APPENDIX A – PROPOSED SPECIFICATIONS

METHODOLOGY

Performance evaluation has been undertaken using compliant software in accordance with Approved Document L of the Building Regulations 2021 and the National Calculation Methodology (NCM) for assessing the energy performance of buildings required. Modelling has been carried out as follows:

- **Non-Domestic:** Tested by a certified CIBSE Energy Assessor using government approved Dynamic Simulation Modelling Software IES virtual Environment which can assess compliance against Part L 2021 and the National Calculation Methodology (NCM). 'Be Seen' results have been calculated using the CIBSE TM54 methodology.

Notes:

- The Developed Design of the building has not yet been undertaken, therefore reasonable assumptions about the performance of the building envelope and building services have been made based on consultation with the design team.

BUILDING FABRIC INPUTS

			U-value target	NOTES
U-VALUES OPAQUE ELEMENTS	External Walls (Existing Cavity Block) - U-value	W/m^{2}K	1.6	
	External Walls (Existing Terrazzo Facade) - U-value	W/m^{2}K	1.55	
	External Walls (New Facade) - U-value	W/m^{2}K	0.15	
	Basement Wall (Existing) – U-value	W/m^{2}K	1.7	
	Party walls	W/m^{2}K	-	
	Internal Wall - U-value	W/m^{2}K	-	
	Intermediate Floor/Ceiling - U-value	W/m^{2}K	-	
	Roof (existing) - U-value	W/m^{2}K	2.3	
	Roof (new) - U-value	W/m^{2}K	0.1	
	Ground/exposed floor (existing) - U-value	W/m^{2}K	0.45	
	Ground/exposed floor (new) - U-value	W/m^{2}K	0.1	
	Opaque Door	W/m^{2}K	1.2	
WINDOWS & GLAZING DOORS (EXISTING)	Window& glazing door: u-value (including frame)	W/m^{2}K	2.0	
	Window& glazing door - Frame factor	%	30	
	Window& glazing door - Glass solar transmission: g-value	g-value	72	
	Window - Light transmittance	LT %	71	
WINDOWS & GLAZING DOORS (NEW)	Window& glazing door: u-value (including frame)	W/m^{2}K	1.2	
	Window& glazing door - Frame factor	%	20	
	Window& glazing door - Glass solar transmission: g-value	g-value	0.4	
	Window - Light transmittance	LT %	0.7	
THERMAL MASS	Thermal Mass	-	Based on build ups	
THERMAL BRIDGING	Thermal bridging allowance (y-value)	W/m^{2}K	Default (25% of u-value)	
AIR PERMEABILITY	Air leakage value (existing)	m^3/m^2.hr @ 50Pa	25	
	Air leakage value (extension)		3	

BUILDING SERVICES INPUTS

Space Type / Grouping								
Space type	NCM building type	NCM activity	HVAC – system level	Ventilation – zonal level	DHW	Lighting	Building Management	LZC technologies
Office	B1: Office	Office (Open)	HVAC-1	VENT-1	DHW-1	LT-1	BM-1	LZC-1
Goods Office	B1: Office	Office (Common)	HVAC-1	VENT-1	DHW-1	LT-1	BM-1	LZC-1
Bin Store	B1: Office	Cupboard	-	-	DHW-1	LT-2	BM-1	LZC-1
Circulation	B1: Office	Circulation area	HVAC-1	-	DHW-1	LT-2	BM-1	LZC-1
Comms Room	B1: Office	Light plant room (office: server)	HVAC-4	-	DHW-1	LT-2	BM-1	LZC-1
Cycle Store	B1: Office	Cupboard	HVAC-2	-	DHW-1	LT-2	BM-1	LZC-1
Plant	B1: Office	Light plant room	-	-	DHW-1	LT-2	BM-1	LZC-1
Laboratory	B2 to B7: Industrial process building	Laboratory	HVAC-6	VENT-1	DHW-1	LT-1	BM-1	LZC-1
Reception	B1: Office	Reception	HVAC-1	VENT-1	DHW-1	LT-1	BM-1	LZC-1
Drying Room	B1: Office	Cupboard	HVAC-2	VENT-3	DHW-1	LT-2	BM-1	LZC-1
Showers	B1: Office	Changing facilities	HVAC-2	VENT-2	DHW-2	LT-2	BM-1	LZC-1
Stairs	B1: Office	Circulation area	HVAC-3	-	DHW-1	LT-2	BM-1	LZC-1
Toilet	B1: Office	Toilet	HVAC-2	VENT-2	DHW-1	LT-2	BM-1	LZC-1
Winter Garden	B1: Office	Office (Speculative)	HVAC-5	VENT-1	DHW-1	LT-1	BM-1	LZC-1
Void / Lift / Risers	Internal void or warm roof	-	-	-	-	-	-	-

Heating, Cooling & Ventilation (HVAC) - SYSTEM LEVEL		HVAC-1	HVAC-2	HVAC-3	HVAC-4	HVAC-5	HVAC-6	
System description	Description	VRF Mixed mode on perimeter	Constant volume system from VRF	Constant volume system from VRF	DX Unit	Winter Garden fan coil	VRF for labs	
UK NCM type	Type	VRF	Constant volume system (variable fresh air rate)	Constant volume system (variable fresh air rate)	Single Room Cooling	Fan coil systems	VRF	
Heating System								
- Heat Fuel Type	Elec/gas	Elec	Elec	Elec	Elec	Elec	Elec	
- Heat generator seasonal efficiency	SCOP	4	4	4	-	4	4	
- Does it Qualify for ECA?	Yes	N/A	N/A	N/A	N/A	N/A	N/A	
Cooling System								
- Cooling system type (assumed system in model)	Description	Heat Pump	Heat Pump	Heat Pump	Heat Pump	Heat Pump	Heat Pump	
- Chiller fuel type	Description	Elec	Elec	Elec	Elec	Elec	Elec	
- Nominal Seasonal EER	SEER	4	4	4	2	4	4	
- Nominal EER	EER	3.5	3.5	3.5	2.5	3.5	3.5	
- Does it Qualify for ECA?	Yes	N/A	N/A	N/A	N/A	N/A	N/A	
System adjustment								
- Ductwork Leakage Classification	Class	Default	Default	Default	Default	Default	Default	
- AHU Leakage Classification	Class	Default	Default	Default	Default	Default	Default	
- Specific Fan Power (AHUs)	W/l/s	1.6	1.6	1.6	N/A	1.6	1.6	
- Pump type	Description	N/A	Variable speed with multiple pressure sensors	Variable speed with multiple pressure sensors	N/A	Variable speed with multiple pressure sensors	N/A	
Metering Provision								
- Does the system have provision for metering?	Yes/No	Yes	Yes	Yes	Yes	Yes	Yes	
- Does the system warn of "out of range" values	Yes/No	Yes	Yes	Yes	Yes	Yes	Yes	
Ventilation & pumping								
- Cooling/vent mechanism	Air con / nat vent	Air con	Air con	Air con	Air con	Air con	Air con	
- Air supply mechanism	Description	Centralised balanced	Centralised balanced	Centralised balanced	Centralised balanced	Centralised balanced	Centralised balanced	
- Heat recovery	% efficiency or n/a	75	75	75	N/A	75	75	
System Controls								
- Central Time Control?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
- Optimum start/stop control?	No	Yes	Yes	Yes	Yes	Yes	Yes	
- Local Time Control?	No	Yes	Yes	Yes	Yes	Yes	Yes	
- Local Temperature Control?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
- Weather Compensation Control?	No	Yes	Yes	Yes	Yes	Yes	Yes	
Ventilation - ZONAL LEVEL		VENT-1	VENT-2	VENT-3				
System description	Description	Office and laboratory	WC / Shower Extract	Drying Room Extract				
Applies to....	Room types	Office and laboratory areas	Toilets	Drying Room				
Specific Fan Power (Terminal units)	W/l/s	N/A	0.3 (extract)	0.3 (extract)				
Fan location	Description	N/A	Remote from room	Remote from room				
Air change rate (if applicable)	ACH	N/A	10 / 20	10				

Demand Control Ventilation (DCV)	Description / type	Yes / CO_2 sensors + speed control	N/A	Yes				
Domestic DHW		DHW-1	DHW-2					
System description	Description	POU	ASHP for showers					
Heating fuel	Elec/gas	Elec	Elec					
Heat generator seasonal efficiency	%	100%	280%					
Is a CHP system installed? (see below for details)	Yes/No	No	No					
DHW delivery efficiency	%	95	95					
Is the system a storage system?	Yes/No	No	Yes					
Storage system size	litres	N/A	1000					
Storage system losses	kWh/(l.day)	N/A	50mm insulation assumed					
Does the system have secondary circulation?	Yes/No	No	Yes					
Secondary circulation total flow & return pipe length & losses	m / W/m	N/A	50 / 10					
DHW pump power / time switch?	W / Time switch?	N/A	200 / yes					
Lighting		LT-1	LT-2					
Lamp Type	type	LED	LED					
Illuminance	lux	-	-					
Averaged lighting power density across the building OR....	Lumens/circuit W	100	100					
Installed lighting Power Density	W/m2/(100lx)	-	-					
PIR controls?	Description	Auto on/off	Auto on/off					
PIR - Parasitic Power	W/m^2	0.1	0.1					
PIR - Time switching?	Yes/No	Yes	Yes					
Automatic Daylighting Control?	Yes/No	Yes (perimeter zones only)	No					
Control Type (Switching/Dimming)	Switch/Dim	Dimming	-					
Sensor Type (Standalone/Addressable)	Stand/Add	Addressable	-					
Daylight - Parasitic Power	W/m^2	0.1	-					
Display lighting uses efficient lamps?	lm	85	85					
Building Management		BM-1						
Electric Power Factor of the building	Power Factor Control	0.95-0.98						
Lighting systems have provision for metering?	Yes/No	YES						
Lighting systems metering warns of 'out of range' values?	Yes/No	YES						
Does the system have provision for metering?	Yes/No	YES						
Does the metering warn "out of range" values?	Yes/No	YES						
LZC Details - PV		LZC-1						
Area	m^2	32						
PV module efficiency	%	19.8						
Inclination	°	10						
Azimuth – from north	°	220						
Reference irradiance from NOCT	W/m^2	800						
Nominal cell temperature (NOCT)	°C	45						
Temperature coefficient for module efficiency	1/K	-0.36						
Electrical conversion efficiency	%	96						
Shading factor	0–1	1						

APPENDIX B – OVERHEATING ANALYSIS

This document summarises the outcomes of an overheating analysis undertaken to evaluate compliance of the office areas of the proposed development against the criteria established within CIBSE Technical Memoranda (TM) 52: 2013 – The limits of thermal comfort: avoiding overheating in European buildings. The following sections summarise inputs, methodology and performance and have been structured in line with the recommended by the standard.

Introduction to CIBSE TM52

TM52 is a Technical Memorandum (TM) about predicting overheating in non-domestic buildings, developed by CIBSE. TM52 methodology, which is based on Dynamic Thermal Simulation It is intended to inform designers, developers and others responsible for defining the indoor environment in buildings. The methodology will:

- allow different designs to be compared with a common approach, based on reasonable assumptions
- support design decisions that improve comfort without cooling
- provide consistency across the industry as all consultants will be using the same methodology for overheating risk prediction.

The methodology will not:

- guarantee that people will always be comfortable in compliant spaces
- take into account unusual usage of the spaces.

CIBSE TM52 Adaptive Comfort Criteria

The following criteria is for overheating in free running buildings - buildings without active cooling:

1. The first criterion sets a limit for the number of hours that the operative temperature can exceed the threshold comfort temperature (upper limit of the range of comfort temperature) by 1 K or more during the occupied hours of a typical non-heating season (1 May to 30 September).
2. The second criterion deals with the severity of overheating within any one day, which can be as important as its frequency, the level of which is a function of both temperature rise and its duration. This criterion sets a daily limit for acceptability.
3. The third criterion sets an absolute maximum daily temperature for a room, beyond which the level of overheating is unacceptable.

The upper limits of the above criteria are:

- Criteria 1: **3%**
- Criteria 2: **6 hours**
- Criteria 3: **4 hours**

According to CIBSE TM52 methodology, a room or building that fails any two of the three criteria is classed as overheating.

Methodology and key assumptions

This section summarises the key assumptions made for the analysis including design proposal and modelling inputs.

Modelling tool

The analysis has been undertaken using the Dynamic Thermal Simulation software IES VE – 2023 which is compliant with the methodology in CIBSE AM11: Building Performance Modelling (2015b). A 3D model has been developed which reflects the geometry and thermal performance of the proposed development.

Design proposals

Floors 2, 7 and 8 were assessed as the representative floor for compliance against the TM52 adaptive method criteria. Floorplans, sections, and elevations provided by Gortt Scott in March 2024 formed the basis of the model developed to carry out the calculations.

The following image shoes the energy model developed to test the overheating risk of the office and laboratory areas.

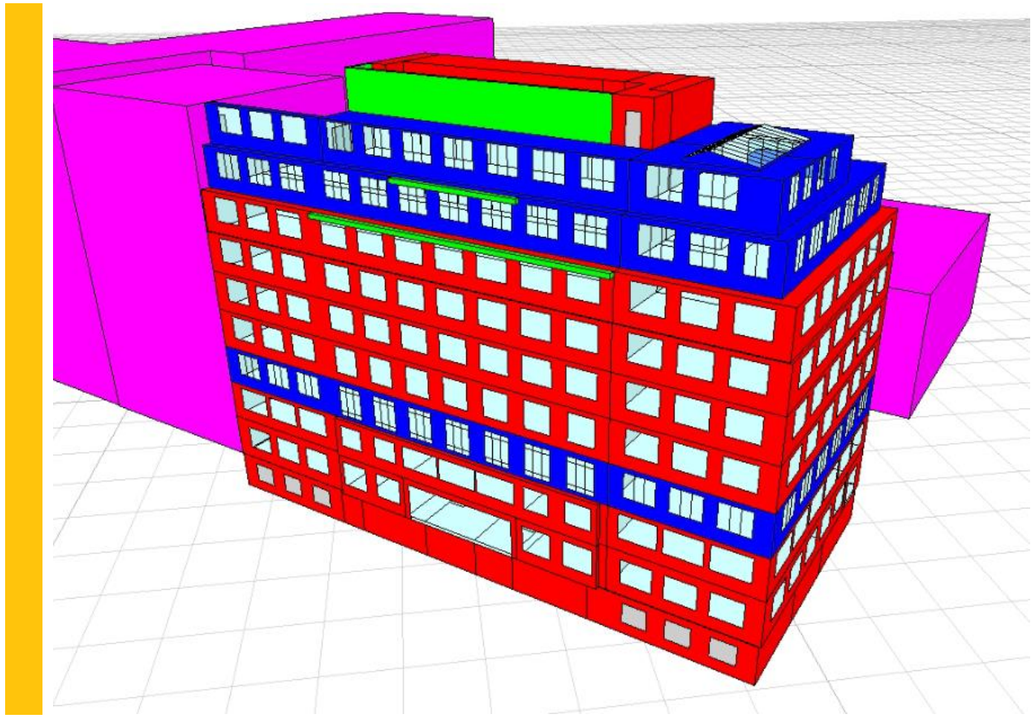


Figure 13 Model Geometry (tested floors shaded in blue)

Weather files

In line with the recommended within the GLA's Energy Assessment Guidance (March 2022), compliance has been tested using LWC_DSY1 for the 2020's high emissions, 50% percentile scenario.

Additional testing will be undertaken if compliance with DSY-1 achieved using the 2020 versions of the following more extreme design weather years:

- DSY2 – 2003: a year with a very intense single warm spell.
- DSY3 – 1976: a year with a prolonged period of sustained warmth.

Assumptions

The following paragraphs summarise key modelling inputs.

Thermal comfort category

The thermal category assumed for this project is Cat II.

Building constructions

Please refer to section Appendix A for details of the building constructions. The constructions have been based on information provided by Gort Scott Architects and NCM build ups.

Internal Gains

Internal gains including people, lighting and equipment have been taken from the project specific Outline Specification (dated October 2023) and assumed as per NCM, where unknown.

Internal gain	Units	All areas	Notes
Lighting	W/m²	8	As per Design parameters
Equipment (Small Power)	W/m²	25 (Office) 75 (Laboratory)	As per Design parameters
Occupancy	m²/person	10 55 people in Winter Garden	As per Design parameters
Profiles of Use	**Time period**	**Percentage of Gains (%)**	**Notes**
Lighting	09:00 – 17:00	100%	As per NABERS UK
Occupancy	09:00 – 17:00	70%	As per NABERS UK
Occupancy – Winter Garden	09:00 – 17:00 (Mon – Thurs) 12:00 – 16:00 (Fri)	15% 100%	Assumed based on design team/client feedback
Equipment	09:00 – 17:00	100%	As per NABERS UK

Table 27 Internal gain assumptions and inputs

Openings

Openable windows are provided to existing office floors, these openings have been modelled in the following manner:

- Windows will have a maximum opening angle of 20-degrees. Rooflights will have a maximum opening angle of 30-degrees.
- Panels open between the hours of 7am and 6pm if the internal temperature is above 22°C.

An example of the window assignment within IESVE can be seen in the following figure.

