Expecting all major developments to set up and/or connect to local energy generation networks where possible. We will develop local energy networks across Southwark.
    - Requiring developments to use low and zero carbon sources of energy.

3. Enabling existing buildings to become more energy efficient and make use of low and zero carbon sources of energy.

2.2 New Southwark Plan

The following policy from the draft New Southwark Plan have been identified as having relevance to the developments energy strategy.

P69 Energy

Energy Hierarchy
Development must minimise carbon emissions on site in accordance with the following energy hierarchy:

1. Be lean (energy efficient design and construction); then
2. Be clean (low carbon energy supply); then
3. Be green (on site renewable energy generation and storage).

Targets for major development
Major development must reduce carbon dioxide emissions on site by:

1. 100% on 2013 Building Regulations Part L standards for residential development; and

2. A minimum of 40% on 2013 Buildings Regulations Part L and zero carbon (100%) for non-residential developments.
3. Any shortfall against carbon emissions reduction requirements must be secured off site through, planning obligations or as a financial contribution.

Decentralised energy
Major development must be designed to incorporate decentralised energy in accordance with the following hierarchy:

1. Connect to an existing decentralised energy network; then
2. Be future-proofed to connect to a planned decentralised energy network; or
3. Implement a site-wide low carbon communal heating system; and
4. Explore and evaluate the potential to oversize the communal heating system for connection and supply to adjacent sites and, where feasible be implemented.

2.3 The London Plan

Policy SI 2 Minimising greenhouse gas emissions

A. Major development should be net zero-carbon. This means reducing greenhouse gas emissions in operation and minimising both annual and peak energy demand in accordance with the following energy hierarchy:
    1. be lean: use less energy and manage demand during operation
    2. be clean: exploit local energy resources (such as secondary heat) and supply energy efficiently and cleanly
    3. be green: maximise opportunities for renewable energy by producing, storing and using renewable energy on-site
    4. be seen: monitor, verify and report on energy performance.

B. Major development proposals should include a detailed energy strategy to demonstrate how the zero-carbon target will be met within the framework of the energy hierarchy.

C. A minimum on-site reduction of at least 35 per cent beyond Building Regulations is required for major development. Residential development should achieve 10 per cent, and non-residential development should achieve 15 per cent through energy efficiency measures. Where it is clearly demonstrated that the zero-carbon target cannot be fully achieved on-site, any shortfall should be provided, in agreement with the borough, either:
    a. through a cash in lieu contribution to the borough's carbon offset fund, or
    b. off-site provided that an alternative proposal is identified, and delivery is certain.

D. Boroughs must establish and administer a carbon offset fund. Offset fund payments must be ring-fenced to implement projects that deliver carbon reductions. The operation of offset funds should be monitored and reported on annually.

E. Major development proposals should calculate and minimise carbon emissions from any other part of the development, including plant or equipment, that are not covered by Building Regulations, i.e. unregulated emissions.

F. Development proposals referable to the Mayor should calculate whole life-cycle carbon emissions through a nationally recognised Whole Life-Cycle Carbon Assessment and demonstrate actions taken to reduce life-cycle carbon emissions.

Policy SI 3 Energy infrastructure

A. Boroughs and developers should engage at an early stage with relevant energy companies and bodies to establish the future energy and infrastructure requirements arising from large-scale development proposals such as Opportunity Areas, Town Centres, other growth areas or clusters of significant new development.

B. Energy masterplans should be developed for large-scale development locations (such as those outlined in Part A and other opportunities) which establish the most effective energy supply options. Energy masterplans should identify:
    1. major heat loads (including anchor heat loads, with particular reference to sites such as universities, hospitals and social housing)
    2. heat loads from existing buildings that can be connected to future phases of a heat network
    3. major heat supply plant including opportunities to utilise heat from energy from waste plants
    4. secondary heat sources, including both environmental and waste heat
    5. opportunities for low and ambient temperature heat networks
    6. possible land for energy centres and/or energy storage
    7. possible heating and cooling network routes
    8. opportunities for futureproofing utility infrastructure networks to minimise the impact from road works
    9. infrastructure and land requirements for electricity and gas supplies
    10. implementation options for delivering feasible projects, considering issues of procurement, funding and risk, and the role of the public sector
    11. opportunities to maximise renewable electricity generation and incorporate demand-side response measures.

C. Development Plans should:
    1. identify the need for, and suitable sites for, any necessary energy infrastructure requirements including energy centres, energy storage and upgrades to existing infrastructure
    2. identify existing heating and cooling networks, identify proposed locations for future heating and cooling networks and identify opportunities for expanding and inter-connecting existing networks as well as establishing new networks.

D. Major development proposals within Heat Network Priority Areas should have a communal low-temperature heating system:
    1. the heat source for the communal heating system should be selected in accordance with the following heating hierarchy:

2. connect to local existing or planned heat networks
3. use zero-emission or local secondary heat sources (in conjunction with heat pump, if required)
4. use low-emission combined heat and power (CHP) (only where there is a case for CHP to enable the delivery of an area-wide heat network, meet the development's electricity demand and provide demand response to the local electricity network)
5. use ultra-low NOx gas boilers
6. CHP and ultra-low NOx gas boiler communal or district heating systems should be designed to ensure that they meet the requirements in Part B of Policy SI 1 Improving air quality
7. where a heat network is planned but not yet in existence the development should be designed to allow for the cost-effective connection at a later date.

E. Heat networks should achieve good practice design and specification standards for primary, secondary and tertiary systems comparable to those set out in the CIBSE/ADE Code of Practice CP1 or equivalent.

Policy SI 4 Managing heat risk

A. Development proposals should minimise adverse impacts on the urban heat island through design, layout, orientation, materials and the incorporation of green infrastructure.

B. Major development proposals should demonstrate through an energy strategy how they will reduce the potential for internal overheating and reliance on air conditioning systems in accordance with the following cooling hierarchy:

1. reduce the amount of heat entering a building through orientation, shading, high albedo materials, fenestration, insulation and the provision of green infrastructure
2. minimise internal heat generation through energy efficient design
3. manage the heat within the building through exposed internal thermal mass and high ceilings
4. provide passive ventilation
5. provide mechanical ventilation
6. provide active cooling systems.

3 Energy Strategy

An energy strategy has been developed following the energy hierarchy 'Be Lean, Be Clean, Be Green', 'Be Seen'. Energy calculations using Building Regulations approved and accredited software have been undertaken at each stage to calculate the savings associated with the measures incorporated.

The energy consumption and carbon emission figures within this report have been calculated using IES VE Apache tool to produce separate BRUKLS for employment use and/or community health hub and/or education use and student sections of the development.

For the purposes of energy modelling, the Class E employment use and/or community health hub and/or Class F1(a) education use section has been treated as office space.

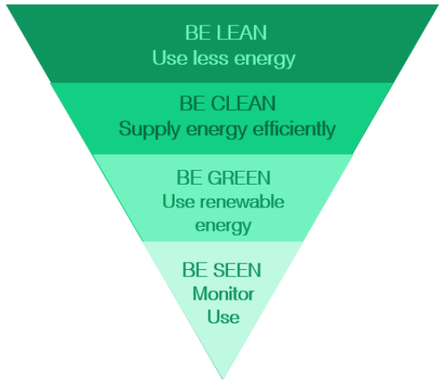


Figure 3-01 The Energy Hierarchy

3.1 Energy Targets

In line with the London Plan and the New Southwark plan, there is a target of zero carbon for the development, with at least a 40% reduction over Part L 2013. Table 3-01 and 3-02 detail the energy and carbon breakdown of the Part L target emission rate. The SAP 10 Carbon Factors have been used for all calculations for the development.

Use Type	Gas (kWh/yr)			Gas CO2 (kg/yr)	Electricity (kWh/yr)						Electricity CO2 (kg/yr)
	Space Heating	Hot Water	Total		Space Heating	HW	Cooling	Pumps & Fans	Lighting	Total	
Student	172,428	687,269	**859,697**	**180,536**	0	0	0	31,409	94,228	**122,497**	**28,542**
Employment	8,624	4,639	**13,263**	**2,785**	0	0	10,115	3,048	32,621	**44,639**	**10,401**
Total	**181,052**	**691,907**	**872,960**	**183,322**	**0**	**0**	**10,115**	**34,457**	**126,849**	**167,136**	**38,943**

Table 3-01 Target regulated energy demand and carbon emissions per energy source

Use Type	Total Energy (kWh/yr)	Total CO2 (kg/yr)
Student	982,193	209,078
Employment	57,902	13,186
Total	**1,040,095**	**222,264**

Table 3-02 Total target regulated energy demand and carbon emissions

3.2 Be Lean

As part of the Be Lean approach, passive design measures have been considered throughout the pre-planning stage to reduce initial energy demand.

Solar Gain Control and Daylight

Solar gains are a passive form of heating from the sun's radiation and are beneficial to a building during winter months as they provide an effective source of heat and reduce internal heating requirements. However, during summer months they must be controlled in order to mitigate the risk of overheating. They can be controlled through glazing and shading design in order to allow low level winter sun to enter the building and to limit access to high level summer sun.

The glazing strategy design has carefully considered orientation and window size in order to maximise daylight while controlling excessive solar gains. Glazing will incorporate low emissivity coatings to limit overheating without compromising light transmittance.

Overheating

The building follows the steps in the cooling hierarchy to minimise overheating. A separate dynamic overheating assessment has been conducted, please refer to the overheating report for further details.

Building Fabric

Designing an efficient thermal envelope will greatly reduce the need for space heating and cooling as heat transmittance through the thermal elements is reduced. Low air permeability rates will also reduce heating and cooling energy demand by reducing the volume of air that can penetrate the building. As part of a 'fabric first' approach, the building fabric has been carefully considered and specified to meet or exceed current Building Regulations minimum requirements, as detailed in Table 3-03 below.

Fabric Component	Proposed Student Specification	Proposed Employment Specification
External Walls	0.15 W/m²K	0.15 W/m²K
Basement walls	0.15 W/m²K	0.15 W/m²K
Internal Partition between heated/unheated spaces	0.30 W/m²K	0.30 W/m²K
Roof	0.13 W/m²K	0.15 W/m²K
Ground Floor	0.15 W/m²K	0.15 W/m²K
Exposed Floor	0.13 W/m²K	0.15 W/m²K
Windows (including glazed doors)	1.2 W/m²K, G-value 0.40	1.2 W/m²K, G-value 0.40
External Doors	1.5 W/m²K	1.5 W/m²K
Air Tightness	3 m³/m²/h	3 m³/m²/h

Table 3-03 Proposed Be Lean passive design measures

Building Services

A communal gas boiler has been assumed for Be Lean calculations only, in line with the guidance in the London plan, and does not reflect the energy strategy of the development. A communal gas boiler of 96% seasonal efficiency has been used in the be lean calculations. Systems have been specified to maximise efficiency therefore reducing energy used to deliver services. The services for the Employment space are assumed at this point, as the end use if not known. Table 3-04 shows the proposed services strategy and energy efficiency measures for the development.

Services Component	Proposed Student Specification	Assumed Employment Specification
Space Heating	*Communal Gas boiler, 96% efficient assumed for Be Lean*	*Communal Gas boiler, 96% efficient assumed for Be Lean*
Domestic Hot Water	*Communal Gas boiler, 96% efficient assumed for Be Lean*	*Communal Gas boiler, 96% efficient assumed for Be Lean*
Cooling	-	VRF, SEER 5.6
Ventilation	MVHR 85% efficient, SFP 0.95 W/l/s Demand control based on occupant density	MVHR 85% efficient, SFP 0.95 W/l/s
Lighting & Controls	LED lighting, 100lm/W, occupancy sensors in circulation spaces, daylight dimming and occupancy sensors in living areas, Display lighting 60 lm/W	LED lighting, 100lm/W, daylight dimming on ground and 1st floor spaces, occupancy sensors throughout, Display lighting 60 lm/W
Metering	Metering with warnings for out of range values for HVAC & lighting	Metering with warnings for out of range values for HVAC & lighting
Power Factor Correction	0.95	0.95

Table 3-04 Proposed energy efficient design measures

Energy Use

The breakdown of carbon and energy use has been identified for the site. Table 3-05 and 3-06 show the breakdown of carbon and energy use once the strategies proposed at the be lean stage are incorporated.

Use Type	Gas (kWh/yr)			Gas CO2 (kg/yr)	Electricity (kWh/yr)						Electricity CO2 (kg/yr)
	Space Heating	Hot Water	Total		Space Heating	HW	Cooling	Pumps & Fans	Lighting	Total	
Student	69,647	685,759	**755,406**	**158,635**	0	0	0	56,063	46,216	**99,721**	**23,235**
Employment	3,098	4,622	**7,720**	**1,621**	0	0	8,892	5,191	17,885	**31,169**	**7,262**
Total	**72,745**	**690,381**	**763,126**	**160,256**	**0**	**0**	**8,892**	**61,254**	**64,100**	**130,890**	**30,497**

Table 3-05 Be Lean regulated energy demand and carbon emissions per energy source

Use Type	Total Energy (kWh/yr)	Total CO2 (kg/yr)
Student	855,127	181,870
Employment	38,889	8,884
Total	**894,016**	**190,754**

Table 3-06 Be Lean target regulated energy demand and carbon emissions

Carbon Savings

Table 3-07 and Figure 3-02 demonstrates the percentage improvement over the notional baseline levels for the be lean stage. Overall, the development demonstrates a 14.2% reduction in CO2 emissions over the gas boiler baseline scenario. This does not meet the London plan target of 15%, however all reasonable measures have been taken to maximise be lean savings.

	Student			Employment			Site Wide		
	CO_2 Emissions (tonnes /annum)	CO_2 Savings (tonnes /annum)	% Saving	CO_2 Emissions (tonnes /annum)	CO_2 Savings (tonnes /annum)	% Saving	CO_2 Emissions (tonnes /annum)	CO_2 Savings (tonnes /annum)	% Saving
Baseline	209.08			13.19			222.26		
Be Lean	**181.87**	**27.21**	**13.0%**	**8.88**	**4.30**	**32.6%**	**190.75**	**31.51**	**14.2%**

Table 3-07 Be Lean improvements over building regulations gas boiler baseline

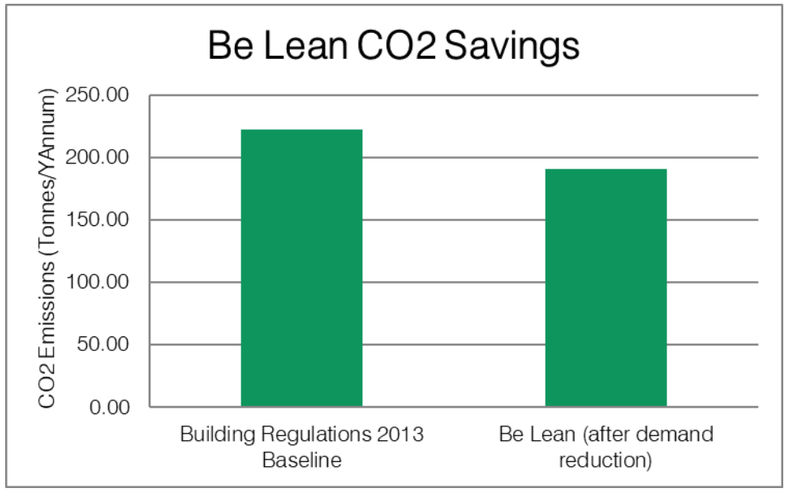


Figure 3-02 Be Lean improvement over the building regulations gas boiler baseline

The student section of the development achieves a 13.0% saving at the be lean stage. Although this does not achieve the target of 15% for non-residential, this is greater than the London plan target for residential development, and the nature of the building is for residential purposes.

The development does not meet the 15% target at the be lean stage, due to the high energy use attributed to domestic hot water (DHW) for student developments within the NCM methodology. Within the baseline scenario, DHW represents 68.8% of the overall buildings CO2 emissions.

This means that measures such as efficient fabric and lighting, which drastically reduce the energy demand for heating and lighting, have relatively little impact on the overall be lean savings, as DHW is so dominate. The development has employed an extremely efficient fabric, MVHR and efficient lighting and controls to halve the baseline emissions for heating and lighting at the be lean stage.

Feedback received from completed student schemes has also generally indicated that the NCM methodology massively overestimates the DHW demand of student schemes, so it is highly unlikely to be as high as indicated in the building regulation calculations. Water efficient appliances will also be installed within the scheme to reduce water use for showering and washing, which will reduce hot water demand for the development, however there is no way to account for this within the energy calculations.

The only available measure to reduce carbon emissions from DHW at the be lean stage is Waste Water Heat Recovery (WWHR). WWHR can help to reduce energy demand and therefore carbon emissions. For multi-tenanted buildings, particularly student accommodation, some issues have been identified with maintenance. The efficiency of the system will drop over time due to scum, dirt etc., that goes down the drain. Significant maintenance programs will be required to stop this. The technology is not widely used due to low overall savings compared to installation costs. Feasibility studies general indicate that the energy savings from WWHR are not as significant as energy modelling demonstrates. This means the real world cost savings in terms of energy reduction is quite low when compared to the cost of installation and maintenance of WWHR technology, and that the payback period for the technology can be longer then the design life of the development and the installed technology. There are also some concerns about the increased risk of legionella, due to the fact that some water will remain in the pipes once pre-warmed, at a temperature of 20-30 degrees, which is a breeding temperature for legionella. Although this risk is not thought to be extremely high, it is still a cause for concern. This is again particularly relevant in buildings like these where occupancy can be more sporadic. For these reasons the use of WWHR has been discounted

Be Lean Savings – DHW excluded

In order to demonstrate that the development is making Be Lean savings, but is limited by the extremely high hot water demand attributed to student accommodation under part L, calculations have been conducted with all DHW excluded.

These are shown in table 3-08, and demonstrate that the development achieves extremely high be lean stage savings, when just looking at heating, cooling, ventilation and lighting. The student section achieves 41.5% savings across these categories, and the employment section achieves 35.2% savings across these categories. Overall the site wide savings are 40.5% at the be lean stage, with DHW excluded.

	Student			Employment			Site Wide		
	CO_2 Emissions (tonnes /annum)	CO_2 Savings (tonnes /annum)	% Saving	CO_2 Emissions (tonnes /annum)	CO_2 Savings (tonnes /annum)	% Saving	CO_2 Emissions (tonnes /annum)	CO_2 Savings (tonnes /annum)	% Saving
Baseline	64.75			12.21			76.96		
Be Lean	**37.86**	**26.89**	**41.5%**	**7.91**	**4.30**	**35.2%**	**45.77**	**31.19**	**40.5%**

Table 3-08 Be Lean improvements over building regulations gas boiler baseline

3.3 Be Clean

As part of the Be Clean approach, the use of energy efficient equipment, heat networks and community heating have been considered.

The development is located near elephant and castle roundabout. The london heat map does not demonstrate that any existing or proposed networks run close to the site.

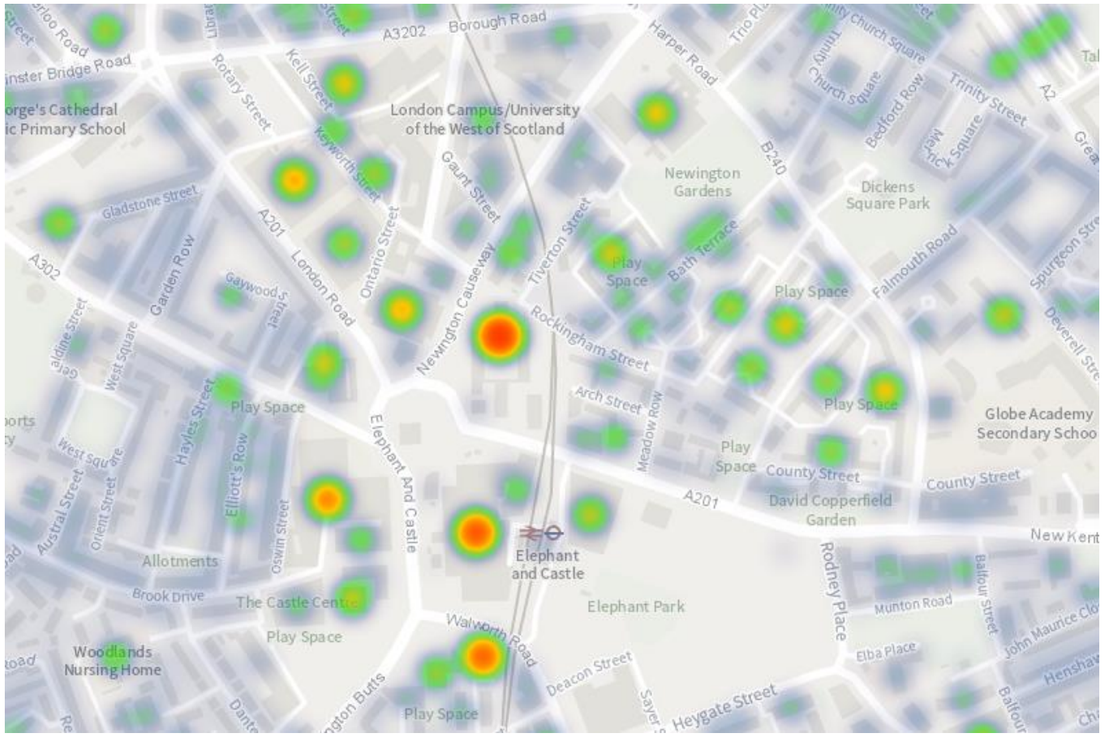


Figure 3-03 London Heat Map for Avonmouth House and surrounding area

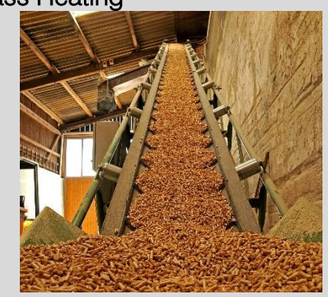
E.ON, the operator of the heat network at nearby Elephant Park, were also contacted regarding the feasibility of connection to their heat network. They confirmed that the site is too far away from any current proposed route for the network, and that it would not be feasible to connect to. A letter of confirmation from E.ON regarding discussions is shown in the Appendix.

Efficient systems for energy delivery have also been investigated. At the scale of this development, Combined Heat and Power (CHP) systems are not viable. CHP requires a high base energy demand load in order to operate efficiently. It is usually more suited to hotel or hospital schemes which have a high hot water demand, or very large residential schemes incorporating hundreds of units. With the continued decarbnisation fo the grid over the buildings lifespan, in the long term, CHP is also not viewed as the ideal technology for reducing carbon emissions.

The development will incorporate a community heating system, with a communal heating system for the student section. This will futureproof the development for connection to any heat networks that become available in the future.

3.4 Be Green

At the Be Green stage, renewable and low carbon technologies are investigated. Table 3-09 considers the feasibility of renewable energy technologies for the scheme.

LZC Technologies	Description	Noise	Visual impact	Internal Space	External Space	Capital Cost	Maintenance	Feasibility	
Solar Thermal Collectors 	Solar thermal collectors can be used to provide hot water using the irradiation from the sun. They can generally provide approximately 50% of the hot water demand.	🟢	🟡	🟢	🟡	🔴	🟡	There are areas of flat roof that can incorporate solar technologies. However, carbon savings are quite low and it is quite a high cost technology.	✗
Solar Photovoltaic Panels 	Solar PV panels generate electricity from the sun's energy. They should be installed within 90° of due south ideally at a 30° angle. The electricity can be used to supply the landlords load.	🟢	🟡	🟢	🟡	🟡	🟡	There are areas of flat roof that can incorporate solar technologies. Solar PV is ideal for making carbon savings while being a simple technology.	✓
Biomass Heating 	Solid, liquid or gaseous fuels derived from plant material can provide boiler heat for space and water heating. A biomass boiler would supplement a standard gas heating system so some of the cost may be offset through money saved on using smaller traditional boilers. Reliability of fuel access/supply can be a problem.	🟡	🟢	🔴	🟡	🔴	🔴	Biomass is not considered feasible for this development due to issues with fuel storage, access for delivery vehicles and local NO_x emissions.	✗

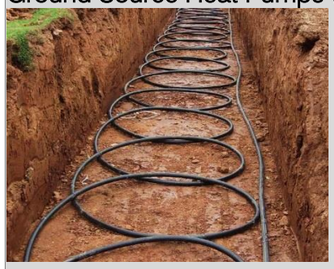
Wind Turbines 	Vertical and horizontal axis wind turbines enable electricity to be generated using the energy within the wind. Not suitable for urban environments due to low wind conditions and obstructions.	🔴	🔴	🟢	🔴	🔴	🟡	This development is in an urban environment and so a wind turbine will not be an effective solution.	×
Ground Source Heat Pumps (GSHP) 	Utilising horizontal loops or vertical boreholes, GSHP make use of the grounds almost constant temperature to provide heating and/or cooling using a heat exchanger connected to a space/water heating delivery system. Optimum efficiency with underfloor heating systems.	🟡	🟢	🟡	🟡	🔴	🟡	GSHP are not a feasible technology for the site since there is a limited external space available for installation of boreholes.	×
Air Source Heat Pumps (ASHP) 	Air Source Heat Pumps extract latent energy from the external air in a manner similar to ground source heat pumps. Optimum efficiency with underfloor heating systems.	🟡	🟡	🟡	🟡	🟡	🟡	Air source heat pumps are feasible option for both the student and employment spaces.	✓

Table 3-09 Feasibility of LZC technologies for the development

Renewable and low carbon systems

The feasibility study has identified ASHP as the most appropriate technology for the development. A communal ASHP is proposed for the development, with a separate VRF heat pump for the Employment section of the development. All suitable roof space on the development has been reserved for solar PV. All suitable roof space on the top floors has been reserved for Solar PV. The estimated system for the development is outlined in Table 3-10.

Services Component	Proposed Student specification	Proposed Employment Specification
Photovoltaic panels	Total Capacity - 14.5 kWp Orientation – South-West Angle of elevation – 10˚ Estimated Generation: 15.4 MWh/year Estimated array – 58 panels, 250 Wp, 20% efficiency, panel area 1.6m^2 Area - 92.8m^2	-
Space Heating	Communal ASHP, SCOP 3.13, 90% load Direct Electric Immersion, 10% load (assumed) 95% DHW delivery efficency	Heating via VRF, SCOP 4.1
Domestic Hot Water		Communal ASHP, SCOP 3.13, 90% load Direct Electric Immersion, 10% load (assumed) 95% DHW delivery efficency

Table 3-10 Proposed Be Green systems

An initial design for the centralised ASHP system has been produced by the M&E consultant. This will be developed in more details as the design progresses. The system is based of products provided by Lochinvar, and performance figures have been taken from the documentation provided by the manufacturer, shown in the appendix. The performance of systems is likely to change as the system design develops, and other manufacturers may be explored.

A capped off connection will be provided to the proposed employment space to allow for future connection for the provision of domestic hot water.

3.5 Energy and Carbon Savings

Energy Use

The breakdown of carbon and energy use has been identified for the site. Table 3-11 and 3-12 demonstrates the breakdown of carbon and energy use once the strategies proposed in this report are incorporated.

Use Type	Electricity (kWh/yr)							Electricity CO2 (kg/yr)
	Space Heating	Hot Water	Cooling	Pumps & Fans	Lighting	PV	Total	
Student	25,947	255,156	0	56,063	46,216	-15,381	**358,800**	**83,600**
Employment	720	1,725	8,892	5,191	17,885		**33,553**	**7,818**
Total	**26,667**	**256,881**	**8,892**	**61,254**	**64,100**	**-15,381**	**392,353**	**91,418**

Table 3-11 Be Green regulated energy demand and carbon emissions per energy source

Use Type	Total Energy (kWh/yr)	Total CO2 (kg/yr)
Student	358,800	83,600
Employment	33,553	7,818
Total	**392,353**	**91,418**

Table 3-12 Be Green target regulated energy demand and carbon emissions

Carbon Savings

Table 3-12 and Figure 3-04 demonstrate the percentage improvement over the notional baseline levels for the development for the district heating case, with renewable measures incorporated.

	Student			Employment			Site Wide		
	CO_2 Emissions (tonnes /annum)	CO_2 Savings (tonnes /annum)	% Saving	CO_2 Emissions (tonnes /annum)	CO_2 Savings (tonnes /annum)	% Saving	CO_2 Emissions (tonnes /annum)	CO_2 Savings (tonnes /annum)	% Saving
Baseline	209.08			13.19			222.26		
Be Lean	181.87	27.21	13.0%	8.88	4.30	32.6%	190.75	31.51	14.2%
Be Clean	181.87	0.00	0.0%	8.88	0.00	0.0%	190.75	0.00	0.0%
Be Green	83.60	98.27	47.0%	7.82	1.07	8.1%	91.42	99.34	44.7%
Total		**125.48**	**60.0%**		**5.37**	**40.7%**		**130.85**	**58.9%**

Table 3-13 Be Green improvements over building regulations gas boiler baseline

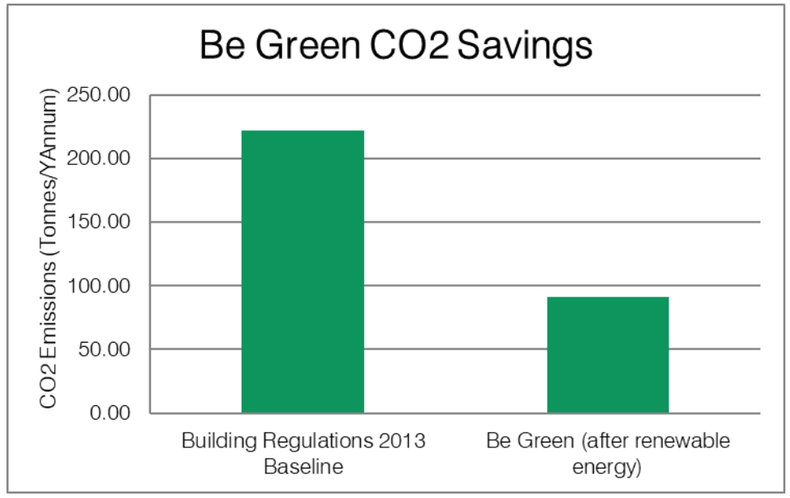


Figure 3-04 Be Green improvement over the building regulations gas boiler baseline

Carbon Offset Payment

Overall, the development has achieved a 58.9% improvement over the baseline scenario, which meets the London plan requirements of on-site carbon savings. In line with the London Plan carbon reduction requirements, there is a target of zero carbon, which can be achieved through an offset payment when there is a shortfall on site. The carbon offset payment is detailed in the Table below, estimated at a carbon price of £95/tonne.

	Carbon emissions (tonnes / annum)	30 year carbon emissions	Offset payment (£95/tonne)
Student	83.60		
Employment	7.82		
Total	91.42	2743	£ 260,542

Table 3-14 Carbon offset payment for the development

3.6 Be Seen

All major plant will be fitted with meters to allow remote monitoring of energy used by the communal heating systems and electrical distribution boards. A contract will be put in place to monitor the readings so that they can be compared with the predicted energy performance, and this information will be reported, as detailed in the GLA's 'Be Seen' guidance.

