



Energy and Sustainability Statement

Land at 116 Norfolk Avenue, London N13 6AJ

PR10687

Date: 21/12/2023



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Executive summary

ERS Consultants Ltd has been appointed to prepare an Energy & Sustainability Statement for the 2 dwellings on Land at 116 Norfolk Avenue, London N13 6AJ.

This report will be focusing on the dwellings being proposed and look at implementing careful design and sustainable measures; so that the project creates attractive new residential units.

Proposed schedules of accommodation are as follows:

- Construction of 2 x 3-Bedroom Flats

Total combined internal floor area for the 2 dwellings: 164.96m²

(Drawings can be found in the appendix of this report)

This energy and sustainability report outlines the key measures to be incorporated in the design, in regards to sustainability, carbon emissions, renewable energy and environmental impact of the considered development in accordance and with guidance from the following documents and policies:

- Strategy for Greater London plan (March 2021);
- Haringey's Local Plan Strategic Policies 2013-2026 (SP4);
- London Plan Policy SI2: Be Green – maximising opportunities for renewable energy by producing, storing, and using renewable energy on-site;
- Local Plan SP4: 20% carbon dioxide emission reduction from on-site renewable energy generation; and
- Policy DM21: demonstrate sustainable design, layout and construction techniques

According to the Haringey's Local Plan Strategic Policies (Policy SP4), "All new residential development shall be zero carbon from 2016 onwards". Noting this factor and being in line with the Strategy for Greater London plan, the development would need to achieve a 35% reduction in regulated CO₂ emissions against a Building Regulations (Part L 2021) compliant scheme.

In addition to passive design and energy efficiency measures, this energy and sustainability statement will demonstrate that, highly-efficient Air Source Heat Pumps are going to provide heating and energy to the dwellings.

An energy simulation has been undertaken to establish the energy consumption and carbon emissions of the proposed building.

The methodology used to determine the expected operational CO₂ emissions for the development is in accordance with the the Strategy for Greater London plan three-step Energy Hierarchy and the CO₂ savings achieved for each step are outlined below:

Baseline – (CO₂ emissions Part L 2021 of the Building Regulation)

Initially in the energy assessment must be established that the regulated CO₂ emissions of the development comply with the Part L 2021 of the Building Regulations using the approved compliance software SAP. The total site-wide baseline CO₂ amounts to 2.30 tonnes CO₂/year.

Be Lean – Use less energy

The second step addresses reduction in energy demand, through the adoption of passive and active design measures with emphasis on a fabric first approach.

Emphasis will be put on the buildings fabric performance in order to reduce energy consumption, as less heating and cooling will be lost through the high performance fabric hence reducing the demand. Fabric first measures include levels of insulation beyond Building Regulation 2021 requirements which will help in achieving low air tightness levels.

With the addition mechanical ventilation and be lean fabric specification, the site wide increase in CO₂ emissions from the baseline amounts to 30% (to 1.60 tonnes CO₂/year) for the development.

Be Clean – Supply energy efficiently

Once demand for energy has been minimised, all planning applications must demonstrate how their energy systems will exploit local energy resources (such as secondary heat) and supply energy efficiently and cleanly to reduce CO₂ emissions.

When selecting the proposed heating system, it is imperative to consider carbon dioxide emissions, as all combustion processes can emit oxides of Nitrogen (NO_x) and, solid or liquid fueled appliances (such as those using biomass or biodiesel) can also emit Particulate Matter. These pollutants contribute to local air quality and can have negative impacts on the health of local residents and occupiers of the development. It is important that these impacts are taken into account in determining the heating strategy of a development.

The space conditioning and hot water system network of the proposed development due lack of space on site will not be connected to communal systems and further low-zero carbon solutions are to be considered, therefore there are no further changes/CO2 reductions to be made at the Be Clean stage.

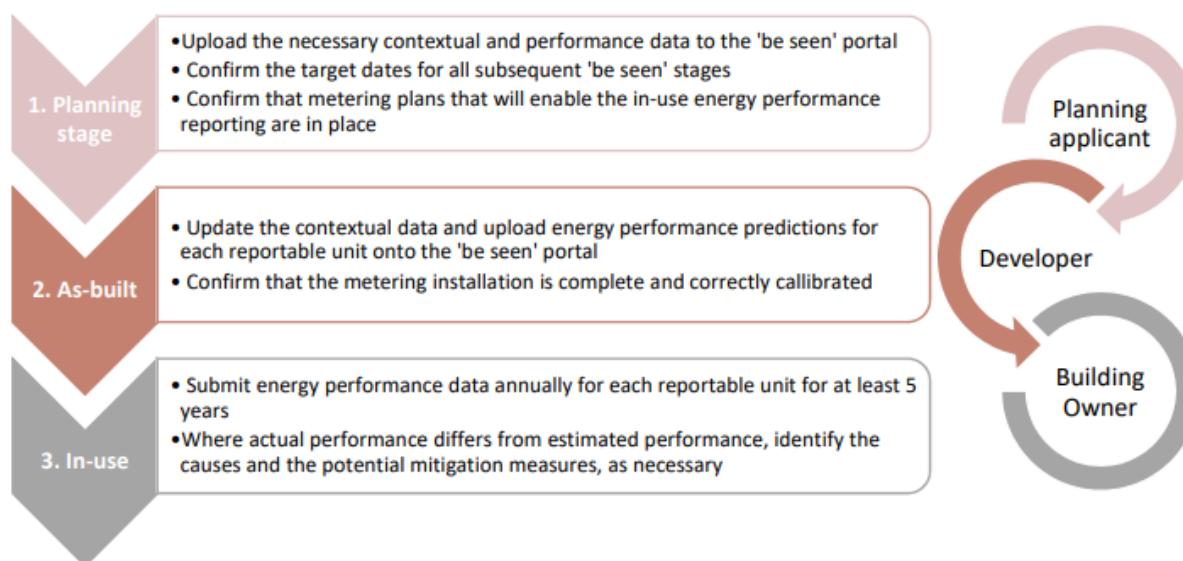
Be Green – Use renewable energy

The incorporation of the low-zero carbon heat pump will reduce CO2 emissions on site by a 66% (0.8 tonnes CO2/year) for the development compared to the baseline.

The proposed building achieves a reduction of 66%, which fulfills the required 35.00% Carbon Emissions Reduction against Part L 2021 Building Regulations, in accordance with the Strategy for Greater London plan (March 2021). The proposed dwellings achieve a reduction of over 65%, thus meaning this proposed development using the proposed specification in this report completes the required **35% Carbon Emissions Reduction** against Part L1A, 2021 Building Regulations, in accordance with the Greater London plan (March 2021).

Be Seen – Monitor, Verify and Report

This is the post construction monitoring process that developer will need to report against the performance indicators at each stage of the process by downloading the 'be seen' reporting spreadsheet from the 'be seen' of the GLA's website. The online 'be seen' portal will be available later and applicants will be able to report via this portal instead of emailing information to the GLA.



