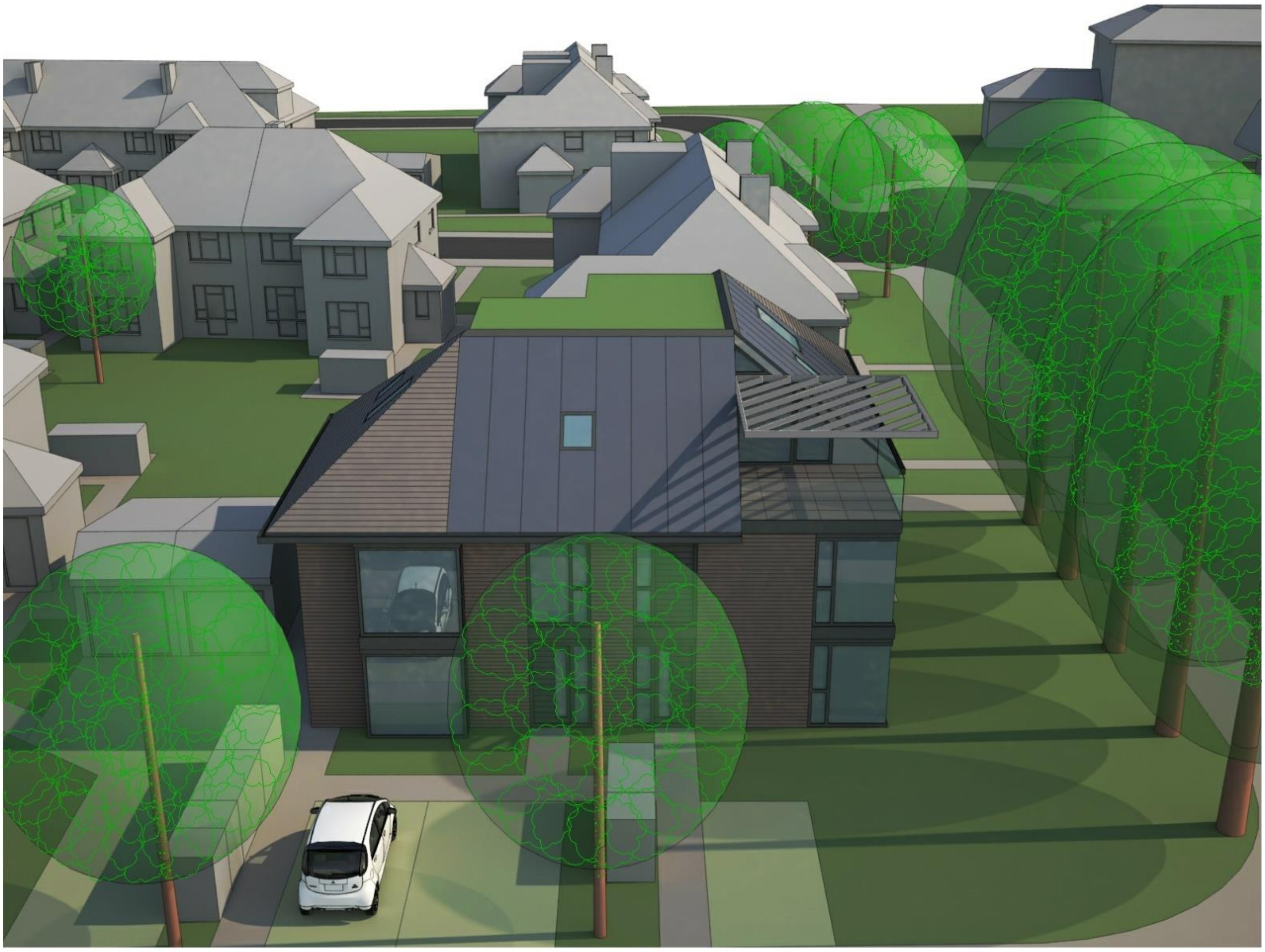
Energy Statement

Proposed development of three maisonettes. Land at the junction of Roseleigh Close and Cambridge Park, Twickenham TW1 2JT



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CONTENTS

REVISION HISTORY

Revision	Status	Date	Author	Reviewer	Approver
00	S2	24.03.2023	AE	AL	AL
01	S2	05.05.2023	AE	AL	AL
02	S2	08.06.2023	AE	AL	AL

1. EXECUTIVE SUMMARY

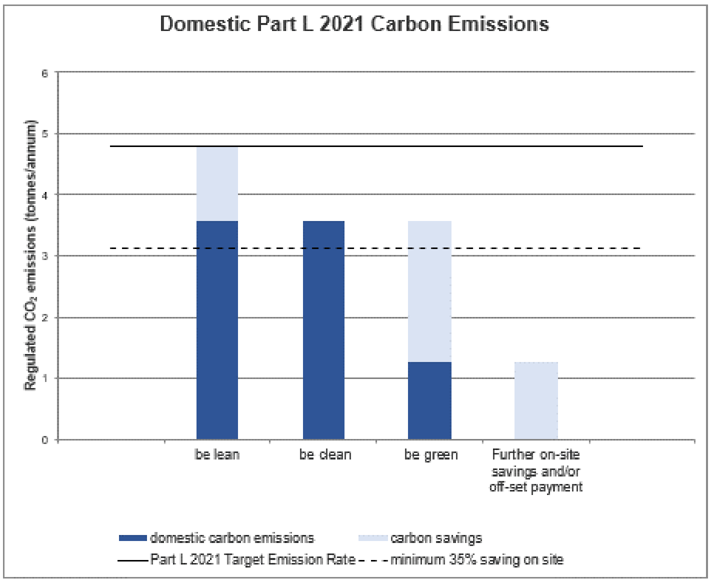
This report develops the energy and sustainability strategy for the proposed development of three maisonette units on a site at the junction of Roseleigh Court and Cambridge Park, Twickenham TW1 2JT.

The guidance and policies used in formulating this report are listed below and the resulting findings are compliant with the content of each;

- Richmond Local Planning Documents;
- London Plan 2021;
- Building Regulations Part L 2021 Volume 1

The energy strategy proposed meets the Building Regulations Part L 2021 Volume 1 requirements and is aimed to achieve the best outcoming in terms of sustainability and energy efficiency. The proposed design strategy achieves a 77% improvement over Part L, therefore meeting the Local Planning targets of 35% improvement. In order to make the development net-zero carbon an offset payment of £3,073 would be required.

	Regulated residential carbon dioxide savings	
	(Tonnes CO_2 per annum)	**(%)**
Be lean: savings from energy demand reduction	1.3	28%
Be clean: savings from heat network	0.0	0%
Be green: savings from renewable energy	2.4	50%
Cumulative on site savings	**3.7**	**77%**
Annual savings from off-set payment	1.1	-
	(Tonnes CO_2)	
Cumulative savings for off-set payment	**32**	-
Cash in-lieu contribution (£)	**3,073**	



2. INTRODUCTION

The proposed development is located at the junction of Roseleigh Court and Cambridge Park, Twickenham TW1 2JT.

The property consists of three maisonette units within a single building of two storeys. Each of the maisonettes has a small basement for services and storage purposes. Accommodation is arranged on ground and first floors, with two of the units also having loft level accommodation.

This report sets out the energy strategy for the proposed development. In developing this strategy local and regional planning policies have been addressed.

The format of this report follows the Local Plan to ensure that energy needs are met in the most efficient way.

The energy consumption of the development has been assessed in line with the Local policy and the CO_2 emissions have been estimated with SAP software.

This report identifies the proposed energy strategy to meet Building Regulations Part L requirements. The proposed Sustainability Principles and Engineering Concepts incorporate the requirements and guidelines of the relevant British Standards and CIBSE Guides.