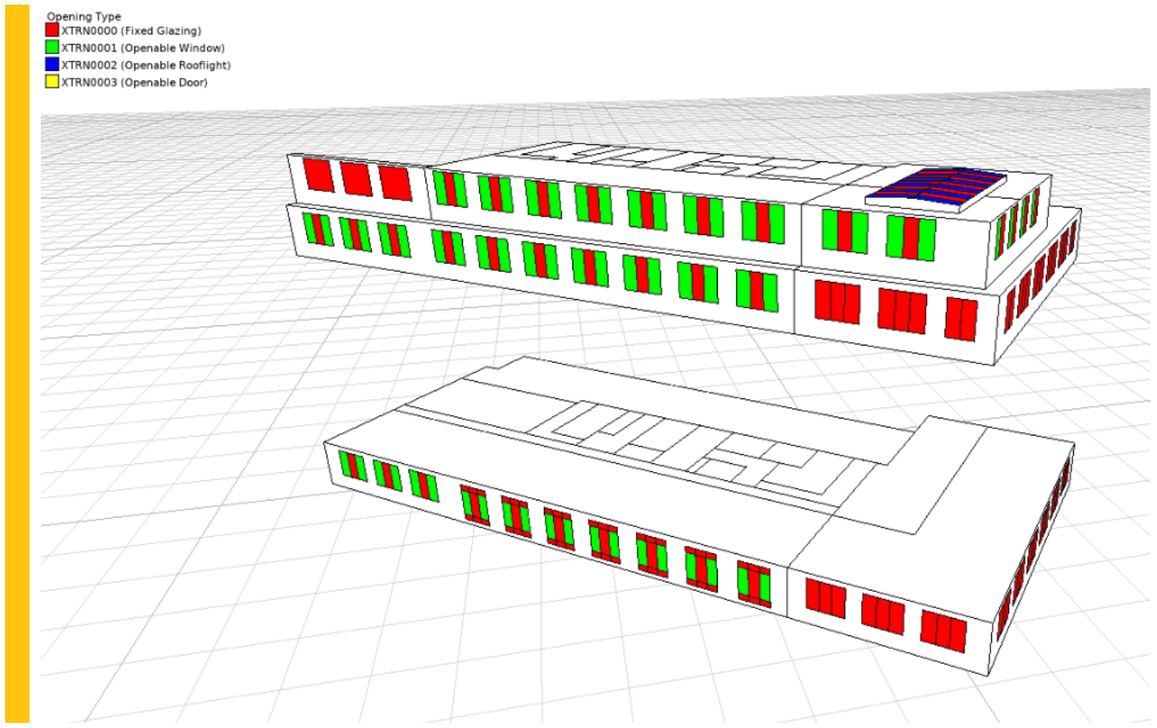


Figure 14 IESVE MacroFlo assignment

Infiltration

An infiltration rate of 0.60 ach-1 was modelled, based on 25.0 m³ /m²/hr @ 50 Pa as per CIBSE Guide A.

Mechanical ventilation

Ventilation	Units	Laboratory	Office	Notes
Mechanical ventilation	l/s/person	6 ach	14	As per Design parameters
Profiles of Use	**Time period**	**Laboratory**	**Office**	**Notes**
Ventilation	07:00-19:00	-	-	As per NABERS UK

Table 28 Ventilation assumptions and inputs

Results

A summary of results for the assessed spaces against the DSY-1 weather file are presented in the next sections. The overheating assessments of the proposed office building demonstrates the following:

- All spaces fail to comply with the CIBSE TM52 overheating criteria for free-running buildings against the DSY-1 weather file.

The overheating assessment shows that due to the design requirements for the laboratory spaces, which have very high equipment gains compared to a typical office and no openable windows (due to the requirements for a controlled environment), the spaces will not meet the overheating criteria for free-running buildings. As such, integration of active cooling is required to ensure a thermally comfortable environment for occupants and future proof the building. However, where openable windows have been provided, the risk of overheating is significantly reduced when compared to areas with a sealed façade.

Buildings with provision of active cooling need to be assessed against different thermal comfort criteria, as per CIBSE Guide A, requiring a more detailed evaluation of spaces, central plant cooling capacities and terminal units locations in addition to other comfort variables. These details will be developed and evaluated as the design progresses.

DSY1 Weather file

The table below summarise the results of the analysis against the DSY1 weather file.

Room Name	Criteria 1 (%Hours Top-Tmax≥1K) Target ≤3%	Criteria 2 (Ma Daily Deg.Hours) Target ≤6	Criteria 3 (Max Daily Deg.Hours) Target ≤4K	Pass/Fail
Lab (P)_L2	92.3	138	12	Fail
Lab (P)_L2	87.2	140	12	Fail
Lab_L2	91.2	136	12	Fail
Lab_L2	88.1	137	12	Fail
Office (P)_L2	10.9	48	6	Fail
Office_L2	11.3	48	6	Fail
Lab (P)_L7	77.7	147	13	Fail
Lab (P)_L7	68.3	140	13	Fail
Lab_L7	70.4	139	13	Fail
Office (P)_L7	6.2	40	5	Fail
Office_L7	7.1	40	5	Fail
Office (P)_L8	7.6	43	6	Fail
Winter Garden_L8	4.3	23	5	Fail

Table 29 TM52 results – DSY-1

APPENDIX C – RENEWABLE TECHNOLOGY FEASIBILITY

PHOTOVOLTAICS

Photovoltaics (PV) are a method of generating electrical power by converting sunlight into direct current electricity using semiconducting materials. Uses of this technology have been explored for more than 50 years and nowadays it is a well-established and reliable technology which has seen prices dramatically reduce over the last decade thanks to economies of scale and the introduction of Feed-in-Tariff's in the UK (which was closed to new applicants in March 2019). This has resulted in typical financial payback of 8-9 years with returns on investment over 20 years typically in the order of 8-12%.

Table 30. Image of PV panel

Types of PV Panels

There are three basic types of PV technologies: Monocrystalline, Polycrystalline (or multi-crystalline) and Amorphous.

- **Monocrystalline cells.** These are cut from a single crystal of silicon. In appearance, it has a smooth texture and the thickness of the slice can be easily seen. These PV cells have efficiencies of 13-17% and are the most efficient of the three types of silicon PV cell. However, they require more time and energy to produce than polycrystalline silicon PV cells, and are therefore more expensive.

- **Polycrystalline (or Multi-crystalline).** Polycrystalline silicon is produced from a molten and highly pure molten silicon but using a casting process. The silicon is heated to a high temperature and cooled under controlled conditions in a mould. It sets as an irregular poly- or multi-crystalline form. The square silicon block is then cut into 0.3mm slices. The typical blue appearance is due to the application of an anti-reflective layer. The thickness of this layer determines the colour - blue has the best optical qualities. It reflects the least and absorbs the lightest. More chemical processes and fixing of the conducting grid and electrical contacts complete the process. Mass-produced polycrystalline PV cell modules have an efficiency of 11-15%.

- **Amorphous silicon.** These are made from non-crystalline silicon, similar to the material found in pocket calculators etc. The layer of semi-conductor material is only 0.5-2.0um thick, where 1um is 0.001mm. This means that considerably less raw material is necessary in their production compared with crystalline silicon PV production. The film of amorphous silicon is deposited as a gas on a surface such as glass. Further chemical processes and the fixing of a conducting grid and electrical contacts follow. These PV cells have an efficiency of between 6-8%. Multi-junction amorphous thin film PV cells are also available which are sensitive to different wavelengths of the light spectrum. These have slightly higher efficiencies.

The favourable efficiency-to-cost ratio of polycrystalline silicon makes them the most commonly used form of PV. The amount of silicon waste produced during manufacture is also less compared to monocrystalline panels.

Applicability to Development

Installation of solar technologies (PV and/or solar hot water) requires unshaded flat or south-facing areas. The potential to install PV at roof level has been reviewed based on availability of roof, access to the panels and overshadowing. For the above reasons, **PV is deemed a viable renewable energy solution for the development.**

SOLAR HOT WATER

Solar water heating is a widely used technology within a number of hot and sunny countries and has also been proven a viable technology within the UK climate.

Heat is trapped by collectors usually located on the roof which in turn is used to preheat water, which is typically stored in a dual coil cylinder. In order to ensure adequate hot water (particularly during the winter months), and to prevent legionella, the hot water tank usually incorporates a second heating coil which is heated via a gas boiler or electric immersion heater.

Table 31. Image of an evacuated tubes solar thermal panel

Types of Solar Water Heating Collectors

There are two main types of solar water heating collectors: evacuated tubes and flat plate. **Evacuated tube** solar thermal systems are one of the most popular solar thermal systems available and are the most efficient with an efficiency of up to 70%. Their efficiency is achieved because of the way in which the evacuated tube systems are constructed, meaning they have excellent insulation and are virtually unaffected by air temperatures. The collector itself is made up of rows of insulated glass tubes which contain a vacuum with

copper pipes at their core. Water is heated in the collector and is then sent through the pipes to the water tank.

The cylindrical shape of evacuated tubes means that they are able to collect sunlight throughout the day and at all times in the year. Evacuated tube collectors are also easier to install as they are light, compact, easy to maintain - the tubes can be replaced individually if one becomes faulty – and reliable but are also the most expensive type of collectors. The system is efficient and durable with the vacuum inside the collector tubes having been proven to last for over twenty years. The reflective coating on the inside of the tube will also not degrade unless the vacuum is lost.

Flat plate solar thermal systems comprise a dark-coloured flat plate absorber with an insulated cover, a heat transfer liquid containing antifreeze to transfer heat from the absorber to the hot water tank, and an insulated backing. The flat plate feature of the solar panel increases the surface area for heat absorption. The heat transfer liquid is circulated through copper or silicon tubes contained within the flat surface plate.

In an area of the UK that produces an average level of solar energy, the amount of energy a flat plate solar collector generates equates to around one square foot panel generating one gallon (4.5 litres) of one day's hot water.

This design of solar panel is, overall, slightly less compact and less efficient when compared with an evacuated tube system, however this is reflected in a lower overall price. Solar thermal can typically provide up to 50% of total hot water demand (depending on the size of the system) and can have a life expectancy of over 25 years.

Applicability to Development

As with PV panels, installation of solar collectors requires unshaded surfaces which receive direct sunlight. SHW collectors would compete with PV panels for the available roof space. PV panels are anticipated to result in higher carbon emissions savings and are deemed more suitable for the development, therefore SHW collectors are not recommended. Therefore, Solar Hot Water **is not recommended**.

HEAT PUMPS

A heat pump is a device that is able to transfer heat from one fluid (e.g. external air) which is at a lower temperature to another fluid (e.g. internal air) at a higher temperature. This is typically achieved through use of a refrigerant that is pumped around a closed circuit of pipework using a pump (compressor). Heat pumps can be considered low or zero carbon when the heat is taken from a renewable source such as ground heat or external air. The efficiency of a heat pump is termed 'coefficient of performance' or COP and is the ratio of electrical (input) energy to drive the pump to the heat or output energy of the system. A typical air source heat pump has a COP of ~2.5 which means that for every unit of electrical energy used by the pump, the system will produce 2.5 units of heat energy (of which 1.5 units comes from the air, and the other 1 unit comes from the pumping energy). The figure below shows the main components and refrigeration cycle within a heat pump

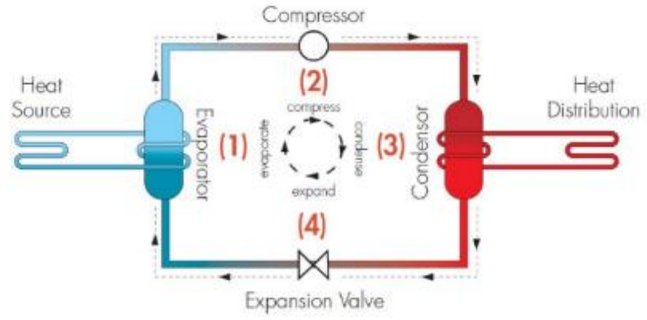


Table 32 Heat Pump components and refrigeration cycle

Types of Heat Pumps

Heat Pumps are categorised as follows depending on the source of heat:

- A **Ground Source Heat Pump (GSHP)** uses buried coils to extract the heat from the ground into a fluid that contains a mixture of water and antifreeze. The fluid is then passed through a heat exchanger into the heat pump. The ground stays at a fairly constant temperature under the surface, so the heat pump can be used throughout the year – even in the middle of winter. Coils can be laid down horizontally, which requires larger surface areas, vertically into 100-150m deep boreholes or can be integrated into the building piles – also called thermal piles. When there is an aquifer in close proximity to the site, boreholes can be 'open loop' and directly circulate water from the aquifer as the working fluid.

- A **Water Source Heat Pump (WSHP)** produces heat in a similar way to ground source systems. Pipes are submerged in a river, stream or lake, where temperatures can remain at a relatively constant level of between 7 and 12°C. Fluid in the pipes absorbs the heat from the open water source. This fluid in turn is passed through a heat pump which transfers the heat energy to a distribution system within the building (e.g. radiators, underfloor heating or fan coil units).

- An **Air Source Heat Pump (ASHP)** takes heat directly from the external air and boosts it to a higher temperature using a heat pump. As with the above systems, the pump (compressor) needs electricity to operate. As with most Heat Pumps, ASHPs are available in different sizes and configurations. One form of ASHP is called Variable Refrigerant Flow / Volume (VRF/VRV) which can deliver both heating and cooling within a building, but also recover heat from one area and transfer the heat to another area through a refrigeration circuit. This can therefore maximise the carbon emissions savings, when installed in buildings that may have concurrent heating and cooling demand such as in offices.

Applicability to Development

Heat pumps provide a low carbon form of heating and cooling with zero local emissions, helping to minimise the impact of the building on local air quality. **Therefore, heat pumps are suitable for the development.**

WIND TURBINES

Wind turbines use the energy of the wind to generate electricity. On-shore and off-shore wind farms are one of the most widely used technologies for large scale generation of renewable energy with a total installed capacity in the UK of over 28 gigawatts with a 60%/40% on-shore/off-shore split (as of 2014). Whilst large scale turbines (1MW+) are a financially viable technology for producing clean energy, their visual impact together with the extensive area requirements make them unsuitable for use in most city/town centre locations.

With sizes typically between 0.3 and 10kW, 'Microwind' or 'Small-wind' turbines, are an alternative which can be considered for on-site use as roof-mounted devices. According to the Energy Saving Trust, forty percent of all the wind energy in Europe blows over the UK, making it an ideal country for domestic turbines. Whilst this statement applies to some areas, ground roughness due to the built landscape can create turbulence which quite often makes the use of roof mounted turbines unfeasible. Also, it is recommended that annual wind speeds average at least 6m/s to provide significant carbon emissions savings.

Table 33 Image of a wind turbine

Applicability to Development

Large scale wind turbines can present nuisances such as noise and flicker effect which are not considered acceptable for an urban development of this nature and are likely to face significant objection through the planning process.

With regards to roof-mounted wind turbines, recent studies demonstrate that they underperform in urban environments as a result of turbulent air flows, and therefore they are not deemed suitable for a building in this location. Additionally, roof-mounted turbines present issues to the currently proposed building structure due to vibration and structural loading. Therefore, Wind Turbines are **not a suitable option** for this development.

BIOMASS HEATING

Biomass heating systems for domestic or commercial use typically burn wood pellets, chips or logs to provide warmth to a single room, or multiple rooms when the heat is delivered through a central heating system. Biomass can also be produced from non-woody fuel sources such as sugar, starch or oils, although most commercially available systems in the UK work with wood-based fuel usually in the shape of wood chips or pellets. Wood, in the form of logs, can also be used in some systems, but needs to be manually fed and therefore are not viable for most commercial buildings.

Wood chips are typically the cheapest form of biomass (depending on the source of supply) but require larger storage space than pellets as they typically have a lower calorific value per unit volume of fuel as a result of their irregular shape and higher moisture content. On the other hand, pellets require more energy to manufacture and quality can significantly vary, therefore sourcing needs careful consideration. In both cases, in addition to the storage requirements of biomass fuels, long-term local reliable supply can be an issue. With limited availability in the UK, it is important to set up supply agreements when installing a biomass boiler to avoid price escalation, lack of supply or sourcing of the fuel from abroad. New sustainability criteria regarding biomass has been introduced for the Renewable Heat Incentive (RHI), which will make sure biomass meets the Government's carbon and environmental objectives, ensuring that support delivers value for money. This will affect domestic and non-domestic RHI participants, producers and traders of biomass fuels.

Biomass boilers are available in a wide range of sizes and fuel storage / feed configurations. As well as heat-only boilers, a limited number of manufacturers also produce biomass combined heat and power systems that can run on biomass fuel, although they are relatively expensive and are only available in a limited range of sizes (outputs).

Table 34. Image of wood pellets

Applicability to Development

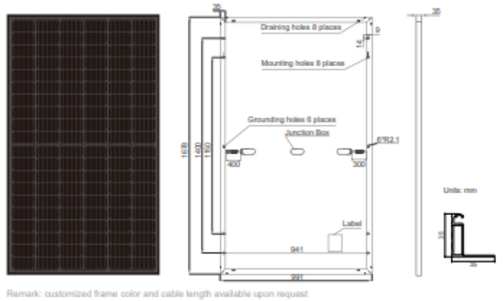
Use of biomass heating requires a large area for the supply of pellets which must be within easy reach for the pellets/chips to be blown. The development does not have any available area, making the use of this technology unfeasible. In addition, the burning of biomass produces high particulate and NOx emissions which can reduce local air quality, particularly in urban settings. Therefore, Biomass Heating **is not considered suitable** for this development.

APPENDIX D – INDICATIVE PV PANEL SPECIFICATION AND LAYOUT

JA SOLAR

JAM60S08 310-330/PR/1000V Series

MECHANICAL DIAGRAMS



Remark: customized frame color and cable length available upon request

SPECIFICATIONS

Cell	Mono
Weight	18.5kg±3%
Dimensions	1678mm×991mm×35mm
Cable Cross Section Size	4mm²
No. of cells	120(6x20)
Connector	PV-ZH202 PV-KBT4/6II(female),PV-KST4/6II(male) QC4.10 Helios H4 H4 UTX
Country of Manufacturer	China/Vietnam

ELECTRICAL PARAMETERS AT STC

TYPE	JAM60S08-310 /PR/1000V	JAM60S08-315 /PR/1000V	JAM60S08-320 /PR/1000V	JAM60S08-325 /PR/1000V	JAM60S08-330 /PR/1000V
Rated Maximum Power(Pmax) [W]	310	315	320	325	330
Open Circuit Voltage(Voc) [V]	39.61	39.93	40.22	40.56	40.84
Maximum Power Voltage(Vmp) [V]	32.78	33.07	33.34	33.65	33.91
Short Circuit Current(Isc) [A]	10.03	10.10	10.16	10.22	10.29
Maximum Power Current(Imp) [A]	9.46	9.53	9.60	9.66	9.74
Module Efficiency [%]	18.6	18.9	19.2	19.5	19.8
Power Tolerance	0~+5W				
Temperature Coefficient of Isc(α_Isc)	+0.051%/℃				
Temperature Coefficient of Voc(β_Voc)	-0.289%/℃				
Temperature Coefficient of Pmax(γ_Pmp)	-0.360%/℃				
STC	Irradiance 1000W/m², cell temperature 25℃, AM1.5G				

Remark: Electrical data in this catalog do not refer to a single module and they are not part of the offer.They only serve for comparison among different module types.