Energy & carbon demand summary

Table 1 Energy and Carbon Reductions, offset Shortfall

	CO ₂ Emissions (tonnes CO ₂ /Year)	CO ₂ Emissions Savings (%)
Baseline	2.30	
Be Lean	1.60	30.00%
Be Clean	1.60	0.00%
Be Green	0.80	36.00%
Total Reduction	1.50	66.00%
Off-Set £95/tonneCO₂	23.60	£2,243

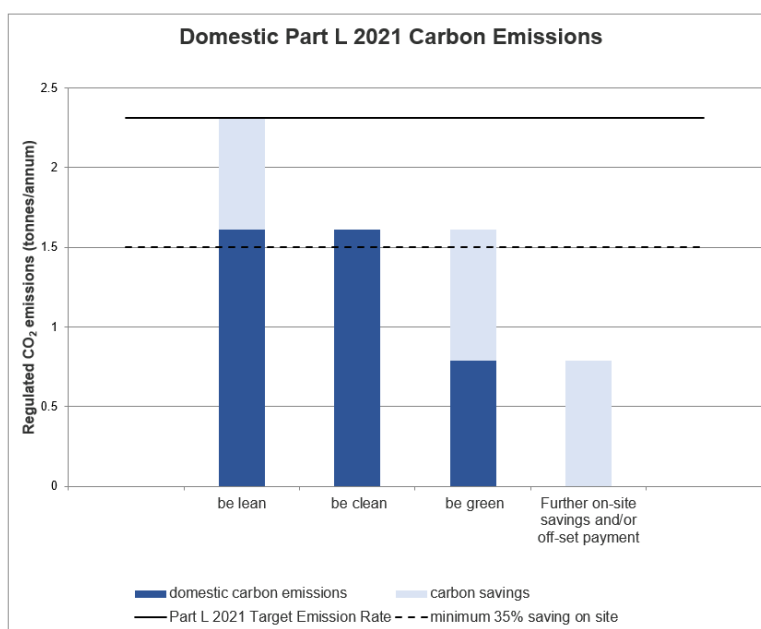


Fig.1 CO₂ Reduction

As shown in Table 1, the baseline annual carbon emissions being 2.4 tonnes CO₂/yr. the incorporation of energy saving measures and low zero carbon technology, following the London plan 2021 Policy SI 2 local plan guidance, the site would reduce the energy requirement and CO₂ emissions to 0.8 tonnes CO₂/year, respectively.

The total reduction with "Be Green" measures would result in a total of 66% CO₂ reduction that is in comparison to the Part L 2021 Building regulations baseline as shown in Figure 1, achieving the required target.

Table 2. Proposed Specifications

Proposed Specifications			
Fabric	U-Value (W/m2K)	New External Walls	0.17
		Corridor Walls	0.20
		Roof insulated at Joists	0.11
		New Flat Roof	0.15
		Roof insulated at joists	0.10
		Roof insulated at rafters	0.15
		Floor	0.12
		Windows and Rooflights	1.40 Double glazed units, Low-E Soft Coat; (g-value:0.63)
		Door to Corridor	1.40 Solid
Air permeability	Q (m3/m2h)	3.00 due to MVHR being proposed;	
Space Heating	Air Source Heat Pump	Mitsubishi Ecodan 8.5 kW PUHZ-W85VAA to radiators; Assumed design stage model; one heat pump per dwelling;	
Controls	Time and Temperature Zone Control;		
Water Heating	From Main Heating; Domestic 210 litre Hot Water Cylinder; Standing Heat Loss: 1.36kWh/day		
Thermal Bridging	Enhanced construction details are to be used based on the proposed construction;		
Lighting Systems	Lighting type	LED Lighting, throughout each dwelling;	
Renewables	Photovoltaic Panels	None;	
This specification is a recommendation but may change during the construction stage, to meet site constraints, any worsening of the u-values must ensure the required reduction in Carbon is met before completion;			

Introduction

Site & proposal

The site is located on Land at 116 Norfolk Avenue, London N13 6AJ.

The total development measures internally, approximately 164.96 m² in area. The approximate site plan of the proposed development is shown in the site plan Figure.2.



Site Location Plan
1:500

Fig.2 Site Plan

Policy context

This energy and sustainability statement will seek to respond to the energy policies that apply to this development. The most relevant applicable energy policies in the context of the proposed development are presented below.

- Strategy for Greater London plan (March 2021);
- Haringey's Local Plan Strategic Policies 2013-2026 (SP4);
- London Plan Policy SI2: Be Green – maximising opportunities for renewable energy by producing, storing, and using renewable energy on-site;
- Local Plan SP4: 20% carbon dioxide emission reduction from on-site renewable energy generation; and
- Policy DM21: demonstrate sustainable design, layout and construction techniques

All the aforementioned policies focus on zero carbon targets for residential developments with a minimum 35 per cent on site reduction beyond Part L 2021.

Calculation methodology

The sections below present the methodology followed in determining carbon emissions reduction savings for the proposed scheme.

The methodology employed by the energy and sustainability statement is in line with the GLA's Guidance on preparing energy assessments.

The baseline CO₂ emissions are first established, i.e. the emissions of a scheme that is compliant with Part L 2021 of the Building Regulations.

The approved software used to model and calculate the energy performance and carbon emissions is Design SAP 10 by Elmhurst Energy Systems Ltd.

The TER which is used as the baseline figure for the carbon reductions for each non-domestic element is multiplied by its floor area to establish the total emissions. Similarly, the DER is calculated in the same method to determine the energy performance and CO₂ emissions of the proposed scheme for each of the steps of the Energy Hierarchy.

Baseline:

The development's baseline uses the notional fabric specification and the heating system in the baseline model is the notional dwelling and target to better in the SAP calculations.

Be Lean: Use less energy

The demand for energy is reduced through a range of passive and active energy efficiency measures; as part of this step the development's fabric u-values, thermal bridging, air tightness and glazing have been improved to a high standard; A gas combination boiler and MVHR system have been implemented to bring a reduction of over 10% at the Be Lean Stage.

Be Clean: Supply energy efficiently

In this building there will be no direct heating networks or CHP incorporated, therefore the Be Clean scenario will not further reduce CO₂ emissions on site.

Be Green: Renewable energy

Low-zero carbon technologies are further improved to high performance heat pump to offset a minimum of 20% of the carbon emissions as per Local Plan SP4.

The implementation of the Energy Hierarchy determines the total regulated carbon savings that can be feasibly and viably achieved on site.

The 66% improvement for the flats against the baseline emissions is compared to the relevant targets for each element and in case of a shortfall; savings through off-site measures should be achieved.

The Conclusions section summarizes the energy strategy and associated carbon savings for the proposed development.

Be Seen:

This is the post construction monitoring process that developer will need to report against the performance indicators at each stage of the process by downloading the 'be seen' reporting spreadsheet from the 'be seen' of the GLA's website.

The Conclusions' section summarizes the energy strategy and associated carbon savings for the proposed development.

The carbon emissions factors used in all calculations in this document are those used for Part L of the Building Regulations. The relevant factors are reproduced in Table 3 below.

Table 3 Carbon Emission Factors for selected fuel type

Fuel	CO ₂ emission factor (kgCO ₂ /kWh)
Mains Gas-Baseline	0.210 kgCo2/kWh
Grid Electricity-Proposed	0.157 kgCo2/kWh

Be Lean – Use less energy

The proposals incorporate a range of passive and active design measures that will reduce the energy demand for space conditioning, hot water, and lighting.