3. PLANNING POLICY BACKGROUND

The main planning documents which constitute the statutory development plan for Richmond and form the basis on which decisions will be made for the proposed development are:

- Building Regulations Part L 2021 Volume 1;
- Richmond Local Plan 2018;
- London Plan 2021;
- CIBSE Technical Manuals and Guide;

The main planning documents which constitute the statutory development plan and form the basis on which decisions will be made for the proposed development are outlined below.

3.1. Building Regulation Compliance

Building Regulations apply to all developments, and are in place to ensure buildings meet health, safety, welfare, convenience and sustainability standards: they focus on the technical aspects of designing and constructing a building.

The proposed development at Roseleigh Close will be fully compliant with all revisions of the Building Regulations relevant to MEPH design. The most relevant document is the Part L Approved Document: Part L 2021 Volume 1: Conservation of Fuel and Power in Dwellings.

In line with 4.6, the thermal elements shall be in compliance with the minimum targets in Table 4.1.

Table 4.1 Limiting U-values for new fabric elements and air permeability in new dwellings

Element type	Maximum U-value[1] $W/(m^2 \cdot K)$
All roof types[2]	0.16
Wall[2]	0.26
Floor	0.18
Party wall	0.20
Swimming pool basin[3]	0.25
Window[4][5]	1.6
Rooflight[6][7]	2.2
Doors (including glazed doors)	1.6
Air permeability	$8.0m^3/(h \cdot m^2)$ @ 50Pa $1.57m^3/(h \cdot m^2)$ @ 4Pa

All new thermal elements will be in line with Part L requirements. Compliance at the design stage is demonstrated.by calculating the CO_2 emissions rate for the proposed development, known as the Building Emissions Rate (BER), which is compared to an equivalent notional building of the same geometry but with a set of benchmark performance characteristics as specified in the 2010 NCM modelling guide, known as the Target Emissions Rate (TER). Compliance is achieved when the BER is lower than TER.

In addition to the requirement for the BER to be lower than the TER of the notional building, each dwelling needs to achieve a lower dwelling fabric energy efficiency (DFEE) than the notional target fabric energy efficiency (TFEE) and lower primary energy rate than that of the notional.

NCM methodologies using SAP software were employed to calculate this.

3.2. Richmond Planning Policies 2018

Richmond Council strongly encourages new developments to be energy and resource efficient. According to Local Plan 2018 all proposed developments are required to minimise use of energy and other non-renewable resources, as well as to facilitate an increase in the use of low and zero carbon technologies to help reduce carbon dioxide (CO_2) emissions and air pollutants harmful to health.

In accordance with Policy LP 22, all new residential developments should achieve a reduction of 35% over Part L.

Local Plan 2018, and the new Local Plan currently under review, also mentions to follow London Plan for demonstrating compliance. This is done by demonstrating sustainable energy practices in line with the London Plan Energy Hierarchy (Policy SI 2), by requiring developments to:

- Use less energy (Be Lean);
- Supply energy efficiently (Be Clean)
- Use renewable energy (Be Green); and
- Monitor, verify and report on energy performance (Be Seen)

In addition to demonstrating reduction of energy consumption and associated carbon emissions, the scheme will need to demonstrate that risk of overheating has been addressed.

The dwellings shall achieve a maximum water consumption of 110 l/person/day.

3.3. London Plan 2021

As a minor development, the London Plan 2021 does not have targets for the degree of improvement over Part L However the development should still follow the energy hierarchy and try to achieve the same level of reductions as a major development. Policy SI 2 Minimising greenhouse gas emissions stipulate that major developments should be net zero-carbon with a minimum onsite reduction of 35% beyond Building Regulations. Additionally, 10% reduction needs to be achieved through energy efficiency measures alone i.e. without the use of renewable technologies for residential buildings. As a minor development these percentages of improvements at each step are not required but the energy hierarchy has been followed as a basis of design to ensure maximum reduction of onsite carbon emissions.

3.4. Planning Conditions

Prior to commencement of the development, an energy statement shall be submitted to and approved in writing by the Local Planning Authority. The development shall be carried out in accordance with the approved development thereafter.

4. ENVIRONMENTAL DESIGN STRATEGY

It is proposed to use a number of energy efficiency measures to reduce the energy demand of the development in line with the energy hierarchy of Be Lean, Be Clean, Be Green and Be Seen.

4.1. Be Lean

The first step of the London Plan energy hierarchy is to reduce energy use through both passive and active lean design measures. A number of sustainable design and construction methods have been incorporated into the design of the building which comply with the requirement to reduce energy demand. These include:

High Performance Building Envelope

Element	Building Regulation Part L Limit U-Value [W/m^{2}K]	Proposed Average U-Value [W/m^{2}K] Design
External Wall	0.26	0.12
Floor	0.25	0.10
Roof	0.18	0.11
Windows	1.6	1.20
Rooflights	2.20	1.20

Enhanced Air Tightness and Good Detailing

As a new development, good detailing shall be achieved in order to avoid the creation of thermal bridges in the fabric and meeting points of elements such as between walls and floors and ceilings. The development will target an air permeability of 1.5 m^3/h/m^2 at 50Pa or better.

Limit Overheating

Systems have been designed to minimise internal heat gains by creating as short as possible service runs and the use of low energy lighting. The façade will be designed in such a way as to maximise solar gains in colder winter months while limiting them in summer months. The development has a mechanical ventilation system with summer bypass mode which will help deal with periods of high temperatures and to ensure a comfortable indoor environment.

Daylight

The maximisation of daylight is one of the most important environmental factors for buildings. Artificial lighting contributes up to 25% of the energy costs of a typical building, despite operation largely within daylight hours. Anecdotal evidence also suggests that the provision of good levels of natural light can contribute to enhanced health and well-being. The design shall maximise daylight while limiting solar gains during summer months.

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Ventilation

The dwellings are mechanically ventilated via an individual mechanical ventilation heat recovery unit (MVHR) to each flat. Heat recovery will use exhaust air to heat up incoming air and therefore reduce heating loads. The MVHR units will use a summer bypass mode in high temperature periods to help maintain a cooler and more comfortable indoor environment. Openable windows will allow for natural ventilation.

Efficient Systems

Use of efficient systems and equipment with suitable time and temperature controls which have been appropriately commissioned such that the systems can be operated efficiently.

Minimization of lengths and diameters of 'dead legs'. Efficient components i.e. fans, pumps, refrigeration equipment have been appropriately sized to have no more capacity for demand and standby than is required for the task to operate at their optimum levels.

Insulation of pipework, ductwork and hot water systems have been selected to be in line with the future highest standards.

Minimising Water Usage

The design shall incorporate water saving strategies, such as low flush toilets, and non-concussive spray taps in order to keep the maximum water usage to 110 litres/person per day (in accordance with Policy LP 22). Water consumption will be monitored. Other features shall include mains leak detection and sanitary shut-off. A water-use calculation is provided in Appendix B.

Energy Efficient Lighting and Appliances

Provision of the required lighting levels whilst minimizing energy consumption by appropriate specification of light fittings and effective control of lighting systems by:

- Specifying 100% of the fixed internal light fittings as dedicated energy efficient fixtures.
- Having suitable energy consumption metering.
- Ensuring systems have been appropriately commissioned.
- Using lighting systems which are efficient and make use of daylight where possible/practical.
- Provision of low output or energy efficient external lighting.

A lighting efficacy of minimum average 95 lumens per circuit watt has been used as the design standard. This will be achieved including LED lighting sources throughout.

4.2. Be Clean

New Community heat network / Connection to Existing Low Carbon Heating Infrastructure

The map below displays the heat map for the area where the proposed development sits. As can be seen, the area does not fall within the proximity of an existing or proposed heat network and a connection to one is not feasible.

The proposed building will be utilising ASHP's for heating. This is advantageous for the local air quality of the surrounding area and its users (Policy SI1 Improving air quality).

However, the carbon reduction of this ASHP system will be assessed under the Be Green heading as a renewable energy source, and therefore no additional carbon reduction strategies are proposed for this stage. The aim would be to improve on the efficiency of heat and power delivery. This will reduce the auxiliary energy in association with their operation.