ELECTRICAL PARAMETERS AT NOCT

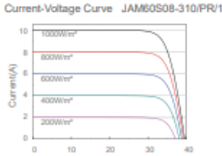
TYPE	JAM60S08-310/PR/1000V	JAM60S08-315/PR/1000V	JAM60S08-320/PR/1000V	JAM60S08-325/PR/1000V	JAM60S08-330/PR/1000V
Rated Max Power(Pmax) [W]	229	233	237	241	244
Open Circuit Voltage(Voc) [V]	36.61	36.93	37.15	37.38	37.65
Max Power Voltage(Vmp) [V]	32.77	33.06	33.31	33.54	33.82
Short Circuit Current(Isc) [A]	8.02	8.08	8.14	8.20	8.25
Max Power Current(Imp) [A]	7.00	7.05	7.11	7.17	7.22
NOCT	Irradiance 800W/m², ambient temperature 20℃, wind speed 1m/s, AM1.5G				

OPERATING CONDITIONS

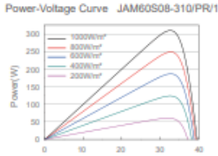
Maximum System Voltage	1000V DC(IEC)
Operating Temperature	-40℃~+85℃
Maximum Series Fuse	20A
Maximum Static Load,Front	3600Pa, 1.5
Maximum Static Load,Back	1600Pa, 1.5
NOCT	45±2℃
Application Class	Class A

CHARACTERISTICS

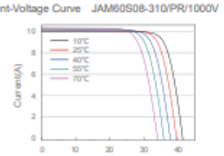
Current-Voltage Curve JAM60S08-310/PR/1000V



Power-Voltage Curve JAM60S08-310/PR/1000V



Current-Voltage Curve JAM60S08-310/PR/1000V



Premium Cells, Premium Modules Version No. : Global_EN_20181205A

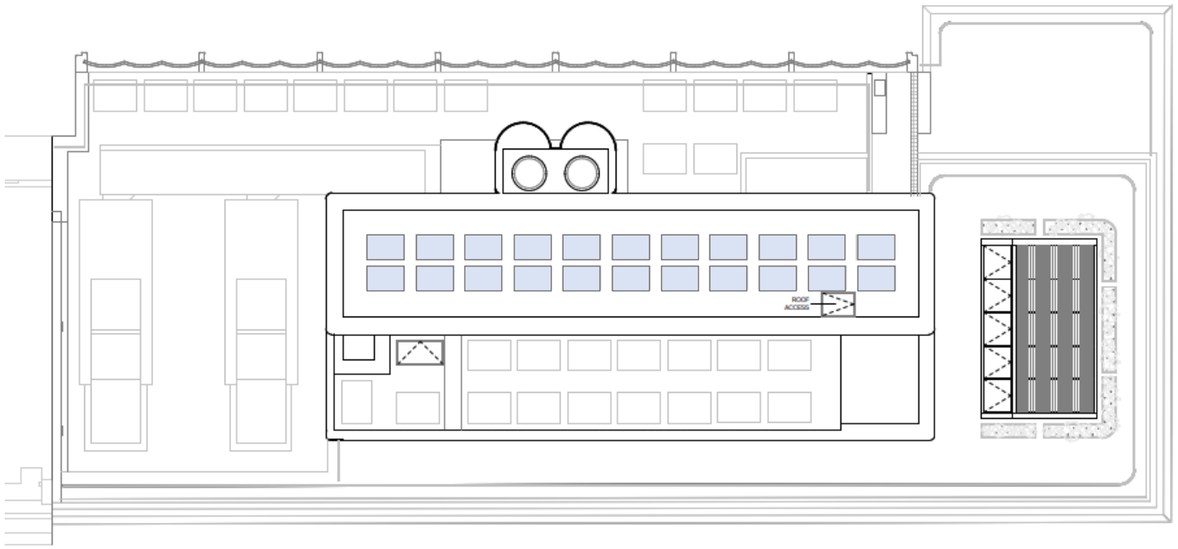


Figure 15 Indicate PV array layout, panels highlighted in blue

APPENDIX E – NON-DOMESTIC BRUKL REPORTS

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2021

Project name

Tavis House - Extension Be Lean As designed

Date: Mon Mar 18 17:04:34 2024

Administrative information

Building Details

Address:

Certifier details

Name:

Telephone number:

Address: , ,

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.25

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.25

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

Foundation area [m²]: 173.89

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

Target CO_2 emission rate (TER), $kgCO_2/m^2annum$	17.87	
Building CO_2 emission rate (BER), $kgCO_2/m^2annum$	15.29	
Target primary energy rate (TPER), kWh_{pe}/m^2annum	194.51	
Building primary energy rate (BPER), kWh_{pe}/m^2annum	165.41	
Do the building's emission and primary energy rates exceed the targets?	BER =< TER	BPER =< TPER

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

Fabric element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	First surface with maximum value
Walls*	0.26	0.15	0.15	GF000003:Surf[3]
Floors	0.18	0.17	0.45	GF000003:Surf[0]
Pitched roofs	0.16	-	-	No pitched roofs in building
Flat roofs	0.18	0.1	0.1	FF00000E:Surf[10]
Windows** and roof windows	1.6	1.2	1.2	GF000003:Surf[1]
Rooflights***	2.2	-	-	No roof lights in building
Personnel doors^	1.6	-	-	No personnel doors in building
Vehicle access & similar large doors	1.3	-	-	No vehicle access doors in building
High usage entrance doors	3	-	-	No high usage entrance doors in building

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [W/(m²K)] $U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [W/(m²K)]

$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [W/(m²K)]

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

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

^ For fire doors, limiting U-value is 1.8 W/m²K

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

Air permeability	Limiting standard	This building
$m^3/(h.m^2)$ at 50 Pa	8	21.25

Building services

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

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

1- HVAC-1

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.09	4	0	1.6	0.75
Standard value	2.5*	N/A	N/A	2^	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.

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

2- HVAC-6

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.09	4	0	1.6	0.75
Standard value	2.5*	N/A	N/A	2^	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.

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

1- DHW-1

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	1.05	-
Standard value	1	N/A

"No zones in project where local mechanical ventilation, exhaust, or terminal unit is applicable"

General lighting and display lighting	General luminaire	Display light source	
Zone name	Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m²]
Standard value	95	80	0.3
Circulation_L0	100	-	-
Circulation_L0	100	-	-
Lab (P)_L2	100	-	-
Lab (P)_L3	100	-	-
Lab (P)_L4	100	-	-
Lab (P)_L5	100	-	-
Lab (P)_L6	100	-	-
Lab (P)_L7	100	-	-
Goods Office_L0	100	-	-
Lab (P)_L1	100	-	-

The spaces in the building should have appropriate passive control measures to limit solar gains in summer

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Circulation_L0	NO (-48%)	NO
Circulation_L0	NO (-74%)	NO

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Lab (P)_L2	NO (-35%)	NO
Lab (P)_L3	NO (-26.4%)	NO
Lab (P)_L4	NO (-16.9%)	NO
Lab (P)_L5	NO (-16%)	NO
Lab (P)_L6	NO (-14.5%)	NO
Lab (P)_L7	NO (-5%)	NO
Goods Office_L0	NO (-34%)	NO
Lab (P)_L1	NO (-41.8%)	NO

Regulation 25A: Consideration of high efficiency alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Floor area [m²]	1391.2	1391.2
External area [m²]	1321.6	1321.6
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	21	5
Average conductance [W/K]	585.87	393.1
Average U-value [W/m²K]	0.44	0.3
Alpha value* [%]	25	10

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

Building Use

% Area	Building Type
	Retail/Financial and Professional Services
	Restaurants and Cafes/Drinking Establishments/Takeaways
3	**Offices and Workshop Businesses**
97	**General Industrial and Special Industrial Groups**
	Storage or Distribution
	Hotels
	Residential Institutions: Hospitals and Care Homes
	Residential Institutions: Residential Schools
	Residential Institutions: Universities and Colleges
	Secure Residential Institutions
	Residential Spaces
	Non-residential Institutions: Community/Day Centre
	Non-residential Institutions: Libraries, Museums, and Galleries
	Non-residential Institutions: Education
	Non-residential Institutions: Primary Health Care Building
	Non-residential Institutions: Crown and County Courts
	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/m²]

	Actual	Notional
Heating	6.85	2.26
Cooling	0.78	0.61
Auxiliary	75.6	85.1
Lighting	24.29	39.86
Hot water	4.14	3.94
Equipment*	29.43	29.43
TOTAL**	**111.65**	**131.76**

* 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/m²]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
Displaced electricity	*0*	*0*

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	75.98	32.77
Primary energy [kWh_{PE}/m²]	165.41	194.51
Total emissions [kg/m²]	15.29	17.87

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] Variable refrigerant flow, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	365.8	27.2	36.6	2.8	5.6	2.78	2.67	3.09	4
	Notional	200.2	15.9	20	1	8.1	2.78	4.63	---	---
[ST] Variable refrigerant flow, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	60.9	7	6.1	0.7	77.4	2.78	2.67	3.09	4
	Notional	18	10.1	1.8	0.6	87.1	2.78	4.63	---	---
[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

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2021

Project name

Tavis House - Extension Be Green

As designed

Date: Mon Mar 18 16:51:59 2024

Administrative information

Building Details

Address:

Certifier details

Name:

Telephone number:

Address: , ,

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.25

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.25

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

Foundation area [m²]: 173.89

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

Target CO_2 emission rate (TER), $kgCO_2/m^2$annum	17.87	
Building CO_2 emission rate (BER), $kgCO_2/m^2$annum	14.93	
Target primary energy rate (TPER), kWh_{pe}/m^2annum	194.51	
Building primary energy rate (BPER), kWh_{pe}/m^2annum	161.6	
Do the building's emission and primary energy rates exceed the targets?	BER =< TER	BPER =< TPER

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

Fabric element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	First surface with maximum value
Walls*	0.26	0.15	0.15	GF000003:Surf[3]
Floors	0.18	0.17	0.45	GF000003:Surf[0]
Pitched roofs	0.16	-	-	No pitched roofs in building
Flat roofs	0.18	0.1	0.1	FF00000E:Surf[10]
Windows** and roof windows	1.6	1.2	1.2	GF000003:Surf[1]
Rooflights***	2.2	-	-	No roof lights in building
Personnel doors^	1.6	-	-	No personnel doors in building
Vehicle access & similar large doors	1.3	-	-	No vehicle access doors in building
High usage entrance doors	3	-	-	No high usage entrance doors in building

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [$W/(m^2K)$] $U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [$W/(m^2K)$]
$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [$W/(m^2K)$]
* Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.
** Display windows and similar glazing are excluded from the U-value check. *** Values for rooflights refer to the horizontal position.
^ For fire doors, limiting U-value is 1.8 W/m^2K
NB: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air permeability	Limiting standard	This building
$m^3/(h.m^2)$ at 50 Pa	8	21.25

Building services

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

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

1- HVAC-1

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4	4	0	1.6	0.75
Standard value	2.5*	N/A	N/A	2^	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.

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

2- HVAC-6

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4	4	0	1.6	0.75
Standard value	2.5*	N/A	N/A	2^	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.

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

1- DHW-1

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	1	-
Standard value	1	N/A

"No zones in project where local mechanical ventilation, exhaust, or terminal unit is applicable"

General lighting and display lighting	General luminaire	Display light source	
Zone name	**Efficacy [lm/W]**	**Efficacy [lm/W]**	**Power density [W/m²]**
Standard value	95	80	0.3
Circulation_L0	100	-	-
Circulation_L0	100	-	-
Lab (P)_L2	100	-	-
Lab (P)_L3	100	-	-
Lab (P)_L4	100	-	-
Lab (P)_L5	100	-	-
Lab (P)_L6	100	-	-
Lab (P)_L7	100	-	-
Goods Office_L0	100	-	-
Lab (P)_L1	100	-	-

The spaces in the building should have appropriate passive control measures to limit solar gains in summer

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Circulation_L0	NO (-48%)	NO
Circulation_L0	NO (-74%)	NO

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Lab (P)_L2	NO (-35%)	NO
Lab (P)_L3	NO (-26.4%)	NO
Lab (P)_L4	NO (-16.9%)	NO
Lab (P)_L5	NO (-16%)	NO
Lab (P)_L6	NO (-14.5%)	NO
Lab (P)_L7	NO (-5%)	NO
Goods Office_L0	NO (-34%)	NO
Lab (P)_L1	NO (-41.8%)	NO

Regulation 25A: Consideration of high efficiency alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Floor area [m²]	1391.2	1391.2
External area [m²]	1321.6	1321.6
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	21	5
Average conductance [W/K]	585.87	393.1
Average U-value [W/m²K]	0.44	0.3
Alpha value* [%]	25	10

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

Building Use

% Area	Building Type
	Retail/Financial and Professional Services
	Restaurants and Cafes/Drinking Establishments/Takeaways
3	**Offices and Workshop Businesses**
97	**General Industrial and Special Industrial Groups**
	Storage or Distribution
	Hotels
	Residential Institutions: Hospitals and Care Homes
	Residential Institutions: Residential Schools
	Residential Institutions: Universities and Colleges
	Secure Residential Institutions
	Residential Spaces
	Non-residential Institutions: Community/Day Centre
	Non-residential Institutions: Libraries, Museums, and Galleries
	Non-residential Institutions: Education
	Non-residential Institutions: Primary Health Care Building
	Non-residential Institutions: Crown and County Courts
	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/m²]

	Actual	Notional
Heating	4.86	2.26
Cooling	0.78	0.61
Auxiliary	75.6	85.1
Lighting	24.29	39.86
Hot water	4.36	3.94
Equipment*	29.43	29.43
TOTAL**	**109.88**	**131.76**

* 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/m²]

	Actual	Notional
Photovoltaic systems	0.72	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
Displaced electricity	*0.72*	*0*

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	75.98	32.77
Primary energy [kWh_{PE}/m²]	161.6	194.51
Total emissions [kg/m²]	14.93	17.87

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] Variable refrigerant flow, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	365.8	27.2	25.9	2.8	5.6	3.92	2.67	4	4
	Notional	200.2	15.9	20	1	8.1	2.78	4.63	----	----
[ST] Variable refrigerant flow, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	60.9	7	4.3	0.7	77.4	3.92	2.67	4	4
	Notional	18	10.1	1.8	0.6	87.1	2.78	4.63	----	----
[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

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2021

Project name

Tavis House - Refurb Appendix 3

As designed

Date: Mon Mar 18 15:57:38 2024

Administrative information

Building Details

Address:

Certifier details

Name:

Telephone number:

Address: , ,

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.25

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.25

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

Foundation area [m²]: 526.54

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

The building does not comply with England Building Regulations Part L 2021

Target CO_2 emission rate (TER), $kgCO_2/m^2annum$	9.23	
Building CO_2 emission rate (BER), $kgCO_2/m^2annum$	16.06	
Target primary energy rate (TPER), kWh_{PE}/m^2annum	100.84	
Building primary energy rate (BPER), kWh_{PE}/m^2annum	174.62	
Do the building's emission and primary energy rates exceed the targets?	BER > TER	BPER > TPER

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

Fabric element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	First surface with maximum value
Walls*	0.26	0.55	0.55	LF00002C:Surf[1]
Floors	0.18	0.25	0.25	GF000004:Surf[0]
Pitched roofs	0.16	-	-	No pitched roofs in building
Flat roofs	0.18	0.18	0.18	LF00002C:Surf[0]
Windows** and roof windows	1.6	1.4	1.4	FF000014:Surf[1]
Rooflights***	2.2	1.4	1.4	WN000000:Surf[16]
Personnel doors^	1.6	1.2	1.2	CR000016:Surf[0]
Vehicle access & similar large doors	1.3	-	-	No vehicle access doors in building
High usage entrance doors	3	-	-	No high usage entrance doors in building

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [$W/(m^2K)$] $U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [$W/(m^2K)$]
$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [$W/(m^2K)$]
* Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.
** Display windows and similar glazing are excluded from the U-value check. *** Values for rooflights refer to the horizontal position.
^ For fire doors, limiting U-value is 1.8 W/m^2K
NB: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air permeability	Limiting standard	This building
$m^3/(h.m^2)$ at 50 Pa	8	25

Building services

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

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- HVAC-3

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	2.5	5	0	2.6	0.7
Standard value	2.5*	N/A	N/A	2^	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

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

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

2- HVAC-1

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	2.5	5	0	2.6	0.7
Standard value	2.5*	N/A	N/A	2^	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

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

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

3- HVAC-2

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	2.5	5	0	2.6	0.7
Standard value	2.5*	N/A	N/A	2^	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

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

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

4- HVAC-4

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	2.5	5	-	-	-
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					NO

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

5- HVAC-6

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	2.5	5	0	2.6	0.7
Standard value	2.5*	N/A	N/A	2^	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

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

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

6- HVAC-1 (MM)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	2.5	5	0	2.6	0.7
Standard value	2.5*	N/A	N/A	2^	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

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

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

7- HVAC-5

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	2.5	5	0	2.6	0.7
Standard value	2.5*	N/A	N/A	2^	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

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

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

1- DHW-1

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	1	-
Standard value	1	N/A

2- DHW-2

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	2	-
Standard value	2*	N/A

* Standard shown is for all types except absorption and gas engine heat pumps.