Materials and Waste

A site waste management plan that provides details of waste minimisation, sorting, reuse and recycling procedures is required for all levels in the planning guidance. Sustainable waste management should follow the hierarchy described in *BS 5906: Waste management in buildings. Code of practice*. This outlines the following principles in decreasing order of desirability:

- Reuse land and buildings wherever feasible and consistent with maintaining and enhancing local character and distinctiveness.
- Reuse and recycle materials that arise through demolition and refurbishment, including the reuse of excavated soil and hardcore within the site.
- Prioritise the use of materials and construction techniques that have smaller ecological and carbon footprints, help to sustain or create good air quality, and improve resilience to a changing climate where appropriate.
- Incorporate green roofs and/or walls into the structure of buildings where technically feasible to improve water management in the built environment, provide space for biodiversity and aid resilience and adaptation to climate change.
- Consider the lifecycle of the building and public spaces, including how they can be easily adapted and modified to meet changing social and economic needs and how materials can be recycled at the end of their lifetime.

Space is provided and appropriately designed to foster greater levels of recycling of domestic waste.

Using Recycled/Recyclable Materials and Sourcing them Responsibly

The following measures will be put in place to minimise environmental impact

Regard for reuse & efficient use of materials: Material efficiency will be a priority for the design team and will be one of the key considerations during detailed design. Potential measures for reducing the material demand and for designing out waste will be explored by all key design team disciplines at each design stage, according to the first stages of the Waste Hierarchy.

Regard will be given to reducing the use of virgin materials, such as ensuring a recycled aggregate of content 10-15% in concrete, for example.

Specifically, the following notes have been made on the durability and recycling potential of project materials:

- Brick in the wall finishes has a long usable life and can be reclaimed / re-used in the future. It can also be recycled although it is a more a down-cycle into rubble material for aggregates.
- Window glass, carpeting, and concrete can also be down-cycled.
- The hard landscaping has many timber elements (seats, benches, fences, the acoustic fence) which is a renewable material and is likely to be FSC certified. It can also be recycled or down-cycled into chipboard / crushed timber.
- Off-site construction and Prefabrication; An effective way of managing materials efficiency is through off-site construction or 'Prefabrication', meaning that major components of buildings are manufactured off-site and assembled on-site. This has many benefits, as factory environments help to ensure quality of construction, reduce waste because of spoilage on site (e.g. due to poor storage practices or inclement weather) and encouraging the re-use of materials that otherwise may be wasted. This will be actively explored particularly in relation to the houses.
- Similarly, the use of pre-made sections, such as pre-cast floor slabs in the flatted element will reduce waste and maximise material efficiency. A study by the HSE concluded that waste reductions approaching 70% were possible when compared with traditional techniques.
- The design seeks to use prefabrication for some internal spaces and will be used, subject to the availability of skilled labour and resources within a reasonable distance of the site.
- The design utilises stacking, repeating floor plans where possible within the site constraints, making the use of modular construction possible. If this is a variable option it would reduce transport journeys, reduce site congestion and increase safety.

Environmentally conscious materials

- Materials with the lowest environmental impact tend to have only minimal processing requirements and contain as many naturally occurring constituents as possible. The design team will ensure that 'good practice' is implemented in the specification of materials, making conscious decisions to specify more natural products and wider environmental impact of the materials will be considered when choosing between different options. This could include reviewing Environmental Product Declarations.
- Furthermore, efforts will be made to use materials with low/zero Global Warming Potential (GWP), low Ozone Depletion Potential (ODP) and low embodied energy.
- Local and responsible sourcing Transport associated with extracting, processing and delivering materials can contribute significantly to their carbon and environmental footprint. A robust system of responsible materials sourcing will ensure that native materials will be used as a matter of preference, before any are sourced internationally. It is reasonable to expect as well that deliveries will be made using fuel efficient vehicles.
- The responsible sourcing of materials will be a key consideration in the selection of suppliers, and a sustainable procurement strategy will be produced for the development prior to construction.
- Materials from suppliers who participate in responsible sourcing schemes such as the BRE BES 6001:2008 Responsible Sourcing Standard will be prioritised where economically possible.

Where there are suitable opportunities to recycle a proportion of the material recovered from the existing site it should always be done.

Enhanced U-values

The heat loss of different building fabric elements is dependent upon their U-value. A building with low U-Values provide better levels of insulation and reduced heating demand during the cooler months.

The proposed development will incorporate high levels of insulation and high-performance glazing beyond Part L 2021 targets and notional building specifications, to reduce the demand for space conditioning (heating and/or cooling).

Table 4 demonstrates the improved performance of the proposed building fabric beyond the Building Regulations requirements.

Table 4 Proposed fabric U-Values

Domestic (U-Values in W/m ² k)		
Element	Part L 2021	Proposed
Wall	0.26	0.17 [New External Walls] 0.20 [Corridor Wall]
Floor	0.18	0.12
Roof	0.16	0.10 [Pitched Roof insulated at Joists] 0.15 [Flat Roof] 0.15 [Roof insulated at Rafter]
Windows	1.40	1.30
Door	1.40	1.40 [Door to Corridor]
These u-values are recommended but may change during the construction stage, to meet site constraints, any worsening of the u-values must ensure the required reduction in Carbon is met before completion;		

Air tightness improvement

Heat loss may also occur due to air infiltration. Although this cannot be eliminated altogether, good construction detailing and the use of best practice construction techniques can minimise the amount of air infiltration.

The proposed development will aim to improve upon the Part L 2021 minimum standards for air tightness by targeting air permeability rates of **5.00m³/m².h at 50Pa for the unit**, should the air test be below **3.00m³/m².h at 50Pa Mechanical ventilation will be required, this design initially suggests an MVHR unit so therefore the target of 3.00 is adopted.**

Reducing the need for artificial lighting

The development has been designed to maximize daylight in all habitable spaces as a way of improving the health and wellbeing of its occupants.

Natural light Natural lighting reduces the energy used for artificial lighting and creates a healthier internal environment. Issues to consider include how much of the sky is visible through a window (the more, the better), the dimensions of the interior living/working space and distance from the window, and the proportion of glazed surfaces. The depth of the room is an important factor in determining the amount of natural light received. Naturally dark rooms may be lit naturally through measures such as sun tubes which 'pipe' sunlight from sunny areas to internal areas.

Glare created by natural or artificial light can be uncomfortable for people both inside and outside a building. This can be minimised if considered early in the design process through building layout (e.g. low eaves height) or building design (e.g. blinds, brise soleil screening). If considered together with a lighting strategy this can reduce energy consumption.

All of the habitable areas will benefit from suitable level glazed fenestration to increase the amount of daylight within the internal spaces where possible. This is expected to reduce the need for artificial lighting whilst delivering pleasant, healthy spaces for occupants.

Waste

A site waste management plan that provides details of waste minimisation, sorting, reuse and recycling procedures is required for all levels in the planning guidance. Sustainable waste management should follow the hierarchy described in BS 5906: *Waste management in buildings. Code of practice*. This outlines the following principles in decreasing order of desirability:

- Reduce waste
- Re-use materials and equipment (and facilitate future reuse)
- Recycle waste (and facilitate recycling)
- Compost biodegradable waste
- Recover energy from waste (and facilitate energy recovery from waste)
- Disposal

Active design measures

High efficiency & low energy lighting

Where artificial lighting will be needed it will be low energy lighting without compensating for luminance, and will accommodate LED.