4.3. Be Green

The final reductions in energy consumption and related carbon emissions should be through the use of on-site renewable energy sources in the bid to reach the required carbon reductions. Air Source Heat Pumps are a highly efficient way to generate hot water and heating and will aid the carbon savings for this development.

In addition, two areas of roof have allowance for solar photovoltaics. It has been estimated that a total of 12 panels will be able to fit on the west-facing roof and provide 1.23kWp capacity to each dwelling.

In line with Building Regulations Part L, an improvement of 77% over Part L is achieved.

4.4. Be Seen

Sufficient information about the building, the fixed building services and their maintenance requirements will be provided to the users so that the building can be operated in such a manner as to use no more fuel and power than is reasonable in the circumstances. The systems provided within the development will allow for monitoring to ensure they are run at optimum performance.

Energy consumption and performance of the proposed design is to be monitored as stipulated in the London Plan 2021 Policy SI 2 Minimising greenhouse gas emissions (clause A4) Be Seen.

5. LOW AND ZERO CARBON TECHNOLOGIES

The following section provides a feasibility analysis of Low or Zero Carbon (LZC) technologies for use at Roseleigh Close. There are various options when it comes to LZC technology, but a combination of project constraints rules the majority of these out. The constraints are:

- Capital expenditure
- Return on Investment
- Carbon savings potential
- Clean energy output potential
- Spatial requirements
- Operation and maintenance requirements
- Planning requirements

Out of the technologies considered the following were discounted immediately for this site:

- Hydrogen: generation and storage are still in the experimental stage at this scale and no systems are currently commercially available.
- Biomass: is not considered a viable solution due to issues with emissions and transport.
- CHP: the base heat load is not large enough to make CHP an efficient solution, plus emissions from gas-fired combustion are likely to raise planning concerns.
- Biomass CHP: as above.
- Wind Turbines: wind turbine technology is not suitable for high density areas and those within close proximity to residential properties.

The feasibility study therefore reviewed the use of the following technologies to offset CO2 emissions:

- Low-energy mechanical ventilation
- Air Source Heat Pumps
- Photovoltaics
- Solar Thermal Panels
- Open/Closed Loop Ground Source Heat Pumps

The followingtypes of green/renewable energy technologies have been selected in order to maximise on-site renewable energy generation:

- Mechanical ventilation with heat recovery
- Air Source Heat pumps
- Photovoltaics

5.1. Feasibility of Selected Technologies

5.1.1. Ventilation

Ventilation losses in modern and well insulated homes can account for up to 50% of the home's total energy costs per year. Increasingly, high quality, airtight buildings benefit from devices that control the movement of air and recycle waste heat to minimise these losses and improve overall air quality in the home.

Mechanical Extract and Trickle Ventilation

Mechanical extraction is the use of a fan unit, typically in bathrooms and kitchens, to remove warm, moist air or odour from the property. To avoid condensation however, extraction of warm, moist air is not enough, it must be in conjunction with input of fresh air, yet this is often overlooked for several different reasons. The fresh air not only creates a fresh atmosphere, it also promotes air movement to ensure that air is circulated around the property.

Trickle Vents, known also as background ventilators, are natural ventilation devices which can be integrated into façades or window systems as an alternative to operable vents. As the name suggests, the vent is designed to allow a trickle of air to pass through. This helps provide 'natural' ventilation within a home. Some types of vents incorporate a sliding switch to increase or decrease the ventilation.

There can be issues with this sort of ventilation, however. Trickle vents may still allow draughts through, even when turned to a 'closed' position. Even the small gaps used for trickle vents will affect the home's energy-efficiency to a certain degree, allowing some heat to dissipate.

Mechanical Ventilation and Heat Recovery (MVHR)

Whole-house MVHR units not only gather and redistribute heat around a building, but also purify and filter the air. This reduces allergens, smells and humidity in addition to providing heating or cooling.

An MVHR unit operates by utilising a network of concealed ducting to recover heat produced within a property from lighting, cooking, general electrical appliances, heating systems and occupants. This recovered heat is then used to warm up incoming cooler fresh air.

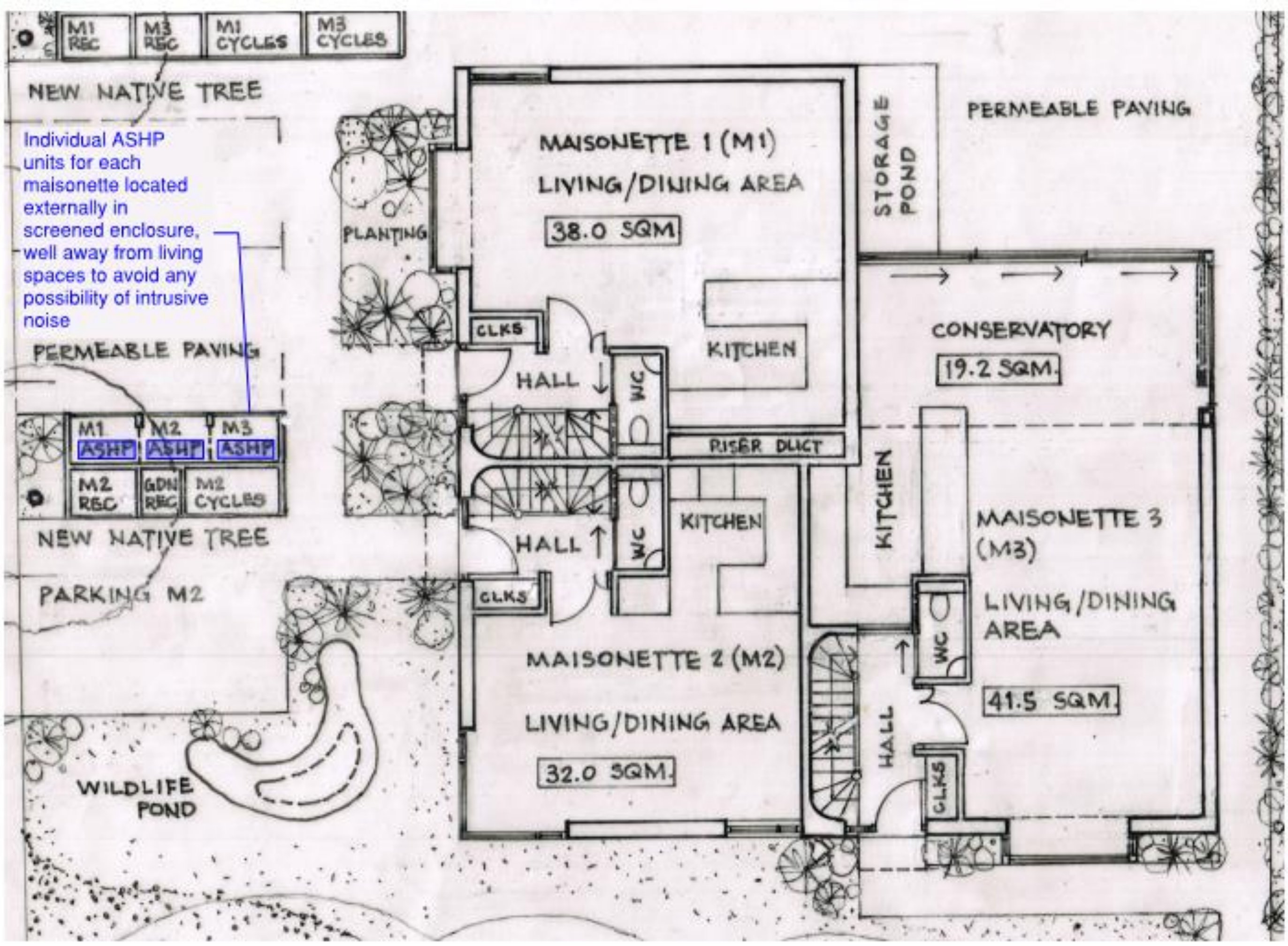
Based on the improved air tightness and reduction in heat loss, MVHR units have been selected as the baseline ventilation system for this development.