Zone-level mechanical ventilation, exhaust, and terminal units

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

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

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	2.3	2	0.5	0.5	0.4	1	Zone	Standard
WC_L0	-	-	0.5	-	-	-	-	-	-	-	N/A
Acc WC_L0	-	-	0.5	-	-	-	-	-	-	-	N/A
WC_L1	-	-	0.5	-	-	-	-	-	-	-	N/A
Acc WC_L1	-	-	0.5	-	-	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	2.3	2	0.5	0.5	0.4	1	Zone	Standard
WC_L2	-	-	0.5	-	-	-	-	-	-	-	N/A
Acc WC_L2	-	-	0.5	-	-	-	-	-	-	-	N/A
WC_L3	-	-	0.5	-	-	-	-	-	-	-	N/A
Acc WC_L3	-	-	0.5	-	-	-	-	-	-	-	N/A
WC_L4	-	-	0.5	-	-	-	-	-	-	-	N/A
Acc WC_L4	-	-	0.5	-	-	-	-	-	-	-	N/A
WC_L5	-	-	0.5	-	-	-	-	-	-	-	N/A
Acc WC_L5	-	-	0.5	-	-	-	-	-	-	-	N/A
WC_L6	-	-	0.5	-	-	-	-	-	-	-	N/A
Acc WC_L6	-	-	0.5	-	-	-	-	-	-	-	N/A
WC_L7	-	-	0.5	-	-	-	-	-	-	-	N/A
Acc WC_L7	-	-	0.5	-	-	-	-	-	-	-	N/A
WC_L8	-	-	0.5	-	-	-	-	-	-	-	N/A
Acc WC_L8	-	-	0.5	-	-	-	-	-	-	-	N/A
Acc WC_B1	-	-	0.5	-	-	-	-	-	-	-	N/A
WC_B1	-	-	0.5	-	-	-	-	-	-	-	N/A
Acc Shower_B1	-	-	0.5	-	-	-	-	-	-	-	N/A
Drying Room_B1	-	-	0.5	-	-	-	-	-	-	-	N/A
WC_B1	-	-	0.5	-	-	-	-	-	-	-	N/A

General lighting and display lighting	General luminaire	Display light source	
Zone name	Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m²]
Standard value	95	80	0.3
Stairs_L0	60	-	-
Circulation_L0	60	-	-
Lobby_L0	60	-	-
WC_L0	60	-	-
Circulation_L0	60	-	-
Circulation_L0	60	-	-
Stairs_L0	60	-	-
Acc WC_L0	60	-	-
Stairs_L1	60	-	-
Circulation_L1	60	-	-
Lobby_L1	60	-	-
WC_L1	60	-	-
Circulation_L1	60	-	-
Circulation_L1	60	-	-
Stairs_L1	60	-	-
Acc WC_L1	60	-	-
Stairs_L2	60	-	-
Circulation_L2	60	-	-
Lobby_L2	60	-	-
WC_L2	60	-	-

General lighting and display lighting	General luminaire	Display light source	
Zone name	Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m²]
Standard value	95	80	0.3
Circulation_L2	60	-	-
Circulation_L2	60	-	-
Stairs_L2	60	-	-
Acc WC_L2	60	-	-
Stairs_L3	60	-	-
Circulation_L3	60	-	-
Lobby_L3	60	-	-
WC_L3	60	-	-
Circulation_L3	60	-	-
Circulation_L3	60	-	-
Stairs_L3	60	-	-
Acc WC_L3	60	-	-
Stairs_L4	60	-	-
Circulation_L4	60	-	-
Lobby_L4	60	-	-
WC_L4	60	-	-
Circulation_L4	60	-	-
Circulation_L4	60	-	-
Stairs_L4	60	-	-
Acc WC_L4	60	-	-
Stairs_L5	60	-	-
Circulation_L5	60	-	-
Lobby_L5	60	-	-
WC_L5	60	-	-
Circulation_L5	60	-	-
Circulation_L5	60	-	-
Stairs_L5	60	-	-
Acc WC_L5	60	-	-
Stairs_L6	60	-	-
Circulation_L6	60	-	-
Lobby_L6	60	-	-
WC_L6	60	-	-
Circulation_L6	60	-	-
Circulation_L6	60	-	-
Stairs_L6	60	-	-
Acc WC_L6	60	-	-
Stairs_L7	60	-	-
Circulation_L7	60	-	-
Lobby_L7	60	-	-
WC_L7	60	-	-
Circulation_L7	60	-	-
Circulation_L7	60	-	-
Stairs_L7	60	-	-

General lighting and display lighting	General luminaire	Display light source	
Zone name	Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m²]
Standard value	95	80	0.3
Acc WC_L7	60	-	-
Lobby_L8	60	-	-
WC_L8	60	-	-
Circulation_L8	60	-	-
Circulation_L8	60	-	-
Stairs_L8	60	-	-
Acc WC_L8	60	-	-
Circulation_L8	60	-	-
Stairs_L8	60	-	-
Stairs_L8	60	-	-
Plant_L8	60	-	-
Plant_B1	60	-	-
Circulation_B1	60	-	-
Goods In Store_B1	60	-	-
Lobby_B1	60	-	-
Acc WC_B1	60	-	-
Circulation_B1	60	-	-
Stairs_B1	60	-	-
Comms Room_B1	60	-	-
Lab Support_B1	60	-	-
Plant_B1	60	-	-
Lab Support_B1	60	-	-
Plant_B1	60	-	-
Changing_B1	60	-	-
WC_B1	60	-	-
Acc Shower_B1	60	-	-
Drying Room_B1	60	-	-
WC_B1	60	-	-
Changing_B1	60	-	-
Post Room_B1	60	-	-
Circulation_B1	60	-	-
Cycle Store_B1	60	-	-
Switch Room_B1	60	-	-
Plant_B1	60	-	-
Office (P)_L0	60	-	-
Office_L7	60	-	-
Lab_L7	60	-	-
Lab_L0	60	-	-
Office (P)_L0	60	-	-
Office (P)_L0	60	-	-
Reception (P)_L0	60	15	9
Office_L0	60	-	-
Reception_L0	60	15	9
Office_L0	60	-	-
Lab_L1	60	-	-

General lighting and display lighting	General luminaire	Display light source	
Zone name	Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m²]
Standard value	95	80	0.3
Lab_L1	60	-	-
Office_L1	60	-	-
Office (P)_L1	60	-	-
Lab_L2	60	-	-
Lab_L2	60	-	-
Office_L2	60	-	-
Lab_L3	60	-	-
Lab_L3	60	-	-
Office_L3	60	-	-
Lab_L4	60	-	-
Lab_L4	60	-	-
Office_L4	60	-	-
Lab_L5	60	-	-
Lab_L5	60	-	-
Office_L5	60	-	-
Lab_L6	60	-	-
Lab_L6	60	-	-
Office_L6	60	-	-
Lab(P)_L6	60	-	-
Office(P)_L6	60	-	-
Lab(P)_L6	60	-	-
Office(P)_L6	60	-	-
Bin Store_L0	60	-	-
Lab (P)_L0	60	-	-
Lab (P)_L1	60	-	-
Office(P)_L2	60	-	-
Lab(P)_L2	60	-	-
Office(P)_L3	60	-	-
Lab(P)_L3	60	-	-
Office(P)_L4	60	-	-
Lab(P)_L4	60	-	-
Office(P)_L5	60	-	-
Lab(P)_L5	60	-	-
Office(P)_L7	60	-	-
Lab(P)_L7	60	-	-
Store_L8	60	-	-
Office(P)_L8	60	-	-
Winter Garden_L8	60	-	-

The spaces in the building should have appropriate passive control measures to limit solar gains in summer

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Stairs_L0	N/A	N/A
Circulation_L0	N/A	N/A
Lobby_L0	N/A	N/A
WC_L0	N/A	N/A

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Circulation_L0	N/A	N/A
Circulation_L0	NO (-100%)	NO
Stairs_L0	N/A	N/A
Acc WC_L0	N/A	N/A
Stairs_L1	N/A	N/A
Circulation_L1	N/A	N/A
Lobby_L1	N/A	N/A
WC_L1	N/A	N/A
Circulation_L1	N/A	N/A
Circulation_L1	N/A	N/A
Stairs_L1	N/A	N/A
Acc WC_L1	N/A	N/A
Stairs_L2	N/A	N/A
Circulation_L2	N/A	N/A
Lobby_L2	N/A	N/A
WC_L2	N/A	N/A
Circulation_L2	N/A	N/A
Circulation_L2	N/A	N/A
Stairs_L2	N/A	N/A
Acc WC_L2	N/A	N/A
Stairs_L3	N/A	N/A
Circulation_L3	N/A	N/A
Lobby_L3	N/A	N/A
WC_L3	N/A	N/A
Circulation_L3	N/A	N/A
Circulation_L3	N/A	N/A
Stairs_L3	N/A	N/A
Acc WC_L3	N/A	N/A
Stairs_L4	N/A	N/A
Circulation_L4	N/A	N/A
Lobby_L4	N/A	N/A
WC_L4	N/A	N/A
Circulation_L4	N/A	N/A
Circulation_L4	N/A	N/A
Stairs_L4	N/A	N/A
Acc WC_L4	N/A	N/A
Stairs_L5	N/A	N/A
Circulation_L5	N/A	N/A
Lobby_L5	N/A	N/A
WC_L5	N/A	N/A
Circulation_L5	N/A	N/A
Circulation_L5	N/A	N/A
Stairs_L5	N/A	N/A
Acc WC_L5	N/A	N/A
Stairs_L6	N/A	N/A
Circulation_L6	N/A	N/A
Lobby_L6	N/A	N/A
WC_L6	N/A	N/A
Circulation_L6	N/A	N/A

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Circulation_L6	N/A	N/A
Stairs_L6	N/A	N/A
Acc WC_L6	N/A	N/A
Stairs_L7	N/A	N/A
Circulation_L7	N/A	N/A
Lobby_L7	N/A	N/A
WC_L7	N/A	N/A
Circulation_L7	N/A	N/A
Circulation_L7	N/A	N/A
Stairs_L7	N/A	N/A
Acc WC_L7	N/A	N/A
Lobby_L8	N/A	N/A
WC_L8	N/A	N/A
Circulation_L8	N/A	N/A
Circulation_L8	N/A	N/A
Stairs_L8	N/A	N/A
Acc WC_L8	N/A	N/A
Circulation_L8	N/A	N/A
Stairs_L8	N/A	N/A
Stairs_L8	N/A	N/A
Circulation_B1	N/A	N/A
Lobby_B1	N/A	N/A
Acc WC_B1	N/A	N/A
Circulation_B1	NO (-100%)	NO
Acc WC_B1	N/A	N/A
Circulation_B1	NO (-100%)	NO
Stairs_B1	N/A	N/A
Comms Room_B1	N/A	N/A
Lab Support_B1	N/A	N/A
Changing_B1	NO (-100%)	NO
WC_B1	NO (-99.9%)	NO
Acc Shower_B1	N/A	N/A
Drying Room_B1	NO (-100%)	NO
WC_B1	N/A	N/A
Changing_B1	N/A	N/A
Circulation_B1	NO (-100%)	NO
Cycle Store_B1	N/A	N/A
Office (P)_L0	NO (-60.1%)	NO
Office_L7	NO (-80%)	NO
Lab_L7	NO (-58.9%)	NO
Lab_L0	NO (-74.8%)	NO
Office (P)_L0	NO (-3.8%)	NO
Office (P)_L0	NO (-22.5%)	NO
Reception (P)_L0	YES (+45.1%)	NO
Office_L0	NO (-55.3%)	NO
Reception_L0	YES (+46.8%)	NO
Office_L0	YES (+10.6%)	NO
Lab_L1	N/A	N/A
Lab_L1	NO (-75.5%)	NO
Office_L1	NO (-21.3%)	NO
Office (P)_L1	NO (-19.6%)	NO

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Lab_L2	N/A	N/A
Lab_L2	NO (-79.4%)	NO
Office_L2	YES (+11.2%)	NO
Lab_L3	N/A	N/A
Lab_L3	NO (-77.2%)	NO
Office_L3	YES (+1.2%)	NO
Lab_L4	N/A	N/A
Lab_L4	NO (-75.8%)	NO
Office_L4	YES (+1.5%)	NO
Lab_L5	N/A	N/A
Lab_L5	NO (-74.9%)	NO
Office_L5	YES (+2.1%)	NO
Lab_L6	N/A	N/A
Lab_L6	NO (-72.6%)	NO
Office_L6	NO (-6.9%)	NO
Lab(P)_L6	YES (+12.9%)	NO
Office(P)_L6	NO (-34.9%)	NO
Lab (P)_L0	NO (-16.4%)	NO
Lab (P)_L1	YES (+0.8%)	NO
Office(P)_L2	NO (-17.2%)	NO
Lab(P)_L2	NO (-14.1%)	NO
Office(P)_L3	NO (-25.6%)	NO
Lab(P)_L3	NO (-6%)	NO
Office(P)_L4	NO (-26.1%)	NO
Lab(P)_L4	NO (-0.5%)	NO
Office(P)_L5	NO (-25.8%)	NO
Lab(P)_L5	YES (+3.6%)	NO
Office(P)_L7	NO (-20.7%)	NO
Lab(P)_L7	YES (+15%)	NO
Office(P)_L8	NO (-23.5%)	NO
Winter Garden_L8	YES (+89.5%)	NO

Regulation 25A: Consideration of high efficiency alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Floor area [m²]	6213.4	6213.4
External area [m²]	4596.4	4596.4
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	25	4
Average conductance [W/K]	2796.49	1580.33
Average U-value [W/m²K]	0.61	0.34
Alpha value* [%]	25.3	10

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

Building Use

% Area	Building Type
	Retail/Financial and Professional Services
	Restaurants and Cafes/Drinking Establishments/Takeaways
63	**Offices and Workshop Businesses**
37	**General Industrial and Special Industrial Groups**
	Storage or Distribution
	Hotels
	Residential Institutions: Hospitals and Care Homes
	Residential Institutions: Residential Schools
	Residential Institutions: Universities and Colleges
	Secure Residential Institutions
	Residential Spaces
	Non-residential Institutions: Community/Day Centre
	Non-residential Institutions: Libraries, Museums, and Galleries
	Non-residential Institutions: Education
	Non-residential Institutions: Primary Health Care Building
	Non-residential Institutions: Crown and County Courts
	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/m²]

	Actual	Notional
Heating	6.99	0.82
Cooling	2.03	2.39
Auxiliary	56.36	36.94
Lighting	38.96	20.84
Hot water	10.92	7.43
Equipment*	40.14	40.14
TOTAL**	115.25	68.42

* 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/m²]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
Displaced electricity	*0*	*0*

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	82.51	41.35
Primary energy [kWh_{PE}/m²]	174.62	100.84
Total emissions [kg/m²]	16.06	9.23

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] Variable refrigerant flow, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	45.2	62	5.2	5.6	10.5	2.42	3.06	2.5	5
	Notional	5.2	91.8	0.5	5.5	7.7	2.78	4.63	----	---
[ST] Constant volume system (variable fresh air rate), [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	82.1	11.9	9.6	1.5	39.8	2.37	2.27	2.5	5
	Notional	6	41	0.6	2.5	17.1	2.78	4.63	----	---
[ST] Constant volume system (variable fresh air rate), [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	57.2	19.8	6.7	2.4	22.3	2.37	2.27	2.5	5
	Notional	5.3	52.3	0.5	3.1	7.6	2.78	4.63	----	---
[ST] Variable refrigerant flow, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	69.6	16.5	8	1.5	10.2	2.42	3.06	2.5	5
	Notional	11.3	34.3	1.1	3.4	8.3	2.78	2.84	----	---
[ST] Single room cooling system, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	0	0	0	0	0	2.33	3.55	2.5	5
	Notional	0	0	0	0	0	2.78	4.63	----	---
[ST] Variable refrigerant flow, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	158.6	76.9	18.2	7	10.2	2.42	3.06	2.5	5
	Notional	58	19.8	5.8	1.9	8	2.78	2.84	----	---
[ST] Variable refrigerant flow, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	64.6	12	7.4	1.1	132.4	2.42	3.06	2.5	5
	Notional	6.5	11.3	0.7	0.7	87.1	2.78	4.63	----	---
[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

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2021

Project name

Tavis House - Refurb Be Lean

As designed

Date: Mon Mar 18 17:07:44 2024

Administrative information

Building Details

Address:

Certifier details

Name:

Telephone number:

Address: , ,

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.25

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.25

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

Foundation area [m²]: 526.54

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

The building does not comply with England Building Regulations Part L 2021

Target CO_2 emission rate (TER), $kgCO_2/m^2annum$	9.23	
Building CO_2 emission rate (BER), $kgCO_2/m^2annum$	10.06	
Target primary energy rate (TPER), kWh_{PE}/m^2annum	100.84	
Building primary energy rate (BPER), kWh_{PE}/m^2annum	108.08	
Do the building's emission and primary energy rates exceed the targets?	BER > TER	BPER > TPER

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

Fabric element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	First surface with maximum value
Walls*	0.26	1.59	1.7	B1000000:Surf[3]
Floors	0.18	0.45	0.45	GF000004:Surf[0]
Pitched roofs	0.16	-	-	No pitched roofs in building
Flat roofs	0.18	1.56	2.3	B1000000:Surf[1]
Windows** and roof windows	1.6	1.97	2	FF00001B:Surf[3]
Rooflights***	2.2	1.4	1.4	WN000000:Surf[16]
Personnel doors^	1.6	1.2	1.2	CR000016:Surf[0]
Vehicle access & similar large doors	1.3	-	-	No vehicle access doors in building
High usage entrance doors	3	-	-	No high usage entrance doors in building

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

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

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

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

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

Air permeability	Limiting standard	This building
$m^3/(h.m^2)$ at 50 Pa	8	21.25

Building services

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

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

1- HVAC-3

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.09	4	0	1.6	0.75
Standard value	2.5*	N/A	N/A	2^	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.

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

2- HVAC-1

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.09	4	0	1.6	0.75
Standard value	2.5*	N/A	N/A	2^	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.

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

3- HVAC-2

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.09	4	0	1.6	0.75
Standard value	2.5*	N/A	N/A	2^	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.

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

4- HVAC-4

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.09	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.

5- HVAC-6

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.09	4	0	1.6	0.75
Standard value	2.5*	N/A	N/A	2^	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.

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

6- HVAC-1 (MM)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.09	4	0	1.6	0.75
Standard value	2.5*	N/A	N/A	2^	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.

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

7- HVAC-5

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.09	5	0	1.6	0.75
Standard value	2.5*	N/A	N/A	2^	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.

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

1- DHW-1

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	1.05	-
Standard value	1	N/A

2- DHW-2

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	3.01	-
Standard value	2*	N/A

* Standard shown is for all types except absorption and gas engine heat pumps.