Water Efficiency Measures

Policy requires water efficiency in new development to meet the highest national standard. For residential development, this is defined in the supporting text as the 'optional Building Regulation' for water efficiency in new dwellings, which is 110 litres per day per person, or a tighter standard if one becomes available nationally.

There are presently no other national standards for non-residential developments than those in the Building Regulations. However, the principle of water efficiency in line with the waste hierarchy applies to all developments. As a result, all developments should seek to reduce demand through efficiency measures, and then meet remaining demand from sustainable sources wherever possible.

For all developments, the submitted information should set out an approach to water management that reduces water usage and waste and prioritises demand reduction measures over supply measures.

Reducing water use

Development, whether new construction or change of use and refurbishment, can save water by including measures such as:

- systems for greywater reuse
- aerated washbasin/kitchen taps and shower heads,
- tapered and low-capacity baths,
- sensor and low flush toilets, • shower timers, and
- water efficient white goods and appliances such as washing machines and dishwashers.

Water use during construction can be reduced through measures including:

- closed loop wheel washers,
- waterless wheel washing using angled steel grids to remove debris,
- high pressure low volume power hoses, recirculating water where possible,
- limiting the water used for flushing building services by stopping it as soon as the flush water turns clear, and
- employing a regime for monitoring water use and water waste.

Choosing the best location for a boiler can reduce water consumption and heat loss. By minimising the length of hot water pipes the volume of water that must be drawn off

each time a tap or shower is used can be reduced. Positioning hot water pipes above pipes carrying cold water will reduce heat transfer. Further heat loss can be reduced by insulating the piping.

For all new dwellings, a completed “water efficiency calculator for new dwellings” worksheet that accords with Part G of the building regulations’ Approved Documents should be provided prior to occupation. The calculation must demonstrate that the new dwellings will achieve a maximum water usage of 110 litres per person per day.

Rainwater harvesting

Rainwater harvesting is the collection of rainwater directly from a surface it falls on (e.g. a roof). Once collected and stored it can be used for non-potable purposes such as watering gardens, supplying washing machines and flushing toilets, thereby reducing consumption of potable water. Potable water is produced through a purification process and is pumped over large distances, both of which require energy and result in embodied carbon that is not present in water harvested locally. In a residential development, rainwater can be captured for domestic use using water butts connected to a down pipe. Larger systems can use water stored in underground water tanks.

Schemes should be designed to include space for water storage. In residential developments, down pipes should be carefully placed so that water collection and use is convenient for residents.

Greywater re-use

Water that is recycled from bathrooms and kitchens for non-potable uses is known as greywater. Greywater systems must ensure treatment on a regular basis to prevent a build-up of bacteria, and some systems are powered, which entails an energy cost. As a result, greywater reuse is generally less preferable than water use minimisation measures.

Water recycling systems are better suited to new developments rather than retrofitting in existing buildings because of the excavation required for storage tanks and changes needed to the plumbing system, and they are generally more cost effective for new developments and developments of a larger scale.

Recycling systems should be backed up by a mains supply or a sufficiently large reserve storage system to meet higher demands during dry spells. Storage tanks will need an overflow to allow excess water to be released which should be able to flow into a soak away.

Controls and Monitoring

Advanced lighting and space conditioning controls will be incorporated, specifically:

- For areas of infrequent use, occupant sensors will be fitted for lighting, whereas day lit areas will incorporate daylight sensors where appropriate;
- Heating and cooling systems controls will comprise time and temperature controls, both centrally for the whole building, and locally for each space;
- Smart metering to be installed on all new dwellings for adequate monitoring;

Be Lean CO₂ emissions

With the addition of the be lean fabric improvements, the site wide increase in CO₂ emissions from the baseline amounts to 30% (to 1.60 tonnes CO₂/year) for the development.

Be Clean – Supply energy efficiently

Low Carbon Energy Sources

Combined Heat and Power (CHP)

The presence of a year-round base hot water generation heat load in residential units is favourable to CHP. To date, there are readily available micro gas fired CHP units (such as EC power) on the market. At this stage gas fired CHP will be provisionally incorporated into the development's LZC strategy, however, the carbon reductions due to CHP are extremely sensitive to the system design, unit selection and running time.

CHP (Combined Heat & Power) is a great technology to use, however the system itself needs to run on a 24-hour basis. The heat generated would be exceeding the demand and needs for this site, and would require to have an outlet area which can profit from this excess; however, this development does not have a space that benefit from this; therefore, this option has considered not feasible for this development.

In this project there will be no direct heating networks or CHP incorporated so therefore, the Be Clean scenario will not further reduce CO₂ emissions on site for the proposed Site, therefore meaning there are no changes to the carbon reduction to be implemented to the property.

Be Green –Renewable energy

Renewable technologies feasibility study

Methods of generating on-site renewable energy (Green) were assessed, once Lean and Clean measures were considered.

This section provides an overview of the technologies considered, a brief assessment of their feasibility, a proposed mixture of suitable technologies.

The proposed development will benefit from an energy efficient building fabric which will reduce the energy consumption of the proposed development in the first instance.

A range of renewable technologies were subsequently considered including:

- Biomass;
- Ground/water source heat pumps;
- Wind energy;
- Photovoltaic panels, and,
- Solar thermal panels.

In determining the appropriate renewable technology for the site, the following factors were considered:

- CO₂ savings achieved;
- Site constraints;
- Financial benefit
- Any potential visual impacts

Demand profiles

The balance of technologies chosen will depend on the development's energy demand patterns. Keeping in mind that the space heating energy demand changes according to the season. While hot water energy demand will provide a significant base load throughout the year.

Electrical demand is likely to be moderate throughout the year. Lighting loads will be highest during the evening but will continue at reduced levels throughout the night and during the day.

Feasibility

At this early stage in the design, it is possible only to outline the likely feasibility of specific technologies. Further descriptions of the LZC technologies below are included in Appendix A.

Table 5. Renewable and Low Zero Carbon Technologies

Renewable Technology	Comments	Lifetime (Years)	Maintenance	Impact on External Appearance	Site Feasibility	Adopted for Site
BIOMASS 	Burning of wood pellets releases high NOx emissions and there are limitations for their storage and delivery within an urban location.	20	High	High	3	☐
PV 	PV panels would generate significant carbon savings, but due to excess shading caused by neighboring properties and a lack of suitable roof space, this is not a feasible option.	25	Low	Med	3	☐
Solar Thermal 	Solar thermal array mounted on the roof would conflict with the savings made from the proposed low-zero carbon technology and have a large impact on external appearance.	25	Low	High	4	☐
ASHP 	Ground loops require space and additional time at the beginning of the construction process and very high capital costs, however, the air source heat pump solution is a viable and cost-effective solution to meet the required carbon reductions.	20	Med	Low	9	☒
Wind 	Due to insufficient open area for installation of a stand-alone wind turbine and planning issues this option has not considered in this development.	25	Med	High	3	☐

Detailed assessment of air source heat pump (chosen option)