3.7 Operational costs

The cost to operate the building has been considered as part of the energy strategy. As described in section 3.2, all practical measures have been taken to reduce the energy demand through energy efficiency measures. This will help to keep long term operational costs down. Direct running costs for operational energy for the student units have been estimated to be an average of £232 per annum per unit, based on total electricity use and an electricity price of 15.1 p/kWh. Student occupants are not likely to pay bills directly but have the cost incorporated into rent.

As the building management will cover the cost of operating the building, they will be motivated to reduce the energy use of the building to reduce costs. Within the building, All services will be designed and maintained to CIBSE and other relevant quality standards, to maximise efficiency and reduce waste energy use and ensure prolonged life of services. A BMS system will be in place to allow the building management to monitor energy use by individual plant, and identify any areas of excessive or unexpected energy use.

Comprehensive commissioning will be undertaken of all services to CIBSE/BSRIA standards, with a commissioning manager providing advice on commissioning of complex systems. BUGs and training schedules will be produced for the development to ensure operation of all plant within the building is clear.

As part of the BREEAM strategy, the development is targeting all Man 05 Aftercare credits. This includes providing a minimum of 12 months aftercare support to building occupants, as well as 12 months of seasonal commissioning where relevant and a Post Occupancy Evaluation survey to be conducted by a third party.

4 Conclusion

This report outlines the energy strategy for the proposed development at Avonmouth House. The proposed development consists of the demolition of existing building and structures and erection of a part 2, part 7, part 14, part 16 storey plus basement mixed-use development comprising 1733sqm (GIA) of space for Class E employment use and/or community health hub and 233 purpose-built student residential rooms with associated amenity space and public realm works, car and cycle parking, and ancillary infrastructure.

As required by the London Plan, the development follows the energy hierarchy, incorporating passive design measures, energy efficient equipment and renewable energy.

The development employs an efficient building fabric, including well insulated walls and highly efficient glazing and efficient systems. At the be lean stage, this results in an 14.2% saving for the development as a whole. Although this does not quite meet the London Plan target of 15%, all reasonable measures have been taken to maximise be lean savings. Justification for why the 15% is not achievable has been outlined.

At the be green stage, PV Panels and an air source heat pump for heating and hot water are proposed to maximise carbon savings for the site. Overall, the development achieves a 58.9% improvement over the building regulation gas boiler baseline, which meets the London plan target for on-site carbon savings.

There is a target of zero carbon, which can be achieved through an offset payment. The carbon offset is estimated at £260,542.

The figures within this report are based on preliminary analysis only and further detailed studies will be required at the detailed design stage before specifying any of the proposed systems.

5 Appendix

5.1 BRUKL Output Documents

The BRUKL output documents for the Employment and Student sections are shown below.

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

220523 Avonmouth House Commercial Energy (be Lean)

As designed

Date: Mon May 23 10:21:37 2022

Administrative information

Building Details

Address: Address 1, City, Postcode

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.14

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.14

BRUKL compliance check version: v5.6.b.0

Certifier details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Criterion 1: The calculated CO_2 emission rate for the building must not exceed the target

CO_2 emission rate from the notional building, $kgCO_2/m^2.annum$	15.5
Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	15.5
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	10.7
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.15	0.15	L00001A6:Surf[2]
Floor	0.25	0.13	0.13	L0000132:Surf[0]
Roof	0.25	0.15	0.15	L0000132:Surf[1]
Windows***, roof windows, and rooflights	2.2	1.24	2	SP000040:Surf[3]
Personnel doors	2.2	1.64	2.2	L0000160:Surf[1]
Vehicle access & similar large doors	1.5	-	-	No Vehicle access doors in building
High usage entrance doors	3.5	-	-	No High usage entrance doors in building

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

* There might be more than one surface where the maximum U-value occurs.
** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.
*** Display windows and similar glazing are excluded from the U-value check.
N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
$m^3/(h.m^2)$ at 50 Pa	10	3

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	YES
Whole building electric power factor achieved by power factor correction	>0.95

1- VRF, MVHR (Gas Base Case)

	Heating efficiency	**Cooling efficiency**	**Radiant efficiency**	**SFP [W/(l/s)]**	**HR efficiency**
This system	0.96	5.6	0	-	0.85
Standard value	0.91*	2.6	N/A	N/A	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.

1- ASHP, DHW (Gas Base Case)

	Water heating efficiency	**Storage loss factor [kWh/litre per day]**
This building	0.96	-
Standard value	0.8	N/A

Local mechanical ventilation, exhaust, and terminal units

ID	**System type in Non-domestic Building Services Compliance Guide**
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	**SFP [W/(l/s)]**									**HR efficiency**	
ID of system type	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	**Zone**	**Standard**
Commercial L00 Employment Space	-	-	-	1	-	-	-	-	-	-	N/A
Commercial L01 Employment Space	-	-	-	1	-	-	-	-	-	-	N/A
Commercial L01 Employment Space	-	-	-	1	-	-	-	-	-	-	N/A
Commercial LB1 Employment Space	-	-	-	1	-	-	-	-	-	-	N/A
Commercial LB1 Employment Space	-	-	-	1	-	-	-	-	-	-	N/A

General lighting and display lighting

	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
Commercial L00 bin store	100	-	-	17
Commercial L00 cycle storage	100	-	-	36
Commercial L00 Employment Space	100	-	-	1631
Commercial L00 stairs	-	100	-	49
Commercial L00 stairs	-	100	-	64
Commercial L01 Employment Space	100	-	-	2706

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
Commercial L01 Employment Space	100	-	-	1064
Commercial L01 stairs	-	100	-	50
Commercial L01 stairs	-	100	-	49
Commercial LB1 Employment Space	100	-	-	1524
Commercial LB1 Employment Space	100	-	-	1976
Commercial LB1 hall	-	100	-	28
Commercial LB1 hall	-	100	-	21
Commercial LB1 stairs	-	100	-	49
Commercial LB1 stairs	-	100	-	50

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Commercial L00 Employment Space	NO (-68.8%)	NO
Commercial L01 Employment Space	NO (-46.7%)	NO
Commercial L01 Employment Space	NO (-53.7%)	NO
Commercial LB1 Employment Space	NO (-68.3%)	NO
Commercial LB1 Employment Space	NO (-83.4%)	NO

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	YES
Is evidence of such assessment available as a separate submission?	YES
Are any such measures included in the proposed design?	YES

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m^2]	1674.6	1674.6
External area [m^2]	1461.8	1461.8
Weather	LON	LON
Infiltration [m^3/hm^2@ 50Pa]	3	3
Average conductance [W/K]	454.23	799.38
Average U-value [W/m^2K]	0.31	0.55
Alpha value* [%]	10.1	10

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
	A1/A2 Retail/Financial and Professional services
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
100	**B1 Offices and Workshop businesses**
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
	Residential spaces
	D1 Non-residential Institutions: Community/Day Centre
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
	D1 Non-residential Institutions: Education
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others: Stand alone utility block

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

	Actual	Notional
Heating	1.85	5.15
Cooling	5.31	6.04
Auxiliary	3.1	1.82
Lighting	10.68	19.48
Hot water	2.76	2.77
Equipment*	37.47	37.47
TOTAL**	**23.69**	**35.26**

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m^2]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m^2]	86.23	98.38
Primary energy* [kWh/m^2]	62.75	91.5
Total emissions [kg/m^2]	10.7	15.5

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	7.2	91.6	2.1	6.1	3.5	0.94	4.19	0.96	5.6
	Notional	18.3	94.4	5.9	6.9	2.1	0.86	3.79	----	----
[ST] No Heating or Cooling										
	Actual	0	0	0	0	0	0	0	0	0
	Notional	0	0	0	0	0	0	0	----	----

Key to terms

Heat dem [MJ/m2] = Heating energy demand
Cool dem [MJ/m2] = Cooling energy demand
Heat con [kWh/m2] = Heating energy consumption
Cool con [kWh/m2] = Cooling energy consumption
Aux con [kWh/m2] = Auxiliary energy consumption
Heat SSEFF = Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER = Cooling system seasonal energy efficiency ratio
Heat gen SSEFF = Heating generator seasonal efficiency
Cool gen SSEER = Cooling generator seasonal energy efficiency ratio
ST = System type
HS = Heat source
HFT = Heating fuel type
CFT = Cooling fuel type

Key Features

The Building Control Body is advised to give particular attention to items whose specifications are better than typically expected.

Building fabric

Element	$U_{i\text{-}Typ}$	$U_{i\text{-}Min}$	Surface where the minimum value occurs*
Wall	0.23	0.15	LB000002:Surf[7]
Floor	0.2	0.13	L0000132:Surf[0]
Roof	0.15	0.15	L0000132:Surf[1]
Windows, roof windows, and rooflights	1.5	1.2	L00001A7:Surf[1]
Personnel doors	1.5	1.5	L00001A6:Surf[0]
Vehicle access & similar large doors	1.5	-	No Vehicle access doors in building
High usage entrance doors	1.5	-	No High usage entrance doors in building

$U_{i\text{-}Typ}$ = Typical individual element U-values [W/(m²K)] $U_{i\text{-}Min}$ = Minimum individual element U-values [W/(m²K)]

* There might be more than one surface where the minimum U-value occurs.

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	3

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

220523 Avonmouth House Student Energy (be lean)

As designed

Date: Mon May 23 10:47:03 2022

Administrative information

Building Details

Address: Address 1, City, Postcode

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.14

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.14

BRUKL compliance check version: v5.6.b.0

Certifier details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Criterion 1: The calculated CO_2 emission rate for the building must not exceed the target

CO_2 emission rate from the notional building, $kgCO_2/m^2.annum$	34.7
Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	34.7
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	29.9
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.15	0.15	L0000061:Surf[2]
Floor	0.25	0.15	0.15	LB000021:Surf[0]
Roof	0.25	0.13	0.15	SP000026:Surf[6]
Windows***, roof windows, and rooflights	2.2	1.2	1.2	L00001A8:Surf[2]
Personnel doors	2.2	1.5	1.5	L0000061:Surf[0]
Vehicle access & similar large doors	1.5	-	-	No Vehicle access doors in building
High usage entrance doors	3.5	-	-	No High usage entrance doors in building

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

* There might be more than one surface where the maximum U-value occurs.
** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.
*** Display windows and similar glazing are excluded from the U-value check.
N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
$m^3/(h.m^2)$ at 50 Pa	10	3

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	YES
Whole building electric power factor achieved by power factor correction	>0.95

1- ASHP, No MVHR (Gas Base Case)

	Heating efficiency	**Cooling efficiency**	**Radiant efficiency**	**SFP [W/(l/s)]**	**HR efficiency**
This system	0.96	-	0.2	-	-
Standard value	0.91*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.					

2- ASHP, MVHR (Gas Base Case)

	Heating efficiency	**Cooling efficiency**	**Radiant efficiency**	**SFP [W/(l/s)]**	**HR efficiency**
This system	0.96	-	0.2	-	0.85
Standard value	0.91*	N/A	N/A	N/A	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.					

1- ASHP, DHW (Gas Base Case)

	Water heating efficiency	**Storage loss factor [kWh/litre per day]**
This building	0.96	-
Standard value	0.8	N/A

Local mechanical ventilation, exhaust, and terminal units

ID	**System type in Non-domestic Building Services Compliance Guide**
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	**SFP [W/(l/s)]**									**HR efficiency**	
ID of system type	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	**Zone**	**Standard**
L00 WC	-	-	-	1	-	-	-	-	-	-	N/A
L02.A LKD	-	-	-	1	-	-	-	-	-	-	N/A
L02.A.01 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L02.A.01 WC	-	-	-	1	-	-	-	-	-	-	N/A
L02.A.02 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L02.A.02 WC	-	-	-	1	-	-	-	-	-	-	N/A
L02.A.03 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L02.A.03 WC	-	-	-	1	-	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
L02.A.04 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L02.A.04 WC	-	-	-	1	-	-	-	-	-	-	N/A
L02.A.05 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L02.A.05 WC	-	-	-	1	-	-	-	-	-	-	N/A
L02.A.06 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L02.A.06 WC	-	-	-	1	-	-	-	-	-	-	N/A
L02.A.07 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L02.A.07 WC	-	-	-	1	-	-	-	-	-	-	N/A
L02.A.08 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L02.A.08 WC	-	-	-	1	-	-	-	-	-	-	N/A
L02.B LKD	-	-	-	1	-	-	-	-	-	-	N/A
L02.B.01 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L02.B.01 WC	-	-	-	1	-	-	-	-	-	-	N/A
L02.B.02 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L02.B.02 WC	-	-	-	1	-	-	-	-	-	-	N/A
L02.B.03 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L02.B.03 WC	-	-	-	1	-	-	-	-	-	-	N/A
L02.B.04 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L02.B.04 WC	-	-	-	1	-	-	-	-	-	-	N/A
L02.B.05 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L02.B.05 WC	-	-	-	1	-	-	-	-	-	-	N/A
L02.B.06 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L02.B.06 WC	-	-	-	1	-	-	-	-	-	-	N/A
L02.B.07 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L02.B.07 WC	-	-	-	1	-	-	-	-	-	-	N/A
L02.B.08 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L02.B.08 WC	-	-	-	1	-	-	-	-	-	-	N/A
L02.C LKD	-	-	-	1	-	-	-	-	-	-	N/A
L02.C.01 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L02.C.01 WC	-	-	-	1	-	-	-	-	-	-	N/A
L02.C.02 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L02.C.02 WC	-	-	-	1	-	-	-	-	-	-	N/A
L02.C.03 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L02.C.03 WC	-	-	-	1	-	-	-	-	-	-	N/A
L02.C.04 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L02.C.04 WC	-	-	-	1	-	-	-	-	-	-	N/A
L02.C.05 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L02.C.05 WC	-	-	-	1	-	-	-	-	-	-	N/A
L02.C.06 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L02.C.06 WC	-	-	-	1	-	-	-	-	-	-	N/A
L02.D.01 Studio	-	-	-	1	-	-	-	-	-	-	N/A
L02.D.01 WC	-	-	-	1	-	-	-	-	-	-	N/A
L03.A LKD	-	-	-	1	-	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
L03.A.01 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L03.A.01 WC	-	-	-	1	-	-	-	-	-	-	N/A
L03.A.02 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L03.A.02 WC	-	-	-	1	-	-	-	-	-	-	N/A
L03.A.03 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L03.A.03 WC	-	-	-	1	-	-	-	-	-	-	N/A
L03.A.04 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L03.A.04 WC	-	-	-	1	-	-	-	-	-	-	N/A
L03.A.05 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L03.A.05 WC	-	-	-	1	-	-	-	-	-	-	N/A
L03.A.06 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L03.A.06 WC	-	-	-	1	-	-	-	-	-	-	N/A
L03.A.07 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L03.A.07 WC	-	-	-	1	-	-	-	-	-	-	N/A
L03.A.08 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L03.A.08 WC	-	-	-	1	-	-	-	-	-	-	N/A
L03.B LKD	-	-	-	1	-	-	-	-	-	-	N/A
L03.B.01 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L03.B.01 WC	-	-	-	1	-	-	-	-	-	-	N/A
L03.B.02 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L03.B.02 WC	-	-	-	1	-	-	-	-	-	-	N/A
L03.B.03 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L03.B.03 WC	-	-	-	1	-	-	-	-	-	-	N/A
L03.B.04 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L03.B.04 WC	-	-	-	1	-	-	-	-	-	-	N/A
L03.B.05 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L03.B.05 WC	-	-	-	1	-	-	-	-	-	-	N/A
L03.B.06 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L03.B.06 WC	-	-	-	1	-	-	-	-	-	-	N/A
L03.B.07 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L03.B.07 WC	-	-	-	1	-	-	-	-	-	-	N/A
L03.B.08 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L03.B.08 WC	-	-	-	1	-	-	-	-	-	-	N/A
L03.C LKD	-	-	-	1	-	-	-	-	-	-	N/A
L03.C.01 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L03.C.01 WC	-	-	-	1	-	-	-	-	-	-	N/A
L03.C.02 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L03.C.02 WC	-	-	-	1	-	-	-	-	-	-	N/A
L03.C.03 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L03.C.03 WC	-	-	-	1	-	-	-	-	-	-	N/A
L03.C.04 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L03.C.04 WC	-	-	-	1	-	-	-	-	-	-	N/A
L03.C.05 Bed	-	-	-	1	-	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
L03.C.05 WC	-	-	-	1	-	-	-	-	-	-	N/A
L03.C.06 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L03.C.06 WC	-	-	-	1	-	-	-	-	-	-	N/A
L03.D.01 Studio	-	-	-	1	-	-	-	-	-	-	N/A
L03.D.01 WC	-	-	-	1	-	-	-	-	-	-	N/A
L04.A LKD	-	-	-	1	-	-	-	-	-	-	N/A
L04.A.01 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L04.A.01 WC	-	-	-	1	-	-	-	-	-	-	N/A
L04.A.02 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L04.A.02 WC	-	-	-	1	-	-	-	-	-	-	N/A
L04.A.03 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L04.A.03 WC	-	-	-	1	-	-	-	-	-	-	N/A
L04.A.04 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L04.A.04 WC	-	-	-	1	-	-	-	-	-	-	N/A
L04.A.05 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L04.A.05 WC	-	-	-	1	-	-	-	-	-	-	N/A
L04.A.06 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L04.A.06 WC	-	-	-	1	-	-	-	-	-	-	N/A
L04.A.07 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L04.A.07 WC	-	-	-	1	-	-	-	-	-	-	N/A
L04.A.08 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L04.A.08 WC	-	-	-	1	-	-	-	-	-	-	N/A
L04.B LKD	-	-	-	1	-	-	-	-	-	-	N/A
L04.B.01 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L04.B.01 WC	-	-	-	1	-	-	-	-	-	-	N/A
L04.B.02 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L04.B.02 WC	-	-	-	1	-	-	-	-	-	-	N/A
L04.B.03 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L04.B.03 WC	-	-	-	1	-	-	-	-	-	-	N/A
L04.B.04 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L04.B.04 WC	-	-	-	1	-	-	-	-	-	-	N/A
L04.B.05 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L04.B.05 WC	-	-	-	1	-	-	-	-	-	-	N/A
L04.B.06 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L04.B.06 WC	-	-	-	1	-	-	-	-	-	-	N/A
L04.B.07 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L04.B.07 WC	-	-	-	1	-	-	-	-	-	-	N/A
L04.B.08 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L04.B.08 WC	-	-	-	1	-	-	-	-	-	-	N/A
L04.C LKD	-	-	-	1	-	-	-	-	-	-	N/A
L04.C.01 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L04.C.01 WC	-	-	-	1	-	-	-	-	-	-	N/A
L04.C.02 Bed	-	-	-	1	-	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
L04.C.02 WC	-	-	-	1	-	-	-	-	-	-	N/A
L04.C.03 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L04.C.03 WC	-	-	-	1	-	-	-	-	-	-	N/A
L04.C.04 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L04.C.04 WC	-	-	-	1	-	-	-	-	-	-	N/A
L04.C.05 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L04.C.05 WC	-	-	-	1	-	-	-	-	-	-	N/A
L04.C.06 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L04.C.06 WC	-	-	-	1	-	-	-	-	-	-	N/A
L04.D.01 Studio	-	-	-	1	-	-	-	-	-	-	N/A
L04.D.01 WC	-	-	-	1	-	-	-	-	-	-	N/A
L05.A LKD	-	-	-	1	-	-	-	-	-	-	N/A
L05.A.01 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L05.A.01 WC	-	-	-	1	-	-	-	-	-	-	N/A
L05.A.02 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L05.A.02 WC	-	-	-	1	-	-	-	-	-	-	N/A
L05.A.03 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L05.A.03 WC	-	-	-	1	-	-	-	-	-	-	N/A
L05.A.04 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L05.A.04 WC	-	-	-	1	-	-	-	-	-	-	N/A
L05.A.05 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L05.A.05 WC	-	-	-	1	-	-	-	-	-	-	N/A
L05.A.06 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L05.A.06 WC	-	-	-	1	-	-	-	-	-	-	N/A
L05.A.07 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L05.A.07 WC	-	-	-	1	-	-	-	-	-	-	N/A
L05.A.08 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L05.A.08 WC	-	-	-	1	-	-	-	-	-	-	N/A
L05.B LKD	-	-	-	1	-	-	-	-	-	-	N/A
L05.B.01 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L05.B.01 WC	-	-	-	1	-	-	-	-	-	-	N/A
L05.B.02 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L05.B.02 WC	-	-	-	1	-	-	-	-	-	-	N/A
L05.B.03 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L05.B.03 WC	-	-	-	1	-	-	-	-	-	-	N/A
L05.B.04 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L05.B.04 WC	-	-	-	1	-	-	-	-	-	-	N/A
L05.B.05 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L05.B.05 WC	-	-	-	1	-	-	-	-	-	-	N/A
L05.B.06 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L05.B.06 WC	-	-	-	1	-	-	-	-	-	-	N/A
L05.B.07 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L05.B.07 WC	-	-	-	1	-	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
L05.B.08 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L05.B.08 WC	-	-	-	1	-	-	-	-	-	-	N/A
L05.C LKD	-	-	-	1	-	-	-	-	-	-	N/A
L05.C.01 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L05.C.01 WC	-	-	-	1	-	-	-	-	-	-	N/A
L05.C.02 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L05.C.02 WC	-	-	-	1	-	-	-	-	-	-	N/A
L05.C.03 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L05.C.03 WC	-	-	-	1	-	-	-	-	-	-	N/A
L05.C.04 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L05.C.04 WC	-	-	-	1	-	-	-	-	-	-	N/A
L05.C.05 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L05.C.05 WC	-	-	-	1	-	-	-	-	-	-	N/A
L05.C.06 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L05.C.06 WC	-	-	-	1	-	-	-	-	-	-	N/A
L05.D.01 Studio	-	-	-	1	-	-	-	-	-	-	N/A
L05.D.01 WC	-	-	-	1	-	-	-	-	-	-	N/A
L06.A LKD	-	-	-	1	-	-	-	-	-	-	N/A
L06.A.01 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L06.A.01 WC	-	-	-	1	-	-	-	-	-	-	N/A
L06.A.02 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L06.A.02 WC	-	-	-	1	-	-	-	-	-	-	N/A
L06.A.03 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L06.A.03 WC	-	-	-	1	-	-	-	-	-	-	N/A
L06.A.04 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L06.A.04 WC	-	-	-	1	-	-	-	-	-	-	N/A
L06.A.05 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L06.A.05 WC	-	-	-	1	-	-	-	-	-	-	N/A
L06.A.06 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L06.A.06 WC	-	-	-	1	-	-	-	-	-	-	N/A
L06.A.07 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L06.A.07 WC	-	-	-	1	-	-	-	-	-	-	N/A
L06.A.08 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L06.A.08 WC	-	-	-	1	-	-	-	-	-	-	N/A
L06.B LKD	-	-	-	1	-	-	-	-	-	-	N/A
L06.B.01 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L06.B.01 WC	-	-	-	1	-	-	-	-	-	-	N/A
L06.B.02 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L06.B.02 WC	-	-	-	1	-	-	-	-	-	-	N/A
L06.B.03 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L06.B.03 WC	-	-	-	1	-	-	-	-	-	-	N/A
L06.B.04 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L06.B.04 WC	-	-	-	1	-	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
L06.B.05 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L06.B.05 WC	-	-	-	1	-	-	-	-	-	-	N/A
L06.B.06 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L06.B.06 WC	-	-	-	1	-	-	-	-	-	-	N/A
L06.B.07 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L06.B.07 WC	-	-	-	1	-	-	-	-	-	-	N/A
L06.B.08 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L06.B.08 WC	-	-	-	1	-	-	-	-	-	-	N/A
L06.C LKD	-	-	-	1	-	-	-	-	-	-	N/A
L06.C.01 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L06.C.01 WC	-	-	-	1	-	-	-	-	-	-	N/A
L06.C.02 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L06.C.02 WC	-	-	-	1	-	-	-	-	-	-	N/A
L06.C.03 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L06.C.03 WC	-	-	-	1	-	-	-	-	-	-	N/A
L06.C.04 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L06.C.04 WC	-	-	-	1	-	-	-	-	-	-	N/A
L06.C.05 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L06.C.05 WC	-	-	-	1	-	-	-	-	-	-	N/A
L06.C.06 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L06.C.06 WC	-	-	-	1	-	-	-	-	-	-	N/A
L06.D.01 Studio	-	-	-	1	-	-	-	-	-	-	N/A
L06.D.01 WC	-	-	-	1	-	-	-	-	-	-	N/A
L07.A LKD	-	-	-	1	-	-	-	-	-	-	N/A
L07.A.01 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L07.A.01 WC	-	-	-	1	-	-	-	-	-	-	N/A
L07.A.02 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L07.A.02 WC	-	-	-	1	-	-	-	-	-	-	N/A
L07.A.03 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L07.A.03 WC	-	-	-	1	-	-	-	-	-	-	N/A
L07.A.04 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L07.A.04 WC	-	-	-	1	-	-	-	-	-	-	N/A
L07.A.05 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L07.A.05 WC	-	-	-	1	-	-	-	-	-	-	N/A
L07.A.06 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L07.A.06 WC	-	-	-	1	-	-	-	-	-	-	N/A
L07.A.07 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L07.A.07 WC	-	-	-	1	-	-	-	-	-	-	N/A
L07.B. LKD	-	-	-	1	-	-	-	-	-	-	N/A
L07.B.01 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L07.B.01 WC	-	-	-	1	-	-	-	-	-	-	N/A
L07.B.02 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L07.B.02 WC	-	-	-	1	-	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
L07.B.03 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L07.B.03 WC	-	-	-	1	-	-	-	-	-	-	N/A
L07.B.04 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L07.B.04 WC	-	-	-	1	-	-	-	-	-	-	N/A
L07.C.01 studio	-	-	-	1	-	-	-	-	-	-	N/A
L07.C.01 WC	-	-	-	1	-	-	-	-	-	-	N/A
L07.C.02 studio	-	-	-	1	-	-	-	-	-	-	N/A
L07.C.02 WC	-	-	-	1	-	-	-	-	-	-	N/A
L07.C.03 Studio	-	-	-	1	-	-	-	-	-	-	N/A
L07.C.03 WC	-	-	-	1	-	-	-	-	-	-	N/A
L08.A LKD	-	-	-	1	-	-	-	-	-	-	N/A
L08.A.01 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L08.A.01 WC	-	-	-	1	-	-	-	-	-	-	N/A
L08.A.02 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L08.A.02 WC	-	-	-	1	-	-	-	-	-	-	N/A
L08.A.03 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L08.A.03 WC	-	-	-	1	-	-	-	-	-	-	N/A
L08.A.04 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L08.A.04 WC	-	-	-	1	-	-	-	-	-	-	N/A
L08.A.05 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L08.A.05 WC	-	-	-	1	-	-	-	-	-	-	N/A
L08.A.06 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L08.A.06 WC	-	-	-	1	-	-	-	-	-	-	N/A
L08.A.07 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L08.A.07 WC	-	-	-	1	-	-	-	-	-	-	N/A
L08.B. LKD	-	-	-	1	-	-	-	-	-	-	N/A
L08.B.01 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L08.B.01 WC	-	-	-	1	-	-	-	-	-	-	N/A
L08.B.02 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L08.B.02 WC	-	-	-	1	-	-	-	-	-	-	N/A
L08.B.03 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L08.B.03 WC	-	-	-	1	-	-	-	-	-	-	N/A
L08.B.04 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L08.B.04 WC	-	-	-	1	-	-	-	-	-	-	N/A
L08.B.05 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L08.B.05 WC	-	-	-	1	-	-	-	-	-	-	N/A
L08.B.06 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L08.B.06 WC	-	-	-	1	-	-	-	-	-	-	N/A
L08.B.07 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L08.B.07 WC	-	-	-	1	-	-	-	-	-	-	N/A
L08.C.01 Studio	-	-	-	1	-	-	-	-	-	-	N/A
L08.C.01 WC	-	-	-	1	-	-	-	-	-	-	N/A
L09.A LKD	-	-	-	1	-	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
L09.A.01 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L09.A.01 WC	-	-	-	1	-	-	-	-	-	-	N/A
L09.A.02 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L09.A.02 WC	-	-	-	1	-	-	-	-	-	-	N/A
L09.A.03 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L09.A.03 WC	-	-	-	1	-	-	-	-	-	-	N/A
L09.A.04 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L09.A.04 WC	-	-	-	1	-	-	-	-	-	-	N/A
L09.A.05 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L09.A.05 WC	-	-	-	1	-	-	-	-	-	-	N/A
L09.A.06 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L09.A.06 WC	-	-	-	1	-	-	-	-	-	-	N/A
L09.A.07 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L09.A.07 WC	-	-	-	1	-	-	-	-	-	-	N/A
L09.B. LKD	-	-	-	1	-	-	-	-	-	-	N/A
L09.B.01 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L09.B.01 WC	-	-	-	1	-	-	-	-	-	-	N/A
L09.B.02 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L09.B.02 WC	-	-	-	1	-	-	-	-	-	-	N/A
L09.B.03 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L09.B.03 WC	-	-	-	1	-	-	-	-	-	-	N/A
L09.B.04 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L09.B.04 WC	-	-	-	1	-	-	-	-	-	-	N/A
L09.B.05 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L09.B.05 WC	-	-	-	1	-	-	-	-	-	-	N/A
L09.B.06 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L09.B.06 WC	-	-	-	1	-	-	-	-	-	-	N/A
L09.B.07 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L09.B.07 WC	-	-	-	1	-	-	-	-	-	-	N/A
L09.C.01 Studio	-	-	-	1	-	-	-	-	-	-	N/A
L09.C.01 WC	-	-	-	1	-	-	-	-	-	-	N/A
L10.A LKD	-	-	-	1	-	-	-	-	-	-	N/A
L10.A.01 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L10.A.01 WC	-	-	-	1	-	-	-	-	-	-	N/A
L10.A.02 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L10.A.02 WC	-	-	-	1	-	-	-	-	-	-	N/A
L10.A.03 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L10.A.03 WC	-	-	-	1	-	-	-	-	-	-	N/A
L10.A.04 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L10.A.04 WC	-	-	-	1	-	-	-	-	-	-	N/A
L10.A.05 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L10.A.05 WC	-	-	-	1	-	-	-	-	-	-	N/A
L10.A.06 Bed	-	-	-	1	-	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
L10.A.06 WC	-	-	-	1	-	-	-	-	-	-	N/A
L10.A.07 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L10.A.07 WC	-	-	-	1	-	-	-	-	-	-	N/A
L10.B. LKD	-	-	-	1	-	-	-	-	-	-	N/A
L10.B.01 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L10.B.01 WC	-	-	-	1	-	-	-	-	-	-	N/A
L10.B.02 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L10.B.02 WC	-	-	-	1	-	-	-	-	-	-	N/A
L10.B.03 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L10.B.03 WC	-	-	-	1	-	-	-	-	-	-	N/A
L10.B.04 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L10.B.04 WC	-	-	-	1	-	-	-	-	-	-	N/A
L10.B.05 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L10.B.05 WC	-	-	-	1	-	-	-	-	-	-	N/A
L10.B.06 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L10.B.06 WC	-	-	-	1	-	-	-	-	-	-	N/A
L10.B.07 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L10.B.07 WC	-	-	-	1	-	-	-	-	-	-	N/A
L10.C.01 Studio	-	-	-	1	-	-	-	-	-	-	N/A
L10.C.01 WC	-	-	-	1	-	-	-	-	-	-	N/A
L11.A LKD	-	-	-	1	-	-	-	-	-	-	N/A
L11.A.01 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L11.A.01 WC	-	-	-	1	-	-	-	-	-	-	N/A
L11.A.02 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L11.A.02 WC	-	-	-	1	-	-	-	-	-	-	N/A
L11.A.03 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L11.A.03 WC	-	-	-	1	-	-	-	-	-	-	N/A
L11.A.04 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L11.A.04 WC	-	-	-	1	-	-	-	-	-	-	N/A
L11.A.05 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L11.A.05 WC	-	-	-	1	-	-	-	-	-	-	N/A
L11.A.06 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L11.A.06 WC	-	-	-	1	-	-	-	-	-	-	N/A
L11.A.07 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L11.A.07 WC	-	-	-	1	-	-	-	-	-	-	N/A
L11.B. LKD	-	-	-	1	-	-	-	-	-	-	N/A
L11.B.01 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L11.B.01 WC	-	-	-	1	-	-	-	-	-	-	N/A
L11.B.02 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L11.B.02 WC	-	-	-	1	-	-	-	-	-	-	N/A
L11.B.03 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L11.B.03 WC	-	-	-	1	-	-	-	-	-	-	N/A
L11.B.04 Bed	-	-	-	1	-	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
L11.B.04 WC	-	-	-	1	-	-	-	-	-	-	N/A
L11.B.05 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L11.B.05 WC	-	-	-	1	-	-	-	-	-	-	N/A
L11.B.06 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L11.B.06 WC	-	-	-	1	-	-	-	-	-	-	N/A
L11.B.07 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L11.B.07 WC	-	-	-	1	-	-	-	-	-	-	N/A
L11.C.01 Studio	-	-	-	1	-	-	-	-	-	-	N/A
L11.C.01 WC	-	-	-	1	-	-	-	-	-	-	N/A
L12.A LKD	-	-	-	1	-	-	-	-	-	-	N/A
L12.A.01 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L12.A.01 WC	-	-	-	1	-	-	-	-	-	-	N/A
L12.A.02 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L12.A.02 WC	-	-	-	1	-	-	-	-	-	-	N/A
L12.A.03 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L12.A.03 WC	-	-	-	1	-	-	-	-	-	-	N/A
L12.A.04 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L12.A.04 WC	-	-	-	1	-	-	-	-	-	-	N/A
L12.A.05 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L12.A.05 WC	-	-	-	1	-	-	-	-	-	-	N/A
L12.A.06 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L12.A.06 WC	-	-	-	1	-	-	-	-	-	-	N/A
L12.A.07 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L12.A.07 WC	-	-	-	1	-	-	-	-	-	-	N/A
L12.B. LKD	-	-	-	1	-	-	-	-	-	-	N/A
L12.B.01 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L12.B.01 WC	-	-	-	1	-	-	-	-	-	-	N/A
L12.B.02 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L12.B.02 WC	-	-	-	1	-	-	-	-	-	-	N/A
L12.B.03 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L12.B.03 WC	-	-	-	1	-	-	-	-	-	-	N/A
L12.B.04 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L12.B.04 WC	-	-	-	1	-	-	-	-	-	-	N/A
L12.B.05 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L12.B.05 WC	-	-	-	1	-	-	-	-	-	-	N/A
L12.B.06 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L12.B.06 WC	-	-	-	1	-	-	-	-	-	-	N/A
L12.B.07 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L12.B.07 WC	-	-	-	1	-	-	-	-	-	-	N/A
L12.C.01 Studio	-	-	-	1	-	-	-	-	-	-	N/A
L12.C.01 WC	-	-	-	1	-	-	-	-	-	-	N/A
L13.A LKD	-	-	-	1	-	-	-	-	-	-	N/A
L13.A.01 Bed	-	-	-	1	-	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
L13.A.01 WC	-	-	-	1	-	-	-	-	-	-	N/A
L13.A.02 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L13.A.02 WC	-	-	-	1	-	-	-	-	-	-	N/A
L13.A.03 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L13.A.03 WC	-	-	-	1	-	-	-	-	-	-	N/A
L13.A.04 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L13.A.04 WC	-	-	-	1	-	-	-	-	-	-	N/A
L13.A.05 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L13.A.05 WC	-	-	-	1	-	-	-	-	-	-	N/A
L13.A.06 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L13.A.06 WC	-	-	-	1	-	-	-	-	-	-	N/A
L13.A.07 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L13.A.07 WC	-	-	-	1	-	-	-	-	-	-	N/A
L13.B. LKD	-	-	-	1	-	-	-	-	-	-	N/A
L13.B.01 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L13.B.01 WC	-	-	-	1	-	-	-	-	-	-	N/A
L13.B.02 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L13.B.02 WC	-	-	-	1	-	-	-	-	-	-	N/A
L13.B.03 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L13.B.03 WC	-	-	-	1	-	-	-	-	-	-	N/A
L13.B.04 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L13.B.04 WC	-	-	-	1	-	-	-	-	-	-	N/A
L13.B.05 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L13.B.05 WC	-	-	-	1	-	-	-	-	-	-	N/A
L13.B.06 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L13.B.06 WC	-	-	-	1	-	-	-	-	-	-	N/A
L13.B.07 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L13.B.07 WC	-	-	-	1	-	-	-	-	-	-	N/A
L13.C.01 Studio	-	-	-	1	-	-	-	-	-	-	N/A
L13.C.01 WC	-	-	-	1	-	-	-	-	-	-	N/A
L14.A LKD	-	-	-	1	-	-	-	-	-	-	N/A
L14.A.01 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L14.A.01 WC	-	-	-	1	-	-	-	-	-	-	N/A
L14.A.02 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L14.A.02 WC	-	-	-	1	-	-	-	-	-	-	N/A
L14.A.03 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L14.A.03 WC	-	-	-	1	-	-	-	-	-	-	N/A
L14.A.04 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L14.A.04 WC	-	-	-	1	-	-	-	-	-	-	N/A
L14.A.05 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L14.A.05 WC	-	-	-	1	-	-	-	-	-	-	N/A
L14.A.06 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L14.A.06 WC	-	-	-	1	-	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
L14.B.01 Studio	-	-	-	1	-	-	-	-	-	-	N/A
L14.B.01 WC	-	-	-	1	-	-	-	-	-	-	N/A
L15.A LKD	-	-	-	1	-	-	-	-	-	-	N/A
L15.A.01 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L15.A.01 WC	-	-	-	1	-	-	-	-	-	-	N/A
L15.A.02 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L15.A.02 WC	-	-	-	1	-	-	-	-	-	-	N/A
L15.A.03 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L15.A.03 WC	-	-	-	1	-	-	-	-	-	-	N/A
L15.A.04 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L15.A.04 WC	-	-	-	1	-	-	-	-	-	-	N/A
L15.A.05 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L15.A.05 WC	-	-	-	1	-	-	-	-	-	-	N/A
L15.A.06 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L15.A.06 WC	-	-	-	1	-	-	-	-	-	-	N/A
L15.B.01 Studio	-	-	-	1	-	-	-	-	-	-	N/A
L15.B.01 WC	-	-	-	1	-	-	-	-	-	-	N/A