Zone-level mechanical ventilation, exhaust, and terminal units

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

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

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	2.3	2	0.5	0.5	0.4	1	Zone	Standard
WC_L0	-	-	0.3	-	-	-	-	-	-	-	N/A
Acc WC_L0	-	-	0.3	-	-	-	-	-	-	-	N/A
WC_L1	-	-	0.3	-	-	-	-	-	-	-	N/A
Acc WC_L1	-	-	0.3	-	-	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	2.3	2	0.5	0.5	0.4	1	Zone	Standard
WC_L2	-	-	0.3	-	-	-	-	-	-	-	N/A
Acc WC_L2	-	-	0.3	-	-	-	-	-	-	-	N/A
WC_L3	-	-	0.3	-	-	-	-	-	-	-	N/A
Acc WC_L3	-	-	0.3	-	-	-	-	-	-	-	N/A
WC_L4	-	-	0.3	-	-	-	-	-	-	-	N/A
Acc WC_L4	-	-	0.3	-	-	-	-	-	-	-	N/A
WC_L5	-	-	0.3	-	-	-	-	-	-	-	N/A
Acc WC_L5	-	-	0.3	-	-	-	-	-	-	-	N/A
WC_L6	-	-	0.3	-	-	-	-	-	-	-	N/A
Acc WC_L6	-	-	0.3	-	-	-	-	-	-	-	N/A
WC_L7	-	-	0.3	-	-	-	-	-	-	-	N/A
Acc WC_L7	-	-	0.3	-	-	-	-	-	-	-	N/A
WC_L8	-	-	0.3	-	-	-	-	-	-	-	N/A
Acc WC_L8	-	-	0.3	-	-	-	-	-	-	-	N/A
Acc WC_B1	-	-	0.3	-	-	-	-	-	-	-	N/A
WC_B1	-	-	0.3	-	-	-	-	-	-	-	N/A
Acc Shower_B1	-	-	0.3	-	-	-	-	-	-	-	N/A
Drying Room_B1	-	-	0.3	-	-	-	-	-	-	-	N/A
WC_B1	-	-	0.3	-	-	-	-	-	-	-	N/A

General lighting and display lighting	General luminaire	Display light source	
Zone name	Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m²]
Standard value	95	80	0.3
Stairs_L0	100	-	-
Circulation_L0	100	-	-
Lobby_L0	100	-	-
WC_L0	100	-	-
Circulation_L0	100	-	-
Circulation_L0	100	-	-
Stairs_L0	100	-	-
Acc WC_L0	100	-	-
Stairs_L1	100	-	-
Circulation_L1	100	-	-
Lobby_L1	100	-	-
WC_L1	100	-	-
Circulation_L1	100	-	-
Circulation_L1	100	-	-
Stairs_L1	100	-	-
Acc WC_L1	100	-	-
Stairs_L2	100	-	-
Circulation_L2	100	-	-
Lobby_L2	100	-	-
WC_L2	100	-	-

General lighting and display lighting	General luminaire	Display light source	
Zone name	Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m²]
Standard value	95	80	0.3
Circulation_L2	100	-	-
Circulation_L2	100	-	-
Stairs_L2	100	-	-
Acc WC_L2	100	-	-
Stairs_L3	100	-	-
Circulation_L3	100	-	-
Lobby_L3	100	-	-
WC_L3	100	-	-
Circulation_L3	100	-	-
Circulation_L3	100	-	-
Stairs_L3	100	-	-
Acc WC_L3	100	-	-
Stairs_L4	100	-	-
Circulation_L4	100	-	-
Lobby_L4	100	-	-
WC_L4	100	-	-
Circulation_L4	100	-	-
Circulation_L4	100	-	-
Stairs_L4	100	-	-
Acc WC_L4	100	-	-
Stairs_L4	100	-	-
Acc WC_L4	100	-	-
Stairs_L5	100	-	-
Circulation_L5	100	-	-
Lobby_L5	100	-	-
WC_L5	100	-	-
Circulation_L5	100	-	-
Circulation_L5	100	-	-
Stairs_L5	100	-	-
Acc WC_L5	100	-	-
Stairs_L6	100	-	-
Circulation_L6	100	-	-
Lobby_L6	100	-	-
WC_L6	100	-	-
Circulation_L6	100	-	-
Circulation_L6	100	-	-
Stairs_L6	100	-	-
Acc WC_L6	100	-	-
Stairs_L7	100	-	-
Circulation_L7	100	-	-
Lobby_L7	100	-	-
WC_L7	100	-	-
Circulation_L7	100	-	-
Circulation_L7	100	-	-
Stairs_L7	100	-	-

General lighting and display lighting	General luminaire	Display light source	
Zone name	Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m²]
Standard value	95	80	0.3
Acc WC_L7	100	-	-
Lobby_L8	100	-	-
WC_L8	100	-	-
Circulation_L8	100	-	-
Circulation_L8	100	-	-
Stairs_L8	100	-	-
Acc WC_L8	100	-	-
Circulation_L8	100	-	-
Stairs_L8	100	-	-
Stairs_L8	100	-	-
Plant_L8	100	-	-
Plant_B1	100	-	-
Circulation_B1	100	-	-
Goods In Store_B1	100	-	-
Lobby_B1	100	-	-
Acc WC_B1	100	-	-
Circulation_B1	100	-	-
Stairs_B1	100	-	-
Comms Room_B1	100	-	-
Lab Support_B1	100	-	-
Plant_B1	100	-	-
Changing_B1	100	-	-
WC_B1	100	-	-
Acc Shower_B1	100	-	-
Drying Room_B1	100	-	-
WC_B1	100	-	-
Changing_B1	100	-	-
Post Room_B1	100	-	-
Circulation_B1	100	-	-
Cycle Store_B1	100	-	-
Switch Room_B1	100	-	-
Plant_B1	100	-	-
Office (P)_L0	100	-	-
Office_L7	100	-	-
Lab_L7	100	-	-
Lab_L0	100	-	-
Office (P)_L0	100	-	-
Office (P)_L0	100	-	-
Reception (P)_L0	100	80	1.688
Office_L0	100	-	-
Reception_L0	100	80	1.687
Office_L0	100	-	-
Lab_L1	100	-	-

General lighting and display lighting	General luminaire	Display light source	
Zone name	Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m²]
Standard value	95	80	0.3
Lab_L1	100	-	-
Office_L1	100	-	-
Office (P)_L1	100	-	-
Lab_L2	100	-	-
Lab_L2	100	-	-
Office_L2	100	-	-
Lab_L3	100	-	-
Lab_L3	100	-	-
Office_L3	100	-	-
Lab_L4	100	-	-
Lab_L4	100	-	-
Office_L4	100	-	-
Lab_L5	100	-	-
Lab_L5	100	-	-
Office_L5	100	-	-
Lab_L6	100	-	-
Lab_L6	100	-	-
Office_L6	100	-	-
Lab(P)_L6	100	-	-
Office(P)_L6	100	-	-
Bin Store_L0	100	-	-
Lab (P)_L0	100	-	-
Lab (P)_L1	100	-	-
Office(P)_L2	100	-	-
Lab(P)_L2	100	-	-
Office(P)_L3	100	-	-
Lab(P)_L3	100	-	-
Office(P)_L4	100	-	-
Lab(P)_L4	100	-	-
Office(P)_L5	100	-	-
Lab(P)_L5	100	-	-
Office(P)_L7	100	-	-
Lab(P)_L7	100	-	-
Store_L8	100	-	-
Office(P)_L8	100	-	-
Winter Garden_L8	100	-	-

The spaces in the building should have appropriate passive control measures to limit solar gains in summer

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Stairs_L0	N/A	N/A
Circulation_L0	N/A	N/A
Lobby_L0	N/A	N/A
WC_L0	N/A	N/A

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Circulation_L0	N/A	N/A
Circulation_L0	NO (-100%)	NO
Stairs_L0	N/A	N/A
Acc WC_L0	N/A	N/A
Stairs_L1	N/A	N/A
Circulation_L1	N/A	N/A
Lobby_L1	N/A	N/A
WC_L1	N/A	N/A
Circulation_L1	N/A	N/A
Circulation_L1	N/A	N/A
Stairs_L1	NO (-100%)	NO
Acc WC_L1	N/A	N/A
Stairs_L2	N/A	N/A
Circulation_L2	N/A	N/A
Lobby_L2	N/A	N/A
WC_L2	N/A	N/A
Circulation_L2	N/A	N/A
Circulation_L2	N/A	N/A
Stairs_L2	N/A	N/A
Acc WC_L2	N/A	N/A
Stairs_L3	N/A	N/A
Circulation_L3	N/A	N/A
Lobby_L3	N/A	N/A
WC_L3	N/A	N/A
Circulation_L3	N/A	N/A
Circulation_L3	N/A	N/A
Stairs_L3	N/A	N/A
Acc WC_L3	N/A	N/A
Stairs_L4	N/A	N/A
Circulation_L4	N/A	N/A
Lobby_L4	N/A	N/A
WC_L4	N/A	N/A
Circulation_L4	N/A	N/A
Circulation_L4	N/A	N/A
Stairs_L4	N/A	N/A
Acc WC_L4	N/A	N/A
Stairs_L5	N/A	N/A
Circulation_L5	N/A	N/A
Lobby_L5	N/A	N/A
WC_L5	N/A	N/A
Circulation_L5	N/A	N/A
Circulation_L5	N/A	N/A
Stairs_L5	N/A	N/A
Acc WC_L5	N/A	N/A
Stairs_L6	N/A	N/A
Circulation_L6	N/A	N/A
Lobby_L6	N/A	N/A
WC_L6	N/A	N/A
Circulation_L6	N/A	N/A

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Circulation_L6	N/A	N/A
Stairs_L6	N/A	N/A
Acc WC_L6	N/A	N/A
Stairs_L7	N/A	N/A
Circulation_L7	N/A	N/A
Lobby_L7	N/A	N/A
WC_L7	N/A	N/A
Circulation_L7	N/A	N/A
Circulation_L7	N/A	N/A
Stairs_L7	N/A	N/A
Acc WC_L7	N/A	N/A
Lobby_L8	N/A	N/A
WC_L8	N/A	N/A
Circulation_L8	N/A	N/A
Circulation_L8	N/A	N/A
Stairs_L8	N/A	N/A
Acc WC_L8	N/A	N/A
Circulation_L8	N/A	N/A
Stairs_L8	N/A	N/A
Stairs_L8	N/A	N/A
Circulation_B1	N/A	N/A
Lobby_B1	N/A	N/A
Acc WC_B1	N/A	N/A
Circulation_B1	NO (-100%)	NO
Acc WC_B1	N/A	N/A
Circulation_B1	NO (-100%)	NO
Stairs_B1	N/A	N/A
Comms Room_B1	N/A	N/A
Lab Support_B1	N/A	N/A
Changing_B1	NO (-100%)	NO
WC_B1	NO (-99.8%)	NO
Acc Shower_B1	N/A	N/A
Drying Room_B1	NO (-100%)	NO
WC_B1	N/A	N/A
Changing_B1	N/A	N/A
Circulation_B1	NO (-100%)	NO
Cycle Store_B1	N/A	N/A
Office (P)_L0	NO (-56.8%)	NO
Office_L7	NO (-67.7%)	NO
Lab_L7	NO (-34.3%)	NO
Lab_L0	NO (-59.6%)	NO
Office (P)_L0	YES (+54%)	NO
Office (P)_L0	YES (+22.4%)	NO
Reception (P)_L0	YES (+130.9%)	NO
Office_L0	NO (-35.3%)	NO
Reception_L0	YES (+134.5%)	NO
Office_L0	YES (+77.9%)	NO
Lab_L1	N/A	N/A
Lab_L1	NO (-60.8%)	NO
Office_L1	YES (+27%)	NO
Office (P)_L1	YES (+28.5%)	NO

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Lab_L2	N/A	N/A
Lab_L2	NO (-66.9%)	NO
Office_L2	YES (+79.3%)	NO
Lab_L3	N/A	N/A
Lab_L3	NO (-63.4%)	NO
Office_L3	YES (+63.5%)	NO
Lab_L4	N/A	N/A
Lab_L4	NO (-61.1%)	NO
Office_L4	YES (+63.9%)	NO
Lab_L5	N/A	N/A
Lab_L5	NO (-59.8%)	NO
Office_L5	YES (+64.9%)	NO
Lab_L6	N/A	N/A
Lab_L6	NO (-56%)	NO
Office_L6	YES (+50.3%)	NO
Lab(P)_L6	YES (+79.7%)	NO
Office(P)_L6	YES (+4%)	NO
Lab (P)_L0	YES (+33.1%)	NO
Lab (P)_L1	YES (+60.3%)	NO
Office(P)_L2	YES (+32.4%)	NO
Lab(P)_L2	YES (+36.9%)	NO
Office(P)_L3	YES (+19%)	NO
Lab(P)_L3	YES (+49.7%)	NO
Office(P)_L4	YES (+18.2%)	NO
Lab(P)_L4	YES (+58.4%)	NO
Office(P)_L5	YES (+18.7%)	NO
Lab(P)_L5	YES (+65%)	NO
Office(P)_L7	YES (+26.8%)	NO
Lab(P)_L7	YES (+82.7%)	NO
Office(P)_L8	YES (+22.4%)	NO
Winter Garden_L8	YES (+123%)	NO

Regulation 25A: Consideration of high efficiency alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Floor area [m²]	6213.4	6213.4
External area [m²]	4596.4	4596.4
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	21	4
Average conductance [W/K]	6726.32	1580.33
Average U-value [W/m²K]	1.46	0.34
Alpha value* [%]	25.2	10

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

Building Use

% Area	Building Type
	Retail/Financial and Professional Services
	Restaurants and Cafes/Drinking Establishments/Takeaways
63	**Offices and Workshop Businesses**
37	**General Industrial and Special Industrial Groups**
	Storage or Distribution
	Hotels
	Residential Institutions: Hospitals and Care Homes
	Residential Institutions: Residential Schools
	Residential Institutions: Universities and Colleges
	Secure Residential Institutions
	Residential Spaces
	Non-residential Institutions: Community/Day Centre
	Non-residential Institutions: Libraries, Museums, and Galleries
	Non-residential Institutions: Education
	Non-residential Institutions: Primary Health Care Building
	Non-residential Institutions: Crown and County Courts
	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/m²]

	Actual	Notional
Heating	14.69	0.82
Cooling	1.72	2.39
Auxiliary	32.31	36.94
Lighting	15.94	20.84
Hot water	8.04	7.43
Equipment*	40.14	40.14
TOTAL**	72.7	68.42

* 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/m²]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
Displaced electricity	*0*	*0*

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	163.59	41.35
Primary energy [kWh_{PE}/m²]	108.08	100.84
Total emissions [kg/m²]	10.06	9.23

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] Variable refrigerant flow, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	83.3	48.7	8.3	5.1	4.5	2.78	2.67	3.09	4
	Notional	5.2	91.8	0.5	5.5	7.7	2.78	4.63	---	---
[ST] Constant volume system (variable fresh air rate), [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	208.2	2.6	20.8	0.3	33	2.78	2.31	3.09	4
	Notional	6	41	0.6	2.5	17.1	2.78	4.63	---	---
[ST] Constant volume system (variable fresh air rate), [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	120.9	10.3	12.1	1.2	18.4	2.78	2.31	3.09	4
	Notional	5.3	52.3	0.5	3.1	7.6	2.78	4.63	---	---
[ST] Variable refrigerant flow, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	186.7	12.7	18.7	1.3	2.3	2.78	2.67	3.09	4
	Notional	11.3	34.3	1.1	3.4	8.3	2.78	2.84	---	---
[ST] Single room cooling system, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	0	0	0	0	0	2.78	1.49	3.09	2
	Notional	0	0	0	0	0	2.78	4.63	---	---
[ST] Variable refrigerant flow, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	523.3	49.8	52.3	4.1	2.3	2.78	3.34	3.09	5
	Notional	58	19.8	5.8	1.9	8	2.78	2.84	---	---
[ST] Variable refrigerant flow, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	146.4	10.7	14.6	1.1	77.4	2.78	2.67	3.09	4
	Notional	6.5	11.3	0.7	0.7	87.1	2.78	4.63	---	---
[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

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2021

Project name

Tavis House - Refurb Be Green

As designed

Date: Mon Mar 18 16:55:18 2024

Administrative information

Building Details

Address:

Certifier details

Name:

Telephone number:

Address: , ,

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.25

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.25

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

Foundation area [m²]: 526.54

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

The building does not comply with England Building Regulations Part L 2021

Target CO_2 emission rate (TER), $kgCO_2/m^2$annum	9.23	
Building CO_2 emission rate (BER), $kgCO_2/m^2$annum	9.41	
Target primary energy rate (TPER), kWh_{PE}/m^2annum	100.84	
Building primary energy rate (BPER), kWh_{PE}/m^2annum	101.46	
Do the building's emission and primary energy rates exceed the targets?	BER > TER	BPER > TPER

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

Fabric element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	First surface with maximum value
Walls*	0.26	1.59	1.7	B1000000:Surf[3]
Floors	0.18	0.45	0.45	GF000004:Surf[0]
Pitched roofs	0.16	-	-	No pitched roofs in building
Flat roofs	0.18	1.56	2.3	B1000000:Surf[1]
Windows** and roof windows	1.6	1.97	2	FF00001B:Surf[3]
Rooflights***	2.2	1.4	1.4	WN000000:Surf[16]
Personnel doors^	1.6	1.2	1.2	CR000016:Surf[0]
Vehicle access & similar large doors	1.3	-	-	No vehicle access doors in building
High usage entrance doors	3	-	-	No high usage entrance doors in building

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

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

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

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

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

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

Air permeability	Limiting standard	This building
$m^3/(h.m^2)$ at 50 Pa	8	21.25

Building services

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

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

1- HVAC-3

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4	4	0	1.6	0.75
Standard value	2.5*	N/A	N/A	2^	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.

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

2- HVAC-1

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4	4	0	1.6	0.75
Standard value	2.5*	N/A	N/A	2^	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.

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

3- HVAC-2

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4	4	0	1.6	0.75
Standard value	2.5*	N/A	N/A	2^	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.

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

4- HVAC-4

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	2.5	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.

5- HVAC-6

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4	4	0	1.6	0.75
Standard value	2.5*	N/A	N/A	2^	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.

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

6- HVAC-1 (MM)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4	4	0	1.6	0.75
Standard value	2.5*	N/A	N/A	2^	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.

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

7- HVAC-5

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4	5	0	1.6	0.75
Standard value	2.5*	N/A	N/A	2^	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.

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

1- DHW-1

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	1	-
Standard value	1	N/A

2- DHW-2

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	2.8	-
Standard value	2*	N/A

* Standard shown is for all types except absorption and gas engine heat pumps.