An air source heat pump is an excellent technology to utilize as the main heating system of an energy statement due to its numerous environmental and energy-efficient benefits. Here are some reasons why this technology is recommended:

1. **Renewable Energy Source:** Air source heat pumps extract heat energy from the ambient air, even in cold weather conditions. Unlike fossil fuel-based heating systems, they rely on renewable energy, reducing dependency on finite resources and decreasing greenhouse gas emissions.
2. **Reduced Carbon Footprint:** By utilizing the heat from the air, air source heat pumps produce significantly lower carbon emissions compared to conventional heating systems. This contributes to mitigating climate change and improving air quality.
3. **Energy Efficiency:** Air source heat pumps operate by transferring heat rather than generating it through combustion, making them highly energy-efficient. They typically achieve a Coefficient of Performance (COP) of over 3, meaning they can produce three units of heat energy for every unit of electricity consumed.
4. **Lower Energy Consumption:** Air source heat pumps require less energy to operate compared to traditional heating systems, such as electric resistance heaters or oil-fired boilers. This leads to reduced energy consumption, lower utility bills, and cost savings for users.
5. **Versatility and Convenience:** Air source heat pumps can provide both heating and cooling functions, offering year-round comfort in residential and commercial settings. They can also integrate with existing heating systems, allowing for smooth retrofitting.
6. **Long Lifespan and Durability:** When properly installed and maintained, air source heat pumps can have a lifespan of 15 to 20 years or more. This longevity contributes to their sustainability by reducing the need for frequent replacements and associated resource consumption.

By incorporating air source heat pumps in the energy statement, individuals and developers alike can significantly reduce their environmental impact, decrease energy consumption, and contribute to a more sustainable future.

Detailed assessment of Photovoltaic Panels

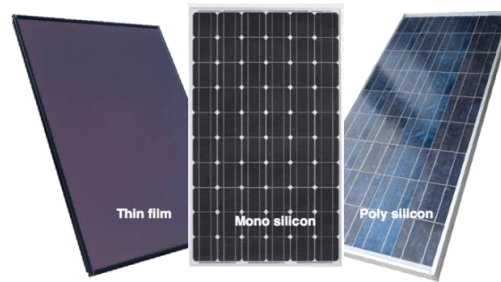


Fig 4. Photovoltaic Panels

Four types of solar cells are available on the market at present and these are mono-crystalline, polycrystalline, thin film and hybrid panels as seen in figure 4. Although mono-crystalline and hybrid cells are the most expensive, they are also the most efficient with an efficiency rate of 12-20%. Poly-crystalline cells are cheaper but they are less efficient (9-15%). Thin film cells are only 5-8% efficient but can be produced as thin and flexible sheets.

1.00 kWp (Kilo Watt Peak) of PV panels can produce approximately 850 kWh/ year of electricity in this region, reducing the grid energy requirement and CO₂ emissions.

The lack of viability for solar panels in this specific context is underscored by several factors, prominently the absence of a roof that would contribute significantly to the development. The limited and visually impactful dormer roof further compounds the challenges associated with solar installation.

In addition to the visual impact and sustainability concerns mentioned earlier, the dormer's design introduces shading complexities that significantly impede the efficacy of solar panels. Shading from the dormer creates shadows, reducing the exposure of solar cells to sunlight and diminishing their overall energy production. This shading effect can lead to uneven energy generation across the solar panel array, further compromising the efficiency of the entire system.

Considering the emphasis on maximizing solar panels on available roof space, the limitations imposed by the dormer's shading effects exacerbate the impracticality of relying on solar technology for this particular development. As a result, alternative renewable energy options or a more comprehensive evaluation of the design's energy demands may need to be explored to ensure a sustainable and effective energy solution for the project.

Be Green CO₂ emissions & savings

The incorporation of low carbon technologies will reduce CO₂ emissions for the development by 66% (to 0.8 tonnes CO₂/year) from the baseline.

Biodiversity

The 'Biodiversity Duty' of the Natural Environment and Rural Communities (NERC) Act 2006 requires that 'every public authority must, in exercising its functions, have regard, so far as is consistent with the proper exercise of those functions, to the purpose of conserving biodiversity'.

This Biodiversity Action Plan is the mechanism by which Haringey Council aims to fulfil its 'Biodiversity Duty' by highlighting priorities and opportunities for protecting and enhancing the borough's biodiversity.

In the case of the current development; wherever possible the following actions have taken place:

1. Identification of local wildlife and ecological habitats and appraisal of the option to include green and brown roof, rainwater harvesting, green wall, bird and bat nesting/roosting opportunities;
2. Protection, management and maintenance of the existing trees and the planting of new trees where appropriate; and
3. Identification and wherever possible protection, enhancement and creation of Sites of Importance for Nature Conservation (SINCs) and Local Nature Reserves (LNRs).

Relevant suggestions have been proposed to the architect/client to enhance the biodiversity aspect of the development and emphasise on the three points above.

Electric Vehicles Charging Points

According to the Emerging Building Regulation (July 2019) recommendations for residential buildings with an associated car parking space should have a charging point installed.

Relevant suggestion has been proposed to the architect/client to include a charging point installed for an electric vehicle.

Conclusion

Following the implementation of the three-step Energy Hierarchy, the regulated CO₂ savings for the site are calculated to be 66% for the development, against a Part L 2021 compliant scheme. Which is an 31% improvement from Part L 2013 baseline standards, so therefore this development is the equivalent of a 97% improvement over the previous building regulation standards, which now uses outdated carbon factors.

Therefore, the proposed development has been designed to meet energy policies set out by the Strategy for Greater London plan (March 2021) plan requirements, which demonstrates the client and the design team's commitment to enhancing sustainability of the scheme.

Furthermore, the project is achieving compliance in accordance with the current Part L 2021 regulations (SAP 10).

Table 6. Summarizes the implementation of the Energy Hierarchy for the proposed scheme and detail the CO₂ emissions and savings against the baseline scheme for each step of the hierarchy;

Table 6. CO₂ emissions after each step of the Energy Hierarchy for the proposed development

	CO ₂ Emissions (tonnes CO ₂ /Year)	CO ₂ Emissions Savings (%)
Baseline	2.30	
Be Lean	1.60	30.00%
Be Clean	1.60	0.00%
Be Green	0.80	36.00%
Total Reduction	1.50	66.00%
Off-Set £95/tonneCO₂	23.60	£2,243

Based on the results and outline figures, the proposed development will satisfy the relevant policies for sustainable design and construction requirements of energy consumption and carbon emissions.

The energy demand and carbon emissions, could be reduced by introducing a combination of highly efficient Air Source Heat Pumps. Based on the calculations and results achieved when those measures were applied, the development achieved a total site reduction of 66% in CO₂ emissions based on the 2021 Regulations (Figure 3).

The new dwellings will be designed with a high level of insulation and low air permeability to reduce heat loss as much as is practically possible, also the use of low

energy lighting and A – Rated White goods are essential for the reduction of energy consumption.

Moreover, the control strategy throughout must be carefully designed to ensure the most economical operation of all equipment throughout the development.

To achieve the required reduction of carbon emissions, several options were considered, however the best option in regards to site location and the development size was the combination of Air Source Heat Pumps and sufficient thermal fabric specification.