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
L00 bin store	100	-	-	54
L00 Circ	-	100	-	54
L00 Circ	-	100	-	53
L00 concierge	-	100	60	191
L00 lift lobby	-	100	60	97
L00 office	100	-	-	274
L00 Plant	100	-	-	100
L00 post	100	-	-	171
L00 stairs	-	100	-	47
L00 WC	-	100	-	33
L00 WC Circ	-	100	-	22
L01 Circ	-	100	-	67
L01 Stairs	-	100	-	37
L02 Circ	-	100	-	52
L02 Stairs	-	100	-	31
L02.A Circ	-	100	-	56
L02.A LKD	-	100	-	230
L02.A.01 Bed	-	100	-	22
L02.A.01 WC	-	100	-	19
L02.A.02 Bed	-	100	-	22
L02.A.02 WC	-	100	-	19
L02.A.03 Bed	-	100	-	25

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
L02.A.03 WC	-	100	-	20
L02.A.04 Bed	-	100	-	24
L02.A.04 WC	-	100	-	19
L02.A.05 Bed	-	100	-	24
L02.A.05 WC	-	100	-	19
L02.A.06 Bed	-	100	-	23
L02.A.06 WC	-	100	-	19
L02.A.07 Bed	-	100	-	23
L02.A.07 WC	-	100	-	16
L02.A.08 Bed	-	100	-	24
L02.A.08 WC	-	100	-	17
L02.B Circ	-	100	-	72
L02.B LKD	-	100	-	321
L02.B.01 Bed	-	100	-	24
L02.B.01 WC	-	100	-	17
L02.B.02 Bed	-	100	-	26
L02.B.02 WC	-	100	-	17
L02.B.03 Bed	-	100	-	26
L02.B.03 WC	-	100	-	17
L02.B.04 Bed	-	100	-	26
L02.B.04 WC	-	100	-	17
L02.B.05 Bed	-	100	-	26
L02.B.05 WC	-	100	-	17
L02.B.06 Bed	-	100	-	24
L02.B.06 WC	-	100	-	17
L02.B.07 Bed	-	100	-	24
L02.B.07 WC	-	100	-	17
L02.B.08 Bed	-	100	-	24
L02.B.08 WC	-	100	-	17
L02.C Circ	-	100	-	58
L02.C LKD	-	100	-	264
L02.C.01 Bed	-	100	-	24
L02.C.01 WC	-	100	-	17
L02.C.02 Bed	-	100	-	24
L02.C.02 WC	-	100	-	17
L02.C.03 Bed	-	100	-	24
L02.C.03 WC	-	100	-	17
L02.C.04 Bed	-	100	-	24
L02.C.04 WC	-	100	-	17
L02.C.05 Bed	-	100	-	24
L02.C.05 WC	-	100	-	17
L02.C.06 Bed	-	100	-	24
L02.C.06 WC	-	100	-	17

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
L02.D.01 Studio	-	100	-	31
L02.D.01 WC	-	100	-	29
L03 Circ	-	100	-	52
L03 Stairs	-	100	-	31
L03.A Circ	-	100	-	56
L03.A LKD	-	100	-	230
L03.A.01 Bed	-	100	-	22
L03.A.01 WC	-	100	-	19
L03.A.02 Bed	-	100	-	22
L03.A.02 WC	-	100	-	19
L03.A.03 Bed	-	100	-	25
L03.A.03 WC	-	100	-	20
L03.A.04 Bed	-	100	-	24
L03.A.04 WC	-	100	-	19
L03.A.05 Bed	-	100	-	24
L03.A.05 WC	-	100	-	19
L03.A.06 Bed	-	100	-	23
L03.A.06 WC	-	100	-	19
L03.A.07 Bed	-	100	-	23
L03.A.07 WC	-	100	-	16
L03.A.08 Bed	-	100	-	24
L03.A.08 WC	-	100	-	17
L03.B Circ	-	100	-	72
L03.B LKD	-	100	-	321
L03.B.01 Bed	-	100	-	24
L03.B.01 WC	-	100	-	17
L03.B.02 Bed	-	100	-	26
L03.B.02 WC	-	100	-	17
L03.B.03 Bed	-	100	-	26
L03.B.03 WC	-	100	-	17
L03.B.04 Bed	-	100	-	26
L03.B.04 WC	-	100	-	17
L03.B.05 Bed	-	100	-	26
L03.B.05 WC	-	100	-	17
L03.B.06 Bed	-	100	-	24
L03.B.06 WC	-	100	-	17
L03.B.07 Bed	-	100	-	24
L03.B.07 WC	-	100	-	17
L03.B.08 Bed	-	100	-	24
L03.B.08 WC	-	100	-	17
L03.C Circ	-	100	-	58
L03.C LKD	-	100	-	264
L03.C.01 Bed	-	100	-	24

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
L03.C.01 WC	-	100	-	17
L03.C.02 Bed	-	100	-	24
L03.C.02 WC	-	100	-	17
L03.C.03 Bed	-	100	-	24
L03.C.03 WC	-	100	-	17
L03.C.04 Bed	-	100	-	24
L03.C.04 WC	-	100	-	17
L03.C.05 Bed	-	100	-	24
L03.C.05 WC	-	100	-	17
L03.C.06 Bed	-	100	-	24
L03.C.06 WC	-	100	-	17
L03.D.01 Studio	-	100	-	31
L03.D.01 WC	-	100	-	29
L04 Circ	-	100	-	52
L04 Stairs	-	100	-	31
L04.A Circ	-	100	-	56
L04.A LKD	-	100	-	230
L04.A.01 Bed	-	100	-	22
L04.A.01 WC	-	100	-	19
L04.A.02 Bed	-	100	-	22
L04.A.02 WC	-	100	-	19
L04.A.03 Bed	-	100	-	25
L04.A.03 WC	-	100	-	20
L04.A.04 Bed	-	100	-	24
L04.A.04 WC	-	100	-	19
L04.A.05 Bed	-	100	-	24
L04.A.05 WC	-	100	-	19
L04.A.06 Bed	-	100	-	23
L04.A.06 WC	-	100	-	19
L04.A.07 Bed	-	100	-	23
L04.A.07 WC	-	100	-	16
L04.A.08 Bed	-	100	-	24
L04.A.08 WC	-	100	-	17
L04.B Circ	-	100	-	72
L04.B LKD	-	100	-	321
L04.B.01 Bed	-	100	-	24
L04.B.01 WC	-	100	-	17
L04.B.02 Bed	-	100	-	26
L04.B.02 WC	-	100	-	17
L04.B.03 Bed	-	100	-	26
L04.B.03 WC	-	100	-	17
L04.B.04 Bed	-	100	-	26
L04.B.04 WC	-	100	-	17

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
L04.B.05 Bed	-	100	-	26
L04.B.05 WC	-	100	-	17
L04.B.06 Bed	-	100	-	24
L04.B.06 WC	-	100	-	17
L04.B.07 Bed	-	100	-	24
L04.B.07 WC	-	100	-	17
L04.B.08 Bed	-	100	-	24
L04.B.08 WC	-	100	-	17
L04.C Circ	-	100	-	58
L04.C LKD	-	100	-	264
L04.C.01 Bed	-	100	-	24
L04.C.01 WC	-	100	-	17
L04.C.02 Bed	-	100	-	24
L04.C.02 WC	-	100	-	17
L04.C.03 Bed	-	100	-	24
L04.C.03 WC	-	100	-	17
L04.C.04 Bed	-	100	-	24
L04.C.04 WC	-	100	-	17
L04.C.05 Bed	-	100	-	24
L04.C.05 WC	-	100	-	17
L04.C.06 Bed	-	100	-	24
L04.C.06 WC	-	100	-	17
L04.D.01 Studio	-	100	-	31
L04.D.01 WC	-	100	-	29
L05 Circ	-	100	-	52
L05 Stairs	-	100	-	31
L05.A Circ	-	100	-	56
L05.A LKD	-	100	-	230
L05.A.01 Bed	-	100	-	22
L05.A.01 WC	-	100	-	19
L05.A.02 Bed	-	100	-	22
L05.A.02 WC	-	100	-	19
L05.A.03 Bed	-	100	-	25
L05.A.03 WC	-	100	-	20
L05.A.04 Bed	-	100	-	24
L05.A.04 WC	-	100	-	19
L05.A.05 Bed	-	100	-	24
L05.A.05 WC	-	100	-	19
L05.A.06 Bed	-	100	-	23
L05.A.06 WC	-	100	-	19
L05.A.07 Bed	-	100	-	23
L05.A.07 WC	-	100	-	16
L05.A.08 Bed	-	100	-	24

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
L05.A.08 WC	-	100	-	17
L05.B Circ	-	100	-	72
L05.B LKD	-	100	-	321
L05.B.01 Bed	-	100	-	24
L05.B.01 WC	-	100	-	17
L05.B.02 Bed	-	100	-	26
L05.B.02 WC	-	100	-	17
L05.B.03 Bed	-	100	-	26
L05.B.03 WC	-	100	-	17
L05.B.04 Bed	-	100	-	26
L05.B.04 WC	-	100	-	17
L05.B.05 Bed	-	100	-	26
L05.B.05 WC	-	100	-	17
L05.B.06 Bed	-	100	-	24
L05.B.06 WC	-	100	-	17
L05.B.07 Bed	-	100	-	24
L05.B.07 WC	-	100	-	17
L05.B.08 Bed	-	100	-	24
L05.B.08 WC	-	100	-	17
L05.C Circ	-	100	-	58
L05.C LKD	-	100	-	264
L05.C.01 Bed	-	100	-	24
L05.C.01 WC	-	100	-	17
L05.C.02 Bed	-	100	-	24
L05.C.02 WC	-	100	-	17
L05.C.03 Bed	-	100	-	24
L05.C.03 WC	-	100	-	17
L05.C.04 Bed	-	100	-	24
L05.C.04 WC	-	100	-	17
L05.C.05 Bed	-	100	-	24
L05.C.05 WC	-	100	-	17
L05.C.06 Bed	-	100	-	24
L05.C.06 WC	-	100	-	17
L05.D.01 Studio	-	100	-	31
L05.D.01 WC	-	100	-	29
L06 Circ	-	100	-	52
L06 Stairs	-	100	-	31
L06.A Circ	-	100	-	56
L06.A LKD	-	100	-	230
L06.A.01 Bed	-	100	-	22
L06.A.01 WC	-	100	-	19
L06.A.02 Bed	-	100	-	22
L06.A.02 WC	-	100	-	19

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
L06.A.03 Bed	-	100	-	25
L06.A.03 WC	-	100	-	20
L06.A.04 Bed	-	100	-	24
L06.A.04 WC	-	100	-	19
L06.A.05 Bed	-	100	-	24
L06.A.05 WC	-	100	-	19
L06.A.06 Bed	-	100	-	23
L06.A.06 WC	-	100	-	19
L06.A.07 Bed	-	100	-	23
L06.A.07 WC	-	100	-	16
L06.A.08 Bed	-	100	-	24
L06.A.08 WC	-	100	-	17
L06.B Circ	-	100	-	72
L06.B LKD	-	100	-	321
L06.B.01 Bed	-	100	-	24
L06.B.01 WC	-	100	-	17
L06.B.02 Bed	-	100	-	26
L06.B.02 WC	-	100	-	17
L06.B.03 Bed	-	100	-	26
L06.B.03 WC	-	100	-	17
L06.B.04 Bed	-	100	-	26
L06.B.04 WC	-	100	-	17
L06.B.05 Bed	-	100	-	26
L06.B.05 WC	-	100	-	17
L06.B.06 Bed	-	100	-	24
L06.B.06 WC	-	100	-	17
L06.B.07 Bed	-	100	-	24
L06.B.07 WC	-	100	-	17
L06.B.08 Bed	-	100	-	24
L06.B.08 WC	-	100	-	17
L06.C Circ	-	100	-	58
L06.C LKD	-	100	-	264
L06.C.01 Bed	-	100	-	24
L06.C.01 WC	-	100	-	17
L06.C.02 Bed	-	100	-	24
L06.C.02 WC	-	100	-	17
L06.C.03 Bed	-	100	-	24
L06.C.03 WC	-	100	-	17
L06.C.04 Bed	-	100	-	24
L06.C.04 WC	-	100	-	17
L06.C.05 Bed	-	100	-	24
L06.C.05 WC	-	100	-	17
L06.C.06 Bed	-	100	-	24

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
L06.C.06 WC	-	100	-	17
L06.D.01 Studio	-	100	-	31
L06.D.01 WC	-	100	-	29
L07 Stairs	-	100	-	31
L07.A Circ	-	100	-	47
L07.A LKD	-	100	-	230
L07.A.01 Bed	-	100	-	22
L07.A.01 WC	-	100	-	19
L07.A.02 Bed	-	100	-	22
L07.A.02 WC	-	100	-	19
L07.A.03 Bed	-	100	-	25
L07.A.03 WC	-	100	-	20
L07.A.04 Bed	-	100	-	24
L07.A.04 WC	-	100	-	19
L07.A.05 Bed	-	100	-	24
L07.A.05 WC	-	100	-	19
L07.A.06 Bed	-	100	-	23
L07.A.06 WC	-	100	-	19
L07.A.07 Bed	-	100	-	23
L07.A.07 WC	-	100	-	16
L07.B Circ	-	100	-	61
L07.B. LKD	-	100	-	283
L07.B.01 Bed	-	100	-	24
L07.B.01 WC	-	100	-	17
L07.B.02 Bed	-	100	-	24
L07.B.02 WC	-	100	-	17
L07.B.03 Bed	-	100	-	26
L07.B.03 WC	-	100	-	17
L07.B.04 Bed	-	100	-	26
L07.B.04 WC	-	100	-	17
L07.C Circ	-	100	-	79
L07.C.01 studio	-	100	-	30
L07.C.01 WC	-	100	-	21
L07.C.02 studio	-	100	-	29
L07.C.02 WC	-	100	-	21
L07.C.03 Studio	-	100	-	31
L07.C.03 WC	-	100	-	29
L08 Circ	-	100	-	52
L08 Stairs	-	100	-	31
L08.A Circ	-	100	-	47
L08.A LKD	-	100	-	230
L08.A.01 Bed	-	100	-	22
L08.A.01 WC	-	100	-	19

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
L08.A.02 Bed	-	100	-	22
L08.A.02 WC	-	100	-	19
L08.A.03 Bed	-	100	-	25
L08.A.03 WC	-	100	-	20
L08.A.04 Bed	-	100	-	24
L08.A.04 WC	-	100	-	19
L08.A.05 Bed	-	100	-	24
L08.A.05 WC	-	100	-	19
L08.A.06 Bed	-	100	-	23
L08.A.06 WC	-	100	-	19
L08.A.07 Bed	-	100	-	23
L08.A.07 WC	-	100	-	16
L08.B Circ	-	100	-	79
L08.B. LKD	-	100	-	283
L08.B.01 Bed	-	100	-	24
L08.B.01 WC	-	100	-	17
L08.B.02 Bed	-	100	-	24
L08.B.02 WC	-	100	-	17
L08.B.03 Bed	-	100	-	26
L08.B.03 WC	-	100	-	17
L08.B.04 Bed	-	100	-	26
L08.B.04 WC	-	100	-	17
L08.B.05 Bed	-	100	-	24
L08.B.05 WC	-	100	-	17
L08.B.06 Bed	-	100	-	24
L08.B.06 WC	-	100	-	18
L08.B.07 Bed	-	100	-	29
L08.B.07 WC	-	100	-	19
L08.C.01 Studio	-	100	-	31
L08.C.01 WC	-	100	-	29
L09 Circ	-	100	-	52
L09 Stairs	-	100	-	31
L09.A Circ	-	100	-	47
L09.A LKD	-	100	-	230
L09.A.01 Bed	-	100	-	22
L09.A.01 WC	-	100	-	19
L09.A.02 Bed	-	100	-	22
L09.A.02 WC	-	100	-	19
L09.A.03 Bed	-	100	-	25
L09.A.03 WC	-	100	-	20
L09.A.04 Bed	-	100	-	24
L09.A.04 WC	-	100	-	19
L09.A.05 Bed	-	100	-	24

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
L09.A.05 WC	-	100	-	19
L09.A.06 Bed	-	100	-	23
L09.A.06 WC	-	100	-	19
L09.A.07 Bed	-	100	-	23
L09.A.07 WC	-	100	-	16
L09.B Circ	-	100	-	79
L09.B. LKD	-	100	-	283
L09.B.01 Bed	-	100	-	24
L09.B.01 WC	-	100	-	17
L09.B.02 Bed	-	100	-	24
L09.B.02 WC	-	100	-	17
L09.B.03 Bed	-	100	-	26
L09.B.03 WC	-	100	-	17
L09.B.04 Bed	-	100	-	26
L09.B.04 WC	-	100	-	17
L09.B.05 Bed	-	100	-	24
L09.B.05 WC	-	100	-	17
L09.B.06 Bed	-	100	-	24
L09.B.06 WC	-	100	-	18
L09.B.07 Bed	-	100	-	29
L09.B.07 WC	-	100	-	19
L09.C.01 Studio	-	100	-	31
L09.C.01 WC	-	100	-	29
L10 Circ	-	100	-	52
L10 Stairs	-	100	-	31
L10.A Circ	-	100	-	47
L10.A LKD	-	100	-	230
L10.A.01 Bed	-	100	-	22
L10.A.01 WC	-	100	-	19
L10.A.02 Bed	-	100	-	22
L10.A.02 WC	-	100	-	19
L10.A.03 Bed	-	100	-	25
L10.A.03 WC	-	100	-	20
L10.A.04 Bed	-	100	-	24
L10.A.04 WC	-	100	-	19
L10.A.05 Bed	-	100	-	24
L10.A.05 WC	-	100	-	19
L10.A.06 Bed	-	100	-	23
L10.A.06 WC	-	100	-	19
L10.A.07 Bed	-	100	-	23
L10.A.07 WC	-	100	-	16
L10.B Circ	-	100	-	79
L10.B. LKD	-	100	-	283

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
L10.B.01 Bed	-	100	-	24
L10.B.01 WC	-	100	-	17
L10.B.02 Bed	-	100	-	24
L10.B.02 WC	-	100	-	17
L10.B.03 Bed	-	100	-	26
L10.B.03 WC	-	100	-	17
L10.B.04 Bed	-	100	-	26
L10.B.04 WC	-	100	-	17
L10.B.05 Bed	-	100	-	24
L10.B.05 WC	-	100	-	17
L10.B.06 Bed	-	100	-	24
L10.B.06 WC	-	100	-	18
L10.B.07 Bed	-	100	-	29
L10.B.07 WC	-	100	-	19
L10.C.01 Studio	-	100	-	31
L10.C.01 WC	-	100	-	29
L11 Circ	-	100	-	52
L11 Stairs	-	100	-	31
L11.A Circ	-	100	-	47
L11.A LKD	-	100	-	230
L11.A.01 Bed	-	100	-	22
L11.A.01 WC	-	100	-	19
L11.A.02 Bed	-	100	-	22
L11.A.02 WC	-	100	-	19
L11.A.03 Bed	-	100	-	25
L11.A.03 WC	-	100	-	20
L11.A.04 Bed	-	100	-	24
L11.A.04 WC	-	100	-	19
L11.A.05 Bed	-	100	-	24
L11.A.05 WC	-	100	-	19
L11.A.06 Bed	-	100	-	23
L11.A.06 WC	-	100	-	19
L11.A.07 Bed	-	100	-	23
L11.A.07 WC	-	100	-	16
L11.B Circ	-	100	-	79
L11.B. LKD	-	100	-	283
L11.B.01 Bed	-	100	-	24
L11.B.01 WC	-	100	-	17
L11.B.02 Bed	-	100	-	24
L11.B.02 WC	-	100	-	17
L11.B.03 Bed	-	100	-	26
L11.B.03 WC	-	100	-	17
L11.B.04 Bed	-	100	-	26

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
L11.B.04 WC	-	100	-	17
L11.B.05 Bed	-	100	-	24
L11.B.05 WC	-	100	-	17
L11.B.06 Bed	-	100	-	24
L11.B.06 WC	-	100	-	18
L11.B.07 Bed	-	100	-	29
L11.B.07 WC	-	100	-	19
L11.C.01 Studio	-	100	-	31
L11.C.01 WC	-	100	-	29
L12 Circ	-	100	-	52
L12 Stairs	-	100	-	31
L12.A Circ	-	100	-	47
L12.A LKD	-	100	-	230
L12.A.01 Bed	-	100	-	22
L12.A.01 WC	-	100	-	19
L12.A.02 Bed	-	100	-	22
L12.A.02 WC	-	100	-	19
L12.A.03 Bed	-	100	-	25
L12.A.03 WC	-	100	-	20
L12.A.04 Bed	-	100	-	24
L12.A.04 WC	-	100	-	19
L12.A.05 Bed	-	100	-	24
L12.A.05 WC	-	100	-	19
L12.A.06 Bed	-	100	-	23
L12.A.06 WC	-	100	-	19
L12.A.07 Bed	-	100	-	23
L12.A.07 WC	-	100	-	16
L12.B Circ	-	100	-	79
L12.B. LKD	-	100	-	283
L12.B.01 Bed	-	100	-	24
L12.B.01 WC	-	100	-	17
L12.B.02 Bed	-	100	-	24
L12.B.02 WC	-	100	-	17
L12.B.03 Bed	-	100	-	26
L12.B.03 WC	-	100	-	17
L12.B.04 Bed	-	100	-	26
L12.B.04 WC	-	100	-	17
L12.B.05 Bed	-	100	-	24
L12.B.05 WC	-	100	-	17
L12.B.06 Bed	-	100	-	24
L12.B.06 WC	-	100	-	18
L12.B.07 Bed	-	100	-	29
L12.B.07 WC	-	100	-	19

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
L12.C.01 Studio	-	100	-	31
L12.C.01 WC	-	100	-	29
L13 Circ	-	100	-	52
L13 Stairs	-	100	-	31
L13.A Circ	-	100	-	47
L13.A LKD	-	100	-	230
L13.A.01 Bed	-	100	-	22
L13.A.01 WC	-	100	-	19
L13.A.02 Bed	-	100	-	22
L13.A.02 WC	-	100	-	19
L13.A.03 Bed	-	100	-	25
L13.A.03 WC	-	100	-	20
L13.A.04 Bed	-	100	-	24
L13.A.04 WC	-	100	-	19
L13.A.05 Bed	-	100	-	24
L13.A.05 WC	-	100	-	19
L13.A.06 Bed	-	100	-	23
L13.A.06 WC	-	100	-	19
L13.A.07 Bed	-	100	-	23
L13.A.07 WC	-	100	-	16
L13.B Circ	-	100	-	79
L13.B. LKD	-	100	-	283
L13.B.01 Bed	-	100	-	24
L13.B.01 WC	-	100	-	17
L13.B.02 Bed	-	100	-	24
L13.B.02 WC	-	100	-	17
L13.B.03 Bed	-	100	-	26
L13.B.03 WC	-	100	-	17
L13.B.04 Bed	-	100	-	26
L13.B.04 WC	-	100	-	17
L13.B.05 Bed	-	100	-	24
L13.B.05 WC	-	100	-	17
L13.B.06 Bed	-	100	-	24
L13.B.06 WC	-	100	-	18
L13.B.07 Bed	-	100	-	29
L13.B.07 WC	-	100	-	19
L13.C.01 Studio	-	100	-	31
L13.C.01 WC	-	100	-	29
L14 Circ	-	100	-	50
L14 Stairs	-	100	-	31
L14.A Circ	-	100	-	61
L14.A LKD	-	100	-	243
L14.A.01 Bed	-	100	-	21