5.1.2. Air Source Heat Pumps

Air source heat pumps (ASHP) use electricity to convert energy gathered from the air into low temperature water for heating and domestic hot water use. Individual high efficiency, monobloc air source heat pumps, providing heating and hot water are proposed for each maisonette.

These units operate at a lower flow temperature than traditional boiler systems, making them particularly suitable for operation with underfloor heating systems. The temperature of the hot water supplied by the heat pumps impacts the COP (coefficient of performance) of the units, with the ideal flow and return temperatures of around 45°C/40°C.

The intention is to locate the external ASHP units in a screened enclosure separated from the properties:



Internally a monobloc heat pump requires no additional equipment, except for a manifold connecting it to the central heating circuits and a domestic hot water (DHW) cylinder.

Based on economic and technical considerations ASHPs are considered appropriate for the project and may also be used for compliance with the Be Green criteria.

The performance of the heat pump system should be monitored post construction to ensure it is achieving the expected performance approved during planning as will be specified in the Mechanical Specifications.

5.1.3. Solar Photovoltaic (PV) Panels

Solar photovoltaic panels are employed to reduce the amount of energy used by the household from the main electricity network and in turn reduce the overall electricity bill for the home. Photovoltaic systems have minimal internal components to consider and can easily be integrated into the home electricity supply.

Roof mounted panels on most homes outside of conservation areas are within permitted development rights and can be installed without planning permission. Panels are now available in all types of colours, finishes and roof integration formats and so for more aesthetically sensitive areas there is often an acceptable solution. Black panels and solar slates are often used in aesthetically sensitive areas.

The south facing roof is limited for PV use by shading caused by the five horse chestnut trees located along the southern boundary. The west facing roof at a slope of 40° is thus the optimal location for solar PV panels.

It has been estimated that a total of 12 panels will be able to fit on the west-facing roof and provide 1.23kWp capacity to each dwelling. Based on this array size it is unlikely that there will be excess generation exported to the grid.

Under G98 regulations, generation capacity is limited to 16amps per phase of incoming electrical supply. This roughly equates to 4kWp per phase, which can be installed without additional permissions from the local District Network Operator (DNO).. In this case permission would not be needed as the PV array proposed for each maisonette does not exceed the approximate 4kWp limit.

5.2. Feasibility study of the discarded technologies

5.2.1. Ground Source Heating

A Ground Source Heat Pump (GSHP) is a system that extracts heat from the ground, upgrades it to a higher temperature and releases it where required for use for space and water heating. Most systems are 'closed loop' and comprise of plastic piping buried in the ground and connected to a heat pump. A water or water-antifreeze mixture is passed around the looped pipe where it absorbs heat from the ground. The fluid flows into an electrically powered heat pump, comprising a compressor and a pair of heat exchangers before discharging back to the underground loop. Pipes can either be buried in trenches, usually in a slinky arrangement to reduce the amount of surface area that is required, or in a borehole, in a vertical loop system. Vertical loop systems require less surface space but are considerably more expensive.

Although their efficiency and potential for significant carbon reductions are attractive, the capital expenditure and on-going maintenance would add unnecessary costs and complications to the construction process. Extensive ground works would be required on a site with very limited space. Therefore GSHPs are deemed not feasible based on the site constraints, with ASHPs being the preferred technology due to similar efficiencies.

5.2.2. Solar Thermal Systems

Similarly to PV panels, solar thermal panels can either be integrated into the sloped roof structure. Either flat plate or evacuated tube type panels could be used. The solar thermal panels will be used to heat water which can be used for the domestic hot water supply to the dwellings.

It has identified that it would be more efficient for this kind of development to install heat pumps as the available unshaded roof surfaces will be used for PVs. Therefore solar thermal panels are not recommended for this site.

6. SUSTAINABLE TECHNOLOGIES

Additional sustainable technologies have been considered for integration into this development.

6.1. Electric Vehicle (EV) Charging

To encourage the use of electric vehicles and to future-proof the development for the expected shift towards the use of electric vehicles, EV charging will be incorporated into the scheme. Electric vehicles can half the cost of driving and reduce CO2 emissions by almost two thirds.

A dedicated EV charge point is recommended, incorporating appropriate load management and safety features. It is proposed to install a Type 2 (7kW) charge point, which will be compatible with the property's single-phase supply and is the most 'standard' amongst manufacturers, for each maisonette. This will charge a car in around 4 - 6hrs.

6.2. Rainwater Harvesting

Rainwater harvesting (RWH) describes the process of collecting rain that falls onto a catchment area. In most cases, the catchment area is the roof of the house, where the rain falls and is then bought to a central point via guttering and down-pipes, before entering a storage tank. In more straightforward water harvesting systems, this storage tank can simply be a water butt, where the water can be tapped off and used in the garden. There are more complex water harvesting systems, which filter the water, for several uses within the home. On the whole rainwater harvesting is much simpler than recycling grey water.

6.2.1. RWH for Garden Watering

For most properties, the catchment area will be the roof. For properties that have limited external space, water tanks can be buried. This has the added benefit of frost protection and bacteria control as temperatures remain cool. A buried system would require the inclusion of a pump to distribute the water and a filter to keep out debris.

Based on the roof drainage area and average rainfall figures, the quantity of water that could be harvested over a 6-month period could amount to some 54,000litres. Calculations show that around 10,000 litres would be required to protect the garden area from drought over an average 18-day period during the summer. It is thus recommended that a 10,000 litre underground storage tank be provided to cover irrigation requirements during dry periods,

6.2.2. RWH For Internal Use

When the rain falls on the roof, it will likely pick up pollutants, potentially from the air (e.g. exhaust fumes), but also things like bird faeces on the roof. Therefore, water from this source is not drinkable unless it undergoes further treatment.

Using a simple sand filter system, the vast majority of pollutants and larger contaminants can be removed, which would enable the water to be used to flush toilets and wash clothes. This system would require a specialised sealed water container and a pump. It is anticipated that rainwater use could reduce mains water dependency by 40-50%.

6.2.3. RWH For Drinking Water

If suitable treatment is in place, rainwater can be made suitable for drinking too. Filters can be used, e.g. a particulate filter that remove particles that are larger than 5 microns in diameter. This can be used in conjunction with ultraviolet light sterilisers, which also kill any dangerous microorganisms in the water to make the water drinkable. Due to the filtration technology needed to support this system, this would be the most maintenance heavy and financially expensive system, and it is not recommended.

7. COOLING HIERARCHY

The development has been designed in line with the cooling hierarchy outlined in Policy SI4 Managing heat risk in London Plan 2021 and Local Plan Policy LP 20. The following measures have been taken at each stage of the hierarchy in order to reduce the demand for cooling.

7.1. Minimising Internal Heat Gains

Stage one of the Cooling Hierarchy is to minimise internal heat generation through energy efficient design.

Heat distribution infrastructure will be designed to minimise pipe lengths. This will be achieved at coordination stage, ensuring pipework is well insulated and that pipe configurations minimise heat loss. Good daylighting and high efficiency light fittings with occupancy control will also help to reduce excess heat gains from artificial lighting. Low energy lighting has been specified with occupancy controls to be provided for the luminaires.

7.2. Reducing Heat Entering the Building

The design of the façade will help to limit solar gains in the summer.

7.3. Internal Thermal Mass and High Ceilings

The development will utilise the effect of exposed thermal mass on internal finishes wherever possible within the design.

7.4. Passive Ventilation

Large openable windows will allow sufficient natural cross ventilation during occupied hours, and when acoustic requirements allow, to prevent overheating.

7.5. Mechanical Ventilation

The MVHRs are to employ a summer bypass mode in order to maintain a comfortable internal environment.