The proposed development site is not in a close proximity of an existing heat network making this an unviable solution to improve the heating system in the dwellings at time of this application.

The dwellings are to have suitable meter/smart meter management installed on every household, so that the homeowner can benefit from accurate savings to allow for suitable management of energy usage.

The baseline annual carbon emissions of the dwellings on this development has been calculated to be 2.30 tonnes CO₂/yr of CO₂ emissions. By incorporating high fabric standards and low carbon technologies, the total CO₂ emissions will be reduced to 0.8 tonnes CO₂/yr, equivalent to 66% reduction over Part L 2021 requirements.

Different possible renewable energy options have been identified; bearing in mind that selection is a complex process which requires a more detailed estimation of energy demand patterns, therefore, further analysis will be undertaken as the design progresses should the proposed system and specification become unfeasible. Especially as with all developments solar panels are to be maximised on available roof space, but due to lack of a roof that will provide a beneficial improvement to the development this has determined to not be a viable solution.

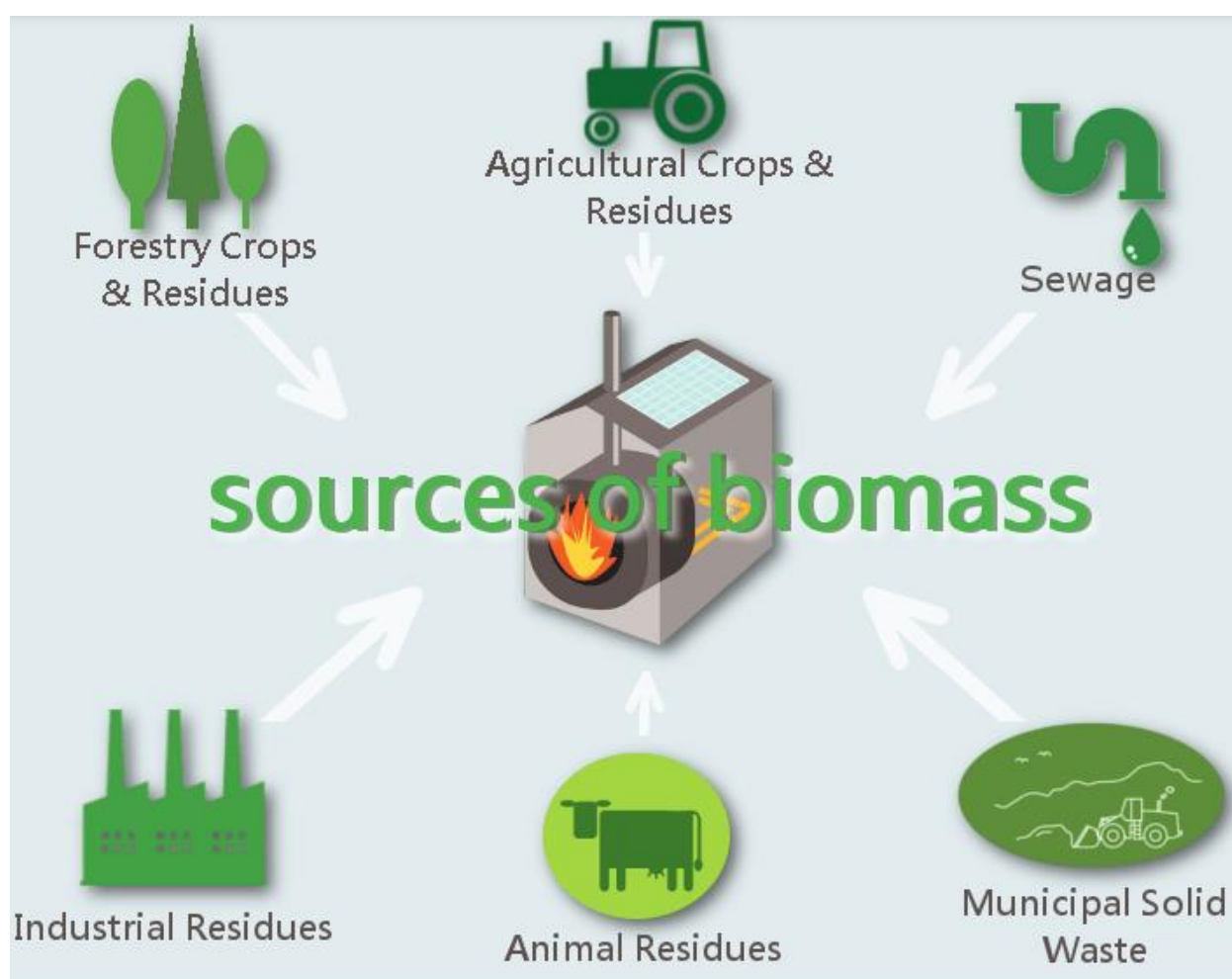
The development satisfy the requirements of this document and building regulation standards at the time of completion, this is to be provided as BREL worksheet and EPC.

Appendix A - Low or Zero Carbon Energy Sources

Biomass As a fuel

Biomass is a renewable energy source, generated from burning wood, plants and other organic matter, such as manure or household waste. It releases CO₂ when burned, but considerably less than fossil fuels. We consider biomass a renewable energy source, if the plants or other organic materials being burned are replaced.

Biomass is known for its versatility, given it can be used to generate heat, electricity, be used in combined heat and power units and be used as liquid fuel. In domestic settings, it tends to be found in the form of wood-fuelled heating systems.



Geothermal Energy:

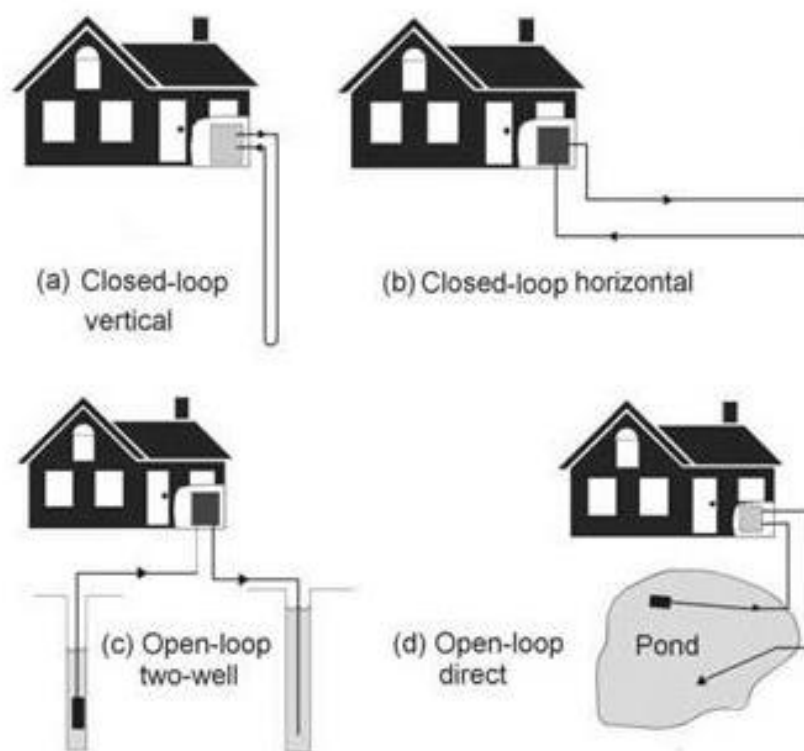
Geothermal energy technologies use the heat energy stored in ground; either for direct-use applications: such as using the grounds' heat to defrost a driveway or the indirect use with additional equipment such as a geothermal heat pump. Most

commercial installations couple a heat pump with the ground to upgrade the low-grade heat from the ground or ground water to a higher-grade heat, where it can be used for heating purposes.