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
L14.A.01 WC	-	100	-	20
L14.A.02 Bed	-	100	-	22
L14.A.02 WC	-	100	-	19
L14.A.03 Bed	-	100	-	22
L14.A.03 WC	-	100	-	19
L14.A.04 Bed	-	100	-	24
L14.A.04 WC	-	100	-	17
L14.A.05 Bed	-	100	-	24
L14.A.05 WC	-	100	-	16
L14.A.06 Bed	-	100	-	24
L14.A.06 WC	-	100	-	16
L14.B.01 Studio	-	100	-	29
L14.B.01 WC	-	100	-	22
L15 Circ	-	100	-	50
L15 Stairs	-	100	-	31
L15.A Circ	-	100	-	61
L15.A LKD	-	100	-	243
L15.A.01 Bed	-	100	-	21
L15.A.01 WC	-	100	-	20
L15.A.02 Bed	-	100	-	22
L15.A.02 WC	-	100	-	19
L15.A.03 Bed	-	100	-	22
L15.A.03 WC	-	100	-	19
L15.A.04 Bed	-	100	-	24
L15.A.04 WC	-	100	-	17
L15.A.05 Bed	-	100	-	24
L15.A.05 WC	-	100	-	16
L15.A.06 Bed	-	100	-	24
L15.A.06 WC	-	100	-	16
L15.B.01 Studio	-	100	-	29
L15.B.01 WC	-	100	-	22
LB1 Circ	-	100	-	54
LB1 stairs	-	100	-	47
LB2 Circ	-	100	-	41
LB2 Circ	-	100	-	44
LB2 Circ	-	100	-	69
LB2 cycle store	100	-	-	156
LB2 cycle store	100	-	-	60
LB2 laundry	-	100	-	133
LB2 plant	100	-	-	87
LB2 plant	100	-	-	911
LB2 stairs	-	100	-	47
LB2 store	100	-	-	24

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
L00 concierge	NO (-48.4%)	NO
L00 lift lobby	NO (-27.8%)	NO
L00 office	NO (-45.7%)	NO
L00 post	N/A	N/A
L02.A.01 Bed	NO (-83.8%)	NO
L02.A.02 Bed	NO (-91.1%)	NO
L02.A.03 Bed	NO (-89.3%)	NO
L02.A.04 Bed	NO (-73%)	NO
L02.A.05 Bed	NO (-73%)	NO
L02.A.06 Bed	NO (-71.9%)	NO
L02.A.07 Bed	NO (-86.6%)	NO
L02.A.08 Bed	NO (-57%)	NO
L02.B.01 Bed	NO (-57.1%)	NO
L02.B.02 Bed	NO (-67.4%)	NO
L02.B.03 Bed	NO (-57%)	NO
L02.B.04 Bed	NO (-56.1%)	NO
L02.B.05 Bed	NO (-67.4%)	NO
L02.B.06 Bed	NO (-57%)	NO
L02.B.07 Bed	NO (-57%)	NO
L02.B.08 Bed	NO (-57%)	NO
L02.C.01 Bed	NO (-69.9%)	NO
L02.C.02 Bed	NO (-70%)	NO
L02.C.03 Bed	NO (-70.6%)	NO
L02.C.04 Bed	NO (-71.3%)	NO
L02.C.05 Bed	NO (-74.8%)	NO
L02.C.06 Bed	NO (-79.2%)	NO
L02.D.01 Studio	NO (-94.9%)	NO
L03.A.01 Bed	NO (-75%)	NO
L03.A.02 Bed	NO (-87%)	NO
L03.A.03 Bed	NO (-89.3%)	NO
L03.A.04 Bed	NO (-73%)	NO
L03.A.05 Bed	NO (-73%)	NO
L03.A.06 Bed	NO (-71.9%)	NO
L03.A.07 Bed	NO (-86.6%)	NO
L03.A.08 Bed	NO (-57%)	NO
L03.B.01 Bed	NO (-57.1%)	NO
L03.B.02 Bed	NO (-67.4%)	NO
L03.B.03 Bed	NO (-57%)	NO
L03.B.04 Bed	NO (-56.1%)	NO
L03.B.05 Bed	NO (-67.4%)	NO
L03.B.06 Bed	NO (-57%)	NO
L03.B.07 Bed	NO (-57%)	NO
L03.B.08 Bed	NO (-57%)	NO
L03.C.01 Bed	NO (-68.4%)	NO

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
L03.C.02 Bed	NO (-68.2%)	NO
L03.C.03 Bed	NO (-68.2%)	NO
L03.C.04 Bed	NO (-68.2%)	NO
L03.C.05 Bed	NO (-71.1%)	NO
L03.C.06 Bed	NO (-73.9%)	NO
L03.D.01 Studio	NO (-92%)	NO
L04.A.01 Bed	NO (-68.1%)	NO
L04.A.02 Bed	NO (-84%)	NO
L04.A.03 Bed	NO (-89.3%)	NO
L04.A.04 Bed	NO (-73%)	NO
L04.A.05 Bed	NO (-73%)	NO
L04.A.06 Bed	NO (-71.9%)	NO
L04.A.07 Bed	NO (-86.6%)	NO
L04.A.08 Bed	NO (-57%)	NO
L04.B.01 Bed	NO (-57.1%)	NO
L04.B.02 Bed	NO (-67.4%)	NO
L04.B.03 Bed	NO (-57%)	NO
L04.B.04 Bed	NO (-56.1%)	NO
L04.B.05 Bed	NO (-67.4%)	NO
L04.B.06 Bed	NO (-57%)	NO
L04.B.07 Bed	NO (-57%)	NO
L04.B.08 Bed	NO (-57%)	NO
L04.C.01 Bed	NO (-68.4%)	NO
L04.C.02 Bed	NO (-68.2%)	NO
L04.C.03 Bed	NO (-67.8%)	NO
L04.C.04 Bed	NO (-67.4%)	NO
L04.C.05 Bed	NO (-67.9%)	NO
L04.C.06 Bed	NO (-70.6%)	NO
L04.D.01 Studio	NO (-89.6%)	NO
L05.A.01 Bed	NO (-68.1%)	NO
L05.A.02 Bed	NO (-84%)	NO
L05.A.03 Bed	NO (-89.3%)	NO
L05.A.04 Bed	NO (-73%)	NO
L05.A.05 Bed	NO (-73%)	NO
L05.A.06 Bed	NO (-71.9%)	NO
L05.A.07 Bed	NO (-86.6%)	NO
L05.A.08 Bed	NO (-57%)	NO
L05.B.01 Bed	NO (-57.1%)	NO
L05.B.02 Bed	NO (-67.4%)	NO
L05.B.03 Bed	NO (-57%)	NO
L05.B.04 Bed	NO (-56.1%)	NO
L05.B.05 Bed	NO (-67.4%)	NO
L05.B.06 Bed	NO (-57%)	NO
L05.B.07 Bed	NO (-57%)	NO
L05.B.08 Bed	NO (-57%)	NO
L05.C.01 Bed	NO (-68%)	NO
L05.C.02 Bed	NO (-67.8%)	NO
L05.C.03 Bed	NO (-67.7%)	NO
L05.C.04 Bed	NO (-67.3%)	NO

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
L05.C.05 Bed	NO (-67.9%)	NO
L05.C.06 Bed	NO (-70.5%)	NO
L05.D.01 Studio	NO (-89.6%)	NO
L06.A.01 Bed	NO (-68.1%)	NO
L06.A.02 Bed	NO (-84%)	NO
L06.A.03 Bed	NO (-89.3%)	NO
L06.A.04 Bed	NO (-73%)	NO
L06.A.05 Bed	NO (-73%)	NO
L06.A.06 Bed	NO (-71.9%)	NO
L06.A.07 Bed	NO (-86.6%)	NO
L06.A.08 Bed	NO (-57%)	NO
L06.B.01 Bed	NO (-57.1%)	NO
L06.B.02 Bed	NO (-67.4%)	NO
L06.B.03 Bed	NO (-56.7%)	NO
L06.B.04 Bed	NO (-56.1%)	NO
L06.B.05 Bed	NO (-67.2%)	NO
L06.B.06 Bed	NO (-57%)	NO
L06.B.07 Bed	NO (-57%)	NO
L06.B.08 Bed	NO (-57%)	NO
L06.C.01 Bed	NO (-67.9%)	NO
L06.C.02 Bed	NO (-67.8%)	NO
L06.C.03 Bed	NO (-67.7%)	NO
L06.C.04 Bed	NO (-67.2%)	NO
L06.C.05 Bed	NO (-67.9%)	NO
L06.C.06 Bed	NO (-70.5%)	NO
L06.D.01 Studio	NO (-89.6%)	NO
L07.A.01 Bed	NO (-68.1%)	NO
L07.A.02 Bed	NO (-84%)	NO
L07.A.03 Bed	NO (-89.3%)	NO
L07.A.04 Bed	NO (-73%)	NO
L07.A.05 Bed	NO (-73%)	NO
L07.A.06 Bed	NO (-71.9%)	NO
L07.A.07 Bed	NO (-86.6%)	NO
L07.B.01 Bed	NO (-58.4%)	NO
L07.B.02 Bed	NO (-58.5%)	NO
L07.B.03 Bed	NO (-68.5%)	NO
L07.B.04 Bed	NO (-58.4%)	NO
L07.C.01 studio	NO (-79.2%)	NO
L07.C.02 studio	NO (-80.7%)	NO
L07.C.03 Studio	NO (-89.6%)	NO
L08.A.01 Bed	NO (-68.1%)	NO
L08.A.02 Bed	NO (-84%)	NO
L08.A.03 Bed	NO (-89.3%)	NO
L08.A.04 Bed	NO (-73%)	NO
L08.A.05 Bed	NO (-73%)	NO
L08.A.06 Bed	NO (-71.9%)	NO
L08.A.07 Bed	NO (-86.6%)	NO
L08.B.01 Bed	NO (-58.4%)	NO
L08.B.02 Bed	NO (-58.5%)	NO

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
L08.B.03 Bed	NO (-68.5%)	NO
L08.B.04 Bed	NO (-58.4%)	NO
L08.B.05 Bed	NO (-64.3%)	NO
L08.B.06 Bed	NO (-64.9%)	NO
L08.B.07 Bed	NO (-88.7%)	NO
L08.C.01 Studio	NO (-89.6%)	NO
L09.A.01 Bed	NO (-68%)	NO
L09.A.02 Bed	NO (-84%)	NO
L09.A.03 Bed	NO (-89.3%)	NO
L09.A.04 Bed	NO (-73%)	NO
L09.A.05 Bed	NO (-73%)	NO
L09.A.06 Bed	NO (-71.9%)	NO
L09.A.07 Bed	NO (-86.6%)	NO
L09.B.01 Bed	NO (-58.4%)	NO
L09.B.02 Bed	NO (-58.5%)	NO
L09.B.03 Bed	NO (-68.5%)	NO
L09.B.04 Bed	NO (-58.4%)	NO
L09.B.05 Bed	NO (-64.4%)	NO
L09.B.06 Bed	NO (-64.9%)	NO
L09.B.07 Bed	NO (-88.7%)	NO
L09.C.01 Studio	NO (-89.5%)	NO
L10.A.01 Bed	NO (-68%)	NO
L10.A.02 Bed	NO (-84%)	NO
L10.A.03 Bed	NO (-89.3%)	NO
L10.A.04 Bed	NO (-73%)	NO
L10.A.05 Bed	NO (-73%)	NO
L10.A.06 Bed	NO (-71.9%)	NO
L10.A.07 Bed	NO (-86.6%)	NO
L10.B.01 Bed	NO (-58.4%)	NO
L10.B.02 Bed	NO (-58.5%)	NO
L10.B.03 Bed	NO (-68.5%)	NO
L10.B.04 Bed	NO (-58.4%)	NO
L10.B.05 Bed	NO (-63.8%)	NO
L10.B.06 Bed	NO (-64.4%)	NO
L10.B.07 Bed	NO (-88.6%)	NO
L10.C.01 Studio	NO (-89.4%)	NO
L11.A.01 Bed	NO (-68%)	NO
L11.A.02 Bed	NO (-84%)	NO
L11.A.03 Bed	NO (-89.3%)	NO
L11.A.04 Bed	NO (-73%)	NO
L11.A.05 Bed	NO (-73%)	NO
L11.A.06 Bed	NO (-71.9%)	NO
L11.A.07 Bed	NO (-86.6%)	NO
L11.B.01 Bed	NO (-58.4%)	NO
L11.B.02 Bed	NO (-58.5%)	NO
L11.B.03 Bed	NO (-68.5%)	NO
L11.B.04 Bed	NO (-58.4%)	NO
L11.B.05 Bed	NO (-63.8%)	NO
L11.B.06 Bed	NO (-64.4%)	NO

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
L11.B.07 Bed	NO (-88.6%)	NO
L11.C.01 Studio	NO (-89.4%)	NO
L12.A.01 Bed	NO (-68%)	NO
L12.A.02 Bed	NO (-84%)	NO
L12.A.03 Bed	NO (-89.3%)	NO
L12.A.04 Bed	NO (-73%)	NO
L12.A.05 Bed	NO (-73%)	NO
L12.A.06 Bed	NO (-71.9%)	NO
L12.A.07 Bed	NO (-86.6%)	NO
L12.B.01 Bed	NO (-58.4%)	NO
L12.B.02 Bed	NO (-58.5%)	NO
L12.B.03 Bed	NO (-68.5%)	NO
L12.B.04 Bed	NO (-58.4%)	NO
L12.B.05 Bed	NO (-63.8%)	NO
L12.B.06 Bed	NO (-64.4%)	NO
L12.B.07 Bed	NO (-88.6%)	NO
L12.C.01 Studio	NO (-89.4%)	NO
L13.A.01 Bed	NO (-67.8%)	NO
L13.A.02 Bed	NO (-83.9%)	NO
L13.A.03 Bed	NO (-89.3%)	NO
L13.A.04 Bed	NO (-73%)	NO
L13.A.05 Bed	NO (-73%)	NO
L13.A.06 Bed	NO (-71.9%)	NO
L13.A.07 Bed	NO (-86.6%)	NO
L13.B.01 Bed	NO (-58.4%)	NO
L13.B.02 Bed	NO (-58.4%)	NO
L13.B.03 Bed	NO (-68.5%)	NO
L13.B.04 Bed	NO (-58.4%)	NO
L13.B.05 Bed	NO (-63.6%)	NO
L13.B.06 Bed	NO (-64.4%)	NO
L13.B.07 Bed	NO (-88.6%)	NO
L13.C.01 Studio	NO (-89.4%)	NO
L14.A.01 Bed	NO (-89.4%)	NO
L14.A.02 Bed	NO (-84.2%)	NO
L14.A.03 Bed	NO (-84.2%)	NO
L14.A.04 Bed	NO (-58.4%)	NO
L14.A.05 Bed	NO (-58.4%)	NO
L14.A.06 Bed	NO (-88.1%)	NO
L14.B.01 Studio	NO (-83.2%)	NO
L15.A.01 Bed	NO (-89.4%)	NO
L15.A.02 Bed	NO (-84.2%)	NO
L15.A.03 Bed	NO (-84.2%)	NO
L15.A.04 Bed	NO (-58.4%)	NO
L15.A.05 Bed	NO (-58.4%)	NO
L15.A.06 Bed	NO (-88.1%)	NO
L15.B.01 Studio	NO (-83.2%)	NO

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	YES
Is evidence of such assessment available as a separate submission?	YES
Are any such measures included in the proposed design?	YES

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m^2]	7187.5	7187.5
External area [m^2]	6218.9	6218.9
Weather	LON	LON
Infiltration [m^3/hm^2@ 50Pa]	3	3
Average conductance [W/K]	1874.71	3825.86
Average U-value [W/m^2K]	0.3	0.62
Alpha value* [%]	10.11	10

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
	A1/A2 Retail/Financial and Professional services
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
100	**C2 Residential Institutions: Universities and colleges**
	C2A Secure Residential Institutions
	Residential spaces
	D1 Non-residential Institutions: Community/Day Centre
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
	D1 Non-residential Institutions: Education
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others: Stand alone utility block

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

	Actual	Notional
Heating	9.69	23.99
Cooling	0	0
Auxiliary	7.8	4.37
Lighting	6.43	13.11
Hot water	95.41	95.62
Equipment*	39.68	39.68
TOTAL**	**119.34**	**137.1**

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m^2]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m^2]	31.47	74.44
Primary energy* [kWh/m^2]	170.84	198.26
Total emissions [kg/m^2]	29.9	34.7

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	52	0	16	0	3.5	0.9	0	0.96	0
	Notional	32.4	0	10.4	0	1.8	0.86	0	----	----
[ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	36.6	0	11.3	0	11.1	0.9	0	0.96	0
	Notional	105.7	0	34.1	0	6.2	0.86	0	----	----
[ST] No Heating or Cooling										
	Actual	0	0	0	0	0	0	0	0	0
	Notional	0	0	0	0	0	0	0	----	----

Key to terms

Heat dem [MJ/m2] = Heating energy demand
Cool dem [MJ/m2] = Cooling energy demand
Heat con [kWh/m2] = Heating energy consumption
Cool con [kWh/m2] = Cooling energy consumption
Aux con [kWh/m2] = Auxiliary energy consumption
Heat SSEFF = Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER = Cooling system seasonal energy efficiency ratio
Heat gen SSEFF = Heating generator seasonal efficiency
Cool gen SSEER = Cooling generator seasonal energy efficiency ratio
ST = System type
HS = Heat source
HFT = Heating fuel type
CFT = Cooling fuel type

Key Features

The Building Control Body is advised to give particular attention to items whose specifications are better than typically expected.

Building fabric

Element	$U_{i\text{-}Typ}$	$U_{i\text{-}Min}$	Surface where the minimum value occurs*
Wall	0.23	0.15	L100002E:Surf[1]
Floor	0.2	0.13	L000001A:Surf[0]
Roof	0.15	0.13	L00000E6:Surf[0]
Windows, roof windows, and rooflights	1.5	1.2	L00001A8:Surf[2]
Personnel doors	1.5	1.5	L0000061:Surf[0]
Vehicle access & similar large doors	1.5	-	No Vehicle access doors in building
High usage entrance doors	1.5	-	No High usage entrance doors in building

$U_{i\text{-}Typ}$ = Typical individual element U-values [W/(m²K)] $U_{i\text{-}Min}$ = Minimum individual element U-values [W/(m²K)]

* There might be more than one surface where the minimum U-value occurs.

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	3

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

220523 Avonmouth House Commercial Energy (be Green)

As designed

Date: Mon May 23 10:27:54 2022

Administrative information

Building Details

Address: Address 1, City, Postcode

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.14

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.14

BRUKL compliance check version: v5.6.b.0

Certifier details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Criterion 1: The calculated CO_2 emission rate for the building must not exceed the target

CO_2 emission rate from the notional building, $kgCO_2/m^2.annum$	15.2
Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	15.2
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	10.4
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.15	0.15	L00001A6:Surf[2]
Floor	0.25	0.13	0.13	L0000132:Surf[0]
Roof	0.25	0.15	0.15	L0000132:Surf[1]
Windows***, roof windows, and rooflights	2.2	1.24	2	SP000040:Surf[3]
Personnel doors	2.2	1.64	2.2	L0000160:Surf[1]
Vehicle access & similar large doors	1.5	-	-	No Vehicle access doors in building
High usage entrance doors	3.5	-	-	No High usage entrance doors in building

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

* There might be more than one surface where the maximum U-value occurs.
** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.
*** Display windows and similar glazing are excluded from the U-value check.
N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
$m^3/(h.m^2)$ at 50 Pa	10	3

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	YES
Whole building electric power factor achieved by power factor correction	>0.95

1- VRF, MVHR

	Heating efficiency	**Cooling efficiency**	**Radiant efficiency**	**SFP [W/(l/s)]**	**HR efficiency**
This system	4.1	5.6	0	-	0.85
Standard value	2.5*	2.6	N/A	N/A	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.					

1- ASHP, DHW

	Water heating efficiency	**Storage loss factor [kWh/litre per day]**
This building	2.58	-
Standard value	2*	N/A
* Standard shown is for all types except absorption and gas engine heat pumps.		

Local mechanical ventilation, exhaust, and terminal units

ID	**System type in Non-domestic Building Services Compliance Guide**
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	**SFP [W/(l/s)]**									**HR efficiency**	
ID of system type	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	**Zone**	**Standard**
Commercial L00 Employment Space	-	-	-	1	-	-	-	-	-	-	N/A
Commercial L01 Employment Space	-	-	-	1	-	-	-	-	-	-	N/A
Commercial L01 Employment Space	-	-	-	1	-	-	-	-	-	-	N/A
Commercial LB1 Employment Space	-	-	-	1	-	-	-	-	-	-	N/A
Commercial LB1 Employment Space	-	-	-	1	-	-	-	-	-	-	N/A

General lighting and display lighting

	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
Commercial L00 bin store	100	-	-	17
Commercial L00 cycle storage	100	-	-	36
Commercial L00 Employment Space	100	-	-	1631
Commercial L00 stairs	-	100	-	49
Commercial L00 stairs	-	100	-	64

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
Commercial L01 Employment Space	100	-	-	2706
Commercial L01 Employment Space	100	-	-	1064
Commercial L01 stairs	-	100	-	50
Commercial L01 stairs	-	100	-	49
Commercial LB1 Employment Space	100	-	-	1524
Commercial LB1 Employment Space	100	-	-	1976
Commercial LB1 hall	-	100	-	28
Commercial LB1 hall	-	100	-	21
Commercial LB1 stairs	-	100	-	49
Commercial LB1 stairs	-	100	-	50

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Commercial L00 Employment Space	NO (-68.8%)	NO
Commercial L01 Employment Space	NO (-46.7%)	NO
Commercial L01 Employment Space	NO (-53.7%)	NO
Commercial LB1 Employment Space	NO (-68.3%)	NO
Commercial LB1 Employment Space	NO (-83.4%)	NO

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	YES
Is evidence of such assessment available as a separate submission?	YES
Are any such measures included in the proposed design?	YES

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m^2]	1674.6	1674.6
External area [m^2]	1461.8	1461.8
Weather	LON	LON
Infiltration [m^3/hm^2@ 50Pa]	3	3
Average conductance [W/K]	454.23	799.38
Average U-value [W/m^2K]	0.31	0.55
Alpha value* [%]	10.1	10

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
	A1/A2 Retail/Financial and Professional services
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
100	**B1 Offices and Workshop businesses**
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
	Residential spaces
	D1 Non-residential Institutions: Community/Day Centre
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
	D1 Non-residential Institutions: Education
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others: Stand alone utility block

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

	Actual	Notional
Heating	0.43	1.73
Cooling	5.31	6.04
Auxiliary	3.1	1.82
Lighting	10.68	19.48
Hot water	1.03	1.12
Equipment*	37.47	37.47
TOTAL**	**20.55**	**30.19**

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m^2]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m^2]	86.23	98.38
Primary energy* [kWh/m^2]	61.5	90.38
Total emissions [kg/m^2]	10.4	15.2

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	7.2	91.6	0.5	6.1	3.5	4.02	4.19	4.1	5.6
	Notional	18.3	94.4	2	6.9	2.1	2.56	3.79	----	----
[ST] No Heating or Cooling										
	Actual	0	0	0	0	0	0	0	0	0
	Notional	0	0	0	0	0	0	0	----	----

Key to terms

Heat dem [MJ/m2] = Heating energy demand
Cool dem [MJ/m2] = Cooling energy demand
Heat con [kWh/m2] = Heating energy consumption
Cool con [kWh/m2] = Cooling energy consumption
Aux con [kWh/m2] = Auxiliary energy consumption
Heat SSEFF = Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER = Cooling system seasonal energy efficiency ratio
Heat gen SSEFF = Heating generator seasonal efficiency
Cool gen SSEER = Cooling generator seasonal energy efficiency ratio
ST = System type
HS = Heat source
HFT = Heating fuel type
CFT = Cooling fuel type

Key Features

The Building Control Body is advised to give particular attention to items whose specifications are better than typically expected.

Building fabric

Element	$U_{i\text{-}Typ}$	$U_{i\text{-}Min}$	Surface where the minimum value occurs*
Wall	0.23	0.15	LB000002:Surf[7]
Floor	0.2	0.13	L0000132:Surf[0]
Roof	0.15	0.15	L0000132:Surf[1]
Windows, roof windows, and rooflights	1.5	1.2	L00001A7:Surf[1]
Personnel doors	1.5	1.5	L00001A6:Surf[0]
Vehicle access & similar large doors	1.5	-	No Vehicle access doors in building
High usage entrance doors	1.5	-	No High usage entrance doors in building

$U_{i\text{-}Typ}$ = Typical individual element U-values [W/(m²K)] $U_{i\text{-}Min}$ = Minimum individual element U-values [W/(m²K)]

* There might be more than one surface where the minimum U-value occurs.

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	3

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

220523 Avonmouth House Student Energy (be green)

As designed

Date: Mon May 23 11:02:04 2022

Administrative information

Building Details

Address: Address 1, City, Postcode

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.14

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.14

BRUKL compliance check version: v5.6.b.0

Certifier details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Criterion 1: The calculated CO_2 emission rate for the building must not exceed the target

CO_2 emission rate from the notional building, $kgCO_2/m^2.annum$	30.7
Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	30.7
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	25.9
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.15	0.15	L0000061:Surf[2]
Floor	0.25	0.15	0.15	LB000021:Surf[0]
Roof	0.25	0.13	0.15	SP000026:Surf[6]
Windows***, roof windows, and rooflights	2.2	1.2	1.2	L00001A8:Surf[2]
Personnel doors	2.2	1.5	1.5	L0000061:Surf[0]
Vehicle access & similar large doors	1.5	-	-	No Vehicle access doors in building
High usage entrance doors	3.5	-	-	No High usage entrance doors in building

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

* There might be more than one surface where the maximum U-value occurs.
** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.
*** Display windows and similar glazing are excluded from the U-value check.
N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
$m^3/(h.m^2)$ at 50 Pa	10	3

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	YES
Whole building electric power factor achieved by power factor correction	>0.95

1- ASHP, No MVHR

	Heating efficiency	**Cooling efficiency**	**Radiant efficiency**	**SFP [W/(l/s)]**	**HR efficiency**
This system	2.58	-	0.2	-	-
Standard value	2.5*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.					

2- ASHP, MVHR

	Heating efficiency	**Cooling efficiency**	**Radiant efficiency**	**SFP [W/(l/s)]**	**HR efficiency**
This system	2.58	-	0.2	-	0.85
Standard value	2.5*	N/A	N/A	N/A	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.					

1- ASHP, DHW

	Water heating efficiency	**Storage loss factor [kWh/litre per day]**
This building	2.58	-
Standard value	2*	N/A
* Standard shown is for all types except absorption and gas engine heat pumps.		