7.6. Active Cooling

The measures taken in the previous steps will fully negate the need for active cooling in the development. No mechanical cooling is currently proposed.

8. OVERHEATING RISK ANALYSIS

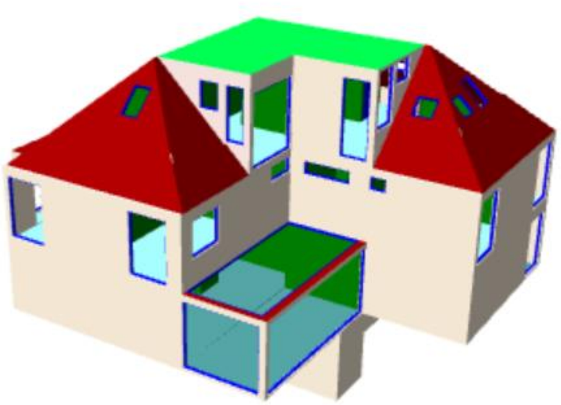
The measures described in the Cooling Hierarchy set out how overheating risk will be mitigated through passive design measures.

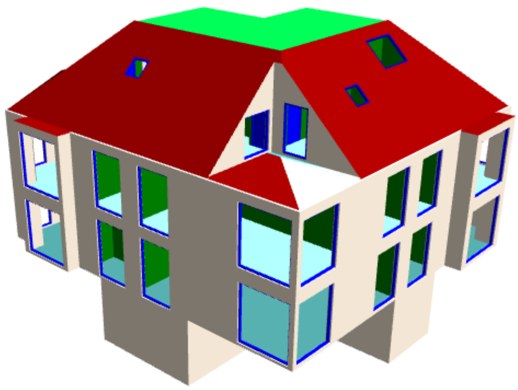
The development's design was tested in order to gauge its capabilities of mitigating overheating risk during summer months. **CIBSE TM59: Design methodology for the assessment of overheating risk in homes** was used to assess to assess this. In accordance with TM59 the following criteria need to be met.

- The number of hours during which delta T of indoor air temperature to outdoor is greater than or equal to one degree (K) during the period of May to September shall not exceed 3% of occupied hours.
- For bedrooms only: to guarantee comfort during the sleeping hours the operative temperature in the bedroom from 10pm to 7am shall not exceed 26˚C for more than 1% of annual hours

In accordance with CIBSE TM59, compliance needs to be achieved for DSY1 2020 50th percentile high emissions scenario. The weather files for London Heathrow were used to represent a suburban environment.

To demonstrate TM59 compliance, a dynamic energy model of the development was created in TAS. When simulating performance, the model uses real climate data and accounts for orientation and massing of building along with any shading impacts from neighbouring buildings.





The U-values were assigned as noted below. Glazing assumed to have a g-value of 0.4 as a baseline. Windows openings were modelled based on architectural elevations, with side hung windows assumed to be 50% openable and sliding windows approximately 66%. Window opening schedules have been modelled in accordance with guidance from TM59 and Building Regulations Part O: Overheating. Ground Floor windows have been modelled as closed at night-time due to perceived security risk.

	Proposed U-value [W/m2K]
Wall	0.12
Floor	0.10
Roof	0.11
Glazing	1.20

A summary of testing can be seen in the table in 8.1, below. Living areas need to achieve 59 hours or below to achieve Criterion 1 and bedrooms need to achieve 110 hours or below. Additionally, bedrooms need to achieve 32 hours or below to be compliant with Criterion 2.

Results indicate at baseline scenario that there is risk of overheating in the living areas of Maisonettes 2 and 3, and in some of the bedrooms. Similarly, one of the loft studios shows risk of overheating due to the rooflight in this room. This is due to the relatively large areas of glazing, designed to optimise levels of daylight in balance with thermal control, both passive and active, to ensure a comfortable indoor environment can be achieved. Note that the baseline assessment includes external blinds to the conservatory glazed roof.

Various iterations were tested to gauge whether it will be possible to ensure a comfortable indoor environment in summer months through passive measures alone. In the first test, the solar transmittance of glazing was improved from 0.4 to 0.3 g-value. This improvement measure is enough to make all rooms, except for one of the bedrooms, comply.

The addition of external blinds to the glazing on the failing bedroom ensures the compliance of this room as well.

Automated integral external blinds will be fitted to all west and south facing windows and rooflights to enable individual control of internal environments during the summer months.

It has been demonstrated, through this thermal modelling, that TM59 compliance can be achieved and therefore no mechanical cooling will be required.

8.1. Overheating analysis results

	Baseline			g-value 0.3			Ext. blinds in Bed 1 (M2)		
Zone Name	Criterion 1: Hours Exceeding Comfort Range	Criterion 2: Number of Night Hours Exceeding 26 °C for Bedrooms.	Result	Criterion 1: Hours Exceeding Comfort Range	Criterion 2: Number of Night Hours Exceeding 26 °C for Bedrooms.	Result	Criterion 1: Hours Exceeding Comfort Range	Criterion 2: Number of Night Hours Exceeding 26 °C for Bedrooms.	Result
1 - Bedroom 1/1	127	12	Fail	74	8	Pass	73	8	Pass
1 - Bedroom 1/2	204	116	Fail	111	70	Fail	11	30	Pass
1 - Bedroom 1/3	141	16	Fail	86	10	Pass	85	10	Pass
1 - Bedroom 2/1	34	14	Pass	14	10	Pass	13	10	Pass
1 - Bedroom 2/2	90	25	Pass	56	15	Pass	33	13	Pass
1 - Bedroom 2/3	65	11	Pass	35	8	Pass	34	8	Pass
Ground 1 - (M1) Living/Dining	22	N/A	Pass	2	N/A	Pass	2	N/A	Pass
Ground 2 - (M2) Living/Dining	95	N/A	Fail	52	N/A	Pass	46	N/A	Pass
Ground 3 - (M3) Living/Dining	97	N/A	Fail	52	N/A	Pass	30	N/A	Pass
Loft - Bedroom 3/1	36	11	Pass	1	7	Pass	1	7	Pass
Loft - Bedroom 3/3	58	7	Pass	38	6	Pass	38	6	Pass
Loft - Studio 1	187	23	Fail	110	16	Pass	110	15	Pass
Loft - Study 1	37	19	Pass	2	15	Pass	2	15	Pass
Loft - Study 2	81	11	Pass	55	10	Pass	55	10	Pass

Notes:

- All window apertures set as per openable areas provided by architect.
- Rooflights with no given openable area assumed to be 40% open all day and night (19°C and 21°C limits)
- Conservatory glazed roof is modelled to be shaded by external blinds (Baseline)
- Sliding door in conservatory modelled to be 66% openable (3-panel door)

9. ENERGY ASSESSMENT

An energy assessment has been carried out to estimate the performance of the dwellings and annual CO_2 emissions that will need to be in line with 2021 Building Regulations. The energy hierarchy outlined in Policy SI2 Minimising greenhouse gas emissions in London Plan 2021 has been followed as a basis.

As part of planning policy, the following criteria apply:

The development should minimise carbon emissions to as high a degree possible

For the energy assessment SAP10.2 carbon factors have been used, and energy demand has been calculated using the approved SAP software.

Energy use has been converted to carbon emissions using the GLA Carbon Emission Reporting Spreadsheet (version 2.0) for the purpose of the energy assessment. The unregulated energy demands of the development have been estimated based on CIBSE Guide F.

TAS software was used to output a Target Emissions Rate (TER) based on the notional building and a Dwelling Emissions Rate (DER) for each stage of the energy hierarchy outlined below:

- Lean – energy efficiency measures. Compared against a notional building with individual gas boilers for hot water and heat generation
- Clean – Same as Lean
- Green – ASHP technology providing heating and cooling, and PV generating onsite electricity

As a minor development, the model does not need to demonstrate compliance at any of these stages.

See Appendix A for full SAP results.