The suitability of a ground source system depends heavily on the type of earth coupling heat exchange system used:

Ground source earth coupling options

The right choice of appropriate heat exchanger depends on several factors such as: size of space heating/hot water system, available site area for the heat exchangers, and local ground conditions. Due to the specialist nature of this technology, we recommend that a specialist is employed to size the heat exchangers based on a desk-top study of the site's geological conditions – this normally being required in advance of any other contractor appointment.



Vertical Closed Loop System

A frequently used and simple ground source heat exchanger, for a small to medium size project, is a closed loop vertical system. The system comprises of vertically drilled boreholes, usually up to 100 m deep, into which are inserted two polyethylene pipes with a U-shape connector at the base of the hole – effectively providing a flow down to the bottom of the hole and return back up to the surface. All the flow and return loops

are connected together across the site - completing the entire heat exchange loop. Water is pumped around the loop and is then circulated around the heat pump to achieve the required heat exchange. The distance between boreholes is dependent on ground conditions but is typically a minimum of a 6mx6m grid, to prevent overlapping of the heat exchange process between loops.

Horizontal Closed Loop System

Horizontal closed loop heat exchangers are usually applied to small projects such as individual houses, which usually require a relatively low heat output. Consisting of horizontal trenches 1.5-2m deep, with either straight pipes or 'slinky' coiled pipes, these require significant excavation work and significant site area to achieve appreciable outputs as such are not normally suited to medium to large projects.

Vertical Open Boreholes System

A further option is a vertical open borehole system. The system involves the abstraction and discharge of natural ground water using boreholes; into which pumps are inserted, connected to collapsible pipework. Each borehole pump abstracts ground water, circulates it around the heat pump and then discharges the water back to the ground via an absorbing well, some distance from the original abstraction borehole. The system is capable of providing very high rates of heat exchange for a relatively small number of boreholes, which makes it very efficient in terms of site area required. However, this depends greatly on the availability of ground water, which in turn varies according to location. A major downside of this system is that the extraction of water from deep boreholes via pumps consumes a lot of energy, as the water has to be physically lifted to the surface by the pump – this in effect reduces the carbon emissions saved by this system as a whole.

Ground source heat exchange options in summary:

Vertical loop system - closed boreholes

- moderate heat capacity
- relatively low installation cost

Vertical open system - open boreholes

- high heat capacity
- high running energy
- high installation cost

Horizontal loop system – straight pipes

- low capacity,
- high installation cost
- extensive ground excavation work

Horizontal coiled loop system – ‘slinky’ pipes

- good capacity
- low installation cost
- extensive ground excavation work

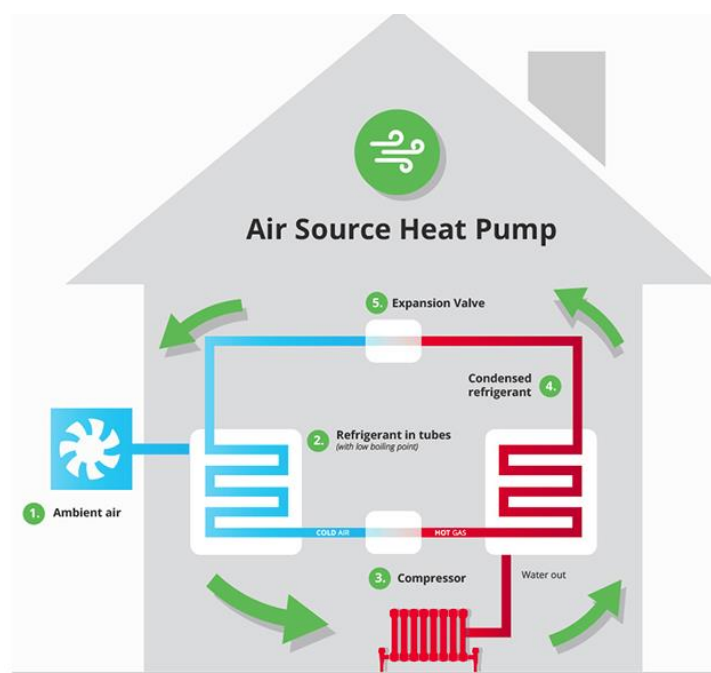
Air Source Heat Pumps

Heat pumps are basically refrigeration units which work in reverse – instead of cooling being produced and heat rejected, the unit produces heat and rejects cooling.

Conventional heat pumps use air as the medium to reject this ‘coolth’ to atmosphere. Ground source units use the ground as a means of improving the unit efficiency because the ground is a constant 11-13 °C at depths of 50m down – this suits the heat pump much better during the coldest weather than the extremes of air temperature. Reversible heat pumps can also be used for cooling, however this is not being considered further for this project.

A heat pump consumes electrical power to drive the compressor and other ancillary elements. The ratio between total energy input and heat energy output of the heat pump is a measure of its efficiency – usually referred to as ‘Coefficient of Performance’ - COP. A ground source heat pump has a higher COP than an air cooled heat pump – this additional energy effectively being the grounds’ natural contribution to the system.

The heat produced by a heat pump is usually used to either provide space heating say to underfloor heating or radiators or the heat is used to generate domestic hot water via a storage vessel.

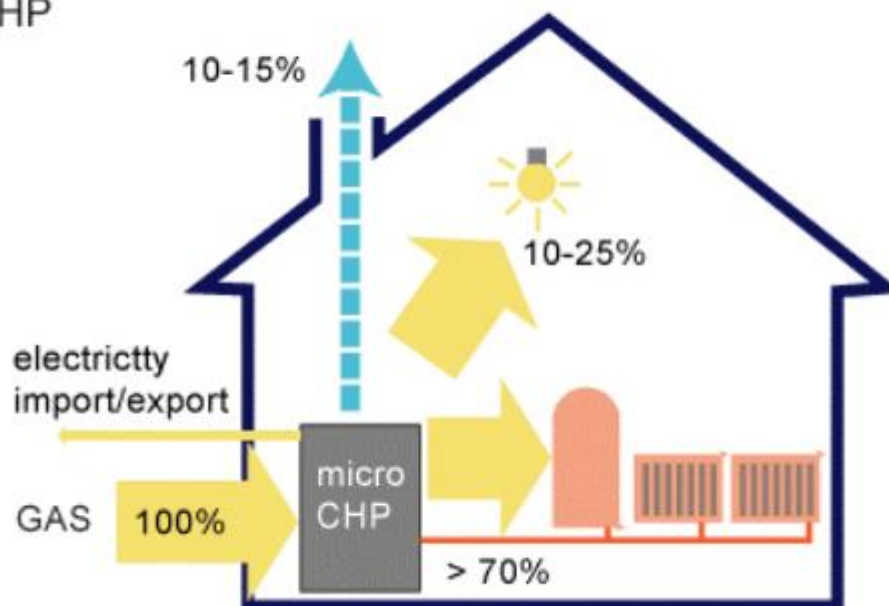


CHP

Combined heat and power (CHP) is a process involving simultaneous generation of heat and electricity, where the heat generated in the process is harnessed via heat recovery equipment. CHP at the large commercial size is now fairly common in premises which have a simultaneous demand for heating and electricity for long periods, such as hospitals, recreational centres and hotels. In addition, small CHP systems are now becoming available for individual houses, group residential units and small non-domestic premises. Compared with using centrally generated electricity supplied via the grid, CHP can offer a more efficient and economic method of supplying energy demand, if installed and operated appropriately, owing to the utilization of heat which is normally rejected to the atmosphere from central generating stations, and by reducing network distribution losses due to local generation and use.