Local mechanical ventilation, exhaust, and terminal units

ID	**System type in Non-domestic Building Services Compliance Guide**
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	**SFP [W/(l/s)]**									**HR efficiency**	
ID of system type	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	**Zone**	**Standard**
L00 WC	-	-	-	1	-	-	-	-	-	-	N/A
L02.A LKD	-	-	-	1	-	-	-	-	-	-	N/A
L02.A.01 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L02.A.01 WC	-	-	-	1	-	-	-	-	-	-	N/A
L02.A.02 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L02.A.02 WC	-	-	-	1	-	-	-	-	-	-	N/A
L02.A.03 Bed	-	-	-	1	-	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
L02.A.03 WC	-	-	-	1	-	-	-	-	-	-	N/A
L02.A.04 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L02.A.04 WC	-	-	-	1	-	-	-	-	-	-	N/A
L02.A.05 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L02.A.05 WC	-	-	-	1	-	-	-	-	-	-	N/A
L02.A.06 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L02.A.06 WC	-	-	-	1	-	-	-	-	-	-	N/A
L02.A.07 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L02.A.07 WC	-	-	-	1	-	-	-	-	-	-	N/A
L02.A.08 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L02.A.08 WC	-	-	-	1	-	-	-	-	-	-	N/A
L02.B LKD	-	-	-	1	-	-	-	-	-	-	N/A
L02.B.01 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L02.B.01 WC	-	-	-	1	-	-	-	-	-	-	N/A
L02.B.02 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L02.B.02 WC	-	-	-	1	-	-	-	-	-	-	N/A
L02.B.03 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L02.B.03 WC	-	-	-	1	-	-	-	-	-	-	N/A
L02.B.04 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L02.B.04 WC	-	-	-	1	-	-	-	-	-	-	N/A
L02.B.05 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L02.B.05 WC	-	-	-	1	-	-	-	-	-	-	N/A
L02.B.06 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L02.B.06 WC	-	-	-	1	-	-	-	-	-	-	N/A
L02.B.07 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L02.B.07 WC	-	-	-	1	-	-	-	-	-	-	N/A
L02.B.08 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L02.B.08 WC	-	-	-	1	-	-	-	-	-	-	N/A
L02.C LKD	-	-	-	1	-	-	-	-	-	-	N/A
L02.C.01 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L02.C.01 WC	-	-	-	1	-	-	-	-	-	-	N/A
L02.C.02 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L02.C.02 WC	-	-	-	1	-	-	-	-	-	-	N/A
L02.C.03 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L02.C.03 WC	-	-	-	1	-	-	-	-	-	-	N/A
L02.C.04 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L02.C.04 WC	-	-	-	1	-	-	-	-	-	-	N/A
L02.C.05 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L02.C.05 WC	-	-	-	1	-	-	-	-	-	-	N/A
L02.C.06 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L02.C.06 WC	-	-	-	1	-	-	-	-	-	-	N/A
L02.D.01 Studio	-	-	-	1	-	-	-	-	-	-	N/A
L02.D.01 WC	-	-	-	1	-	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
L03.A LKD	-	-	-	1	-	-	-	-	-	-	N/A
L03.A.01 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L03.A.01 WC	-	-	-	1	-	-	-	-	-	-	N/A
L03.A.02 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L03.A.02 WC	-	-	-	1	-	-	-	-	-	-	N/A
L03.A.03 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L03.A.03 WC	-	-	-	1	-	-	-	-	-	-	N/A
L03.A.04 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L03.A.04 WC	-	-	-	1	-	-	-	-	-	-	N/A
L03.A.05 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L03.A.05 WC	-	-	-	1	-	-	-	-	-	-	N/A
L03.A.06 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L03.A.06 WC	-	-	-	1	-	-	-	-	-	-	N/A
L03.A.07 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L03.A.07 WC	-	-	-	1	-	-	-	-	-	-	N/A
L03.A.08 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L03.A.08 WC	-	-	-	1	-	-	-	-	-	-	N/A
L03.B LKD	-	-	-	1	-	-	-	-	-	-	N/A
L03.B.01 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L03.B.01 WC	-	-	-	1	-	-	-	-	-	-	N/A
L03.B.02 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L03.B.02 WC	-	-	-	1	-	-	-	-	-	-	N/A
L03.B.03 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L03.B.03 WC	-	-	-	1	-	-	-	-	-	-	N/A
L03.B.04 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L03.B.04 WC	-	-	-	1	-	-	-	-	-	-	N/A
L03.B.05 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L03.B.05 WC	-	-	-	1	-	-	-	-	-	-	N/A
L03.B.06 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L03.B.06 WC	-	-	-	1	-	-	-	-	-	-	N/A
L03.B.07 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L03.B.07 WC	-	-	-	1	-	-	-	-	-	-	N/A
L03.B.08 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L03.B.08 WC	-	-	-	1	-	-	-	-	-	-	N/A
L03.C LKD	-	-	-	1	-	-	-	-	-	-	N/A
L03.C.01 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L03.C.01 WC	-	-	-	1	-	-	-	-	-	-	N/A
L03.C.02 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L03.C.02 WC	-	-	-	1	-	-	-	-	-	-	N/A
L03.C.03 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L03.C.03 WC	-	-	-	1	-	-	-	-	-	-	N/A
L03.C.04 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L03.C.04 WC	-	-	-	1	-	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
L03.C.05 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L03.C.05 WC	-	-	-	1	-	-	-	-	-	-	N/A
L03.C.06 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L03.C.06 WC	-	-	-	1	-	-	-	-	-	-	N/A
L03.D.01 Studio	-	-	-	1	-	-	-	-	-	-	N/A
L03.D.01 WC	-	-	-	1	-	-	-	-	-	-	N/A
L04.A LKD	-	-	-	1	-	-	-	-	-	-	N/A
L04.A.01 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L04.A.01 WC	-	-	-	1	-	-	-	-	-	-	N/A
L04.A.02 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L04.A.02 WC	-	-	-	1	-	-	-	-	-	-	N/A
L04.A.03 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L04.A.03 WC	-	-	-	1	-	-	-	-	-	-	N/A
L04.A.04 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L04.A.04 WC	-	-	-	1	-	-	-	-	-	-	N/A
L04.A.05 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L04.A.05 WC	-	-	-	1	-	-	-	-	-	-	N/A
L04.A.06 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L04.A.06 WC	-	-	-	1	-	-	-	-	-	-	N/A
L04.A.07 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L04.A.07 WC	-	-	-	1	-	-	-	-	-	-	N/A
L04.A.08 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L04.A.08 WC	-	-	-	1	-	-	-	-	-	-	N/A
L04.B LKD	-	-	-	1	-	-	-	-	-	-	N/A
L04.B.01 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L04.B.01 WC	-	-	-	1	-	-	-	-	-	-	N/A
L04.B.02 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L04.B.02 WC	-	-	-	1	-	-	-	-	-	-	N/A
L04.B.03 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L04.B.03 WC	-	-	-	1	-	-	-	-	-	-	N/A
L04.B.04 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L04.B.04 WC	-	-	-	1	-	-	-	-	-	-	N/A
L04.B.05 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L04.B.05 WC	-	-	-	1	-	-	-	-	-	-	N/A
L04.B.06 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L04.B.06 WC	-	-	-	1	-	-	-	-	-	-	N/A
L04.B.07 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L04.B.07 WC	-	-	-	1	-	-	-	-	-	-	N/A
L04.B.08 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L04.B.08 WC	-	-	-	1	-	-	-	-	-	-	N/A
L04.C LKD	-	-	-	1	-	-	-	-	-	-	N/A
L04.C.01 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L04.C.01 WC	-	-	-	1	-	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
L04.C.02 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L04.C.02 WC	-	-	-	1	-	-	-	-	-	-	N/A
L04.C.03 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L04.C.03 WC	-	-	-	1	-	-	-	-	-	-	N/A
L04.C.04 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L04.C.04 WC	-	-	-	1	-	-	-	-	-	-	N/A
L04.C.05 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L04.C.05 WC	-	-	-	1	-	-	-	-	-	-	N/A
L04.C.06 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L04.C.06 WC	-	-	-	1	-	-	-	-	-	-	N/A
L04.D.01 Studio	-	-	-	1	-	-	-	-	-	-	N/A
L04.D.01 WC	-	-	-	1	-	-	-	-	-	-	N/A
L05.A LKD	-	-	-	1	-	-	-	-	-	-	N/A
L05.A.01 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L05.A.01 WC	-	-	-	1	-	-	-	-	-	-	N/A
L05.A.02 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L05.A.02 WC	-	-	-	1	-	-	-	-	-	-	N/A
L05.A.03 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L05.A.03 WC	-	-	-	1	-	-	-	-	-	-	N/A
L05.A.04 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L05.A.04 WC	-	-	-	1	-	-	-	-	-	-	N/A
L05.A.05 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L05.A.05 WC	-	-	-	1	-	-	-	-	-	-	N/A
L05.A.06 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L05.A.06 WC	-	-	-	1	-	-	-	-	-	-	N/A
L05.A.07 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L05.A.07 WC	-	-	-	1	-	-	-	-	-	-	N/A
L05.A.08 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L05.A.08 WC	-	-	-	1	-	-	-	-	-	-	N/A
L05.B LKD	-	-	-	1	-	-	-	-	-	-	N/A
L05.B.01 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L05.B.01 WC	-	-	-	1	-	-	-	-	-	-	N/A
L05.B.02 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L05.B.02 WC	-	-	-	1	-	-	-	-	-	-	N/A
L05.B.03 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L05.B.03 WC	-	-	-	1	-	-	-	-	-	-	N/A
L05.B.04 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L05.B.04 WC	-	-	-	1	-	-	-	-	-	-	N/A
L05.B.05 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L05.B.05 WC	-	-	-	1	-	-	-	-	-	-	N/A
L05.B.06 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L05.B.06 WC	-	-	-	1	-	-	-	-	-	-	N/A
L05.B.07 Bed	-	-	-	1	-	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
L05.B.07 WC	-	-	-	1	-	-	-	-	-	-	N/A
L05.B.08 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L05.B.08 WC	-	-	-	1	-	-	-	-	-	-	N/A
L05.C LKD	-	-	-	1	-	-	-	-	-	-	N/A
L05.C.01 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L05.C.01 WC	-	-	-	1	-	-	-	-	-	-	N/A
L05.C.02 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L05.C.02 WC	-	-	-	1	-	-	-	-	-	-	N/A
L05.C.03 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L05.C.03 WC	-	-	-	1	-	-	-	-	-	-	N/A
L05.C.04 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L05.C.04 WC	-	-	-	1	-	-	-	-	-	-	N/A
L05.C.05 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L05.C.05 WC	-	-	-	1	-	-	-	-	-	-	N/A
L05.C.06 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L05.C.06 WC	-	-	-	1	-	-	-	-	-	-	N/A
L05.D.01 Studio	-	-	-	1	-	-	-	-	-	-	N/A
L05.D.01 WC	-	-	-	1	-	-	-	-	-	-	N/A
L06.A LKD	-	-	-	1	-	-	-	-	-	-	N/A
L06.A.01 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L06.A.01 WC	-	-	-	1	-	-	-	-	-	-	N/A
L06.A.02 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L06.A.02 WC	-	-	-	1	-	-	-	-	-	-	N/A
L06.A.03 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L06.A.03 WC	-	-	-	1	-	-	-	-	-	-	N/A
L06.A.04 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L06.A.04 WC	-	-	-	1	-	-	-	-	-	-	N/A
L06.A.05 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L06.A.05 WC	-	-	-	1	-	-	-	-	-	-	N/A
L06.A.06 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L06.A.06 WC	-	-	-	1	-	-	-	-	-	-	N/A
L06.A.07 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L06.A.07 WC	-	-	-	1	-	-	-	-	-	-	N/A
L06.A.08 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L06.A.08 WC	-	-	-	1	-	-	-	-	-	-	N/A
L06.B LKD	-	-	-	1	-	-	-	-	-	-	N/A
L06.B.01 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L06.B.01 WC	-	-	-	1	-	-	-	-	-	-	N/A
L06.B.02 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L06.B.02 WC	-	-	-	1	-	-	-	-	-	-	N/A
L06.B.03 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L06.B.03 WC	-	-	-	1	-	-	-	-	-	-	N/A
L06.B.04 Bed	-	-	-	1	-	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
L06.B.04 WC	-	-	-	1	-	-	-	-	-	-	N/A
L06.B.05 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L06.B.05 WC	-	-	-	1	-	-	-	-	-	-	N/A
L06.B.06 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L06.B.06 WC	-	-	-	1	-	-	-	-	-	-	N/A
L06.B.07 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L06.B.07 WC	-	-	-	1	-	-	-	-	-	-	N/A
L06.B.08 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L06.B.08 WC	-	-	-	1	-	-	-	-	-	-	N/A
L06.C LKD	-	-	-	1	-	-	-	-	-	-	N/A
L06.C.01 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L06.C.01 WC	-	-	-	1	-	-	-	-	-	-	N/A
L06.C.02 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L06.C.02 WC	-	-	-	1	-	-	-	-	-	-	N/A
L06.C.03 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L06.C.03 WC	-	-	-	1	-	-	-	-	-	-	N/A
L06.C.04 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L06.C.04 WC	-	-	-	1	-	-	-	-	-	-	N/A
L06.C.05 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L06.C.05 WC	-	-	-	1	-	-	-	-	-	-	N/A
L06.C.06 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L06.C.06 WC	-	-	-	1	-	-	-	-	-	-	N/A
L06.D.01 Studio	-	-	-	1	-	-	-	-	-	-	N/A
L06.D.01 WC	-	-	-	1	-	-	-	-	-	-	N/A
L07.A LKD	-	-	-	1	-	-	-	-	-	-	N/A
L07.A.01 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L07.A.01 WC	-	-	-	1	-	-	-	-	-	-	N/A
L07.A.02 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L07.A.02 WC	-	-	-	1	-	-	-	-	-	-	N/A
L07.A.03 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L07.A.03 WC	-	-	-	1	-	-	-	-	-	-	N/A
L07.A.04 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L07.A.04 WC	-	-	-	1	-	-	-	-	-	-	N/A
L07.A.05 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L07.A.05 WC	-	-	-	1	-	-	-	-	-	-	N/A
L07.A.06 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L07.A.06 WC	-	-	-	1	-	-	-	-	-	-	N/A
L07.A.07 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L07.A.07 WC	-	-	-	1	-	-	-	-	-	-	N/A
L07.B. LKD	-	-	-	1	-	-	-	-	-	-	N/A
L07.B.01 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L07.B.01 WC	-	-	-	1	-	-	-	-	-	-	N/A
L07.B.02 Bed	-	-	-	1	-	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
L07.B.02 WC	-	-	-	1	-	-	-	-	-	-	N/A
L07.B.03 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L07.B.03 WC	-	-	-	1	-	-	-	-	-	-	N/A
L07.B.04 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L07.B.04 WC	-	-	-	1	-	-	-	-	-	-	N/A
L07.C.01 studio	-	-	-	1	-	-	-	-	-	-	N/A
L07.C.01 WC	-	-	-	1	-	-	-	-	-	-	N/A
L07.C.02 studio	-	-	-	1	-	-	-	-	-	-	N/A
L07.C.02 WC	-	-	-	1	-	-	-	-	-	-	N/A
L07.C.03 Studio	-	-	-	1	-	-	-	-	-	-	N/A
L07.C.03 WC	-	-	-	1	-	-	-	-	-	-	N/A
L08.A LKD	-	-	-	1	-	-	-	-	-	-	N/A
L08.A.01 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L08.A.01 WC	-	-	-	1	-	-	-	-	-	-	N/A
L08.A.02 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L08.A.02 WC	-	-	-	1	-	-	-	-	-	-	N/A
L08.A.03 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L08.A.03 WC	-	-	-	1	-	-	-	-	-	-	N/A
L08.A.04 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L08.A.04 WC	-	-	-	1	-	-	-	-	-	-	N/A
L08.A.05 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L08.A.05 WC	-	-	-	1	-	-	-	-	-	-	N/A
L08.A.06 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L08.A.06 WC	-	-	-	1	-	-	-	-	-	-	N/A
L08.A.07 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L08.A.07 WC	-	-	-	1	-	-	-	-	-	-	N/A
L08.B. LKD	-	-	-	1	-	-	-	-	-	-	N/A
L08.B.01 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L08.B.01 WC	-	-	-	1	-	-	-	-	-	-	N/A
L08.B.02 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L08.B.02 WC	-	-	-	1	-	-	-	-	-	-	N/A
L08.B.03 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L08.B.03 WC	-	-	-	1	-	-	-	-	-	-	N/A
L08.B.04 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L08.B.04 WC	-	-	-	1	-	-	-	-	-	-	N/A
L08.B.05 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L08.B.05 WC	-	-	-	1	-	-	-	-	-	-	N/A
L08.B.06 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L08.B.06 WC	-	-	-	1	-	-	-	-	-	-	N/A
L08.B.07 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L08.B.07 WC	-	-	-	1	-	-	-	-	-	-	N/A
L08.C.01 Studio	-	-	-	1	-	-	-	-	-	-	N/A
L08.C.01 WC	-	-	-	1	-	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
L09.A LKD	-	-	-	1	-	-	-	-	-	-	N/A
L09.A.01 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L09.A.01 WC	-	-	-	1	-	-	-	-	-	-	N/A
L09.A.02 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L09.A.02 WC	-	-	-	1	-	-	-	-	-	-	N/A
L09.A.03 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L09.A.03 WC	-	-	-	1	-	-	-	-	-	-	N/A
L09.A.04 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L09.A.04 WC	-	-	-	1	-	-	-	-	-	-	N/A
L09.A.05 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L09.A.05 WC	-	-	-	1	-	-	-	-	-	-	N/A
L09.A.06 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L09.A.06 WC	-	-	-	1	-	-	-	-	-	-	N/A
L09.A.07 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L09.A.07 WC	-	-	-	1	-	-	-	-	-	-	N/A
L09.B. LKD	-	-	-	1	-	-	-	-	-	-	N/A
L09.B.01 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L09.B.01 WC	-	-	-	1	-	-	-	-	-	-	N/A
L09.B.02 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L09.B.02 WC	-	-	-	1	-	-	-	-	-	-	N/A
L09.B.03 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L09.B.03 WC	-	-	-	1	-	-	-	-	-	-	N/A
L09.B.04 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L09.B.04 WC	-	-	-	1	-	-	-	-	-	-	N/A
L09.B.05 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L09.B.05 WC	-	-	-	1	-	-	-	-	-	-	N/A
L09.B.06 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L09.B.06 WC	-	-	-	1	-	-	-	-	-	-	N/A
L09.B.07 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L09.B.07 WC	-	-	-	1	-	-	-	-	-	-	N/A
L09.C.01 Studio	-	-	-	1	-	-	-	-	-	-	N/A
L09.C.01 WC	-	-	-	1	-	-	-	-	-	-	N/A
L10.A LKD	-	-	-	1	-	-	-	-	-	-	N/A
L10.A.01 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L10.A.01 WC	-	-	-	1	-	-	-	-	-	-	N/A
L10.A.02 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L10.A.02 WC	-	-	-	1	-	-	-	-	-	-	N/A
L10.A.03 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L10.A.03 WC	-	-	-	1	-	-	-	-	-	-	N/A
L10.A.04 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L10.A.04 WC	-	-	-	1	-	-	-	-	-	-	N/A
L10.A.05 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L10.A.05 WC	-	-	-	1	-	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
L10.A.06 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L10.A.06 WC	-	-	-	1	-	-	-	-	-	-	N/A
L10.A.07 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L10.A.07 WC	-	-	-	1	-	-	-	-	-	-	N/A
L10.B. LKD	-	-	-	1	-	-	-	-	-	-	N/A
L10.B.01 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L10.B.01 WC	-	-	-	1	-	-	-	-	-	-	N/A
L10.B.02 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L10.B.02 WC	-	-	-	1	-	-	-	-	-	-	N/A
L10.B.03 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L10.B.03 WC	-	-	-	1	-	-	-	-	-	-	N/A
L10.B.04 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L10.B.04 WC	-	-	-	1	-	-	-	-	-	-	N/A
L10.B.05 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L10.B.05 WC	-	-	-	1	-	-	-	-	-	-	N/A
L10.B.06 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L10.B.06 WC	-	-	-	1	-	-	-	-	-	-	N/A
L10.B.07 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L10.B.07 WC	-	-	-	1	-	-	-	-	-	-	N/A
L10.C.01 Studio	-	-	-	1	-	-	-	-	-	-	N/A
L10.C.01 WC	-	-	-	1	-	-	-	-	-	-	N/A
L11.A LKD	-	-	-	1	-	-	-	-	-	-	N/A
L11.A.01 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L11.A.01 WC	-	-	-	1	-	-	-	-	-	-	N/A
L11.A.02 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L11.A.02 WC	-	-	-	1	-	-	-	-	-	-	N/A
L11.A.03 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L11.A.03 WC	-	-	-	1	-	-	-	-	-	-	N/A
L11.A.04 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L11.A.04 WC	-	-	-	1	-	-	-	-	-	-	N/A
L11.A.05 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L11.A.05 WC	-	-	-	1	-	-	-	-	-	-	N/A
L11.A.06 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L11.A.06 WC	-	-	-	1	-	-	-	-	-	-	N/A
L11.A.07 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L11.A.07 WC	-	-	-	1	-	-	-	-	-	-	N/A
L11.B. LKD	-	-	-	1	-	-	-	-	-	-	N/A
L11.B.01 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L11.B.01 WC	-	-	-	1	-	-	-	-	-	-	N/A
L11.B.02 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L11.B.02 WC	-	-	-	1	-	-	-	-	-	-	N/A
L11.B.03 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L11.B.03 WC	-	-	-	1	-	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
L11.B.04 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L11.B.04 WC	-	-	-	1	-	-	-	-	-	-	N/A
L11.B.05 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L11.B.05 WC	-	-	-	1	-	-	-	-	-	-	N/A
L11.B.06 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L11.B.06 WC	-	-	-	1	-	-	-	-	-	-	N/A
L11.B.07 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L11.B.07 WC	-	-	-	1	-	-	-	-	-	-	N/A
L11.C.01 Studio	-	-	-	1	-	-	-	-	-	-	N/A
L11.C.01 WC	-	-	-	1	-	-	-	-	-	-	N/A
L12.A LKD	-	-	-	1	-	-	-	-	-	-	N/A
L12.A.01 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L12.A.01 WC	-	-	-	1	-	-	-	-	-	-	N/A
L12.A.02 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L12.A.02 WC	-	-	-	1	-	-	-	-	-	-	N/A
L12.A.03 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L12.A.03 WC	-	-	-	1	-	-	-	-	-	-	N/A
L12.A.04 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L12.A.04 WC	-	-	-	1	-	-	-	-	-	-	N/A
L12.A.05 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L12.A.05 WC	-	-	-	1	-	-	-	-	-	-	N/A
L12.A.06 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L12.A.06 WC	-	-	-	1	-	-	-	-	-	-	N/A
L12.A.07 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L12.A.07 WC	-	-	-	1	-	-	-	-	-	-	N/A
L12.B. LKD	-	-	-	1	-	-	-	-	-	-	N/A
L12.B.01 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L12.B.01 WC	-	-	-	1	-	-	-	-	-	-	N/A
L12.B.02 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L12.B.02 WC	-	-	-	1	-	-	-	-	-	-	N/A
L12.B.03 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L12.B.03 WC	-	-	-	1	-	-	-	-	-	-	N/A
L12.B.04 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L12.B.04 WC	-	-	-	1	-	-	-	-	-	-	N/A
L12.B.05 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L12.B.05 WC	-	-	-	1	-	-	-	-	-	-	N/A
L12.B.06 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L12.B.06 WC	-	-	-	1	-	-	-	-	-	-	N/A
L12.B.07 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L12.B.07 WC	-	-	-	1	-	-	-	-	-	-	N/A
L12.C.01 Studio	-	-	-	1	-	-	-	-	-	-	N/A
L12.C.01 WC	-	-	-	1	-	-	-	-	-	-	N/A
L13.A LKD	-	-	-	1	-	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
L13.A.01 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L13.A.01 WC	-	-	-	1	-	-	-	-	-	-	N/A
L13.A.02 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L13.A.02 WC	-	-	-	1	-	-	-	-	-	-	N/A
L13.A.03 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L13.A.03 WC	-	-	-	1	-	-	-	-	-	-	N/A
L13.A.04 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L13.A.04 WC	-	-	-	1	-	-	-	-	-	-	N/A
L13.A.05 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L13.A.05 WC	-	-	-	1	-	-	-	-	-	-	N/A
L13.A.06 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L13.A.06 WC	-	-	-	1	-	-	-	-	-	-	N/A
L13.A.07 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L13.A.07 WC	-	-	-	1	-	-	-	-	-	-	N/A
L13.B. LKD	-	-	-	1	-	-	-	-	-	-	N/A
L13.B.01 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L13.B.01 WC	-	-	-	1	-	-	-	-	-	-	N/A
L13.B.02 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L13.B.02 WC	-	-	-	1	-	-	-	-	-	-	N/A
L13.B.03 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L13.B.03 WC	-	-	-	1	-	-	-	-	-	-	N/A
L13.B.04 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L13.B.04 WC	-	-	-	1	-	-	-	-	-	-	N/A
L13.B.05 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L13.B.05 WC	-	-	-	1	-	-	-	-	-	-	N/A
L13.B.06 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L13.B.06 WC	-	-	-	1	-	-	-	-	-	-	N/A
L13.B.07 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L13.B.07 WC	-	-	-	1	-	-	-	-	-	-	N/A
L13.C.01 Studio	-	-	-	1	-	-	-	-	-	-	N/A
L13.C.01 WC	-	-	-	1	-	-	-	-	-	-	N/A
L14.A LKD	-	-	-	1	-	-	-	-	-	-	N/A
L14.A.01 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L14.A.01 WC	-	-	-	1	-	-	-	-	-	-	N/A
L14.A.02 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L14.A.02 WC	-	-	-	1	-	-	-	-	-	-	N/A
L14.A.03 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L14.A.03 WC	-	-	-	1	-	-	-	-	-	-	N/A
L14.A.04 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L14.A.04 WC	-	-	-	1	-	-	-	-	-	-	N/A
L14.A.05 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L14.A.05 WC	-	-	-	1	-	-	-	-	-	-	N/A
L14.A.06 Bed	-	-	-	1	-	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
L14.A.06 WC	-	-	-	1	-	-	-	-	-	-	N/A
L14.B.01 Studio	-	-	-	1	-	-	-	-	-	-	N/A
L14.B.01 WC	-	-	-	1	-	-	-	-	-	-	N/A
L15.A LKD	-	-	-	1	-	-	-	-	-	-	N/A
L15.A.01 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L15.A.01 WC	-	-	-	1	-	-	-	-	-	-	N/A
L15.A.02 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L15.A.02 WC	-	-	-	1	-	-	-	-	-	-	N/A
L15.A.03 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L15.A.03 WC	-	-	-	1	-	-	-	-	-	-	N/A
L15.A.04 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L15.A.04 WC	-	-	-	1	-	-	-	-	-	-	N/A
L15.A.05 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L15.A.05 WC	-	-	-	1	-	-	-	-	-	-	N/A
L15.A.06 Bed	-	-	-	1	-	-	-	-	-	-	N/A
L15.A.06 WC	-	-	-	1	-	-	-	-	-	-	N/A
L15.B.01 Studio	-	-	-	1	-	-	-	-	-	-	N/A
L15.B.01 WC	-	-	-	1	-	-	-	-	-	-	N/A

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
L00 bin store	100	-	-	54
L00 Circ	-	100	-	54
L00 Circ	-	100	-	53
L00 concierge	-	100	60	191
L00 lift lobby	-	100	60	97
L00 office	100	-	-	274
L00 Plant	100	-	-	100
L00 post	100	-	-	171
L00 stairs	-	100	-	47
L00 WC	-	100	-	33
L00 WC Circ	-	100	-	22
L01 Circ	-	100	-	67
L01 Stairs	-	100	-	37
L02 Circ	-	100	-	52
L02 Stairs	-	100	-	31
L02.A Circ	-	100	-	56
L02.A LKD	-	100	-	230
L02.A.01 Bed	-	100	-	22
L02.A.01 WC	-	100	-	19
L02.A.02 Bed	-	100	-	22
L02.A.02 WC	-	100	-	19

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
L02.A.03 Bed	-	100	-	25
L02.A.03 WC	-	100	-	20
L02.A.04 Bed	-	100	-	24
L02.A.04 WC	-	100	-	19
L02.A.05 Bed	-	100	-	24
L02.A.05 WC	-	100	-	19
L02.A.06 Bed	-	100	-	23
L02.A.06 WC	-	100	-	19
L02.A.07 Bed	-	100	-	23
L02.A.07 WC	-	100	-	16
L02.A.08 Bed	-	100	-	24
L02.A.08 WC	-	100	-	17
L02.B Circ	-	100	-	72
L02.B LKD	-	100	-	321
L02.B.01 Bed	-	100	-	24
L02.B.01 WC	-	100	-	17
L02.B.02 Bed	-	100	-	26
L02.B.02 WC	-	100	-	17
L02.B.03 Bed	-	100	-	26
L02.B.03 WC	-	100	-	17
L02.B.04 Bed	-	100	-	26
L02.B.04 WC	-	100	-	17
L02.B.05 Bed	-	100	-	26
L02.B.05 WC	-	100	-	17
L02.B.06 Bed	-	100	-	24
L02.B.06 WC	-	100	-	17
L02.B.07 Bed	-	100	-	24
L02.B.07 WC	-	100	-	17
L02.B.08 Bed	-	100	-	24
L02.B.08 WC	-	100	-	17
L02.C Circ	-	100	-	58
L02.C LKD	-	100	-	264
L02.C.01 Bed	-	100	-	24
L02.C.01 WC	-	100	-	17
L02.C.02 Bed	-	100	-	24
L02.C.02 WC	-	100	-	17
L02.C.03 Bed	-	100	-	24
L02.C.03 WC	-	100	-	17
L02.C.04 Bed	-	100	-	24
L02.C.04 WC	-	100	-	17
L02.C.05 Bed	-	100	-	24
L02.C.05 WC	-	100	-	17
L02.C.06 Bed	-	100	-	24

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
L02.C.06 WC	-	100	-	17
L02.D.01 Studio	-	100	-	31
L02.D.01 WC	-	100	-	29
L03 Circ	-	100	-	52
L03 Stairs	-	100	-	31
L03.A Circ	-	100	-	56
L03.A LKD	-	100	-	230
L03.A.01 Bed	-	100	-	22
L03.A.01 WC	-	100	-	19
L03.A.02 Bed	-	100	-	22
L03.A.02 WC	-	100	-	19
L03.A.03 Bed	-	100	-	25
L03.A.03 WC	-	100	-	20
L03.A.04 Bed	-	100	-	24
L03.A.04 WC	-	100	-	19
L03.A.05 Bed	-	100	-	24
L03.A.05 WC	-	100	-	19
L03.A.06 Bed	-	100	-	23
L03.A.06 WC	-	100	-	19
L03.A.07 Bed	-	100	-	23
L03.A.07 WC	-	100	-	16
L03.A.08 Bed	-	100	-	24
L03.A.08 WC	-	100	-	17
L03.B Circ	-	100	-	72
L03.B LKD	-	100	-	321
L03.B.01 Bed	-	100	-	24
L03.B.01 WC	-	100	-	17
L03.B.02 Bed	-	100	-	26
L03.B.02 WC	-	100	-	17
L03.B.03 Bed	-	100	-	26
L03.B.03 WC	-	100	-	17
L03.B.04 Bed	-	100	-	26
L03.B.04 WC	-	100	-	17
L03.B.05 Bed	-	100	-	26
L03.B.05 WC	-	100	-	17
L03.B.06 Bed	-	100	-	24
L03.B.06 WC	-	100	-	17
L03.B.07 Bed	-	100	-	24
L03.B.07 WC	-	100	-	17
L03.B.08 Bed	-	100	-	24
L03.B.08 WC	-	100	-	17
L03.C Circ	-	100	-	58
L03.C LKD	-	100	-	264

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
L03.C.01 Bed	-	100	-	24
L03.C.01 WC	-	100	-	17
L03.C.02 Bed	-	100	-	24
L03.C.02 WC	-	100	-	17
L03.C.03 Bed	-	100	-	24
L03.C.03 WC	-	100	-	17
L03.C.04 Bed	-	100	-	24
L03.C.04 WC	-	100	-	17
L03.C.05 Bed	-	100	-	24
L03.C.05 WC	-	100	-	17
L03.C.06 Bed	-	100	-	24
L03.C.06 WC	-	100	-	17
L03.D.01 Studio	-	100	-	31
L03.D.01 WC	-	100	-	29
L04 Circ	-	100	-	52
L04 Stairs	-	100	-	31
L04.A Circ	-	100	-	56
L04.A LKD	-	100	-	230
L04.A.01 Bed	-	100	-	22
L04.A.01 WC	-	100	-	19
L04.A.02 Bed	-	100	-	22
L04.A.02 WC	-	100	-	19
L04.A.03 Bed	-	100	-	25
L04.A.03 WC	-	100	-	20
L04.A.04 Bed	-	100	-	24
L04.A.04 WC	-	100	-	19
L04.A.05 Bed	-	100	-	24
L04.A.05 WC	-	100	-	19
L04.A.06 Bed	-	100	-	23
L04.A.06 WC	-	100	-	19
L04.A.07 Bed	-	100	-	23
L04.A.07 WC	-	100	-	16
L04.A.08 Bed	-	100	-	24
L04.A.08 WC	-	100	-	17
L04.B Circ	-	100	-	72
L04.B LKD	-	100	-	321
L04.B.01 Bed	-	100	-	24
L04.B.01 WC	-	100	-	17
L04.B.02 Bed	-	100	-	26
L04.B.02 WC	-	100	-	17
L04.B.03 Bed	-	100	-	26
L04.B.03 WC	-	100	-	17
L04.B.04 Bed	-	100	-	26

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
L04.B.04 WC	-	100	-	17
L04.B.05 Bed	-	100	-	26
L04.B.05 WC	-	100	-	17
L04.B.06 Bed	-	100	-	24
L04.B.06 WC	-	100	-	17
L04.B.07 Bed	-	100	-	24
L04.B.07 WC	-	100	-	17
L04.B.08 Bed	-	100	-	24
L04.B.08 WC	-	100	-	17
L04.C Circ	-	100	-	58
L04.C LKD	-	100	-	264
L04.C.01 Bed	-	100	-	24
L04.C.01 WC	-	100	-	17
L04.C.02 Bed	-	100	-	24
L04.C.02 WC	-	100	-	17
L04.C.03 Bed	-	100	-	24
L04.C.03 WC	-	100	-	17
L04.C.04 Bed	-	100	-	24
L04.C.04 WC	-	100	-	17
L04.C.05 Bed	-	100	-	24
L04.C.05 WC	-	100	-	17
L04.C.06 Bed	-	100	-	24
L04.C.06 WC	-	100	-	17
L04.D.01 Studio	-	100	-	31
L04.D.01 WC	-	100	-	29
L05 Circ	-	100	-	52
L05 Stairs	-	100	-	31
L05.A Circ	-	100	-	56
L05.A LKD	-	100	-	230
L05.A.01 Bed	-	100	-	22
L05.A.01 WC	-	100	-	19
L05.A.02 Bed	-	100	-	22
L05.A.02 WC	-	100	-	19
L05.A.03 Bed	-	100	-	25
L05.A.03 WC	-	100	-	20
L05.A.04 Bed	-	100	-	24
L05.A.04 WC	-	100	-	19
L05.A.05 Bed	-	100	-	24
L05.A.05 WC	-	100	-	19
L05.A.06 Bed	-	100	-	23
L05.A.06 WC	-	100	-	19
L05.A.07 Bed	-	100	-	23
L05.A.07 WC	-	100	-	16