Zone-level mechanical ventilation, exhaust, and terminal units

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

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

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	2.3	2	0.5	0.5	0.4	1	Zone	Standard
WC_L0	-	-	0.3	-	-	-	-	-	-	-	N/A
Acc WC_L0	-	-	0.3	-	-	-	-	-	-	-	N/A
WC_L1	-	-	0.3	-	-	-	-	-	-	-	N/A
Acc WC_L1	-	-	0.3	-	-	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	2.3	2	0.5	0.5	0.4	1	Zone	Standard
WC_L2	-	-	0.3	-	-	-	-	-	-	-	N/A
Acc WC_L2	-	-	0.3	-	-	-	-	-	-	-	N/A
WC_L3	-	-	0.3	-	-	-	-	-	-	-	N/A
Acc WC_L3	-	-	0.3	-	-	-	-	-	-	-	N/A
WC_L4	-	-	0.3	-	-	-	-	-	-	-	N/A
Acc WC_L4	-	-	0.3	-	-	-	-	-	-	-	N/A
WC_L5	-	-	0.3	-	-	-	-	-	-	-	N/A
Acc WC_L5	-	-	0.3	-	-	-	-	-	-	-	N/A
WC_L6	-	-	0.3	-	-	-	-	-	-	-	N/A
Acc WC_L6	-	-	0.3	-	-	-	-	-	-	-	N/A
WC_L7	-	-	0.3	-	-	-	-	-	-	-	N/A
Acc WC_L7	-	-	0.3	-	-	-	-	-	-	-	N/A
WC_L8	-	-	0.3	-	-	-	-	-	-	-	N/A
Acc WC_L8	-	-	0.3	-	-	-	-	-	-	-	N/A
Acc WC_B1	-	-	0.3	-	-	-	-	-	-	-	N/A
WC_B1	-	-	0.3	-	-	-	-	-	-	-	N/A
Acc Shower_B1	-	-	0.3	-	-	-	-	-	-	-	N/A
Drying Room_B1	-	-	0.3	-	-	-	-	-	-	-	N/A
WC_B1	-	-	0.3	-	-	-	-	-	-	-	N/A

General lighting and display lighting	General luminaire	Display light source	
Zone name	Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m²]
Standard value	95	80	0.3
Stairs_L0	100	-	-
Circulation_L0	100	-	-
Lobby_L0	100	-	-
WC_L0	100	-	-
Circulation_L0	100	-	-
Circulation_L0	100	-	-
Stairs_L0	100	-	-
Acc WC_L0	100	-	-
Stairs_L1	100	-	-
Circulation_L1	100	-	-
Lobby_L1	100	-	-
WC_L1	100	-	-
Circulation_L1	100	-	-
Circulation_L1	100	-	-
Stairs_L1	100	-	-
Acc WC_L1	100	-	-
Stairs_L2	100	-	-
Circulation_L2	100	-	-
Lobby_L2	100	-	-
WC_L2	100	-	-

General lighting and display lighting	General luminaire	Display light source	
Zone name	Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m²]
Standard value	95	80	0.3
Circulation_L2	100	-	-
Circulation_L2	100	-	-
Stairs_L2	100	-	-
Acc WC_L2	100	-	-
Stairs_L3	100	-	-
Circulation_L3	100	-	-
Lobby_L3	100	-	-
WC_L3	100	-	-
Circulation_L3	100	-	-
Circulation_L3	100	-	-
Stairs_L3	100	-	-
Acc WC_L3	100	-	-
Stairs_L4	100	-	-
Circulation_L4	100	-	-
Lobby_L4	100	-	-
WC_L4	100	-	-
Circulation_L4	100	-	-
Circulation_L4	100	-	-
Stairs_L4	100	-	-
Acc WC_L4	100	-	-
Stairs_L5	100	-	-
Acc WC_L4	100	-	-
Stairs_L5	100	-	-
Circulation_L5	100	-	-
Lobby_L5	100	-	-
WC_L5	100	-	-
Circulation_L5	100	-	-
Circulation_L5	100	-	-
Stairs_L5	100	-	-
Acc WC_L5	100	-	-
Stairs_L6	100	-	-
Circulation_L6	100	-	-
Lobby_L6	100	-	-
WC_L6	100	-	-
Circulation_L6	100	-	-
Circulation_L6	100	-	-
Stairs_L6	100	-	-
Acc WC_L6	100	-	-
Stairs_L7	100	-	-
Circulation_L7	100	-	-
Lobby_L7	100	-	-
WC_L7	100	-	-
Circulation_L7	100	-	-
Circulation_L7	100	-	-
Stairs_L7	100	-	-

General lighting and display lighting	General luminaire	Display light source	
Zone name	Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m²]
Standard value	95	80	0.3
Acc WC_L7	100	-	-
Lobby_L8	100	-	-
WC_L8	100	-	-
Circulation_L8	100	-	-
Circulation_L8	100	-	-
Stairs_L8	100	-	-
Acc WC_L8	100	-	-
Circulation_L8	100	-	-
Stairs_L8	100	-	-
Stairs_L8	100	-	-
Plant_L8	100	-	-
Plant_B1	100	-	-
Circulation_B1	100	-	-
Goods In Store_B1	100	-	-
Lobby_B1	100	-	-
Acc WC_B1	100	-	-
Circulation_B1	100	-	-
Stairs_B1	100	-	-
Comms Room_B1	100	-	-
Lab Support_B1	100	-	-
Plant_B1	100	-	-
Lab Support_B1	100	-	-
Plant_B1	100	-	-
Changing_B1	100	-	-
WC_B1	100	-	-
Acc Shower_B1	100	-	-
Drying Room_B1	100	-	-
WC_B1	100	-	-
Changing_B1	100	-	-
Post Room_B1	100	-	-
Circulation_B1	100	-	-
Cycle Store_B1	100	-	-
Switch Room_B1	100	-	-
Plant_B1	100	-	-
Office (P)_L0	100	-	-
Office_L7	100	-	-
Lab_L7	100	-	-
Lab_L0	100	-	-
Office (P)_L0	100	-	-
Office (P)_L0	100	-	-
Reception (P)_L0	100	80	1.688
Office_L0	100	-	-
Reception_L0	100	80	1.687
Office_L0	100	-	-
Lab_L1	100	-	-

General lighting and display lighting	General luminaire	Display light source	
Zone name	Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m²]
Standard value	95	80	0.3
Lab_L1	100	-	-
Office_L1	100	-	-
Office (P)_L1	100	-	-
Lab_L2	100	-	-
Lab_L2	100	-	-
Office_L2	100	-	-
Lab_L3	100	-	-
Lab_L3	100	-	-
Office_L3	100	-	-
Lab_L4	100	-	-
Lab_L4	100	-	-
Office_L4	100	-	-
Lab_L5	100	-	-
Lab_L5	100	-	-
Office_L5	100	-	-
Lab_L6	100	-	-
Lab_L6	100	-	-
Office_L6	100	-	-
Lab(P)_L6	100	-	-
Office(P)_L6	100	-	-
Bin Store_L0	100	-	-
Lab (P)_L0	100	-	-
Lab (P)_L1	100	-	-
Office(P)_L2	100	-	-
Lab(P)_L2	100	-	-
Office(P)_L3	100	-	-
Lab(P)_L3	100	-	-
Office(P)_L4	100	-	-
Lab(P)_L4	100	-	-
Office(P)_L5	100	-	-
Lab(P)_L5	100	-	-
Office(P)_L7	100	-	-
Lab(P)_L7	100	-	-
Store_L8	100	-	-
Office(P)_L8	100	-	-
Winter Garden_L8	100	-	-

The spaces in the building should have appropriate passive control measures to limit solar gains in summer

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Stairs_L0	N/A	N/A
Circulation_L0	N/A	N/A
Lobby_L0	N/A	N/A
WC_L0	N/A	N/A

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Circulation_L0	N/A	N/A
Circulation_L0	NO (-100%)	NO
Stairs_L0	N/A	N/A
Acc WC_L0	N/A	N/A
Stairs_L1	N/A	N/A
Circulation_L1	N/A	N/A
Lobby_L1	N/A	N/A
WC_L1	N/A	N/A
Circulation_L1	N/A	N/A
Circulation_L1	N/A	N/A
Stairs_L1	NO (-100%)	NO
Acc WC_L1	N/A	N/A
Stairs_L2	N/A	N/A
Circulation_L2	N/A	N/A
Lobby_L2	N/A	N/A
WC_L2	N/A	N/A
Circulation_L2	N/A	N/A
Circulation_L2	N/A	N/A
Stairs_L2	N/A	N/A
Acc WC_L2	N/A	N/A
Stairs_L3	N/A	N/A
Circulation_L3	N/A	N/A
Lobby_L3	N/A	N/A
WC_L3	N/A	N/A
Circulation_L3	N/A	N/A
Circulation_L3	N/A	N/A
Stairs_L3	N/A	N/A
Acc WC_L3	N/A	N/A
Stairs_L4	N/A	N/A
Circulation_L4	N/A	N/A
Lobby_L4	N/A	N/A
WC_L4	N/A	N/A
Circulation_L4	N/A	N/A
Circulation_L4	N/A	N/A
Stairs_L4	N/A	N/A
Acc WC_L4	N/A	N/A
Stairs_L5	N/A	N/A
Circulation_L5	N/A	N/A
Lobby_L5	N/A	N/A
WC_L5	N/A	N/A
Circulation_L5	N/A	N/A
Circulation_L5	N/A	N/A
Stairs_L5	N/A	N/A
Acc WC_L5	N/A	N/A
Stairs_L6	N/A	N/A
Circulation_L6	N/A	N/A
Lobby_L6	N/A	N/A
WC_L6	N/A	N/A
Circulation_L6	N/A	N/A

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Circulation_L6	N/A	N/A
Stairs_L6	N/A	N/A
Acc WC_L6	N/A	N/A
Stairs_L7	N/A	N/A
Circulation_L7	N/A	N/A
Lobby_L7	N/A	N/A
WC_L7	N/A	N/A
Circulation_L7	N/A	N/A
Circulation_L7	N/A	N/A
Stairs_L7	N/A	N/A
Acc WC_L7	N/A	N/A
Lobby_L8	N/A	N/A
WC_L8	N/A	N/A
Circulation_L8	N/A	N/A
Circulation_L8	N/A	N/A
Stairs_L8	N/A	N/A
Acc WC_L8	N/A	N/A
Circulation_L8	N/A	N/A
Stairs_L8	N/A	N/A
Stairs_L8	N/A	N/A
Circulation_B1	N/A	N/A
Lobby_B1	N/A	N/A
Acc WC_B1	N/A	N/A
Circulation_B1	NO (-100%)	NO
Acc WC_B1	N/A	N/A
Circulation_B1	NO (-100%)	NO
Stairs_B1	N/A	N/A
Comms Room_B1	N/A	N/A
Lab Support_B1	N/A	N/A
Changing_B1	NO (-100%)	NO
WC_B1	NO (-99.8%)	NO
Acc Shower_B1	N/A	N/A
Drying Room_B1	NO (-100%)	NO
WC_B1	N/A	N/A
Changing_B1	N/A	N/A
Circulation_B1	NO (-100%)	NO
Cycle Store_B1	N/A	N/A
Office (P)_L0	NO (-56.8%)	NO
Office_L7	NO (-67.7%)	NO
Lab_L7	NO (-34.3%)	NO
Lab_L0	NO (-59.6%)	NO
Office (P)_L0	YES (+54%)	NO
Office (P)_L0	YES (+22.4%)	NO
Reception (P)_L0	YES (+130.9%)	NO
Office_L0	NO (-35.3%)	NO
Reception_L0	YES (+134.5%)	NO
Office_L0	YES (+77.9%)	NO
Lab_L1	N/A	N/A
Lab_L1	NO (-60.8%)	NO
Office_L1	YES (+27%)	NO
Office (P)_L1	YES (+28.5%)	NO

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Lab_L2	N/A	N/A
Lab_L2	NO (-66.9%)	NO
Office_L2	YES (+79.3%)	NO
Lab_L3	N/A	N/A
Lab_L3	NO (-63.4%)	NO
Office_L3	YES (+63.5%)	NO
Lab_L4	N/A	N/A
Lab_L4	NO (-61.1%)	NO
Office_L4	YES (+63.9%)	NO
Lab_L5	N/A	N/A
Lab_L5	NO (-59.8%)	NO
Office_L5	YES (+64.9%)	NO
Lab_L6	N/A	N/A
Lab_L6	NO (-56%)	NO
Office_L6	YES (+50.3%)	NO
Lab(P)_L6	YES (+79.7%)	NO
Office(P)_L6	YES (+4%)	NO
Lab (P)_L0	YES (+33.1%)	NO
Lab (P)_L1	YES (+60.3%)	NO
Office(P)_L2	YES (+32.4%)	NO
Lab(P)_L2	YES (+36.9%)	NO
Office(P)_L3	YES (+19%)	NO
Lab(P)_L3	YES (+49.7%)	NO
Office(P)_L4	YES (+18.2%)	NO
Lab(P)_L4	YES (+58.4%)	NO
Office(P)_L5	YES (+18.7%)	NO
Lab(P)_L5	YES (+65%)	NO
Office(P)_L7	YES (+26.8%)	NO
Lab(P)_L7	YES (+82.7%)	NO
Office(P)_L8	YES (+22.4%)	NO
Winter Garden_L8	YES (+123%)	NO

Regulation 25A: Consideration of high efficiency alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Floor area [m²]	6213.4	6213.4
External area [m²]	4596.4	4596.4
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	21	4
Average conductance [W/K]	6726.32	1580.33
Average U-value [W/m²K]	1.46	0.34
Alpha value* [%]	25.2	10

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

Building Use

% Area	Building Type
	Retail/Financial and Professional Services
	Restaurants and Cafes/Drinking Establishments/Takeaways
63	**Offices and Workshop Businesses**
37	**General Industrial and Special Industrial Groups**
	Storage or Distribution
	Hotels
	Residential Institutions: Hospitals and Care Homes
	Residential Institutions: Residential Schools
	Residential Institutions: Universities and Colleges
	Secure Residential Institutions
	Residential Spaces
	Non-residential Institutions: Community/Day Centre
	Non-residential Institutions: Libraries, Museums, and Galleries
	Non-residential Institutions: Education
	Non-residential Institutions: Primary Health Care Building
	Non-residential Institutions: Crown and County Courts
	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/m²]

	Actual	Notional
Heating	10.52	0.82
Cooling	1.72	2.39
Auxiliary	32.31	36.94
Lighting	15.94	20.84
Hot water	8.59	7.43
Equipment*	40.14	40.14
TOTAL**	**69.08**	**68.42**

* 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/m²]

	Actual	Notional
Photovoltaic systems	0.7	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
Displaced electricity	*0.7*	*0*

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	163.59	41.35
Primary energy [kWh_{PE}/m²]	101.46	100.84
Total emissions [kg/m²]	9.41	9.23

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] Variable refrigerant flow, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	83.3	48.7	5.9	5.1	4.5	3.92	2.67	4	4
	Notional	5.2	91.8	0.5	5.5	7.7	2.78	4.63	---	---
[ST] Constant volume system (variable fresh air rate), [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	208.2	2.6	16.2	0.3	33	3.57	2.31	4	4
	Notional	6	41	0.6	2.5	17.1	2.78	4.63	---	---
[ST] Constant volume system (variable fresh air rate), [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	120.9	10.3	9.4	1.2	18.4	3.57	2.31	4	4
	Notional	5.3	52.3	0.5	3.1	7.6	2.78	4.63	---	---
[ST] Variable refrigerant flow, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	186.7	12.7	13.2	1.3	2.3	3.92	2.67	4	4
	Notional	11.3	34.3	1.1	3.4	8.3	2.78	2.84	---	---
[ST] Single room cooling system, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	0	0	0	0	0	2.45	1.49	2.5	2
	Notional	0	0	0	0	0	2.78	4.63	---	---
[ST] Variable refrigerant flow, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	523.3	49.8	37.1	4.1	2.3	3.92	3.34	4	5
	Notional	58	19.8	5.8	1.9	8	2.78	2.84	---	---
[ST] Variable refrigerant flow, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	146.4	10.7	10.4	1.1	77.4	3.92	2.67	4	4
	Notional	6.5	11.3	0.7	0.7	87.1	2.78	4.63	---	---
[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

APPENDIX F – NON-DOMESTIC BRUKL REPORTS – PART L 2021 CLAUSE 10.11

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2021

Project name

Tavis House - Notional Extension As designed

Date: Wed Mar 20 12:04:08 2024

Administrative information

Building Details

Address:

Certifier details

Name:

Telephone number:

Address: , ,

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.25

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.25

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

Foundation area [m²]: 653

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

Target CO_2 emission rate (TER), $kgCO_2/m^2annum$	10.78	
Building CO_2 emission rate (BER), $kgCO_2/m^2annum$	10.75	
Target primary energy rate (TPER), kWh_{PE}/m^2annum	117.59	
Building primary energy rate (BPER), kWh_{PE}/m^2annum	115.99	
Do the building's emission and primary energy rates exceed the targets?	BER =< TER	BPER =< TPER

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

Fabric element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	First surface with maximum value
Walls*	0.26	1.32	1.7	B1000000:Surf[3]
Floors	0.18	0.41	0.45	GF000003:Surf[0]
Pitched roofs	0.16	-	-	No pitched roofs in building
Flat roofs	0.18	1.24	2.3	B1000000:Surf[1]
Windows** and roof windows	1.6	1.85	2	FF00001B:Surf[3]
Rooflights***	2.2	1.4	1.4	WN000000:Surf[16]
Personnel doors^	1.6	1.2	1.2	CR000016:Surf[0]
Vehicle access & similar large doors	1.3	-	-	No vehicle access doors in building
High usage entrance doors	3	-	-	No high usage entrance doors in building

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [W/(m²K)] $U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [W/(m²K)]

$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [W/(m²K)]

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

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

^ For fire doors, limiting U-value is 1.8 W/m²K

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

Air permeability	Limiting standard	This building
$m^3/(h.m^2)$ at 50 Pa	8	22.1

Building services

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

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

1- HVAC-1

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4	4	0	1.6	0.75
Standard value	2.5*	N/A	N/A	2^	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.

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

2- HVAC-3

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4	4	0	1.6	0.75
Standard value	2.5*	N/A	N/A	2^	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.

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

3- HVAC-2

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4	4	0	1.6	0.75
Standard value	2.5*	N/A	N/A	2^	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.

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

4- HVAC-6

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4	4	0	1.6	0.75
Standard value	2.5*	N/A	N/A	2^	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.

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

5- HVAC-4

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	2.5	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.

6- HVAC-1 (MM)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4	4	0	1.6	0.75
Standard value	2.5*	N/A	N/A	2^	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.

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

7- HVAC-5

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	2.8	3.65	0	1.6	0.75
Standard value	2.5*	N/A	N/A	2^	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.

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

1- DHW-1

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	1	-
Standard value	1	N/A

2- DHW-2

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	2.2	-
Standard value	2*	N/A

* Standard shown is for all types except absorption and gas engine heat pumps.