9.1. SAP Model

Each floor has been divided into the rooms based on layouts of the proposed building.

The following fabric U-values have been assigned based on information from the Architect.

Building Element	U-value (W/m^2K)
External Wall	0.12
Roof	0.11
Floor	0.10

Glazing	U-value (W/m^2K)	G-value	LT-value
Double Glazed Windows	1.20	0.30	0.70

For the Lean stage, the dwellings are heated by gas boilers, with MVHR units providing ventilation. Hot water is provided by the gas boilers. For the Green stage, heating and hot water is via electric air source heat pumps with ventilation from the MVHRs. Each dwelling has been assigned a PV provision of 0.7 kWp. The lighting has been assumed to have a luminous efficacy of 95 lm/W or better.

9.2. Unregulated Energy

The unregulated energy uses have been estimated by the methods and average values described in CIBSE Guide F and TM54: Evaluating operational energy performance of buildings at the design stage. The table below shows the electrical equipment that is used in the development. The number of items of equipment has been estimated based on the number of occupants and layouts as shown in the architectural drawings of the proposed development.

The power consumption of the equipment has been taken from the CIBSE Guide F 2012, paragraph 12.2. The installed capacity (nameplate rating) does not give an accurate estimate of energy use, so the 'average power consumption' as well as 'sleep mode' consumption have been used for the calculation.

The usage hours of the electrical equipment depend on the operating hours. The number of hours per day takes into account the intermittent usage and the variation of the operation from hour to hour and day to day. Instead of use of a diversity factor, multiplied by the power consumption, an estimated number of hours is used. Overnight energy use can contribute significantly to small power energy and has been included. The equation below explains the calculation of the energy consumption.

Annual energy consumption (kWh) = Number of equipment × {[average power consumption during operation × annual hours of operation] + [sleep mode consumption × (8760 - hours of operation)]}

EQUIPMENT	QUANTITY INSTALLED	AVERAGE POWER DEMAND	SLEEP-MODE POWER DEMAND	HOURS OF OPERATION/DAY	TOTAL HOURS/YEAR	ENERGY CONSUMPTION
		(W)	(W)	hours/day	hours/year	(kWh)
laptops	8	40	4	8	2080	692.32
screens	6	60	10	8	2080	815.60
multifunction devices	6	135	60	2	728	1,071.60
miscellaneous	6	15		8	2912	262.08
microwave	3	800		0.5	182	436.80
fridge	3	130	20	24	8760	3,416.40
cooking equipment	3	850		2	730	1,861.50
					TOT (kWh)	**8,556.30**
					Unregulated/m2 (kWh/m2/yr)	**19.34**
					kgCO2/yr	**1,189.33**
					kgCO2/m2/yr	**2.69**

9.3. Results

The results were entered into the GLA spreadsheet to provide a summary of performance and to confirm that fabric energy efficiency targets are met.

			Baseline		'Be Lean'	'Be Clean'	'Be Green'	Fabric Energy Efficiency (FEE)	
Unit identifier (e.g. plot number, dwelling type etc.)	Number of units	Total area represented by model	TER	Energy saving/ generation technology	DER	DER	DER	Target Fabric Energy Efficiency	Dwelling Fabric Energy Efficiency
		(m^2)	($kgCO_2$ / m^2)	($kgCO_2$ p.a.)	($kgCO_2$ / m^2)	($kgCO_2$ / m^2)	($kgCO_2$ / m^2)	(kWh/m^2)	(kWh/m^2)
Roseleigh Maisonette M1	*1*	*118*	**11.82**	**-23.71**	**8.02**	**8.02**	**2.44**	35.50	30.90
Roseleigh Maisonette M2	*1*	*80*	**11.19**	**-25.57**	**8.10**	**8.10**	**2.34**	25.30	24.10
Roseleigh Maisonette M3	*1*	*158*	**9.86**	**-35.79**	**7.86**	**7.86**	**2.48**	35.10	33.60

	Carbon Dioxide Emissions for residential buildings ($Tonnes\ CO_2$ per annum)	
	Regulated	**Unregulated**
Baseline: Part L 2021 of the Building Regulations Compliant Development	4.8	2.7
After energy demand reduction (be lean)	3.4	2.7
After heat network connection (be clean)	3.4	2.7
After renewable energy (be green)	1.1	2.7

	Regulated residential carbon dioxide savings	
	(Tonnes CO_2 per annum)	**(%)**
Be lean: savings from energy demand reduction	1.3	28%
Be clean: savings from heat network	0.0	0%
Be green: savings from renewable energy	2.4	50%
Cumulative on site savings	**3.7**	**77%**
Annual savings from off-set payment	1.1	-
	(Tonnes CO_2)	
Cumulative savings for off-set payment	**32**	-
Cash in-lieu contribution (£)	**3,073**	

As seen in the summary table, a total 77% improvement over Part L is achieved. Full SAP reports of the development can be found in Appendix A.

10. CONCLUSION

In line with the Local and London Plan, Planning Policy, and the project Planning conditions, this energy statement outlines the Environmental Design Strategy for the development and demonstrates the energy efficiency and renewable energy measures applied are able to achieve the required onsite carbon reductions in line with the energy hierarchy.

When applying proposed construction details and U-Values to all thermal elements, high levels of energy efficient lighting, and high efficiency ventilation system the measures equate to a Be Lean stage emissions rate of 3.4 Tonnes CO_2/year. The use of ASHPs to supply heating and photovoltaics further reduces energy consumption and associated carbon emissions. An overall 77% savings in carbon emissions is achieved, in accordance with Part L 2021. As this energy strategy has outlined, all measures within the means available for the project have been taken to achieve a significant improvement over Part L, Local and London Plan requirements.

As previously demonstrated, compliance with Building Regulations is demonstrated by achieving a lower carbon emission rate, dwelling fabric energy efficiency, and primary energy rate than that of the notional building. An improvement of 28% is achieved at Be Lean stage, meeting London Plan minimum requirements of 10%. The requirement of 35% improvement at Be Green is also achieved with an overall energy reduction of 77%.

The final calculated regulated emissions of the development is 1.1 tonnes CO_2/year. A carbon offset payment of £3,073 would be required for the development to meet net-zero carbon requirements.

APPENDIX A – SAP REPORTS

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Stroma SAP 10.2 SAP 10 program, 10.2

Date: Mon 24 Apr 2023 08:54:17

Project Information			
Assessed By	Webb Yates Engineers	Building Type	Maisonette, Enclosed mid-terrace
OCDEA Registration	STRO037816	Assessment Date	2023-03-14

Dwelling Details			
Assessment Type	As designed	Total Floor Area	142 m^2
Site Reference	Roseleigh Maisonette M1	Plot Reference	M1
Address	Roseleigh Close, TWICKENHAM, TW1 2JT		

Client Details	
Name	Not Provided
Company	Not Provided
Address	Not Provided, Not Provided, WF10 5QU

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*11.82 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	2.44 $kgCO_2/m^2$	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*64.83 kWh_{PE}/m^2*	
Dwelling primary energy	25.5 kWh_{PE}/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*35.5 kWh/m^2*	
Dwelling fabric energy efficiency	30.9 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.12	West Wall Ground Floor (0.12)	OK
Party walls	*0.2*	0	M1/M2 Loft Party Wall (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	0.1	Basement Floor (0.1)	OK
Roofs	*0.16*	0.11	R1 (0.11)	OK
Windows, doors, and roof windows	*1.6*	1.2	1 (1.2)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: West Wall Ground Floor	8.56	0.12 **(!)**
Exposed wall: North Wall Ground Floor	19.67	0.12 **(!)**
Exposed wall: East Wall Ground Floor	9.12	0.12 **(!)**
Exposed wall: West Wall First Floor	11.71	0.12 **(!)**
Exposed wall: North Wall First Floor	19.42	0.12 **(!)**
Exposed wall: East Wall First Floor	18.04	0.12 **(!)**
Exposed wall: West Wall Loft Floor	14.08	0.12 **(!)**
Exposed wall: North Wall Loft Floor	12.32	0.12 **(!)**
Exposed wall: East Wall Loft Floor	4.71	0.12 **(!)**
Exposed wall: North Wall Loft Floor	2.2	0.12 **(!)**
Exposed wall: East Wall Loft Floor	4.71	0.12 **(!)**
Basement wall: Basement Walls	54.04	0.12 **(!)**
Party wall: M1/M2 Loft Party Wall	18.2	0 **(!)**
Party wall: M1/M2 Basement P Wall	17.42	0 **(!)**
Party wall: M1/M2 Ground P Wall	18.98	0 **(!)**
Party wall: M1/M3 Ground P Wall	9.62	0 **(!)**
Party wall: M1/M2 First Party Wall	18.98	0 **(!)**