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
L05.A.08 Bed	-	100	-	24
L05.A.08 WC	-	100	-	17
L05.B Circ	-	100	-	72
L05.B LKD	-	100	-	321
L05.B.01 Bed	-	100	-	24
L05.B.01 WC	-	100	-	17
L05.B.02 Bed	-	100	-	26
L05.B.02 WC	-	100	-	17
L05.B.03 Bed	-	100	-	26
L05.B.03 WC	-	100	-	17
L05.B.04 Bed	-	100	-	26
L05.B.04 WC	-	100	-	17
L05.B.05 Bed	-	100	-	26
L05.B.05 WC	-	100	-	17
L05.B.06 Bed	-	100	-	24
L05.B.06 WC	-	100	-	17
L05.B.07 Bed	-	100	-	24
L05.B.07 WC	-	100	-	17
L05.B.08 Bed	-	100	-	24
L05.B.08 WC	-	100	-	17
L05.C Circ	-	100	-	58
L05.C LKD	-	100	-	264
L05.C.01 Bed	-	100	-	24
L05.C.01 WC	-	100	-	17
L05.C.02 Bed	-	100	-	24
L05.C.02 WC	-	100	-	17
L05.C.03 Bed	-	100	-	24
L05.C.03 WC	-	100	-	17
L05.C.04 Bed	-	100	-	24
L05.C.04 WC	-	100	-	17
L05.C.05 Bed	-	100	-	24
L05.C.05 WC	-	100	-	17
L05.C.06 Bed	-	100	-	24
L05.C.06 WC	-	100	-	17
L05.D.01 Studio	-	100	-	31
L05.D.01 WC	-	100	-	29
L06 Circ	-	100	-	52
L06 Stairs	-	100	-	31
L06.A Circ	-	100	-	56
L06.A LKD	-	100	-	230
L06.A.01 Bed	-	100	-	22
L06.A.01 WC	-	100	-	19
L06.A.02 Bed	-	100	-	22

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
L06.A.02 WC	-	100	-	19
L06.A.03 Bed	-	100	-	25
L06.A.03 WC	-	100	-	20
L06.A.04 Bed	-	100	-	24
L06.A.04 WC	-	100	-	19
L06.A.05 Bed	-	100	-	24
L06.A.05 WC	-	100	-	19
L06.A.06 Bed	-	100	-	23
L06.A.06 WC	-	100	-	19
L06.A.07 Bed	-	100	-	23
L06.A.07 WC	-	100	-	16
L06.A.08 Bed	-	100	-	24
L06.A.08 WC	-	100	-	17
L06.B Circ	-	100	-	72
L06.B LKD	-	100	-	321
L06.B.01 Bed	-	100	-	24
L06.B.01 WC	-	100	-	17
L06.B.02 Bed	-	100	-	26
L06.B.02 WC	-	100	-	17
L06.B.03 Bed	-	100	-	26
L06.B.03 WC	-	100	-	17
L06.B.04 Bed	-	100	-	26
L06.B.04 WC	-	100	-	17
L06.B.05 Bed	-	100	-	26
L06.B.05 WC	-	100	-	17
L06.B.06 Bed	-	100	-	24
L06.B.06 WC	-	100	-	17
L06.B.07 Bed	-	100	-	24
L06.B.07 WC	-	100	-	17
L06.B.08 Bed	-	100	-	24
L06.B.08 WC	-	100	-	17
L06.C Circ	-	100	-	58
L06.C LKD	-	100	-	264
L06.C.01 Bed	-	100	-	24
L06.C.01 WC	-	100	-	17
L06.C.02 Bed	-	100	-	24
L06.C.02 WC	-	100	-	17
L06.C.03 Bed	-	100	-	24
L06.C.03 WC	-	100	-	17
L06.C.04 Bed	-	100	-	24
L06.C.04 WC	-	100	-	17
L06.C.05 Bed	-	100	-	24
L06.C.05 WC	-	100	-	17

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
L06.C.06 Bed	-	100	-	24
L06.C.06 WC	-	100	-	17
L06.D.01 Studio	-	100	-	31
L06.D.01 WC	-	100	-	29
L07 Stairs	-	100	-	31
L07.A Circ	-	100	-	47
L07.A LKD	-	100	-	230
L07.A.01 Bed	-	100	-	22
L07.A.01 WC	-	100	-	19
L07.A.02 Bed	-	100	-	22
L07.A.02 WC	-	100	-	19
L07.A.03 Bed	-	100	-	25
L07.A.03 WC	-	100	-	20
L07.A.04 Bed	-	100	-	24
L07.A.04 WC	-	100	-	19
L07.A.05 Bed	-	100	-	24
L07.A.05 WC	-	100	-	19
L07.A.06 Bed	-	100	-	23
L07.A.06 WC	-	100	-	19
L07.A.07 Bed	-	100	-	23
L07.A.07 WC	-	100	-	16
L07.B Circ	-	100	-	61
L07.B. LKD	-	100	-	283
L07.B.01 Bed	-	100	-	24
L07.B.01 WC	-	100	-	17
L07.B.02 Bed	-	100	-	24
L07.B.02 WC	-	100	-	17
L07.B.03 Bed	-	100	-	26
L07.B.03 WC	-	100	-	17
L07.B.04 Bed	-	100	-	26
L07.B.04 WC	-	100	-	17
L07.C Circ	-	100	-	79
L07.C.01 studio	-	100	-	30
L07.C.01 WC	-	100	-	21
L07.C.02 studio	-	100	-	29
L07.C.02 WC	-	100	-	21
L07.C.03 Studio	-	100	-	31
L07.C.03 WC	-	100	-	29
L08 Circ	-	100	-	52
L08 Stairs	-	100	-	31
L08.A Circ	-	100	-	47
L08.A LKD	-	100	-	230
L08.A.01 Bed	-	100	-	22

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
L08.A.01 WC	-	100	-	19
L08.A.02 Bed	-	100	-	22
L08.A.02 WC	-	100	-	19
L08.A.03 Bed	-	100	-	25
L08.A.03 WC	-	100	-	20
L08.A.04 Bed	-	100	-	24
L08.A.04 WC	-	100	-	19
L08.A.05 Bed	-	100	-	24
L08.A.05 WC	-	100	-	19
L08.A.06 Bed	-	100	-	23
L08.A.06 WC	-	100	-	19
L08.A.07 Bed	-	100	-	23
L08.A.07 WC	-	100	-	16
L08.B Circ	-	100	-	79
L08.B. LKD	-	100	-	283
L08.B.01 Bed	-	100	-	24
L08.B.01 WC	-	100	-	17
L08.B.02 Bed	-	100	-	24
L08.B.02 WC	-	100	-	17
L08.B.03 Bed	-	100	-	26
L08.B.03 WC	-	100	-	17
L08.B.04 Bed	-	100	-	26
L08.B.04 WC	-	100	-	17
L08.B.05 Bed	-	100	-	24
L08.B.05 WC	-	100	-	17
L08.B.06 Bed	-	100	-	24
L08.B.06 WC	-	100	-	18
L08.B.07 Bed	-	100	-	29
L08.B.07 WC	-	100	-	19
L08.C.01 Studio	-	100	-	31
L08.C.01 WC	-	100	-	29
L09 Circ	-	100	-	52
L09 Stairs	-	100	-	31
L09.A Circ	-	100	-	47
L09.A LKD	-	100	-	230
L09.A.01 Bed	-	100	-	22
L09.A.01 WC	-	100	-	19
L09.A.02 Bed	-	100	-	22
L09.A.02 WC	-	100	-	19
L09.A.03 Bed	-	100	-	25
L09.A.03 WC	-	100	-	20
L09.A.04 Bed	-	100	-	24
L09.A.04 WC	-	100	-	19

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
L09.A.05 Bed	-	100	-	24
L09.A.05 WC	-	100	-	19
L09.A.06 Bed	-	100	-	23
L09.A.06 WC	-	100	-	19
L09.A.07 Bed	-	100	-	23
L09.A.07 WC	-	100	-	16
L09.B Circ	-	100	-	79
L09.B. LKD	-	100	-	283
L09.B.01 Bed	-	100	-	24
L09.B.01 WC	-	100	-	17
L09.B.02 Bed	-	100	-	24
L09.B.02 WC	-	100	-	17
L09.B.03 Bed	-	100	-	26
L09.B.03 WC	-	100	-	17
L09.B.04 Bed	-	100	-	26
L09.B.04 WC	-	100	-	17
L09.B.05 Bed	-	100	-	24
L09.B.05 WC	-	100	-	17
L09.B.06 Bed	-	100	-	24
L09.B.06 WC	-	100	-	18
L09.B.07 Bed	-	100	-	29
L09.B.07 WC	-	100	-	19
L09.C.01 Studio	-	100	-	31
L09.C.01 WC	-	100	-	29
L10 Circ	-	100	-	52
L10 Stairs	-	100	-	31
L10.A Circ	-	100	-	47
L10.A LKD	-	100	-	230
L10.A.01 Bed	-	100	-	22
L10.A.01 WC	-	100	-	19
L10.A.02 Bed	-	100	-	22
L10.A.02 WC	-	100	-	19
L10.A.03 Bed	-	100	-	25
L10.A.03 WC	-	100	-	20
L10.A.04 Bed	-	100	-	24
L10.A.04 WC	-	100	-	19
L10.A.05 Bed	-	100	-	24
L10.A.05 WC	-	100	-	19
L10.A.06 Bed	-	100	-	23
L10.A.06 WC	-	100	-	19
L10.A.07 Bed	-	100	-	23
L10.A.07 WC	-	100	-	16
L10.B Circ	-	100	-	79

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
L10.B. LKD	-	100	-	283
L10.B.01 Bed	-	100	-	24
L10.B.01 WC	-	100	-	17
L10.B.02 Bed	-	100	-	24
L10.B.02 WC	-	100	-	17
L10.B.03 Bed	-	100	-	26
L10.B.03 WC	-	100	-	17
L10.B.04 Bed	-	100	-	26
L10.B.04 WC	-	100	-	17
L10.B.05 Bed	-	100	-	24
L10.B.05 WC	-	100	-	17
L10.B.06 Bed	-	100	-	24
L10.B.06 WC	-	100	-	18
L10.B.07 Bed	-	100	-	29
L10.B.07 WC	-	100	-	19
L10.C.01 Studio	-	100	-	31
L10.C.01 WC	-	100	-	29
L11 Circ	-	100	-	52
L11 Stairs	-	100	-	31
L11.A Circ	-	100	-	47
L11.A LKD	-	100	-	230
L11.A.01 Bed	-	100	-	22
L11.A.01 WC	-	100	-	19
L11.A.02 Bed	-	100	-	22
L11.A.02 WC	-	100	-	19
L11.A.03 Bed	-	100	-	25
L11.A.03 WC	-	100	-	20
L11.A.04 Bed	-	100	-	24
L11.A.04 WC	-	100	-	19
L11.A.05 Bed	-	100	-	24
L11.A.05 WC	-	100	-	19
L11.A.06 Bed	-	100	-	23
L11.A.06 WC	-	100	-	19
L11.A.07 Bed	-	100	-	23
L11.A.07 WC	-	100	-	16
L11.B Circ	-	100	-	79
L11.B. LKD	-	100	-	283
L11.B.01 Bed	-	100	-	24
L11.B.01 WC	-	100	-	17
L11.B.02 Bed	-	100	-	24
L11.B.02 WC	-	100	-	17
L11.B.03 Bed	-	100	-	26
L11.B.03 WC	-	100	-	17

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
L11.B.04 Bed	-	100	-	26
L11.B.04 WC	-	100	-	17
L11.B.05 Bed	-	100	-	24
L11.B.05 WC	-	100	-	17
L11.B.06 Bed	-	100	-	24
L11.B.06 WC	-	100	-	18
L11.B.07 Bed	-	100	-	29
L11.B.07 WC	-	100	-	19
L11.C.01 Studio	-	100	-	31
L11.C.01 WC	-	100	-	29
L12 Circ	-	100	-	52
L12 Stairs	-	100	-	31
L12.A Circ	-	100	-	47
L12.A LKD	-	100	-	230
L12.A.01 Bed	-	100	-	22
L12.A.01 WC	-	100	-	19
L12.A.02 Bed	-	100	-	22
L12.A.02 WC	-	100	-	19
L12.A.03 Bed	-	100	-	25
L12.A.03 WC	-	100	-	20
L12.A.04 Bed	-	100	-	24
L12.A.04 WC	-	100	-	19
L12.A.05 Bed	-	100	-	24
L12.A.05 WC	-	100	-	19
L12.A.06 Bed	-	100	-	23
L12.A.06 WC	-	100	-	19
L12.A.07 Bed	-	100	-	23
L12.A.07 WC	-	100	-	16
L12.B Circ	-	100	-	79
L12.B. LKD	-	100	-	283
L12.B.01 Bed	-	100	-	24
L12.B.01 WC	-	100	-	17
L12.B.02 Bed	-	100	-	24
L12.B.02 WC	-	100	-	17
L12.B.03 Bed	-	100	-	26
L12.B.03 WC	-	100	-	17
L12.B.04 Bed	-	100	-	26
L12.B.04 WC	-	100	-	17
L12.B.05 Bed	-	100	-	24
L12.B.05 WC	-	100	-	17
L12.B.06 Bed	-	100	-	24
L12.B.06 WC	-	100	-	18
L12.B.07 Bed	-	100	-	29

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
L12.B.07 WC	-	100	-	19
L12.C.01 Studio	-	100	-	31
L12.C.01 WC	-	100	-	29
L13 Circ	-	100	-	52
L13 Stairs	-	100	-	31
L13.A Circ	-	100	-	47
L13.A LKD	-	100	-	230
L13.A.01 Bed	-	100	-	22
L13.A.01 WC	-	100	-	19
L13.A.02 Bed	-	100	-	22
L13.A.02 WC	-	100	-	19
L13.A.03 Bed	-	100	-	25
L13.A.03 WC	-	100	-	20
L13.A.04 Bed	-	100	-	24
L13.A.04 WC	-	100	-	19
L13.A.05 Bed	-	100	-	24
L13.A.05 WC	-	100	-	19
L13.A.06 Bed	-	100	-	23
L13.A.06 WC	-	100	-	19
L13.A.07 Bed	-	100	-	23
L13.A.07 WC	-	100	-	16
L13.B Circ	-	100	-	79
L13.B. LKD	-	100	-	283
L13.B.01 Bed	-	100	-	24
L13.B.01 WC	-	100	-	17
L13.B.02 Bed	-	100	-	24
L13.B.02 WC	-	100	-	17
L13.B.03 Bed	-	100	-	26
L13.B.03 WC	-	100	-	17
L13.B.04 Bed	-	100	-	26
L13.B.04 WC	-	100	-	17
L13.B.05 Bed	-	100	-	24
L13.B.05 WC	-	100	-	17
L13.B.06 Bed	-	100	-	24
L13.B.06 WC	-	100	-	18
L13.B.07 Bed	-	100	-	29
L13.B.07 WC	-	100	-	19
L13.C.01 Studio	-	100	-	31
L13.C.01 WC	-	100	-	29
L14 Circ	-	100	-	50
L14 Stairs	-	100	-	31
L14.A Circ	-	100	-	61
L14.A LKD	-	100	-	243

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
L14.A.01 Bed	-	100	-	21
L14.A.01 WC	-	100	-	20
L14.A.02 Bed	-	100	-	22
L14.A.02 WC	-	100	-	19
L14.A.03 Bed	-	100	-	22
L14.A.03 WC	-	100	-	19
L14.A.04 Bed	-	100	-	24
L14.A.04 WC	-	100	-	17
L14.A.05 Bed	-	100	-	24
L14.A.05 WC	-	100	-	16
L14.A.06 Bed	-	100	-	24
L14.A.06 WC	-	100	-	16
L14.B.01 Studio	-	100	-	29
L14.B.01 WC	-	100	-	22
L15 Circ	-	100	-	50
L15 Stairs	-	100	-	31
L15.A Circ	-	100	-	61
L15.A LKD	-	100	-	243
L15.A.01 Bed	-	100	-	21
L15.A.01 WC	-	100	-	20
L15.A.02 Bed	-	100	-	22
L15.A.02 WC	-	100	-	19
L15.A.03 Bed	-	100	-	22
L15.A.03 WC	-	100	-	19
L15.A.04 Bed	-	100	-	24
L15.A.04 WC	-	100	-	17
L15.A.05 Bed	-	100	-	24
L15.A.05 WC	-	100	-	16
L15.A.06 Bed	-	100	-	24
L15.A.06 WC	-	100	-	16
L15.B.01 Studio	-	100	-	29
L15.B.01 WC	-	100	-	22
LB1 Circ	-	100	-	54
LB1 stairs	-	100	-	47
LB2 Circ	-	100	-	41
LB2 Circ	-	100	-	44
LB2 Circ	-	100	-	69
LB2 cycle store	100	-	-	156
LB2 cycle store	100	-	-	60
LB2 laundry	-	100	-	133
LB2 plant	100	-	-	87
LB2 plant	100	-	-	911
LB2 stairs	-	100	-	47

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
LB2 store	100	-	-	24

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
L00 concierge	NO (-48.4%)	NO
L00 lift lobby	NO (-27.8%)	NO
L00 office	NO (-45.7%)	NO
L00 post	N/A	N/A
L02.A.01 Bed	NO (-83.8%)	NO
L02.A.02 Bed	NO (-91.1%)	NO
L02.A.03 Bed	NO (-89.3%)	NO
L02.A.04 Bed	NO (-73%)	NO
L02.A.05 Bed	NO (-73%)	NO
L02.A.06 Bed	NO (-71.9%)	NO
L02.A.07 Bed	NO (-86.6%)	NO
L02.A.08 Bed	NO (-57%)	NO
L02.B.01 Bed	NO (-57.1%)	NO
L02.B.02 Bed	NO (-67.4%)	NO
L02.B.03 Bed	NO (-57%)	NO
L02.B.04 Bed	NO (-56.1%)	NO
L02.B.05 Bed	NO (-67.4%)	NO
L02.B.06 Bed	NO (-57%)	NO
L02.B.07 Bed	NO (-57%)	NO
L02.B.08 Bed	NO (-57%)	NO
L02.C.01 Bed	NO (-69.9%)	NO
L02.C.02 Bed	NO (-70%)	NO
L02.C.03 Bed	NO (-70.6%)	NO
L02.C.04 Bed	NO (-71.3%)	NO
L02.C.05 Bed	NO (-74.8%)	NO
L02.C.06 Bed	NO (-79.2%)	NO
L02.D.01 Studio	NO (-94.9%)	NO
L03.A.01 Bed	NO (-75%)	NO
L03.A.02 Bed	NO (-87%)	NO
L03.A.03 Bed	NO (-89.3%)	NO
L03.A.04 Bed	NO (-73%)	NO
L03.A.05 Bed	NO (-73%)	NO
L03.A.06 Bed	NO (-71.9%)	NO
L03.A.07 Bed	NO (-86.6%)	NO
L03.A.08 Bed	NO (-57%)	NO
L03.B.01 Bed	NO (-57.1%)	NO
L03.B.02 Bed	NO (-67.4%)	NO
L03.B.03 Bed	NO (-57%)	NO
L03.B.04 Bed	NO (-56.1%)	NO

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
L03.B.05 Bed	NO (-67.4%)	NO
L03.B.06 Bed	NO (-57%)	NO
L03.B.07 Bed	NO (-57%)	NO
L03.B.08 Bed	NO (-57%)	NO
L03.C.01 Bed	NO (-68.4%)	NO
L03.C.02 Bed	NO (-68.2%)	NO
L03.C.03 Bed	NO (-68.2%)	NO
L03.C.04 Bed	NO (-68.2%)	NO
L03.C.05 Bed	NO (-71.1%)	NO
L03.C.06 Bed	NO (-73.9%)	NO
L03.D.01 Studio	NO (-92%)	NO
L04.A.01 Bed	NO (-68.1%)	NO
L04.A.02 Bed	NO (-84%)	NO
L04.A.03 Bed	NO (-89.3%)	NO
L04.A.04 Bed	NO (-73%)	NO
L04.A.05 Bed	NO (-73%)	NO
L04.A.06 Bed	NO (-71.9%)	NO
L04.A.07 Bed	NO (-86.6%)	NO
L04.A.08 Bed	NO (-57%)	NO
L04.B.01 Bed	NO (-57.1%)	NO
L04.B.02 Bed	NO (-67.4%)	NO
L04.B.03 Bed	NO (-57%)	NO
L04.B.04 Bed	NO (-56.1%)	NO
L04.B.05 Bed	NO (-67.4%)	NO
L04.B.06 Bed	NO (-57%)	NO
L04.B.07 Bed	NO (-57%)	NO
L04.B.08 Bed	NO (-57%)	NO
L04.C.01 Bed	NO (-68.4%)	NO
L04.C.02 Bed	NO (-68.2%)	NO
L04.C.03 Bed	NO (-67.8%)	NO
L04.C.04 Bed	NO (-67.4%)	NO
L04.C.05 Bed	NO (-67.9%)	NO
L04.C.06 Bed	NO (-70.6%)	NO
L04.D.01 Studio	NO (-89.6%)	NO
L05.A.01 Bed	NO (-68.1%)	NO
L05.A.02 Bed	NO (-84%)	NO
L05.A.03 Bed	NO (-89.3%)	NO
L05.A.04 Bed	NO (-73%)	NO
L05.A.05 Bed	NO (-73%)	NO
L05.A.06 Bed	NO (-71.9%)	NO
L05.A.07 Bed	NO (-86.6%)	NO
L05.A.08 Bed	NO (-57%)	NO
L05.B.01 Bed	NO (-57.1%)	NO
L05.B.02 Bed	NO (-67.4%)	NO
L05.B.03 Bed	NO (-57%)	NO
L05.B.04 Bed	NO (-56.1%)	NO
L05.B.05 Bed	NO (-67.4%)	NO
L05.B.06 Bed	NO (-57%)	NO
L05.B.07 Bed	NO (-57%)	NO

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
L05.B.08 Bed	NO (-57%)	NO
L05.C.01 Bed	NO (-68%)	NO
L05.C.02 Bed	NO (-67.8%)	NO
L05.C.03 Bed	NO (-67.7%)	NO
L05.C.04 Bed	NO (-67.3%)	NO
L05.C.05 Bed	NO (-67.9%)	NO
L05.C.06 Bed	NO (-70.5%)	NO
L05.D.01 Studio	NO (-89.6%)	NO
L06.A.01 Bed	NO (-68.1%)	NO
L06.A.02 Bed	NO (-84%)	NO
L06.A.03 Bed	NO (-89.3%)	NO
L06.A.04 Bed	NO (-73%)	NO
L06.A.05 Bed	NO (-73%)	NO
L06.A.06 Bed	NO (-71.9%)	NO
L06.A.07 Bed	NO (-86.6%)	NO
L06.A.08 Bed	NO (-57%)	NO
L06.B.01 Bed	NO (-57.1%)	NO
L06.B.02 Bed	NO (-67.4%)	NO
L06.B.03 Bed	NO (-56.7%)	NO
L06.B.04 Bed	NO (-56.1%)	NO
L06.B.05 Bed	NO (-67.2%)	NO
L06.B.06 Bed	NO (-57%)	NO
L06.B.07 Bed	NO (-57%)	NO
L06.B.08 Bed	NO (-57%)	NO
L06.C.01 Bed	NO (-67.9%)	NO
L06.C.02 Bed	NO (-67.8%)	NO
L06.C.03 Bed	NO (-67.7%)	NO
L06.C.04 Bed	NO (-67.2%)	NO
L06.C.05 Bed	NO (-67.9%)	NO
L06.C.06 Bed	NO (-70.5%)	NO
L06.D.01 Studio	NO (-89.6%)	NO
L07.A.01 Bed	NO (-68.1%)	NO
L07.A.02 Bed	NO (-84%)	NO
L07.A.03 Bed	NO (-89.3%)	NO
L07.A.04 Bed	NO (-73%)	NO
L07.A.05 Bed	NO (-73%)	NO
L07.A.06 Bed	NO (-71.9%)	NO
L07.A.07 Bed	NO (-86.6%)	NO
L07.B.01 Bed	NO (-58.4%)	NO
L07.B.02 Bed	NO (-58.5%)	NO
L07.B.03 Bed	NO (-68.5%)	NO
L07.B.04 Bed	NO (-58.4%)	NO
L07.C.01 studio	NO (-79.2%)	NO
L07.C.02 studio	NO (-80.7%)	NO
L07.C.03 Studio	NO (-89.6%)	NO
L08.A.01 Bed	NO (-68.1%)	NO
L08.A.02 Bed	NO (-84%)	NO
L08.A.03 Bed	NO (-89.3%)	NO
L08.A.04 Bed	NO (-73%)	NO

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
L08.A.05 Bed	NO (-73%)	NO
L08.A.06 Bed	NO (-71.9%)	NO
L08.A.07 Bed	NO (-86.6%)	NO
L08.B.01 Bed	NO (-58.4%)	NO
L08.B.02 Bed	NO (-58.5%)	NO
L08.B.03 Bed	NO (-68.5%)	NO
L08.B.04 Bed	NO (-58.4%)	NO
L08.B.05 Bed	NO (-64.3%)	NO
L08.B.06 Bed	NO (-64.9%)	NO
L08.B.07 Bed	NO (-88.7%)	NO
L08.C.01 Studio	NO (-89.6%)	NO
L09.A.01 Bed	NO (-68%)	NO
L09.A.02 Bed	NO (-84%)	NO
L09.A.03 Bed	NO (-89.3%)	NO
L09.A.04 Bed	NO (-73%)	NO
L09.A.05 Bed	NO (-73%)	NO
L09.A.06 Bed	NO (-71.9%)	NO
L09.A.07 Bed	NO (-86.6%)	NO
L09.B.01 Bed	NO (-58.4%)	NO
L09.B.02 Bed	NO (-58.5%)	NO
L09.B.03 Bed	NO (-68.5%)	NO
L09.B.04 Bed	NO (-58.4%)	NO
L09.B.05 Bed	NO (-64.4%)	NO
L09.B.06 Bed	NO (-64.9%)	NO
L09.B.07 Bed	NO (-88.7%)	NO
L09.C.01 Studio	NO (-89.5%)	NO
L10.A.01 Bed	NO (-68%)	NO
L10.A.02 Bed	NO (-84%)	NO
L10.A.03 Bed	NO (-89.3%)	NO
L10.A.04 Bed	NO (-73%)	NO
L10.A.05 Bed	NO (-73%)	NO
L10.A.06 Bed	NO (-71.9%)	NO
L10.A.07 Bed	NO (-86.6%)	NO
L10.B.01 Bed	NO (-58.4%)	NO
L10.B.02 Bed	NO (-58.5%)	NO
L10.B.03 Bed	NO (-68.5%)	NO
L10.B.04 Bed	NO (-58.4%)	NO
L10.B.05 Bed	NO (-63.8%)	NO
L10.B.06 Bed	NO (-64.4%)	NO
L10.B.07 Bed	NO (-88.6%)	NO
L10.C.01 Studio	NO (-89.4%)	NO
L11.A.01 Bed	NO (-68%)	NO
L11.A.02 Bed	NO (-84%)	NO
L11.A.03 Bed	NO (-89.3%)	NO
L11.A.04 Bed	NO (-73%)	NO
L11.A.05 Bed	NO (-73%)	NO
L11.A.06 Bed	NO (-71.9%)	NO
L11.A.07 Bed	NO (-86.6%)	NO
L11.B.01 Bed	NO (-58.4%)	NO

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
L11.B.02 Bed	NO (-58.5%)	NO
L11.B.03 Bed	NO (-68.5%)	NO
L11.B.04 Bed	NO (-58.4%)	NO
L11.B.05 Bed	NO (-63.8%)	NO
L11.B.06 Bed	NO (-64.4%)	NO
L11.B.07 Bed	NO (-88.6%)	NO
L11.C.01 Studio	NO (-89.4%)	NO
L12.A.01 Bed	NO (-68%)	NO
L12.A.02 Bed	NO (-84%)	NO
L12.A.03 Bed	NO (-89.3%)	NO
L12.A.04 Bed	NO (-73%)	NO
L12.A.05 Bed	NO (-73%)	NO
L12.A.06 Bed	NO (-71.9%)	NO
L12.A.07 Bed	NO (-86.6%)	NO
L12.B.01 Bed	NO (-58.4%)	NO
L12.B.02 Bed	NO (-58.5%)	NO
L12.B.03 Bed	NO (-68.5%)	NO
L12.B.04 Bed	NO (-58.4%)	NO
L12.B.05 Bed	NO (-63.8%)	NO
L12.B.06 Bed	NO (-64.4%)	NO
L12.B.07 Bed	NO (-88.6%)	NO
L12.C.01 Studio	NO (-89.4%)	NO
L13.A.01 Bed	NO (-67.8%)	NO
L13.A.02 Bed	NO (-83.9%)	NO
L13.A.03 Bed	NO (-89.3%)	NO
L13.A.04 Bed	NO (-73%)	NO
L13.A.05 Bed	NO (-73%)	NO
L13.A.06 Bed	NO (-71.9%)	NO
L13.A.07 Bed	NO (-86.6%)	NO
L13.B.01 Bed	NO (-58.4%)	NO
L13.B.02 Bed	NO (-58.4%)	NO
L13.B.03 Bed	NO (-68.5%)	NO
L13.B.04 Bed	NO (-58.4%)	NO
L13.B.05 Bed	NO (-63.6%)	NO
L13.B.06 Bed	NO (-64.4%)	NO
L13.B.07 Bed	NO (-88.6%)	NO
L13.C.01 Studio	NO (-89.4%)	NO
L14.A.01 Bed	NO (-89.4%)	NO
L14.A.02 Bed	NO (-84.2%)	NO
L14.A.03 Bed	NO (-84.2%)	NO
L14.A.04 Bed	NO (-58.4%)	NO
L14.A.05 Bed	NO (-58.4%)	NO
L14.A.06 Bed	NO (-88.1%)	NO
L14.B.01 Studio	NO (-83.2%)	NO
L15.A.01 Bed	NO (-89.4%)	NO
L15.A.02 Bed	NO (-84.2%)	NO
L15.A.03 Bed	NO (-84.2%)	NO
L15.A.04 Bed	NO (-58.4%)	NO
L15.A.05 Bed	NO (-58.4%)	NO

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
L15.A.06 Bed	NO (-88.1%)	NO
L15.B.01 Studio	NO (-83.2%)	NO

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	YES
Is evidence of such assessment available as a separate submission?	YES
Are any such measures included in the proposed design?	YES

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m^2]	7187.5	7187.5
External area [m^2]	6218.9	6218.9
Weather	LON	LON
Infiltration [m^3/hm^2@ 50Pa]	3	3
Average conductance [W/K]	1874.71	3825.86
Average U-value [W/m^2K]	0.3	0.62
Alpha value* [%]	10.11	10

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
	A1/A2 Retail/Financial and Professional services
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
100	**C2 Residential Institutions: Universities and colleges**
	C2A Secure Residential Institutions
	Residential spaces
	D1 Non-residential Institutions: Community/Day Centre
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
	D1 Non-residential Institutions: Education
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others: Stand alone utility block

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

	Actual	Notional
Heating	3.61	9.17
Cooling	0	0
Auxiliary	7.8	4.37
Lighting	6.43	13.11
Hot water	35.5	38.57
Equipment*	39.68	39.68
TOTAL**	**53.34**	**65.22**

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m^2]

	Actual	Notional
Photovoltaic systems	2.14	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m^2]	31.47	74.44
Primary energy* [kWh/m^2]	159.65	195.21
Total emissions [kg/m^2]	25.9	30.7

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Central heating using water: radiators, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	52	0	6	0	3.5	2.42	0	2.58	0
	Notional	32.4	0	4	0	1.8	2.26	0	----	----
[ST] Central heating using water: radiators, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	36.6	0	4.2	0	11.1	2.42	0	2.58	0
	Notional	105.7	0	13	0	6.2	2.26	0	----	----
[ST] No Heating or Cooling										
	Actual	0	0	0	0	0	0	0	0	0
	Notional	0	0	0	0	0	0	0	----	----

Key to terms

Heat dem [MJ/m2] = Heating energy demand
Cool dem [MJ/m2] = Cooling energy demand
Heat con [kWh/m2] = Heating energy consumption
Cool con [kWh/m2] = Cooling energy consumption
Aux con [kWh/m2] = Auxiliary energy consumption
Heat SSEFF = Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER = Cooling system seasonal energy efficiency ratio
Heat gen SSEFF = Heating generator seasonal efficiency
Cool gen SSEER = Cooling generator seasonal energy efficiency ratio
ST = System type
HS = Heat source
HFT = Heating fuel type
CFT = Cooling fuel type

Key Features

The Building Control Body is advised to give particular attention to items whose specifications are better than typically expected.