Zone-level mechanical ventilation, exhaust, and terminal units

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

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

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	2.3	2	0.5	0.5	0.4	1	Zone	Standard
WC_L0	-	-	0.3	-	-	-	-	-	-	-	N/A
Acc WC_L0	-	-	0.3	-	-	-	-	-	-	-	N/A
WC_L1	-	-	0.3	-	-	-	-	-	-	-	N/A
Acc WC_L1	-	-	0.3	-	-	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	2.3	2	0.5	0.5	0.4	1	Zone	Standard
WC_L2	-	-	0.3	-	-	-	-	-	-	-	N/A
Acc WC_L2	-	-	0.3	-	-	-	-	-	-	-	N/A
WC_L3	-	-	0.3	-	-	-	-	-	-	-	N/A
Acc WC_L3	-	-	0.3	-	-	-	-	-	-	-	N/A
WC_L4	-	-	0.3	-	-	-	-	-	-	-	N/A
Acc WC_L4	-	-	0.3	-	-	-	-	-	-	-	N/A
WC_L5	-	-	0.3	-	-	-	-	-	-	-	N/A
Acc WC_L5	-	-	0.3	-	-	-	-	-	-	-	N/A
WC_L6	-	-	0.3	-	-	-	-	-	-	-	N/A
Acc WC_L6	-	-	0.3	-	-	-	-	-	-	-	N/A
WC_L7	-	-	0.3	-	-	-	-	-	-	-	N/A
Acc WC_L7	-	-	0.3	-	-	-	-	-	-	-	N/A
WC_L8	-	-	0.3	-	-	-	-	-	-	-	N/A
Acc WC_L8	-	-	0.3	-	-	-	-	-	-	-	N/A
Acc WC_B1	-	-	0.3	-	-	-	-	-	-	-	N/A
WC_B1	-	-	0.3	-	-	-	-	-	-	-	N/A
Acc Shower_B1	-	-	0.3	-	-	-	-	-	-	-	N/A
Drying Room_B1	-	-	0.3	-	-	-	-	-	-	-	N/A
WC_B1	-	-	0.3	-	-	-	-	-	-	-	N/A
Winter Garden_L8	-	-	-	-	-	-	-	0.3	-	-	N/A

General lighting and display lighting	General luminaire	Display light source	
Zone name	Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m²]
Standard value	95	80	0.3
Circulation_L0	100	-	-
Stairs_L0	100	-	-
Circulation_L0	100	-	-
Lobby_L0	100	-	-
WC_L0	100	-	-
Circulation_L0	100	-	-
Circulation_L0	100	-	-
Stairs_L0	100	-	-
Circulation_L0	100	-	-
Acc WC_L0	100	-	-
Stairs_L1	100	-	-
Circulation_L1	100	-	-
Lobby_L1	100	-	-
WC_L1	100	-	-
Circulation_L1	100	-	-
Circulation_L1	100	-	-
Stairs_L1	100	-	-
Acc WC_L1	100	-	-
Stairs_L2	100	-	-

General lighting and display lighting	General luminaire	Display light source	
Zone name	Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m²]
Standard value	95	80	0.3
Circulation_L2	100	-	-
Lobby_L2	100	-	-
WC_L2	100	-	-
Circulation_L2	100	-	-
Circulation_L2	100	-	-
Stairs_L2	100	-	-
Acc WC_L2	100	-	-
Lab (P)_L2	100	-	-
Stairs_L3	100	-	-
Circulation_L3	100	-	-
Lobby_L3	100	-	-
WC_L3	100	-	-
Circulation_L3	100	-	-
Circulation_L3	100	-	-
Stairs_L3	100	-	-
Acc WC_L3	100	-	-
Lab (P)_L3	100	-	-
Stairs_L4	100	-	-
Circulation_L4	100	-	-
Lobby_L4	100	-	-
WC_L4	100	-	-
Circulation_L4	100	-	-
Circulation_L4	100	-	-
Stairs_L4	100	-	-
Acc WC_L4	100	-	-
Lab (P)_L4	100	-	-
Stairs_L5	100	-	-
Circulation_L5	100	-	-
Lobby_L5	100	-	-
WC_L5	100	-	-
Circulation_L5	100	-	-
Circulation_L5	100	-	-
Stairs_L5	100	-	-
Acc WC_L5	100	-	-
Lab (P)_L5	100	-	-
Stairs_L6	100	-	-
Circulation_L6	100	-	-
Lobby_L6	100	-	-
WC_L6	100	-	-
Circulation_L6	100	-	-
Circulation_L6	100	-	-
Stairs_L6	100	-	-
Acc WC_L6	100	-	-

General lighting and display lighting	General luminaire	Display light source	
Zone name	Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m²]
Standard value	95	80	0.3
Lab (P)_L6	100	-	-
Stairs_L7	100	-	-
Circulation_L7	100	-	-
Lobby_L7	100	-	-
WC_L7	100	-	-
Circulation_L7	100	-	-
Circulation_L7	100	-	-
Stairs_L7	100	-	-
Acc WC_L7	100	-	-
Lab (P)_L7	100	-	-
Lobby_L8	100	-	-
WC_L8	100	-	-
Circulation_L8	100	-	-
Circulation_L8	100	-	-
Stairs_L8	100	-	-
Acc WC_L8	100	-	-
Circulation_L8	100	-	-
Stairs_L8	100	-	-
Stairs_L8	100	-	-
Plant_L8	100	-	-
Plant_B1	100	-	-
Circulation_B1	100	-	-
Goods In Store_B1	100	-	-
Lobby_B1	100	-	-
Acc WC_B1	100	-	-
Circulation_B1	100	-	-
Stairs_B1	100	-	-
Comms Room_B1	100	-	-
Lab Support_B1	100	-	-
Plant_B1	100	-	-
Changing_B1	100	-	-
WC_B1	100	-	-
Acc Shower_B1	100	-	-
Drying Room_B1	100	-	-
WC_B1	100	-	-
Changing_B1	100	-	-
Post Room_B1	100	-	-
Circulation_B1	100	-	-
Cycle Store_B1	100	-	-
Switch Room_B1	100	-	-
Plant_B1	100	-	-
Goods Office_L0	100	-	-
Office (P)_L0	100	-	-

General lighting and display lighting	General luminaire	Display light source	
Zone name	Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m²]
Standard value	95	80	0.3
Lab (P)_L1	100	-	-
Office_L7	100	-	-
Lab_L7	100	-	-
Lab_L0	100	-	-
Office (P)_L0	100	-	-
Office (P)_L0	100	-	-
Reception (P)_L0	100	80	1.688
Office_L0	100	-	-
Reception_L0	100	80	1.687
Office_L0	100	-	-
Lab_L1	100	-	-
Lab_L1	100	-	-
Office_L1	100	-	-
Office (P)_L1	100	-	-
Lab_L2	100	-	-
Lab_L2	100	-	-
Office_L2	100	-	-
Lab_L3	100	-	-
Lab_L3	100	-	-
Office_L3	100	-	-
Lab_L4	100	-	-
Lab_L4	100	-	-
Lab_L4	100	-	-
Office_L4	100	-	-
Lab_L5	100	-	-
Lab_L5	100	-	-
Office_L5	100	-	-
Lab_L6	100	-	-
Lab_L6	100	-	-
Office_L6	100	-	-
Lab(P)_L6	100	-	-
Office(P)_L6	100	-	-
Bin Store_L0	100	-	-
Lab (P)_L0	100	-	-
Lab (P)_L1	100	-	-
Office(P)_L2	100	-	-
Lab(P)_L2	100	-	-
Office(P)_L3	100	-	-
Lab(P)_L3	100	-	-
Office(P)_L4	100	-	-
Lab(P)_L4	100	-	-
Office(P)_L5	100	-	-
Lab(P)_L5	100	-	-
Office(P)_L7	100	-	-

General lighting and display lighting	General luminaire	Display light source	
Zone name	Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m²]
Standard value	95	80	0.3
Lab(P)_L7	100	-	-
Store_L8	100	-	-
Office(P)_L8	100	-	-
Winter Garden_L8	100	-	-

The spaces in the building should have appropriate passive control measures to limit solar gains in summer

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Circulation_L0	NO (-79.9%)	NO
Stairs_L0	N/A	N/A
Circulation_L0	N/A	N/A
Lobby_L0	N/A	N/A
WC_L0	N/A	N/A
Circulation_L0	N/A	N/A
Circulation_L0	NO (-100%)	NO
Stairs_L0	N/A	N/A
Circulation_L0	NO (-85.6%)	NO
Acc WC_L0	N/A	N/A
Stairs_L1	N/A	N/A
Circulation_L1	N/A	N/A
Lobby_L1	N/A	N/A
WC_L1	N/A	N/A
Circulation_L1	N/A	N/A
Circulation_L1	N/A	N/A
Stairs_L1	NO (-100%)	NO
Acc WC_L1	N/A	N/A
Stairs_L2	N/A	N/A
Circulation_L2	N/A	N/A
Lobby_L2	N/A	N/A
WC_L2	N/A	N/A
Circulation_L2	N/A	N/A
Circulation_L2	N/A	N/A
Stairs_L2	N/A	N/A
Acc WC_L2	N/A	N/A
Lab (P)_L2	NO (-54.4%)	NO
Stairs_L3	N/A	N/A
Circulation_L3	N/A	N/A
Lobby_L3	N/A	N/A
WC_L3	N/A	N/A
Circulation_L3	N/A	N/A
Circulation_L3	N/A	N/A
Stairs_L3	N/A	N/A
Acc WC_L3	N/A	N/A
Lab (P)_L3	NO (-48.2%)	NO

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Stairs_L4	N/A	N/A
Circulation_L4	N/A	N/A
Lobby_L4	N/A	N/A
WC_L4	N/A	N/A
Circulation_L4	N/A	N/A
Circulation_L4	N/A	N/A
Stairs_L4	N/A	N/A
Acc WC_L4	N/A	N/A
Lab (P)_L4	NO (-47.2%)	NO
Stairs_L5	N/A	N/A
Circulation_L5	N/A	N/A
Lobby_L5	N/A	N/A
WC_L5	N/A	N/A
Circulation_L5	N/A	N/A
Circulation_L5	N/A	N/A
Stairs_L5	N/A	N/A
Acc WC_L5	N/A	N/A
Lab (P)_L5	NO (-46.5%)	NO
Stairs_L6	N/A	N/A
Circulation_L6	N/A	N/A
Lobby_L6	N/A	N/A
WC_L6	N/A	N/A
Circulation_L6	N/A	N/A
Circulation_L6	N/A	N/A
Stairs_L6	N/A	N/A
Acc WC_L6	N/A	N/A
Lab (P)_L6	NO (-45.3%)	NO
Stairs_L7	N/A	N/A
Circulation_L7	N/A	N/A
Lobby_L7	N/A	N/A
WC_L7	N/A	N/A
Circulation_L7	N/A	N/A
Circulation_L7	N/A	N/A
Stairs_L7	N/A	N/A
Acc WC_L7	N/A	N/A
Lab (P)_L7	NO (-35.4%)	NO
Lobby_L8	N/A	N/A
WC_L8	N/A	N/A
Circulation_L8	N/A	N/A
Circulation_L8	N/A	N/A
Stairs_L8	N/A	N/A
Acc WC_L8	N/A	N/A
Circulation_L8	N/A	N/A
Stairs_L8	N/A	N/A
Stairs_L8	N/A	N/A
Circulation_B1	N/A	N/A
Lobby_B1	N/A	N/A
Acc WC_B1	N/A	N/A
Circulation_B1	NO (-100%)	NO

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Stairs_B1	N/A	N/A
Comms Room_B1	N/A	N/A
Lab Support_B1	N/A	N/A
Changing_B1	NO (-100%)	NO
WC_B1	NO (-99.8%)	NO
Acc Shower_B1	N/A	N/A
Drying Room_B1	NO (-100%)	NO
WC_B1	N/A	N/A
Changing_B1	N/A	N/A
Circulation_B1	NO (-100%)	NO
Cycle Store_B1	N/A	N/A
Goods Office_L0	NO (-81%)	NO
Office (P)_L0	NO (-56.8%)	NO
Lab (P)_L1	NO (-53%)	NO
Office_L7	NO (-67.7%)	NO
Lab_L7	NO (-30.2%)	NO
Lab_L0	NO (-59.6%)	NO
Office (P)_L0	YES (+54%)	NO
Office (P)_L0	YES (+22.4%)	NO
Reception (P)_L0	YES (+130.9%)	NO
Office_L0	NO (-35.3%)	NO
Reception_L0	YES (+134.5%)	NO
Office_L0	YES (+77.9%)	NO
Lab_L1	NO (-89.8%)	NO
Lab_L1	NO (-57.5%)	NO
Office_L1	YES (+27%)	NO
Office (P)_L1	YES (+28.5%)	NO
Lab_L2	NO (-89.3%)	NO
Lab_L2	NO (-63.6%)	NO
Office_L2	YES (+79.3%)	NO
Lab_L3	NO (-86.8%)	NO
Lab_L3	NO (-59.7%)	NO
Office_L3	YES (+63.5%)	NO
Lab_L4	NO (-86.4%)	NO
Lab_L4	NO (-57.3%)	NO
Office_L4	YES (+63.9%)	NO
Lab_L5	NO (-86.2%)	NO
Lab_L5	NO (-55.9%)	NO
Office_L5	YES (+64.9%)	NO
Lab_L6	NO (-86%)	NO
Lab_L6	NO (-52.1%)	NO
Office_L6	YES (+50.3%)	NO
Lab(P)_L6	YES (+80.6%)	NO
Office(P)_L6	YES (+4%)	NO
Lab (P)_L0	YES (+33.1%)	NO
Lab (P)_L1	YES (+61.1%)	NO
Office(P)_L2	YES (+32.4%)	NO
Lab(P)_L2	YES (+37.6%)	NO
Office(P)_L3	YES (+19%)	NO

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Lab(P)_L3	YES (+50.5%)	NO
Office(P)_L4	YES (+18.2%)	NO
Lab(P)_L4	YES (+59.3%)	NO
Office(P)_L5	YES (+18.7%)	NO
Lab(P)_L5	YES (+65.8%)	NO
Office(P)_L7	YES (+26.8%)	NO
Lab(P)_L7	YES (+84%)	NO
Office(P)_L8	YES (+22.4%)	NO
Winter Garden_L8	YES (+123%)	NO

Regulation 25A: Consideration of high efficiency alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Floor area [m²]	7604.5	7604.5
External area [m²]	5918	5918
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	22	4
Average conductance [W/K]	7549.75	1973.44
Average U-value [W/m²K]	1.28	0.33
Alpha value* [%]	25.05	10

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

Building Use

% Area	Building Type
	Retail/Financial and Professional Services
	Restaurants and Cafes/Drinking Establishments/Takeaways
52	**Offices and Workshop Businesses**
48	**General Industrial and Special Industrial Groups**
	Storage or Distribution
	Hotels
	Residential Institutions: Hospitals and Care Homes
	Residential Institutions: Residential Schools
	Residential Institutions: Universities and Colleges
	Secure Residential Institutions
	Residential Spaces
	Non-residential Institutions: Community/Day Centre
	Non-residential Institutions: Libraries, Museums, and Galleries
	Non-residential Institutions: Education
	Non-residential Institutions: Primary Health Care Building
	Non-residential Institutions: Crown and County Courts
	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/m²]

	Actual	Notional
Heating	10.29	1.02
Cooling	1.42	1.83
Auxiliary	40.48	45.78
Lighting	17.59	24.32
Hot water	9.11	6.79
Equipment*	38.18	38.18
TOTAL**	**78.9**	**79.74**

* 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/m²]

	Actual	Notional
Photovoltaic systems	0.7	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
Displaced electricity	*0.7*	*0*

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	152.97	35.62
Primary energy [kWh_{PE}/m²]	115.99	117.59
Total emissions [kg/m²]	10.75	10.78

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] Variable refrigerant flow, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	104.4	40.9	7.4	4.3	4.6	3.92	2.67	4	4
	Notional	12.9	72	1.3	4.3	7.7	2.78	4.63	---	---
[ST] Constant volume system (variable fresh air rate), [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	211.8	2.4	16.5	0.3	33.1	3.57	2.31	4	4
	Notional	6.9	37.5	0.7	2.3	17.1	2.78	4.63	---	---
[ST] Constant volume system (variable fresh air rate), [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	138.1	7.1	10.8	0.9	18.5	3.57	2.31	4	4
	Notional	8.8	39.1	0.9	2.3	7.5	2.78	4.63	---	---
[ST] Variable refrigerant flow, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	190.1	12.2	13.5	1.3	2.3	3.92	2.67	4	4
	Notional	12.5	32.2	1.3	3.1	8.2	2.78	2.84	---	---
[ST] Single room cooling system, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	0	0	0	0	0	2.45	1.49	2.5	2
	Notional	0	0	0	0	0	2.78	4.63	---	---
[ST] Fan coil systems, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	524.6	49.5	57.9	4.8	18.6	2.52	2.86	2.8	3.65
	Notional	58.9	19.4	5.9	1.9	11.1	2.78	2.84	---	---
[ST] Variable refrigerant flow, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	121.9	9	8.6	0.9	77.4	3.92	2.67	4	4
	Notional	8.3	10.6	0.8	0.6	87.1	2.78	4.63	---	---
[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

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2021

Project name

Tavis House - Be Green

As designed

Date: Wed Mar 20 14:13:10 2024

Administrative information

Building Details

Address:

Certifier details

Name:

Telephone number:

Address: , ,

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.25

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.25

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

Foundation area [m²]: 653

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

Target CO_2 emission rate (TER), $kgCO_2/m^2annum$	10.78	
Building CO_2 emission rate (BER), $kgCO_2/m^2annum$	10.68	
Target primary energy rate (TPER), kWh_{PE}/m^2annum	117.59	
Building primary energy rate (BPER), kWh_{PE}/m^2annum	115.2	
Do the building's emission and primary energy rates exceed the targets?	BER =< TER	BPER =< TPER

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

Fabric element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	First surface with maximum value
Walls*	0.26	1.3	1.7	B1000000:Surf[3]
Floors	0.18	0.4	0.45	GF000003:Surf[0]
Pitched roofs	0.16	-	-	No pitched roofs in building
Flat roofs	0.18	1.23	2.3	B1000000:Surf[1]
Windows** and roof windows	1.6	1.72	2	FF00001B:Surf[3]
Rooflights***	2.2	1.4	1.4	WN000000:Surf[16]
Personnel doors^	1.6	1.2	1.2	CR000016:Surf[0]
Vehicle access & similar large doors	1.3	-	-	No vehicle access doors in building
High usage entrance doors	3	-	-	No high usage entrance doors in building

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

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

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

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

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

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

Air permeability	Limiting standard	This building
$m^3/(h.m^2)$ at 50 Pa	8	21.25

Building services

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

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

1- HVAC-1

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4	4	0	1.6	0.75
Standard value	2.5*	N/A	N/A	2^	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.