Name	Net area [m²]	U-Value [W/m²K]
Basement floor: Basement Floor	14.7	0.1 **(!)**
Ground floor: Ground Floor	47.6	0.1 **(!)**
Exposed roof: R1	24.85	0.11
Exposed roof: R2	10.32	0.11

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m²]**	**Orientation**	**Frame factor**	**U-Value [W/m²K]**
1, Doors	1.76	West	N/A	1.2
2, Windows (1)	4.62	West	0.9	1.2
3, Windows (1)	3.3	North	0.9	1.2
4, Windows (1)	3.3	North	0.9	1.2
5, Windows (1)	3.3	North	0.9	1.2
6, Windows (1)	0.49	North	0.9	1.2
7, Windows (1)	0.96	North	0.9	1.2
7, Roof windows (1)	0.49	North	0.9	1.2
8, Roof windows (1)	0.96	North	0.9	1.2
9, Roof windows (1)	0.64	North	0.9	1.2
10, Roof windows (1)	0.64	North	0.9	1.2

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))
Building part **1 - Main Dwelling**: SAP default y-value (0.2 W/m²K) used for thermal bridging

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m³/hm²*	
Dwelling air permeability at 50Pa	1.5 m³/hm², Design value **(!)**	**OK**
Air permeability test certificate reference	Not Provided	

4 Space heating	
Main heating system 1: Heat pump with radiators or underfloor heating - Electricity	
Efficiency	250.0%
Emitter type	Both radiators and underfloor
Flow temperature	
System type	
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	250 litres
Declared heat loss	1.91 kWh/day
Primary pipework insulated	Yes
Manufacturer	Gledhill
Model	IND250
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer, TRVs, and bypass	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat and HW separately timed	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	95 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.65 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	89%	OK
Manufacturer/Model		
Commissioning	Not Provided / Not Provided	

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	1.23 kWp
Orientation	West
Pitch	45°
Overshading	None or very little
Manufacturer	Solmatix
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Stroma SAP 10.2 SAP 10 program, 10.2

Date: Mon 24 Apr 2023 08:55:40

Project Information			
Assessed By	Webb Yates Engineers	Building Type	Maisonette, Enclosed mid-terrace
OCDEA Registration	STRO037816	Assessment Date	2023-03-14

Dwelling Details			
Assessment Type	As designed	Total Floor Area	94 m^2
Site Reference	Roseleigh Maisonette M2	Plot Reference	M2
Address	Roseleigh Close, TWICKENHAM, TW1 2JT		

Client Details	
Name	Not Provided
Company	Not Provided
Address	Not Provided, Not Provided, WF10 5QU

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*11.19 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	2.34 $kgCO_2/m^2$	**OK**
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*61.47 kWh_{PE}/m^2*	
Dwelling primary energy	24.82 kWh_{PE}/m^2	**OK**
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*25.3 kWh/m^2*	
Dwelling fabric energy efficiency	24.1 kWh/m^2	**OK**

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.12	West Wall Ground Floor (0.12)	**OK**
Party walls	*0.2*	0	M2/M1 Basement Wall (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	0.1	Basement Floor (0.1)	**OK**
Roofs	*0.16*	0.11	Ceiling/Roof (0.11)	**OK**
Windows, doors, and roof windows	*1.6*	1.2	1 (1.2)	**OK**
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: West Wall Ground Floor	11.79	0.12 **(!)**
Exposed wall: South Wall Ground Floor	10.96	0.12 **(!)**
Basement wall: Basement Walls	23.8	0.12 **(!)**
Exposed wall: South Wall First Floor	13.64	0.12 **(!)**
Exposed wall: West Wall First Floor	15.02	0.12 **(!)**
Party wall: M2/M1 Basement Wall	18.76	0 **(!)**
Party wall: M2/M3 Basement Wall	6.44	0 **(!)**
Party wall: M2/M1 Ground Floor Wall	18.24	0 **(!)**
Party wall: M2/M3 Ground Floor Wall	19.67	0 **(!)**
Party wall: M2/M1 First Floor Wall	18.59	0 **(!)**
Party wall: M2/M3 First Floor Wall	17.94	0 **(!)**
Basement floor: Basement Floor	11.9	0.1 **(!)**
Ground floor: Ground Floor	41.4	0.1 **(!)**
Exposed roof: Ceiling/Roof	32.8	0.11

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
1, Doors	1.76	West	N/A	1.2

Name	Area [m^2]	Orientation	Frame factor	U-Value [W/m^2K]
2, Windows (1)	4.4	West	0.9	1.2
3, Windows (1)	4.4	South	0.9	1.2
4, Windows (1)	4.4	West	0.9	1.2
5, Windows (1)	4.4	South	0.9	1.2

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))
Building part **1 - Main Dwelling**: SAP default y-value (0.2 W/m^2K) used for thermal bridging

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	1.5 m^3/hm^2, Design value **(!)**	**OK**
Air permeability test certificate reference	Not Provided	

4 Space heating	
Main heating system 1: Heat pump with radiators or underfloor heating - Electricity	
Efficiency	250.0%
Emitter type	Both radiators and underfloor
Flow temperature	
System type	
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	250 litres
Declared heat loss	1.91 kWh/day
Primary pipework insulated	Yes
Manufacturer	Gledhill
Model	IND250
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer, TRVs, and bypass	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat and HW separately timed	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	95 lm/W	**OK**
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.55 W/(l/s)	**OK**
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	**OK**
Manufacturer/Model		
Commissioning	Not Provided / Not Provided	

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	1.23 kWp
Orientation	West
Pitch	45°
Overshading	None or very little
Manufacturer	Solmatix
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed:	Assessor ID:
Name:	Date:
b. Client Declaration	
N/A	

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Stroma SAP 10.2 SAP 10 program, 10.2

Date: Mon 24 Apr 2023 08:57:42

Project Information			
Assessed By	Webb Yates Engineers	Building Type	Maisonette, Enclosed mid-terrace
OCDEA Registration	STRO037816	Assessment Date	2023-03-14

Dwelling Details			
Assessment Type	As designed	Total Floor Area	206 m^2
Site Reference	Roseleigh Maisonette M3	Plot Reference	M3
Address	Roseleigh Close, TWICKENHAM, TW1 2JT		

Client Details	
Name	Not Provided
Company	Not Provided
Address	Not Provided, Not Provided, WF10 5QU

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*9.86 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	3.01 $kgCO_2/m^2$	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*53.84 kWh_{PE}/m^2*	
Dwelling primary energy	31.77 kWh_{PE}/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*35.1 kWh/m^2*	
Dwelling fabric energy efficiency	33.6 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.16	East Wall First Floor (0.26)	OK
Party walls	*0.2*	0	Party Wall Ground (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	0.1	Basement Floor (0.1)	OK
Roofs	*0.16*	0.11	South Plane Roof (0.11)	OK
Windows, doors, and roof windows	*1.6*	1.2	1 (1.2)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: South Wall Ground Floor	17.63	0.12 **(!)**
Exposed wall: East Wall Ground Floor	20.52	0.12 **(!)**
Basement wall: All Walls Basement Floor	71.4	0.12 **(!)**
Exposed wall: South Wall First Floor	20.53	0.12 **(!)**
Exposed wall: South Wall Loft Floor	20.02	0.12 **(!)**
Exposed wall: East Wall First Floor	13.26	0.26
Exposed wall: East Wall Loft Floor	18.92	0.26
Exposed wall: North Wall First Floor	12.26	0.26
Exposed wall: North Wall Loft Floor	7.02	0.26
Party wall: Party Wall Ground	33.06	0 **(!)**
Party wall: Party Wall Loft	14.96	0 **(!)**
Party wall: Part Wall First	22.2	0 **(!)**
Basement floor: Basement Floor	22.2	0.1 **(!)**
Ground floor: Ground Floor	72.6	0.1 **(!)**
Exposed roof: South Plane Roof	6.68	0.11
Exposed roof: East Plane Roof	35.86	0.11

2c Openings (better than typically expected values are flagged with a subsequent (!))