Building fabric

Element	$U_{i\text{-}Typ}$	$U_{i\text{-}Min}$	Surface where the minimum value occurs*
Wall	0.23	0.15	L100002E:Surf[1]
Floor	0.2	0.13	L000001A:Surf[0]
Roof	0.15	0.13	L00000E6:Surf[0]
Windows, roof windows, and rooflights	1.5	1.2	L00001A8:Surf[2]
Personnel doors	1.5	1.5	L0000061:Surf[0]
Vehicle access & similar large doors	1.5	-	No Vehicle access doors in building
High usage entrance doors	1.5	-	No High usage entrance doors in building

$U_{i\text{-}Typ}$ = Typical individual element U-values [W/(m²K)] $U_{i\text{-}Min}$ = Minimum individual element U-values [W/(m²K)]

* There might be more than one surface where the minimum U-value occurs.

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	3

5.2 E.On Letter

E.ON City Energy Solutions
Westwood Way
Westwood Business Park
Coventry
CV4 8LG

13TH May 2022

To whom it may concern,

CONNECTION TO ELEPHANT PARK HEAT NETWORK - AVONMOUTH HOUSE

After an initial enquiry, a meeting was held between JAW Sustainability and E.ON in May 2021 to discuss the possibility of the proposed Avonmouth House scheme to connect to the Elephant Park Heat Network. At this stage E.ON confirmed that we did not believe a connection is feasible, due to the distance of the site from the existing network.

Following other potential enquires in the area in the last year, E.ON is now considering extending the Elephant Park Heat Network north to the area surrounding Avonmouth House, which would make a future connection to the scheme possible. Exact timescales for the extension of the network are currently unknow, and are subject to connection of nearby sites, however it is currently expected to be operational around 2026.

Yours sincerely,

Tony Poole
Head of Sales

E.ON UK Infrastructure Services Limited

Registered Office:
Westwood Way
Westwood Business Park
Coventry CV4 8LG

Registered in
England and Wales
No 07537806

5.3 Heat Pump Data

TECHNICAL PRODUCT SUBMITTAL

AMICUS LAHP-852HT AIR SOURCE HEAT PUMP

EFFICIENCY DATA -Part L2		
Heating Capacity (EN14511) external air+7C 30/35 flow	kW	80.1
Total Power input (EN14511) external air+7C 30/35 flow	kW	18.4
COP (EN14511) external air+7C 30/35 flow	W/W	4.35
EFFICIENCY DATA -ErP and Energy Label		
Energy Label Rating Low temperature		A++
SCOP Low Temperature		3.83
Seasonal Efficiency Low temperature	**%**	150.1
Energy Label Rating High temperature		A+
SCOP High Temperature		3.13
Seasonal Efficiency High temperature	%	122
GENERAL		
Refrigerant type		R410A
Compressor Type		E.V.I. Scroll
Number of Compressors		2
Number of Circuits		1
Capacity steps		2
Minimum capacity step	**%**	50
ELECTRICAL DATA		
Power supply	V/Ph/Hz	415/3+N/50
Maximum input power	kW	40
Maximum input current standard unit	A (per phase)	71
Peak input current standard unit	A (per phase)	213
Peak input current unit with soft start option fitted	A (per phase)	143
Fuse rating (delayed)	A	125
Optional Hydraulic kit input power	kW	1.1
Optional Hydraulic kit maximum input current	A	2.45
FANS		
Fan type (standard unit)		Axial
Number of fans (standard unit)		2
Air flow rate for design	m^3/h	32192
Sound power level [2]	dB(A)	74
Sound pressure level [3]	dB(A)	42
WATER		
Flow/Return connections	inch	2
Nominal flow rate	L/sec	4.98
Pressure drop across the heat exchanger	kPa	24.9
Minimum water content in the user circuit	litre	800
BREEAM DATA		
Total refrigerant charge	kg	22.5
Operational life	Years	20
Global warming potential		2088

ErP Data including Product Fiche and Energy Labels where applicable and Warranty information are available at www.lochinvar.ltd.uk

TECHNICAL PRODUCT SUBMITTAL
AMICUS LAHP-852HT AIR SOURCE HEAT PUMP

LAHP-852HT			Heating OUT							
Water Delivery Temperature			35C	40C	45C	50C	55C	60C	65C	Max Outlet
performance data	-10	Heat Output (KW)	46.1	46.3	46.4	46.8	47.3	47.9	49.2	65°c
		Efficiency COP	2.6	2.4	2.2	2.0	1.8	1.6	1.5	
	-9	Heat Output (KW)	47.3	47.5	47.7	47.8	48.4	48.9	50.2	65°c
		Efficiency COP	2.6	2.4	2.2	2.0	1.8	1.6	1.5	
	-8	Heat Output (KW)	48.5	48.6	48.9	49.0	49.4	50.1	51.3	65°c
		Efficiency COP	2.7	2.5	2.3	2.0	1.8	1.7	1.5	
	-7	Heat Output (KW)	49.7	49.8	50.0	50.1	50.6	51.2	52.5	65°c
		Efficiency COP	2.8	2.5	2.3	2.1	1.9	1.7	1.6	
	-6	Heat Output (KW)	50.9	51.0	51.2	51.4	51.8	52.3	53.7	65°c
		Efficiency COP	2.8	2.6	2.4	2.1	1.9	1.7	1.6	
	-5	Heat Output (KW)	52.1	52.2	52.4	52.6	52.9	53.5	54.9	65°c
		Efficiency COP	2.9	2.6	2.4	2.2	2.0	1.8	1.6	
	-4	Heat Output (KW)	53.8	53.9	54.3	54.7	55.1	55.8	57.5	65°c
		Efficiency COP	3.0	2.7	2.5	2.3	2.0	1.8	1.7	
	-3	Heat Output (KW)	56.4	56.4	56.7	57.2	57.7	58.3	60.2	65°c
		Efficiency COP	3.1	2.8	2.5	2.3	2.1	1.9	1.8	
	-2	Heat Output (KW)	58.8	58.8	59.2	59.7	60.4	61.0	62.9	65°c
		Efficiency COP	3.2	2.9	2.7	2.4	2.2	2.0	1.8	
	0	Heat Output (KW)	63.8	64.3	64.4	65.0	65.9	67.0	68.5	65°c
		Efficiency COP	3.5	3.2	2.9	2.6	2.4	2.2	2.0	
	5	Heat Output (KW)	76.1	76.9	77.8	78.6	79.6	80.7	82.5	65°c
		Efficiency COP	4.1	3.8	3.4	3.1	2.8	2.6	2.3	
	10	Heat Output (KW)	84.7	85.3	86.0	86.7	87.6	88.7	90.1	65°c
		Efficiency COP	4.6	4.2	3.8	3.4	3.1	2.8	2.5	
	15	Heat Output (KW)	92.8	93.4	94.0	94.7	95.3	96.2	97.5	65°c
		Efficiency COP	5.2	4.6	4.1	3.7	3.3	3.0	2.7	
	20	Heat Output (KW)	99.4	99.9	100.0	101.0	102.0	102.0	104.0	65°c
		Efficiency COP	5.6	5.0	4.4	4.0	3.6	3.2	2.9	
	25	Heat Output (KW)	106.0	107.0	108.0	108.0	109.0	110.0	112.0	65°c
		Efficiency COP	6.1	5.4	4.8	4.2	3.8	3.4	3.1	

Optional Hydraulic kit Pump details		
Model		LAHP-852HT
Nominal Input power	kW	1.1
Nominal Input current	A	2.45
Nominal water flow rate	l/h	13790
Total head available at the pump	kPa	178
Available head for system pipework	kPa	122
Power supply	V/ph/Hz	400/3/50

Amicus air to water heat pumps must be installed and maintained in line with the Installation Commissioning and Maintenance Instructions which are available on the Literature & Downloads section of www.lochinvar.ltd.uk

ErP Data including Product Fiche and Energy Labels where applicable and Warranty information are available at www.lochinvar.ltd.uk

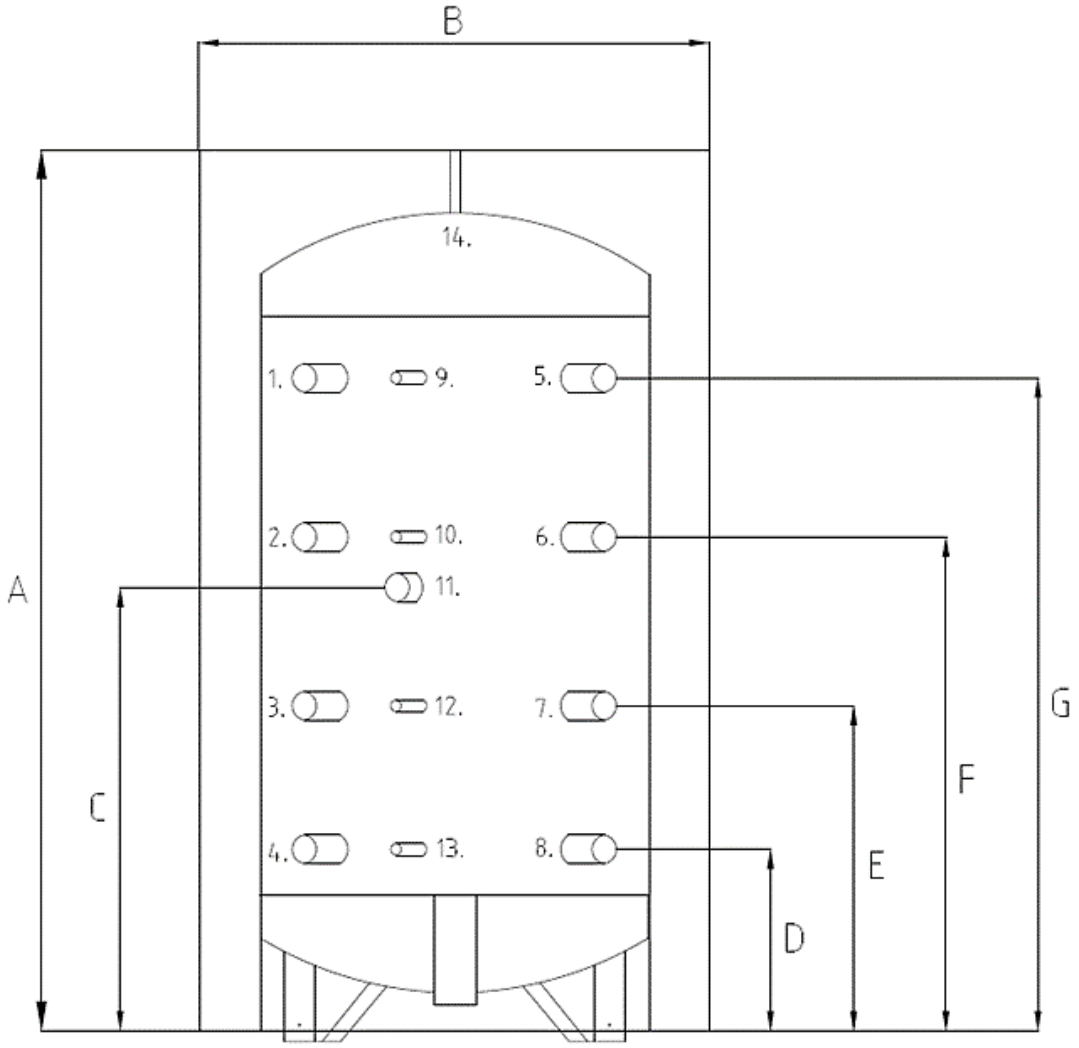
TECHNICAL PRODUCT SUBMITTAL
LBT1000 THERMAL STORE

		LBT1000
EFFICIENCY DATA-Part L2		
Insulation Thickness	mm	80
Insulation Type		Polyurethane
Heat Loss	kWh/24h	3.01
EFFICIENCY DATA ErP AND ENERGY LABEL		
Ecodesign Energy Label rating		C
Standing Loss	W	125.4
GENERAL DATA		
Storage Capacity	litres	1000
Weight Empty	kg	125
Weight Full and Insulated	kg	1125
Maximum Vessel Pressure	bar	5
Maximum Vessel Temperature	°C	95

The LBT Thermal store must be installed and maintained in line with the Installation Commissioning and Maintenance Instructions which are available on the Literature & Downloads section of www.lochinvar.ltd.uk

ErP and Warranty

ErP Data including Product Fiche and Energy Labels where applicable and Warranty information are also available at www.lochinvar.ltd.uk



TECHNICAL PRODUCT SUBMITTAL
LBT1000 THERMAL STORE

No	Description	Unit	LBT300	LBT500	LBT800	LBT1000	LBT1500	LBT2000
A	Total Height (with insulation)	mm	1680	1715	1740	2100	2140	2470
B	Diameter of Water Heater (with insulation)	mm	610	710	990	990	1240	1340
C	Height of Immersion heater connection	mm	880	975	845	1020	1085	1200
D	Connection ASHP return	mm	325	345	290	290	360	390
E	Height of Tank body connection	mm	695	715	660	780	810	930
F	Height of Tank body connection	mm	1065	1085	1030	1270	1260	1470
G	Connection ASHP flow	mm	1435	1455	1400	1760	1710	2010
A	Height of AAV Connection	mm	1680	1715	1740	2100	2140	2470

No	Description	Unit	LBT300	LBT500	LBT800	LBT1000	LBT1500	LBT2000
1	Connection heating system flow	BSP	1¼"	1¼"	1½"	1½"	1½"	1½"
2	Connection Tank body	BSP	1¼"	1¼"	1¼"	1¼"	1¼"	1¼"
3	Connection heating system return	BSP	1¼"	1¼"	1½"	1½"	1½"	1½"
4	Connection alternate heating system return	BSP	1¼"	1¼"	1½"	1½"	1½"	1½"
5	Connection ASHP flow	BSP	1¼"	1¼"	1½"	1½"	1½"	1½"
6	Connection Tank body	BSP	1¼"	1¼"	1¼"	1¼"	1¼"	1¼"
7	Connection Tank body	BSP	1¼"	1¼"	1¼"	1¼"	1¼"	1¼"
8	Connection ASHP return	BSP	1¼"	1¼"	1½"	1½"	1½"	1½"
9	Connection sensor point	BSP	½"	½"	½"	½"	½"	½"
10	Connection sensor point	BSP	½"	½"	½"	½"	½"	½"
11	Connection Immersion heater	BSP	1½"	1½"	1½"	1½"	1½"	1½"
12	Connection sensor point	BSP	½"	½"	½"	½"	½"	½"
13	Connection sensor point	BSP	½"	½"	½"	½"	½"	½"
14	Connection Air vent	BSP	1"	1"	1"	1"	1"	1"

TECHNICAL PRODUCT SUBMITTAL

LST Direct Storage vessel

Key features Include:

- **Clean out door**
- **Enamel lined storage vessel**
- **3 year storage vessel warranty**

RANGE		Model
		LST550GE
Storage Capacity	litres	2500
EFFICIENCY DATA-Part L2		
Insulation Thickness	mm	100
Insulation Type		Rockwool
Standing Loss	kWh/ltr/day	0.005
EFFICIENCY DATA-ErP and Energy Label		
Ecodesign Energy Label rating		n/a
Standing Loss	W	232
GENERAL DATA		
Recovery Rate @ 44°C	l/hr	**Use heat source data**
Recovery Rate @ 50°C	l/hr	**Use heat source data**
Recovery Rate @ 56°C	l/hr	**Use heat source data**
Dimensions (height)	mm	2045
Dimensions (diameter with insulation)	mm	1600
Weight (empty)	kg	485
Weight (full)	kg	2985
Minimum Working Pressure	bar	0.5
Maximum Working Pressure	bar	7
Hot Outlet Connection (inches)	BSP	2
Flow Connection (inches)	BSP	2
Return Connection (inches)	BSP	2
Relief Valve Tapping (inches)	BSP	2
Anode Quantity		3

LST Direct storage vessels must be installed and maintained in line with the Installation Commissioning and Maintenance Instructions which are available on the Literature & Downloads section of www.lochinvar.ltd.uk

If the LST Direct storage vessel is being used alongside a gas fired water heater then the Installation Commissioning and Maintenance instructions for the gas appliance should also be consulted prior to installation as the installation requirements may differ.

Particular attention should be made to:-

- Dimensions and clearances page 7
- Vented and Unvented installation requirements page 9
- Maintenance page 13

ErP and Warranty

ErP Data including Product Fiche and Energy Labels where applicable and Warranty information are also available at www.lochinvar.ltd.uk

5.4 Roof PV Layout

Do not scale from this drawing. This drawing is based on dimensional survey information provided by others. The architect cannot accept resposibility for the accuracy of this survey information. All dimensions are shown in metric.

DRAWING NOTES

ISSUE	REASON FOR ISSUE	DATE
A	Annotations added	14/06/2022

KEY PLAN

stitch.
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London NW1 9DF
www.stitcharchitects.co.uk
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PROJECT
Avonmouth House

PROJECT CODE	CLIENT
21235	Tribe Student Housing

DRAWING TITLE	STATUS
Proposed building Roof plan	Planning

SCALE	SHEET	DATE OF FIRST ISSUE
1:250 @ A3	A3	22.10.21

DRAWING NUMBER: 21235-STCH-XX-RF-DR-A-1109
REVISION: A

5.5 Roof Annual Solar Energy


01/Jan - 00:00 to 31/Dec - 23:00
kWh/m²
915.74
824.17
732.59
641.02
549.44
457.87
366.30
274.72
183.15
91.57
0.00

5.6 WWHR Feasibility Study

TAYLOR PROJECT SERVICES LLP
1999 – 2019 Celebrating 20 Years

Feasibility Report into the Installation of Shower Waste Heat Recovery Units

for

Student Accommodation Development
Avonmouth Street,
London,

SE1 6NX

19th June 2022

Taylor Project Services LLP
No1 Cornhill, London. EC3V 3ND
Telephone: 020 7743 6602
www.taylorprojectservices.com

1.0 Introduction

This desktop study has been produced to investigate the feasibility of installing Waste Heat recovery units from the Shower Waste drainage to using the recovered heat to pre-warm the cold water feed within a 233 bedroom Student Accommodation development at Avonmouth Street, London.

It is proposed that Hot Water and Heating shall be generated on the site by high efficiency heat pumps with the future facility for connection to a local district heating network when it becomes available in the area. As such the hot water for showering will be provided from substantially decarbonised energy.

There are expected to be between 50,000 and 75,000 showers taken and upto 4 million litres of water utilised showering per annum and therefore there is justification for considering heat recovery from showering to reduce the energy used.

This report is a desktop feasibility study for the above site and is not intended for use for any other purpose. Manufacturers data has been used in the evaluation (where available) along with practical engineering assessments of the data.

2.0 Conclusion

The full results of the study are presented below however the cost and practicalities of installing the shower waste heat recovery units far outweigh the carbon and energy savings available.

In simple payback terms, when compared to decarbonised energy from the grid, the payback is likely to be 30-40 years. Even when considering the most favourable conditions and unit efficiencies payback is in excess of 30 years.

For paybacks to become economical each SHRU will need to feed multiple or communal showers (5 or more) which is not possible in this development with individual bathrooms and energy costs would have to treble.

The units are relatively expensive to purchase and install (over £1000.00 each) and with the heat pump efficiency of around 225% (SCOP 2.25) and cost of primary energy from the grid assumed at 18p/kWh the cost of a shower equates to around 16p and the cost of 75,000 showers is around £12,000.00. The WWHR energy cost savings available are at best half of this say £6,000.00.

From review of the layouts most SHRU's can serve 2no. showers maximum (except where not stacked and above those above the Commercial / Access areas) therefore around 140 units will be required and the installation cost is at least £175,000.00. Hence 30 years payback (in simple terms).

If additional maintenance is factored in as the units will need internal cleaning to maintain efficiencies then the units do not pay back at all as to clean 140no. units will cost well in excess of the £6,000.00 per annum predicted saving (maintenance estimated around £10,000.00 per annum).

Additionally there are Legionella aspects to consider with appropriate monitoring and maintenance regime implemented (which cannot be ignored but has not been factored into any running / maintenance costs) together with spatial and access implications requiring access panels for cleaning and to inspect / service mains pressure valves (6 bar) and joints with consequential additional leakage risks.

Over 10 years with installation, maintenance and other factors the costs of SHRU's could be in excess of £275,000.00 and energy saving costs are expected to be circa £41,000.00 to £60,000.00 in this period.

The carbon savings / benefits are also limited because of the heat pump efficiency. Annual energy consumption is expected to be around 52,000kWh per annum and savings are at best 50% of this circa 26,000kWh which equates to around 3.5 Tonnes of carbon per annum (using SAP10.2 conversion factors).

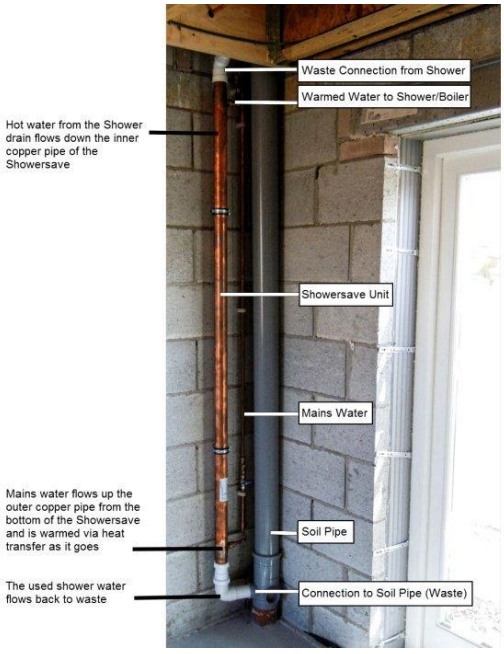
For electrical shower installation or for high flow rate showers then greater savings are achievable but for this development where low flow rate showers are proposed coupled with relatively cheap and substantially decarbonised primary energy source from the Heat Pumps system, there is little benefit to installing these units and the high cost of installation make them unfeasible.

3.0 Background to Shower Heat Recovery Units (SHRU)

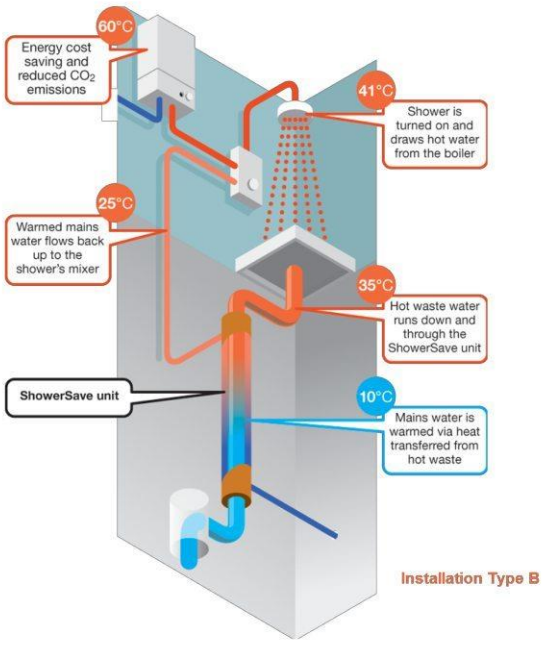
There are various Waste Water Heat Recovery Units that have been developed over the years. A Gravity Film Exchanger (GFX) was first developed for this purpose in the Late 1970's and works on the principle that heat transfers from the Warm Shower Water travelling down the walls of a 3" waste pipe in a thin film (falling film) which transfers heat to Cold water travelling in the opposite direction within an outer casing pre-warming it before it feeds the shower mixer thus reducing the amount of hot water needed for the shower.

Similar systems were developed and marketed in Europe by Gastec NV and Germontis but we do not believe these companies are still trading / manufacturing. We understand that at least one of the larger Electric Shower companies previously looked at this technology as an ideal device to reduce the capacity and energy use of their Electric shower units but have not followed through with commercial production following testing.

Within the last 5-8 years there has been a resurgence in the number of companies promoting the system, including Showersave, Recoup WWHRS, Powerpipe HR, Zap Carbon and Heatrae Sadia. The recent demand principally seems to have been fuelled by SAP calculations / credits which are available from installing the system



Installation Example of a ShowerSave Unit (SHRU)



Operational Schematic of a ShowerSave Unit (SHRU)

4.0 Efficiency of Shower Heat Recovery Units (SHRU)

The efficiency of the units varies between manufacturer the original GFX style unit claimed an average efficiency of 34% however other manufacturers claim upto 65% efficiency. The actual efficiency will depend on the installation configuration, operating temperatures and flow rate of the shower. For a building regulations installation of 6-9l/minute shower the efficiency of a unit is upto 60% for a new/clean Vertical SHRU (Shower Heat Recovery Unit). Horizontal SHRU's are around half as efficient (less than 30%).

5.0 Performance of Shower Heat Recovery Units (SHRU)

The performance of any heat exchanger will depend upon the fouling factor of the fluid and the heat exchanger surfaces for low flow / thin film devices such as these then the effect of fouling on the pipework surface is expected to be significant.

The waste water fouling factor from showers is expected to be significant because of the products, shampoos, gels, creams and conditioners used whilst showering. Also oxidisation / corrosion will occur on the internal surfaces of the drain pipe because of bacteria and microbes and because of this combination the actual efficiency of the unit in use after a period of use is likely to be below the published data. From our desktop research and discussions with manufacturers there has been limited studies into the actual performance of the unit after a number of years in use however the effects of fouling, corrosion and scaling is expected to reduce the efficiency of the unit by at least 10% -15% (potentially more).

For the purpose of this evaluation the manufacturers published data has been de-rated by 10% to allow for a level of fouling and general unit degradation.

6.0 Shower Usage

A typical shower lasts between 5 and 10 minutes and utilises 40 – 75 litres of water. Within the assessment we have assumed 7.5 minutes and 56.25 litres.

The Student Term time is 42 Weeks and we have assumed that all 233 beds are fully occupied during this period. In practice a general level of absenteeism is likely but has not been factored into the assessment. We have assumed that each Student will shower between 4-7 times per week and so 6 has been allowed in the assessment.

7.0 Potential Energy Savings Using SHRU

Assuming an average shower time of 7.5 minutes and a university occupation of 42 Weeks per annum and 6 showers per week during this period = 7.5 x 42 x 6 = 1890 minutes shower time (31.5hrs each year).

Assuming 7.5litres per minute shower = 1890 x 7.5 = 14,175 Litres total used showering (per student per year).

Average mains water temperature = 10^{o}C and shower water temperature = 40^{o}C

Therefore hot water power consumed by students showering = (7.5/60)*4.2*(40-10) = 15.75kW.

Annual Energy used per student showering = 15.75kW*31.5hrs = 496.1kWh per annum.

Therefore if there are 233 Students in residence (ignoring absenteeism) the energy consumed showering within the Building is 115,600kWh (without heat recovery).

At 40°C shower water flow temperature the drain temperature is expected to be 35-38°C. Assuming 36.5°C for evaluation and a 10°C supply temperature with a 50% heat recovery performance the heat recovered is (36.5°C – 10°C) * 50% = 13.25°C.

The heat recovery unit this will elevate the water supply by 13.25°C from 10°C to 23.25°C so the power consumed decreases to = (7.5/60)*4.2*(40-23.25) = 8.8kW

Annual Energy used per student showering = 8.8kW*31.5hrs = 277.2kWh per annum.

Therefore if there are 233 Students in residence (ignoring absenteeism) the energy consumed showering within the Building is 64,600kWh (including heat recovery).

Net savings = 115,600.00 – 64,600.00 = 51, 000.00 kWh per annum (Thermal Energy)

- **Thermal Energy Savings = 51,000kWh**

8.0 Electrical Energy Savings using SHRU

It is proposed that the building hot water is provided from Air Source Heat Pumps with occasional top up by electrical immersion heaters.

The SCOP of the Heat Pumps for hot water production is circa 3.13 (for hot water production at 55°C). However allowing for the electrical element top up and for other general inefficiencies in the system (additional storage losses etc), the actual SCOP of the system is likely to be between 2.0 and 2.5. Therefore 2.25 has been used in calculations.

The electrical energy used in the production of hot water is therefore discounted by the efficiency of the heat pump system.

Electrical Energy Used without Heat Recovery = 115,600 / 2.25 = 51,400kWhe

Electrical Energy Used with Heat Recovery = 64,600 / 2.25 = 28,700kWhe

- **Electrical Savings = 22,700kWhe**

9.0 Cost Savings using SHRU

The cost of commercial electricity is circa 16.5-19.5p/kWh at the time of writing. For this analysis we have utilised an average value of 18p/kWh.

The cost of hot water production for showering is therefore:

- **Annual Savings = 22,700 *0.18 = £4,085.00 (Say £4100.00)**

10.0 Cost of Installation

The costs of the units vary considerably from between £750.00 to over £1000.00 plus installation. To install the unit will require additional space, valves, joints and connectors. The installed cost for the unit is likely to be in the region of £1000.00 - £1500.00.

For the purpose of evaluation we have assumed an installation price of £1250.00 per unit.

If a single unit is installed for each student bedroom (233no.) then the anticipated costs for installation is £291,250.00 (excluding builderswork and access).

There is the possibility that some bedrooms rooms can share a unit and the amount of units can be reduced. This will need to be worked through but it may be feasible to install 1 SWHR per 2 bathroom on the upper levels where bathrooms are back to back or they stack. This will not be possible in all cases in isolated areas and on floors above commercial areas or terraces. However this would reduce the installed number significantly to around 140-150no. and the installed cost to £175,000.00 – £187,500.00 (excluding builderswork and access).

- **Overall anticipated cost of installation = £180,000.00 for the Student Accommodation**

11.0 Simple Payback Calculation

Cost of installation / Annual Energy Saving Cost = £180,000.00 / £4100.00 = 43.9 Years

- **Payback is estimated at over 40 Years (in simple terms)**

12.0 Maintenance Costs

Some manufacturers of the units are suggesting that they are maintenance free, and advertise the product as fit and forget. We do not believe that this is the case and given the potential effects of excessive fouling on the heat exchange efficiency we would suggest that internal cleaning is required to achieve reasonable energy savings.