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

2- HVAC-3

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4	4	0	1.6	0.75
Standard value	2.5*	N/A	N/A	2^	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.

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

3- HVAC-2

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4	4	0	1.6	0.75
Standard value	2.5*	N/A	N/A	2^	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.

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

4- HVAC-6

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4	4	0	1.6	0.75
Standard value	2.5*	N/A	N/A	2^	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.

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

5- HVAC-4

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	2.5	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.

6- HVAC-1 (MM)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4	4	0	1.6	0.75
Standard value	2.5*	N/A	N/A	2^	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.

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

7- HVAC-5

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	2.8	3.65	0	1.6	0.75
Standard value	2.5*	N/A	N/A	2^	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.

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

1- DHW-1

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	1	-
Standard value	1	N/A

2- DHW-2

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	2.2	-
Standard value	2*	N/A

* Standard shown is for all types except absorption and gas engine heat pumps.

Zone-level mechanical ventilation, exhaust, and terminal units

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

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

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	2.3	2	0.5	0.5	0.4	1	Zone	Standard
WC_L0	-	-	0.3	-	-	-	-	-	-	-	N/A
Acc WC_L0	-	-	0.3	-	-	-	-	-	-	-	N/A
WC_L1	-	-	0.3	-	-	-	-	-	-	-	N/A
Acc WC_L1	-	-	0.3	-	-	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	2.3	2	0.5	0.5	0.4	1	Zone	Standard
WC_L2	-	-	0.3	-	-	-	-	-	-	-	N/A
Acc WC_L2	-	-	0.3	-	-	-	-	-	-	-	N/A
WC_L3	-	-	0.3	-	-	-	-	-	-	-	N/A
Acc WC_L3	-	-	0.3	-	-	-	-	-	-	-	N/A
WC_L4	-	-	0.3	-	-	-	-	-	-	-	N/A
Acc WC_L4	-	-	0.3	-	-	-	-	-	-	-	N/A
WC_L5	-	-	0.3	-	-	-	-	-	-	-	N/A
Acc WC_L5	-	-	0.3	-	-	-	-	-	-	-	N/A
WC_L6	-	-	0.3	-	-	-	-	-	-	-	N/A
Acc WC_L6	-	-	0.3	-	-	-	-	-	-	-	N/A
WC_L7	-	-	0.3	-	-	-	-	-	-	-	N/A
Acc WC_L7	-	-	0.3	-	-	-	-	-	-	-	N/A
WC_L8	-	-	0.3	-	-	-	-	-	-	-	N/A
Acc WC_L8	-	-	0.3	-	-	-	-	-	-	-	N/A
Acc WC_B1	-	-	0.3	-	-	-	-	-	-	-	N/A
WC_B1	-	-	0.3	-	-	-	-	-	-	-	N/A
Acc Shower_B1	-	-	0.3	-	-	-	-	-	-	-	N/A
Drying Room_B1	-	-	0.3	-	-	-	-	-	-	-	N/A
WC_B1	-	-	0.3	-	-	-	-	-	-	-	N/A
Winter Garden_L8	-	-	-	-	-	-	-	0.3	-	-	N/A

General lighting and display lighting	General luminaire	Display light source	
Zone name	Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m²]
Standard value	95	80	0.3
Circulation_L0	100	-	-
Stairs_L0	100	-	-
Circulation_L0	100	-	-
Lobby_L0	100	-	-
WC_L0	100	-	-
Circulation_L0	100	-	-
Circulation_L0	100	-	-
Stairs_L0	100	-	-
Circulation_L0	100	-	-
Acc WC_L0	100	-	-
Stairs_L1	100	-	-
Circulation_L1	100	-	-
Lobby_L1	100	-	-
WC_L1	100	-	-
Circulation_L1	100	-	-
Circulation_L1	100	-	-
Stairs_L1	100	-	-
Acc WC_L1	100	-	-
Stairs_L2	100	-	-

General lighting and display lighting	General luminaire	Display light source	
Zone name	Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m²]
Standard value	95	80	0.3
Circulation_L2	100	-	-
Lobby_L2	100	-	-
WC_L2	100	-	-
Circulation_L2	100	-	-
Circulation_L2	100	-	-
Stairs_L2	100	-	-
Acc WC_L2	100	-	-
Lab (P)_L2	100	-	-
Stairs_L3	100	-	-
Circulation_L3	100	-	-
Lobby_L3	100	-	-
WC_L3	100	-	-
Circulation_L3	100	-	-
Circulation_L3	100	-	-
Stairs_L3	100	-	-
Acc WC_L3	100	-	-
Lab (P)_L3	100	-	-
Stairs_L4	100	-	-
Circulation_L4	100	-	-
Lobby_L4	100	-	-
WC_L4	100	-	-
Circulation_L4	100	-	-
Circulation_L4	100	-	-
Stairs_L4	100	-	-
Acc WC_L4	100	-	-
Lab (P)_L4	100	-	-
Stairs_L5	100	-	-
Circulation_L5	100	-	-
Lobby_L5	100	-	-
WC_L5	100	-	-
Circulation_L5	100	-	-
Circulation_L5	100	-	-
Stairs_L5	100	-	-
Acc WC_L5	100	-	-
Lab (P)_L5	100	-	-
Stairs_L6	100	-	-
Circulation_L6	100	-	-
Lobby_L6	100	-	-
WC_L6	100	-	-
Circulation_L6	100	-	-
Circulation_L6	100	-	-
Stairs_L6	100	-	-
Acc WC_L6	100	-	-

General lighting and display lighting	General luminaire	Display light source	
Zone name	Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m²]
Standard value	95	80	0.3
Lab (P)_L6	100	-	-
Stairs_L7	100	-	-
Circulation_L7	100	-	-
Lobby_L7	100	-	-
WC_L7	100	-	-
Circulation_L7	100	-	-
Circulation_L7	100	-	-
Stairs_L7	100	-	-
Acc WC_L7	100	-	-
Lab (P)_L7	100	-	-
Lobby_L8	100	-	-
WC_L8	100	-	-
Circulation_L8	100	-	-
Circulation_L8	100	-	-
Stairs_L8	100	-	-
Acc WC_L8	100	-	-
Circulation_L8	100	-	-
Stairs_L8	100	-	-
Stairs_L8	100	-	-
Plant_L8	100	-	-
Plant_B1	100	-	-
Circulation_B1	100	-	-
Plant_B1	100	-	-
Circulation_B1	100	-	-
Goods In Store_B1	100	-	-
Lobby_B1	100	-	-
Acc WC_B1	100	-	-
Circulation_B1	100	-	-
Stairs_B1	100	-	-
Comms Room_B1	100	-	-
Lab Support_B1	100	-	-
Plant_B1	100	-	-
Changing_B1	100	-	-
WC_B1	100	-	-
Acc Shower_B1	100	-	-
Drying Room_B1	100	-	-
WC_B1	100	-	-
Changing_B1	100	-	-
Post Room_B1	100	-	-
Circulation_B1	100	-	-
Cycle Store_B1	100	-	-
Switch Room_B1	100	-	-
Plant_B1	100	-	-
Goods Office_L0	100	-	-
Office (P)_L0	100	-	-

General lighting and display lighting	General luminaire	Display light source	
Zone name	Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m²]
Standard value	95	80	0.3
Lab (P)_L1	100	-	-
Office_L7	100	-	-
Lab_L7	100	-	-
Lab_L0	100	-	-
Office (P)_L0	100	-	-
Office (P)_L0	100	-	-
Reception (P)_L0	100	80	1.688
Office_L0	100	-	-
Reception_L0	100	80	1.687
Office_L0	100	-	-
Lab_L1	100	-	-
Lab_L1	100	-	-
Office_L1	100	-	-
Office (P)_L1	100	-	-
Lab_L2	100	-	-
Lab_L2	100	-	-
Office_L2	100	-	-
Lab_L3	100	-	-
Lab_L3	100	-	-
Office_L3	100	-	-
Lab_L4	100	-	-
Lab_L4	100	-	-
Lab_L4	100	-	-
Office_L4	100	-	-
Lab_L5	100	-	-
Lab_L5	100	-	-
Office_L5	100	-	-
Lab_L6	100	-	-
Lab_L6	100	-	-
Office_L6	100	-	-
Lab(P)_L6	100	-	-
Office(P)_L6	100	-	-
Bin Store_L0	100	-	-
Lab (P)_L0	100	-	-
Lab (P)_L1	100	-	-
Office(P)_L2	100	-	-
Lab(P)_L2	100	-	-
Office(P)_L3	100	-	-
Lab(P)_L3	100	-	-
Office(P)_L4	100	-	-
Lab(P)_L4	100	-	-
Office(P)_L5	100	-	-
Lab(P)_L5	100	-	-
Office(P)_L7	100	-	-

General lighting and display lighting	General luminaire	Display light source	
Zone name	Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m²]
Standard value	95	80	0.3
Lab(P)_L7	100	-	-
Store_L8	100	-	-
Office(P)_L8	100	-	-
Winter Garden_L8	100	-	-

The spaces in the building should have appropriate passive control measures to limit solar gains in summer

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Circulation_L0	NO (-48%)	NO
Stairs_L0	NO (-100%)	NO
Circulation_L0	N/A	N/A
Lobby_L0	N/A	N/A
WC_L0	N/A	N/A
Circulation_L0	N/A	N/A
Circulation_L0	NO (-100%)	NO
Stairs_L0	N/A	N/A
Circulation_L0	NO (-74%)	NO
Acc WC_L0	N/A	N/A
Stairs_L1	N/A	N/A
Circulation_L1	N/A	N/A
Lobby_L1	N/A	N/A
WC_L1	N/A	N/A
Circulation_L1	N/A	N/A
Circulation_L1	N/A	N/A
Stairs_L1	NO (-100%)	NO
Acc WC_L1	N/A	N/A
Stairs_L2	NO (-99.1%)	NO
Circulation_L2	N/A	N/A
Lobby_L2	N/A	N/A
WC_L2	N/A	N/A
Circulation_L2	N/A	N/A
Circulation_L2	N/A	N/A
Stairs_L2	N/A	N/A
Acc WC_L2	N/A	N/A
Lab (P)_L2	NO (-33.3%)	NO
Stairs_L3	N/A	N/A
Circulation_L3	N/A	N/A
Lobby_L3	N/A	N/A
WC_L3	N/A	N/A
Circulation_L3	N/A	N/A
Circulation_L3	N/A	N/A
Stairs_L3	N/A	N/A
Acc WC_L3	N/A	N/A
Lab (P)_L3	NO (-24.9%)	NO

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Stairs_L4	N/A	N/A
Circulation_L4	N/A	N/A
Lobby_L4	N/A	N/A
WC_L4	N/A	N/A
Circulation_L4	N/A	N/A
Circulation_L4	N/A	N/A
Stairs_L4	N/A	N/A
Acc WC_L4	N/A	N/A
Lab (P)_L4	NO (-15.4%)	NO
Stairs_L5	N/A	N/A
Circulation_L5	N/A	N/A
Lobby_L5	N/A	N/A
WC_L5	N/A	N/A
Circulation_L5	N/A	N/A
Circulation_L5	N/A	N/A
Stairs_L5	N/A	N/A
Acc WC_L5	N/A	N/A
Lab (P)_L5	NO (-14.5%)	NO
Stairs_L6	N/A	N/A
Circulation_L6	N/A	N/A
Lobby_L6	N/A	N/A
WC_L6	N/A	N/A
Circulation_L6	N/A	N/A
Circulation_L6	N/A	N/A
Stairs_L6	N/A	N/A
Acc WC_L6	N/A	N/A
Lab (P)_L6	NO (-12.7%)	NO
Stairs_L7	N/A	N/A
Circulation_L7	N/A	N/A
Lobby_L7	N/A	N/A
WC_L7	N/A	N/A
Circulation_L7	N/A	N/A
Circulation_L7	N/A	N/A
Stairs_L7	N/A	N/A
Acc WC_L7	N/A	N/A
Lab (P)_L7	YES (+1.5%)	NO
Lobby_L8	N/A	N/A
WC_L8	N/A	N/A
Circulation_L8	N/A	N/A
Circulation_L8	N/A	N/A
Stairs_L8	N/A	N/A
Acc WC_L8	N/A	N/A
Circulation_L8	N/A	N/A
Stairs_L8	N/A	N/A
Stairs_L8	N/A	N/A
Circulation_B1	N/A	N/A
Lobby_B1	N/A	N/A
Acc WC_B1	N/A	N/A
Circulation_B1	NO (-100%)	NO

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Stairs_B1	N/A	N/A
Comms Room_B1	N/A	N/A
Lab Support_B1	N/A	N/A
Changing_B1	NO (-100%)	NO
WC_B1	NO (-99.8%)	NO
Acc Shower_B1	N/A	N/A
Drying Room_B1	NO (-100%)	NO
WC_B1	N/A	N/A
Changing_B1	N/A	N/A
Circulation_B1	NO (-100%)	NO
Cycle Store_B1	N/A	N/A
Goods Office_L0	NO (-34%)	NO
Office (P)_L0	NO (-56.8%)	NO
Lab (P)_L1	NO (-38.5%)	NO
Office_L7	NO (-67.7%)	NO
Lab_L7	NO (-27.3%)	NO
Lab_L0	NO (-59.6%)	NO
Office (P)_L0	YES (+54%)	NO
Office (P)_L0	YES (+22.4%)	NO
Reception (P)_L0	YES (+130.9%)	NO
Office_L0	NO (-35.3%)	NO
Reception_L0	YES (+134.5%)	NO
Office_L0	YES (+77.9%)	NO
Lab_L1	NO (-84.5%)	NO
Lab_L1	NO (-55.9%)	NO
Office_L1	YES (+27%)	NO
Office (P)_L1	YES (+28.5%)	NO
Lab_L2	NO (-82.1%)	NO
Lab_L2	NO (-61.8%)	NO
Office_L2	YES (+79.3%)	NO
Lab_L3	NO (-78.1%)	NO
Lab_L3	NO (-57.6%)	NO
Office_L3	YES (+63.5%)	NO
Lab_L4	NO (-75.1%)	NO
Lab_L4	NO (-54.6%)	NO
Office_L4	YES (+63.9%)	NO
Lab_L5	NO (-74.9%)	NO
Lab_L5	NO (-53.2%)	NO
Office_L5	YES (+64.9%)	NO
Lab_L6	NO (-74.5%)	NO
Lab_L6	NO (-49.3%)	NO
Office_L6	YES (+50.3%)	NO
Lab(P)_L6	YES (+81.2%)	NO
Office(P)_L6	YES (+4%)	NO
Lab (P)_L0	YES (+33.1%)	NO
Lab (P)_L1	YES (+61.4%)	NO
Office(P)_L2	YES (+32.4%)	NO
Lab(P)_L2	YES (+38%)	NO
Office(P)_L3	YES (+19%)	NO

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Lab(P)_L3	YES (+51%)	NO
Office(P)_L4	YES (+18.2%)	NO
Lab(P)_L4	YES (+59.9%)	NO
Office(P)_L5	YES (+18.7%)	NO
Lab(P)_L5	YES (+66.5%)	NO
Office(P)_L7	YES (+26.8%)	NO
Lab(P)_L7	YES (+85.4%)	NO
Office(P)_L8	YES (+22.4%)	NO
Winter Garden_L8	YES (+123%)	NO

Regulation 25A: Consideration of high efficiency alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Floor area [m²]	7604.5	7604.5
External area [m²]	5918	5918
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	21	4
Average conductance [W/K]	7312.18	1973.44
Average U-value [W/m²K]	1.24	0.33
Alpha value* [%]	25.03	10

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

Building Use

% Area	Building Type
	Retail/Financial and Professional Services
	Restaurants and Cafes/Drinking Establishments/Takeaways
52	**Offices and Workshop Businesses**
48	**General Industrial and Special Industrial Groups**
	Storage or Distribution
	Hotels
	Residential Institutions: Hospitals and Care Homes
	Residential Institutions: Residential Schools
	Residential Institutions: Universities and Colleges
	Secure Residential Institutions
	Residential Spaces
	Non-residential Institutions: Community/Day Centre
	Non-residential Institutions: Libraries, Museums, and Galleries
	Non-residential Institutions: Education
	Non-residential Institutions: Primary Health Care Building
	Non-residential Institutions: Crown and County Courts
	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/m²]

	Actual	Notional
Heating	9.83	1.02
Cooling	1.49	1.83
Auxiliary	40.49	45.78
Lighting	17.47	24.32
Hot water	9.11	6.79
Equipment*	38.18	38.18
TOTAL**	78.39	79.74

* 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/m²]

	Actual	Notional
Photovoltaic systems	0.7	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
Displaced electricity	*0.7*	*0*

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	147.13	35.62
Primary energy [kWh_{PE}/m²]	115.2	117.59
Total emissions [kg/m²]	10.68	10.78

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] Variable refrigerant flow, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	100.8	43.4	7.1	4.5	4.6	3.92	2.67	4	4
	Notional	12.9	72	1.3	4.3	7.7	2.78	4.63	---	---
[ST] Constant volume system (variable fresh air rate), [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	210	2.5	16.4	0.3	33	3.57	2.31	4	4
	Notional	6.9	37.5	0.7	2.3	17.1	2.78	4.63	---	---
[ST] Constant volume system (variable fresh air rate), [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	134.3	8.1	10.5	1	18.7	3.57	2.31	4	4
	Notional	8.8	39.1	0.9	2.3	7.5	2.78	4.63	---	---
[ST] Variable refrigerant flow, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	188.3	12.5	13.3	1.3	2.3	3.92	2.67	4	4
	Notional	12.5	32.2	1.3	3.1	8.2	2.78	2.84	---	---
[ST] Single room cooling system, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	0	0	0	0	0	2.45	1.49	2.5	2
	Notional	0	0	0	0	0	2.78	4.63	---	---
[ST] Fan coil systems, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	522.9	49.7	57.7	4.8	18.6	2.52	2.86	2.8	3.65
	Notional	58.9	19.4	5.9	1.9	11.1	2.78	2.84	---	---
[ST] Variable refrigerant flow, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	110.8	9.4	7.9	1	77.4	3.92	2.67	4	4
	Notional	8.3	10.6	0.8	0.6	87.1	2.78	4.63	---	---
[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

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