Name	Area [m²]	Orientation	Frame factor	U-Value [W/m²K]
1, Doors	1.76	South	N/A	1.2
2, Windows (1)	4.83	South	0.9	1.2
3, Windows (1)	4.83	South	0.9	1.2
4, Windows (1)	3.08	East	0.9	1.2
5, Windows (1)	3.08	East	0.9	1.2
6, Windows (1)	1.96	North	0.9	1.2
7, Windows (1)	0.9	North	0.9	1.2
8, Windows (1)	7.54	North	0.9	1.2
9, Roof windows (1)	0.64	South	0.9	1.2
10, Roof windows (1)	2.08	South	0.9	1.2
11, Roof windows (1)	0.84	East	0.9	1.2
12, Roof windows (1)	18.9	East	0.9	1.2

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))
Building part **1 - Main Dwelling**: SAP default y-value (0.2 W/m²K) used for thermal bridging

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m³/hm²*	
Dwelling air permeability at 50Pa	1.5 m³/hm², Design value **(!)**	OK
Air permeability test certificate reference	Not Provided	

4 Space heating	
Main heating system 1: Heat pump with radiators or underfloor heating - Electricity	
Efficiency	250.0%
Emitter type	Both radiators and underfloor
Flow temperature	
System type	
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	250 litres
Declared heat loss	1.91 kWh/day
Primary pipework insulated	Yes
Manufacturer	Gledhill
Model	IND250
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer, TRVs, and bypass	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat and HW separately timed	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	95 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.55 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	90%	OK
Manufacturer/Model		
Commissioning	Not Provided / Not Provided	

9 Local generation
N/A

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed:	Assessor ID:
Name:	Date:
b. Client Declaration	
N/A	

APPENDIX B - WATER-USE CALCULATION

Water Efficiency Calculator for New Dwellings (V1f - Aug 2010)

Project Details

Adress/Reference	Roseleigh Close	Case Reference	J5313
Number of Bedrooms	8	Occupancy for Calculation Purposes	9

Appliance/Useage Details

Taps (Excluding Kitchen Taps)

Tap Fitting Type	Flow Rate Litres/Min	Quantity (No.)	Total per Fitting type
Basin	5.00	8	40.00
			0.00
			0.00
			0.00
			0.00
			0.00
Total No. of Fittings (No.)		8	
Total Flow (l/s)			40.00
Maximum Flow (l/s)			5.00
Average Flow (l/s)			5.00
Weighted Average Flow (l/s)			3.50
Flow for Calculation (l/s)			**5.00**

Showers

Shower fitting Type	Flow Rate Litres/Min	Quantity (No.)	Total per Fitting type
	7.60		0.00
	7.60		0.00
Shower	9.50	5	47.50
			0.00
			0.00
			0.00
Total No. of Fittings (No.)		5	
Total Flow (l/s)			47.50
Maximum Flow (l/s)			9.50
Average Flow (l/s)			9.50
Weighted Average Flow (l/s)			6.65
Flow for Calculation (l/s)			**9.50**

Baths

Bath Type	Capacity to Overflow	Quantity (No.)	Total per Fitting type
Rotaldo f/standing bath	190.00	1	190.00
			0.00
Burlington fitted bath	105.00	4	420.00
			0.00
Total No. of Fittings (No.)		5	
Total Capacity (l)			610.00
Maximum Capacity (l)			190.00
Average Capacity (l)			122.00
Weighted Average Capacity (l)			133.00
Capacity for Calculation (l)			**133.00**

WCs

WC Type	Full Flush Volume	Part Flush Volume	Quantity (No)
Vitra concealed cistern	6.00	3.00	8
Total number of fittings			**8**
Average effective flushing volume			**4.00**

Dishwashers

Dishwasher Type	L per Place Setting	Quantity (No.)	Total per Fitting type
Dishwasher	0.98	3	2.93
			0.00
Total No. of Fittings (No.)		3	
Total Consumption (l)			2.93
Maximum Consumption (l)			0.98
Average Consumption (l/s)			0.98
Weighted Average Consumption (l)			0.68
Consumption for Calculation (l/s)			**0.98**

Washing Machines

Washing Machine Type	L per Kg Dry Load	Quantity (No.)	Total per Fitting type
Washing Machine tbc	6.44	3	19.31
			0.00
Total No. of Fittings (No.)		3	
Total Consumption (l)			19.31
Maximum Consumption (l)			6.44
Average Consumption (l/s)			6.44
Weighted Average Consumption (l)			4.51
Consumption for Calculation (l/s)			**6.44**

Kitchen Taps

Tap Fitting Type	Flow Rate Litres/Min	Quantity (No.)	Total per Fitting type
Kitchen Taps	5.00	6	30.00
			0.00
			0.00
Total No. of Fittings (No.)		6	
Total Flow (l/s)			30.00
Maximum Flow (l/s)			5.00
Average Flow (l/s)			5.00
Weighted Average Flow (l/s)			3.50
Flow for Calculation (l/s)			**5.00**

Other Fittings

Waste Disposal Y/N	
Water softner	
Consumption beyond 4% l/p/d	

Use of grey water and harvested rainwater

Total Grey water from WHB taps (l)	
Total Availble Grey Water Supply (l)	505.31
Possible Demand (l)	280.79
Grey/Rain Installed Capacity (l)	
Figure for Calculation lit/person/day	0.00

Water Use Assessment

Installation Type	Unit	Capacity/ Flow Rate	Use Factor	Fixed use (l/p/day)	**Total Use (l/p/day)**
WC Single Flush	Volume (l)	0.00	4.42	0.00	0.00
WC Dual Flush	Full Flush (l)	0.00	1.46	0.00	0.00
	Pt Flush (l)	0.00	2.96	0.00	0.00
WC's (Multiple)	Volume (l)	4.00	4.42	0.00	17.68
Taps Exc. Kitchen	Flow Rate	5.00	1.58	1.58	9.48
Bath (shower present)	(l/s)	133.00	0.11	0.00	14.63
Shower (bath present)	(l/s)	9.50	4.37	0.00	41.52
Bath Only	(l)	0.00	0.50	0.00	0.00
Shower Only	(l/s)	0.00	5.60	0.00	0.00
Kitchen Taps	(l/s)	5.00	0.44	10.36	12.56
Washing Machines	(l/kgdry)	6.44	2.10	0.00	13.52
Dishwashers	(l/place)	0.98	3.60	0.00	3.51
Waste Disposal	(l/s)	0.00	3.08	0.00	0.00
Water Softner	(l/s)	0.00	1.00	0.00	0.00
Total Calculated Water Use (l/p/day)					**112.89**
Grey/RainWater Reused (l)					0.00
Normalisation Factor	(Factor)				0.91
Total Consumption CSH (l/p/day)					**102.73**
External Water Use Allowance (l)					5.00
Total Comsumption Part G (l/p/day)					**107.73**

Assesment Result	**PASS**