The Routine Inspection and Maintenance section of Heatrae Sadia SHRU installation guide states that drain cleaner is used regularly and the unit is inspected and cleaned.

Assuming quarterly application of a de-scaler and internal cleaning every 12 months then the general maintenance cost is anticipated to be upto £75.00 per unit (excluding any additional Legionella measures).

- **The annual maintenance cost of the units within the building is expected to be in the region of £10,000.00 to £12,500.00.**

13.0 Legionella Risk

Once the shower is turned off the water to the shower stops and the waste heat from the drain warms it to a temperature of around 20°C to 25°C. This water is temperature is suitable for the growth of organisms such as legionella bacteria and will sit in the pipe at or around this temperature until the shower is used again.

The shower head creates breathable droplets of water and with the presence of elevated water temperatures the installation must be considered as an increase risk so a special monitoring and inspection regime is likely to be required.

In accordance with HSE ACoP L8 (Publication HSG274) a full risk assessment of their usage should be undertaken and additional measures are likely to be required to periodically sterilise the water feed pipework.

Unit manufacturers Heatrae Sadia state that *"If the hot water system is left to stand for 7 days or more without being used then the system should be flushed to drain for some 3 minutes by turning on a hot water tap slowly so as not to create splashing"* and that "*Any non-domestic users are advised that any showerheads and hoses should be cleaned on a quarterly basis"*. Note that these recommendations are best practice for all shower installations however, these and additional measures may be required by a risk assessment.

Note : Costs for any additional measures have not been factored into this assessment.

14.0 Access and Spatial Requirements

The most efficient units are quite large (around 2375mm long) and these need to be installed along-side the soil stack for the full height of the floor below. This increases the spatial requirements of the communal drainage stack and increases access requirements because the unit has valves and connections under mains water pressure (upto 6 bar) within this high rise development.

Note installation of the vertical (more efficient units) will not be possible in many areas, i.e. above the commercial units, retail, reception and communal use area as the space below will be compromised. Therefore the lower efficiency horizontal units will need to be utilised in these locations.

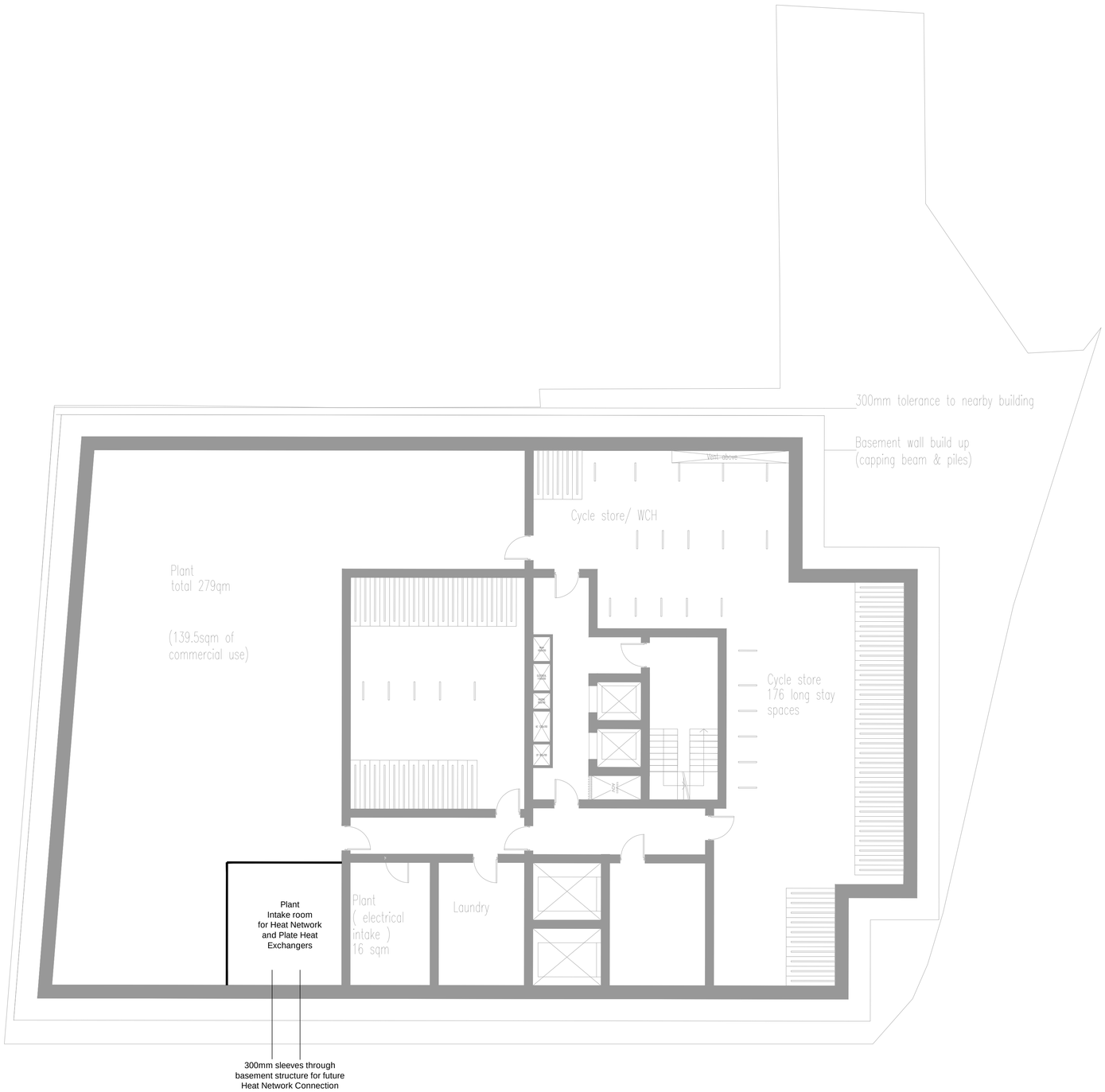
15.0 Leakage and Water Wastage

There are additional joints and connections in the system to incorporate these units which will present additional leakage risk. The Heatrae Sadia SHRU units are rated at 6-10 bar which is within the pressure limits of the system.

Note that any internal leakage within the units will run straight to drain without warning and is a potential for untraced water wastage.

5.7 Heat Network Future Provision

GENERAL NOTES



PRELIMINARY

REV	DATE	DESCRIPTION
0	29.06.22	PRELIMINARY ISSUE

TPS.
Taylor Project Services LLP
No.1 Cornhill
London EC3V 3ND
Tel 020 7743 6602
www.taylorprojectservices.com

CLIENT

Aitch GROUP

PROJECT

AVONMOUTH HOUSE
6 AVONMOUTH STREET
LONDON
SE1 6NX

DRAWING TITLE

BASEMENT PLANT LAYOUT &
HEAT NETWORK CONNECTION

SCALE	1:100@A1	DATE	29.06.22
DRAWN	M.G.	CHECKED	M.G.

DRAWING STATUS
PRELIMINARY

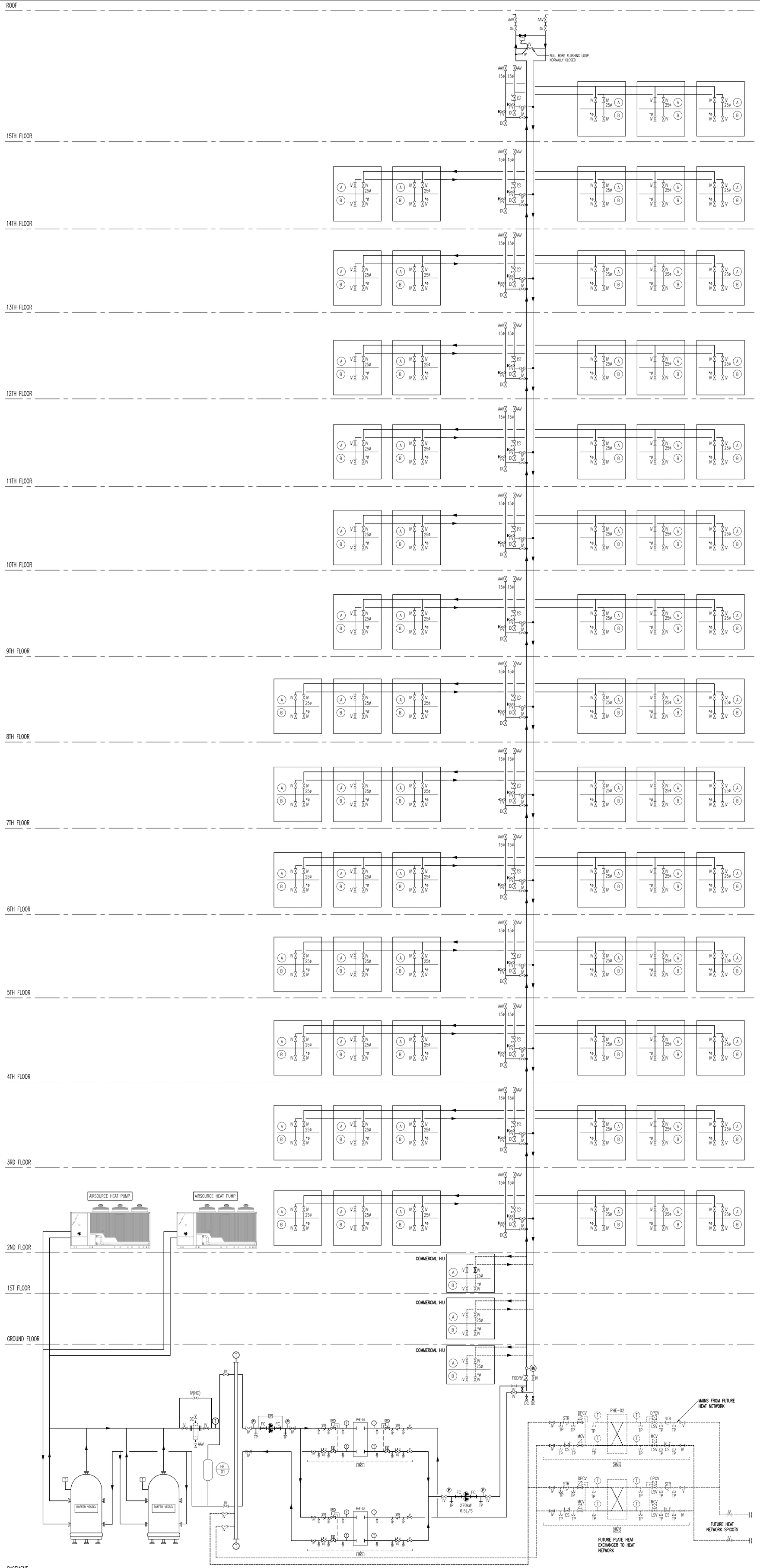
DATE PLOTTED 30/6/22

DRAWING NO. TPS/2223/B/M/HNC

REVISION 0

5.8 Communal System Schematic

GENERAL NOTES



PRELIMINARY

REV	DATE	DESCRIPTION
0	DATE?	STAGE

TPS.
Taylor Project Services LLP
No.1 Cornhill
London EC3V 3ND
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www.taylorprojectservices.com

CLIENT

TRIBE

PROJECT

AVONMOUTH HOUSE
6 AVONMOUTH STREET
LONDON
SE1 6NX

DRAWING TITLE

COMMUNAL HEATING & HEAT NETWORK CONNECTION DISTRIBUTION SCHEMATIC WITH HEAT NETWORK

SCALE	N.T.S.	DATE	29.06.22
DRAWN	D.F.	CHECKED	M.G.

DRAWING STATUS

PRELIMINARY

DATE PLOTTED 30/6/22

DRAWING NO. TPS/2223/HS

REVISION 0

5.9 Operational Energy Prediction / TM 54 Assessment

Avonmouth House, London Borough of Southwark

Operational Energy Report

28th June 2022

Version 01

Prepared by: George Nash

JAWSustainability

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1 Introduction

The purpose of this report is to predict the operational energy of Avonmouth House in order to identify areas of high usage, and meet the requirements of BREEAM Ene 01. The proposed development consists of the demolition of existing building and structures and erection of a part 2, part 7, part 14, part 16 storey plus basement mixed-use development comprising 1733sqm (GIA) of space for Class E employment use and/or community health hub and/or Class F1(a) education use and 233 purpose-built student residential rooms with associated amenity space and public realm works, car and cycle parking, and ancillary infrastructure. The site location is shown in Figure 1-1.

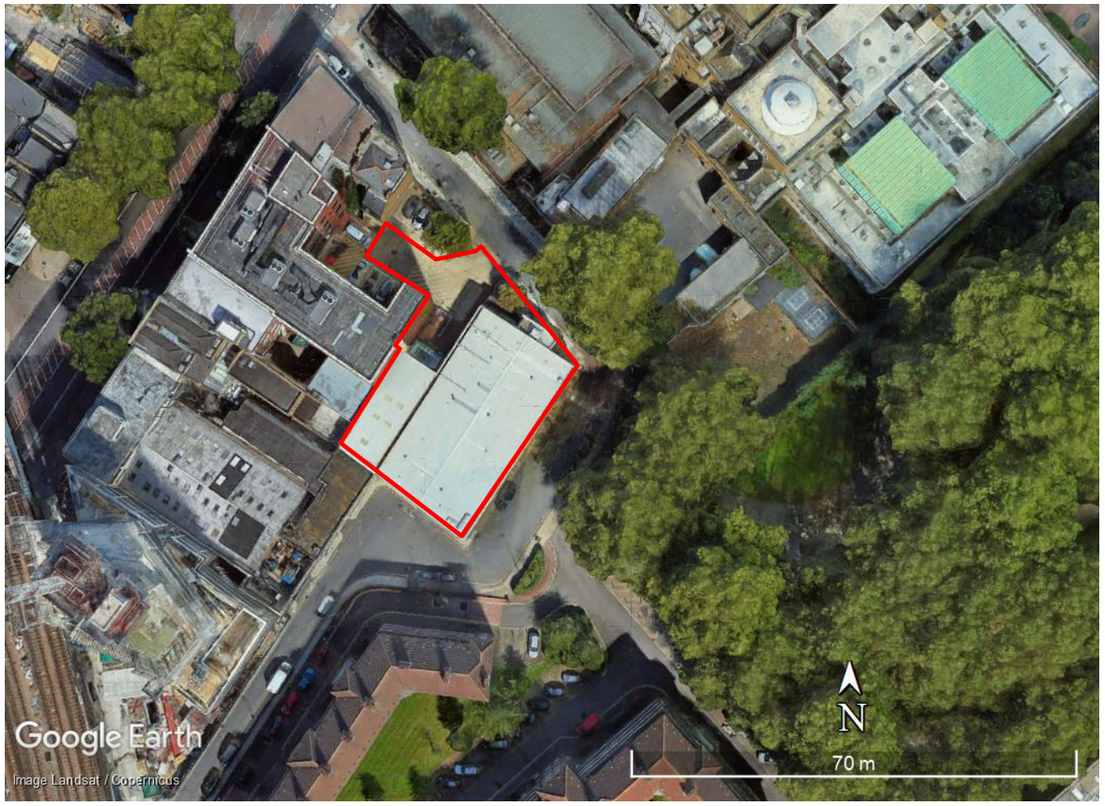

Figure 1-1 – Avonmouth House Site location

The predicted operational energy modelling has been conducted using dynamic thermal modelling within IES VE Apache and modelling has followed methodology outlined in CIBSE TM54, with some variations. Due to the early stage this was conducted, no actual design information is available from the development. It is suggested this exercise is repeated at a later stage with actual design information surrounding the building. The TM54 methodology has been created to help to estimate the likely operational energy performance of a building at the design stage. It also helps to demonstrate that energy performance is not just dependent on the design but is heavily influenced by how the building is constructed, operated and maintained.

It is important to note that with any desk based or modelling exercise, the predicted energy performance is dependent on assumed weather profiles, occupant levels and usage of small power, servers and lighting assumptions regarding the operational hours and efficiency of heating, cooling, ventilation and lighting systems. Building usage is by nature somewhat unpredictable and may change or vary over time, therefore, some deviations from actual usage would be expected.

2 Modelling details

2.1 Establishing floor areas

To allow comparison of the predicted energy use against benchmarks set out in CIBSE Guide F, an accurate and consistent figure for the floor area was established for the building. For the energy calculations the Treated Floor Area (TFA) is being used. That area has been calculated from the model that has been made in IES VE and includes the area of all rooms that are directly heated. The TFA for this development is 7216.50 m^2

2.2 Estimating operating hours and occupancy factors

To estimate the energy use of the building the operating hours and the occupancy factors are essential parts. Based on the profiles from the NABERS UK guide to design for performance for the commercial part of the building ,the profiles from the CIBSE TM 59 for the Student part, and information that has been given from the designing team, individual profiles for the HVAC systems, lighting, occupancy and equipment use have been created and are presented in Appendix A.

The occupancy profiles have been based on a maximum occupancy factor of 8 m^2 per person for the commercial spaces and one person per bedroom for the student part.

2.3 Evaluating lighting energy use

2.3.1 Interior Lighting

In the Student part of the building assumptions about the lighting power load have been made to calculate the lighting energy demand. For the student rooms the lighting power load has been assumed at 15 Watts, for the studios has been at 30 Watts and for the bathrooms at 18 Watts. For the kitchen and circulation areas the standard value from the TM 59 profiles has been used which is 2 W/m^2. The profiles that have been used are based on the CIBSE TM 59 and are presented in Appendix B

2.4 Evaluating energy use for lifts and escalators

As the details of the lift energy has not be specified at the time of the assessment, the consumption was calculated following the equation provided by NABERS UK for modern lift installations:

E_{lifts} (kWh) = (528F + 5.5A)(1-**α**)

$F = \sum all\ floors\ n$

Where α = 0.37 for lifts with regeneration α = 0.26 for lifts without regeneration, A = net internal areas of the building the building and n = the number of lifts serving or express bypassing the floor.

The development does not include escalators so they have not been included in the total energy consumption.

2.5 Evaluating energy use for small power

2.5.1 Office equipment

As the amount and the type of office equipment that would be used in the development is unknown, an average equipment load of 11 W/m^2 from NABERS UK guide to Design for Performance has been used. With the equipment schedules that are presented below, it has been calculated the total office equipment demand of the development.

2.5.2 Other equipment in offices

In an office it is very likely for other equipment to be present and be used from the occupants. Because of the fact that these kind of equipment are depend on the end-users of the development, an assumptions of a power load of 2 W/m^2 has been used for the modelling purposes. In the same way as for office equipment, a use schedule for the other equipment has been created and has been used for the modelling purposes.

2.5.3 Student equipment

The only type of equipment that has been assumed in the bedrooms and studios of the student accommodation part of the building is a laptop, which is an essential tool for the students. A laptop's power load has been assumed to 45 Watts. The operational profiles are presented in the Appendix B.

2.5.4 Laundry equipment

In the drawings that have been provided by the developing team, there is a laundry room in the basement of the development. It has been assumed that there are three washing machines of 3000 Watts and three dryers of 2100 Watts. The operational profiles are presented in the Appendix B

2.6 Evaluating energy use for catering

2.6.1 Office catering equipment

There are no catering facilities in the commercial part of the building, therefore, no annual consumption or energy gains have been included in this assessment regarding the catering facilities.

2.6.2 Student catering equipment

The student accommodation includes kitchens that serve each cluster of student rooms and studios that have their individual kitchen facilities. For this reason typical kitchen equipment have been assumed to those rooms. The typical equipment and their power load are the following :

1. Oven (2100 W)
2. Fridge/freezer (300 W)
3. Microwave (1100 W)
4. Kettle (3000 W)

The operation profiles that have been used for each of the upper appliances is presented in the Appendix B.

2.7 Server rooms

In the drawings that has been prepared by the designing team there are no specific rooms named server rooms or something that indicates the existence of individual rooms dedicated for that purpose. Therefore it is recommended for small server rooms, that would exist within the office spaces, to be included in the model. A new power load that has been calculated as the 20% of the office equipment power load has been created and be linked with a use profile that is presented below.

2.8 Evaluating energy use of domestic hot water

The domestic hot water in the entire development is provided by system connected to a ASHP. More details about the system is presented in the Table 2-3.

The hot water consumption ,for the commercial part, that has been assigned in the model is 8 L/person/day in accordance with CIBSE Guide G .For the student part it has been used that the daily water consumption per person is 150 litres and from those a 7% is for bathroom hot taps and another 5% is for washing dishes, which leads to a daily DHW use of 18 litres. The water consumption is linked to the occupancy profile from Appendix A and B.

The mean cold water inlet temperature is 10 °C and the hot water supply temperature is 60 °C.

The flow rate of DHW for the shower area has been assigned to 360 L/hour in total for each shower in the building and it is linked to a use profile that is presented in Appendix B.

2.9 Evaluating internal heat gains

Heat from three internal gains have been considered: occupancy, lighting and equipment. Where information was not available at the time of the assessment, the NABERS UK guide to design for performance was followed. In the Table 2-2 are presented all the internal gains that have been used.

Internal Gains	Units	Value	Source
Lighting	Watts	60% of lighting demand	CIBSE Guide F
Occupancy (commercial)	W/person	Sensible gains : 90 Latent Gain: 40	CIBSE Guide A
Occupancy (student)	W/person	Sensible gains : 75 Latent Gain: 55	CIBSE TM 59
Office equipment	W/m^2	The same as the power load	Assumption
Other equipment	W/m^2	The same as the power load	Assumption
Bedroom/studio equipment	W	50% of the power load	Assumption
Catering equipment	W	25% of the power load	Assumption
Servers	W/m^2	The same as the power load	Assumption

Table 2-2 List of internal gains

The occupancy density that has been used for the modelling has been given from the designing team and has been set as 8 m^2/person.

2.10 Evaluating energy use of space heating, cooling, fans and pumps

All the systems that have been assigned in different room types along with their details are presented in the Table 2-3.

Services components	Specifications	Area
Space heating	VRF, SCOP 4.1	Commercial spaces
	ASHP, SCOP 3.13	Student spaces
Space cooling	VRF, SEER 5.6	Commercial spaces
Domestic hot water	ASHP, SCOP 3.13	Commercial and Student spaces
Ventilation	MVHR 85% efficient, SFP 0.95 W/l/s	Commercial spaces and Student spaces

Table 2-3 Heating and DHW systems

The heating and cooling set points for each conditioned room are presented in the Table 2-4.

Room Type	Heating set point	Cooling set point
Commercial spaces	20°C	23°C
Student spaces	20°C	N/A

Table 2-4 Heating and cooling set points

Moreover the infiltration of the building has been taken into account in the model. According to CIBSE Technical Memoranda TM23: 2000 the infiltration rate for a typical office building is 0.25 ach. As no further information is available, at the time of the assessment, this value has been used for the modelling purposes.

2.11 Estimating management factors

After a workshop with the members of designing team it has been agreed that the development will be considered well managed and so the management factor has been set to 1.05. Therefore it is a value that changes in the different scenarios that has been examined.

2.12 Weather data

The Test Reference Year (TRY) weather file for London has been used. The weather file is one of the variables that has been examined in the sensitivity analysis that is presented in a following paragraph.

3 Results

In this section are presented the results from the energy modelling. The estimated energy use results are presented for each energy end-use, as well as for the whole building. It should be noted that the floor area of reference of this analysis, is the treated area as detailed on the section 2.1

The actual end uses are presented in the Table 3-1 and Figure 3-1.

	End-use	Energy Use (kWh/m^2/yr)	
Regulated	Space heating	6.4	45.4
	Space cooling	0.9	
	Fans	2.9	
	Pumps	2.9	
	Lighting Internal	8.5	
	DHW	23.7	
Unregulated	Office Equipment	9.9	49.0
	Other Equipment	31.7	
	Lifts	3.3	
	Servers	4.1	
Total		**94.4**	

Table 3-1: Breakdown of energy use per scenario

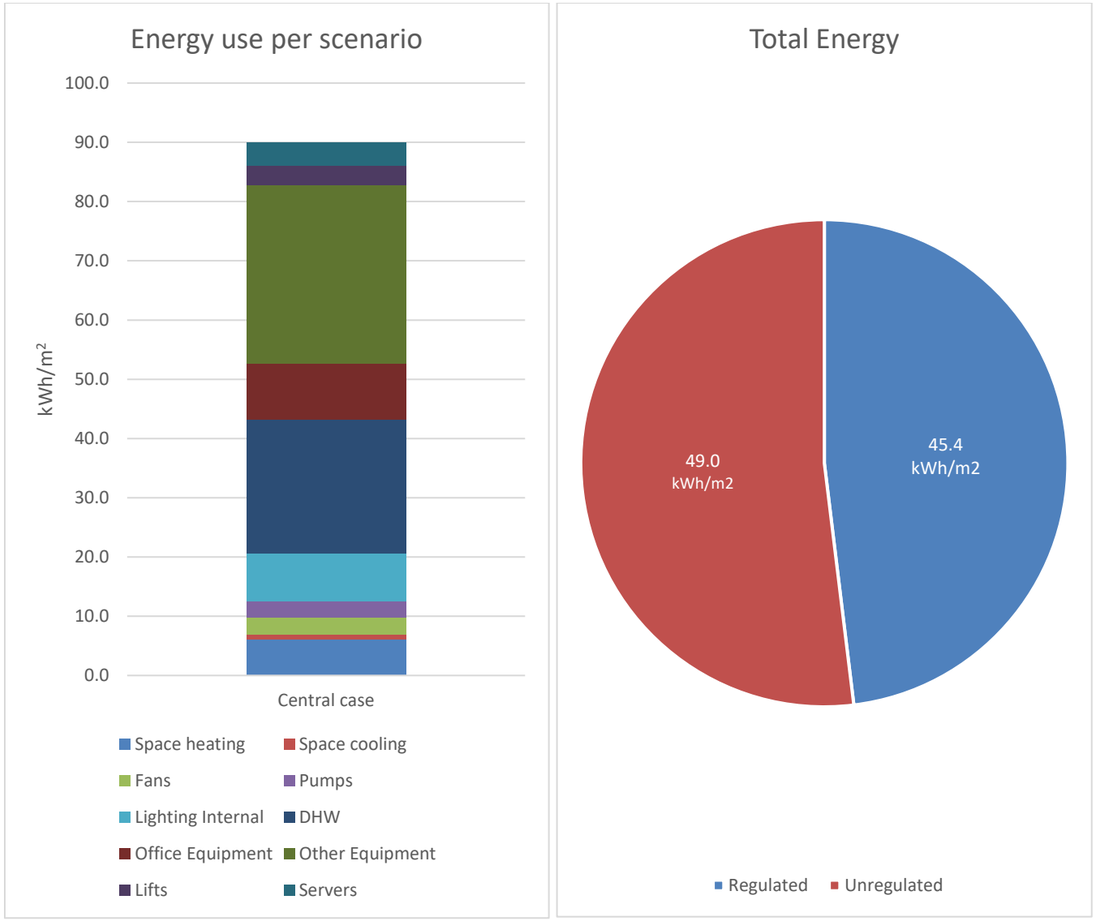

Figure 3-1: Energy Use broken down by end use and regulated/unregulated energy

To estimate the total carbon emissions for both the SAP 2012 carbon factors and SAP 10 carbon factors have been used and are presented in Table 3-2.

Electricity carbon factor	$KgCO_2/kWh$	$KgCO_2eq/m^2$
SAP 2012	0.519	49.0
SAP 10	0.233	22.0

Table 3-2: Carbon emissions

4 Appendix

4.1 Appendix A – Commercial Operation Profiles

In the tables below are presented the operation profiles that have been used in the model. The profiles are based on the profiles that are suggested in the NABERS UK guide to Design for Performance and information that has been given by the design team.

Monday to Friday	Occupancy
00:00-08:00	0%
08:00-09:00	20%
09:00-17:00	70%
17:00-18:00	35%
18:00-21:00	5%
21:00-24:00	0%
Saturday	
00:00-08:00	0%
08:00-09:00	5%
09:00-12:00	15%
12:00-17:00	5%
17:00-24:00	0%
Sunday and Holidays	
00:00-08:00	0%
08:00-17:00	5%
17:00-24:00	0%

Table A-1: Occupancy profile

Monday to Friday	Interal Lighting
00:00-08:00	5%
08:00-09:00	75%
09:00-17:00	100%
17:00-18:00	75%
18:00-21:00	15%
21:00-24:00	5%
Saturday	
00:00-08:00	5%
08:00-12:00	40%
12:00-17:00	15%
17:00-24:00	5%
Sunday and Holidays	
00:00-08:00	5%
08:00-17:00	15%
17:00-24:00	5%

Table A-2: Internal lighting operation profile

Monday to Friday	HVAC Systems
00:00-08:00	0%
08:00-18:00	100%
18:00-24:00	0%
Saturday	
00:00-09:00	0%
09:00-12:00	100%
12:00-24:00	0%
Sunday and Holidays	
00:00-24:00	0%

Table A-3: HVAC systems operation profile

Monday to Friday	Equipment
00:00-08:00	25%
08:00-09:00	90%
09:00-17:00	100%
17:00-18:00	80%
18:00-20:00	55%
20:00-24:00	25%
Saturday	
00:00-24:00	25%
Sunday and Holidays	
00:00-24:00	25%

Table A-4: Equipment operation profile

4.2 Appendix B – Student Operation Profile

Everyday	HVAC System
00:00-08:00	0%
08:00-23:00	100%
23:00-24:00	0%

Table B-1: HVAC systems operation profile

Everyday	Student Equipment
00:00-08:00	0%
08:00-23:00	80%
23:00-24:00	0%

Table B-2: Laptop operation profile

Everyday	Internal Lights
00:00-18:00	0%
18:00-23:00	100%
23:00-24:00	0%

Table B-3 : Internal lights operation profile

Everyday	Occupation
00:00-08:00	70%
18:00-23:00	100%
23:00-24:00	70%

Table B-4 : Occupation profile

Everyday	Occupation
00:00-19:00	0%
19:00-21:00	100%
21:00-24:00	0%

Table B-5 : Oven operational profile

Everyday	Occupation
00:00-24:00	55%

Table B-6 : Fridge operation profile

Everyday	Occupation
00:00-13:00	0%
13:00-14:00	33%
14:00-19:00	0%
19:00-20:00	33%
20:00-24:00	0%

Table B-7: Microwave operation profile

Everyday	Occupation
00:00-08:00	0%
08:00-09:00	16%
09:00-16:00	0%
16:00-17:00	16%
17:00-24:00	0%

Table B-8 : Kettle operation profile

Everyday	Occupation
00:00-08:30	0%
08:30-09:00	100%
09:00-20:30	0%
20:30-21:00	100%
21:00-24:00	0%

Table B-9 : Bathroom lights operation profile

Everyday	Occupation
00:00-24:00	100%

Table B-10 : Circulation lights operation profile

Everyday	Occupation
00:00-20:00	0%
20:00-21:00	100%
21:00-24:00	0%

Table B-11 : Laundry machines operation profile

Everyday	Occupation
00:00-08:00	0%
08:00-09:00	17%
09:00-24:00	0%

Table B-12 : Showers operational profile