Heat generated will be used for space and water heating, and additional heat storage may be used to lengthen use periods, to assist in warm-up and to improve overall energy efficiency. For overall good energy efficiency, as with all CHP, usage must be heat demand led. Thus, a sophisticated control system is required and users should be made aware of efficient operating practices.

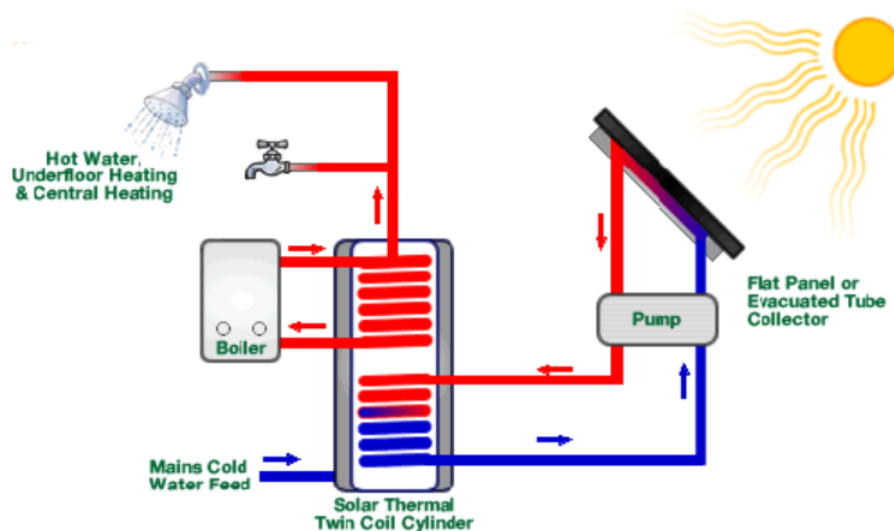
Micro CHP



Solar thermal collectors

Solar thermal collectors (flat plate or evacuated tubes) convert solar thermal energy into heat for hot water generation. These are usually located on a roof oriented south

facing in an ideal slope of 45 degree. Solar collectors properly sized and designed provide approx 50% of annual hot water demand.



Photovoltaic

Photovoltaic modules convert sunlight directly into DC electricity and can be integrated into buildings. Photovoltaics (PVs) are distinct from other renewable energy technologies since they have no moving parts to be maintained and are silent. PV systems can be incorporated into buildings in various ways: on sloped roofs and flat roofs, in façades, atria and shading devices. Modules can be mounted using frames or they can be fully incorporated into the actual building fabric; for example, PV roof tiles are now available which can be fitted in place of standard tiles.



Currently, a PV system will cost between £1500 and £2500 per kWp, and frequently part of this cost can be offset owing to the displacement of a conventional cladding

material. Costs have fallen significantly since the first systems were installed (1980s) and are predicted to fall further still.

While single crystal silicon remains the most efficient flat plate technology (15–16% conversion efficiency); it also has the least potential for cost reduction. PV cells made from poly-crystalline silicon have become popular as they are less expensive to produce, although they have a slightly lower efficiency.

Thin film modules are constructed by depositing extremely thin layers of photosensitive materials on a low-cost backing such as glass, stainless steel or plastic. As much less semiconductor material is required as for crystalline silicon cells, material costs are potentially much lower. Efficiencies are much lower, around 4–5%, although this can be boosted to 8–10% by depositing two or three layers of thin film material. Thin film production also requires less handling as the films are produced as large, complete modules and not as individual cells that have to be mounted in frames and wired together. Hence, there is the potential for significant cost reductions with volume production.

Since PVs generate DC output, an inverter and other equipment is needed to deliver the power to a building or the grid in an acceptable AC form. The cost of the inverter and these 'Balance of System' (BOS) components can approach 30% of the total cost of a PV system. Hence, simplification and cost reductions in these components over the coming years will also be necessary to make PV systems affordable.

Wind energy

Wind power is the most successful and fastest spreading renewable energy technology in the UK with a number of individual and group installations of varying size, capacity and location. Traditionally, turbines are installed in non-urban areas with a strong trend for large offshore wind farms. In parallel with the design and development of ever-bigger machines, which are deemed to be more efficient and cost-effective, it is being increasingly recognized that smaller devices installed at the point of use, i.e. urban settings, can play an important role in reducing carbon emissions if they become mainstream.



At present there is a wide range of available off-the-shelf wind products, many manufactured in the UK and EU with proven good performance and durability. The

dominant type is horizontal axis wind turbines (HAWT), which are typically ground mounted. Vertical axis wind turbines (VAWT) have limited market presence and there is a trade-off between lower efficiency and potentially higher resistance to extreme conditions. Capacity ranges from 500W to more than 1.5MW, but, for practical purposes and in built-up areas in particular, machines of more than 1kW and below 500kW are likely to be considered.

Wind technology is also currently one of the most cost-effective renewable energy technologies, which is attributable to the large scale of installations reducing the unit output cost. Individual building or community wind projects, although smaller, have the advantage of feeding electricity directly into the building's electricity circuit, thus sparing costly distribution network development and avoiding distribution losses. The downside is the still high capital cost per kW installed for smaller turbines, plus location constraints, such as visual intrusion and noise. The wind regime in urban areas is also a concern owing to higher wind turbulence which reduces the potential electricity output.

In most cases, wind turbines are connected to the electricity grid and all generated energy is used regardless of the building demand fluctuations. The output largely depends on the wind speed and the correlation between the two is a cube function. This means that in short periods of above-average wind speeds the generation increases exponentially. As a result, it is difficult to make precise calculations of the annual output of a turbine, but average figures can provide useful guidance to designers and architects. In reasonably windy areas (average wind speed of 6m/s) the expected output from 1kW installed is about 2500kWh annually.

The cost per kW installed varies considerably by manufacturer and size of machine with an indicative bracket of £2,500–£5,000. With a lifespan of more than 20 years, wind turbines can save money if design and planning are carried out in a robust way.

Building-integrated wind turbines are starting to be a reality in the UK, but potential projects may face difficulties with obtaining planning permission. There are a few examples now of permitted development rights for certain rooftop turbines in some local councils. A number of horizontal axis devices specifically designed for building integration are now available commercially, having design and reliability parameters relevant to the urban context. Building-mounted vertical axis devices are under development. At present, turbines installed near buildings, as well as community installations for groups of buildings, should be regarded as the larger wind energy source related to buildings, when they contribute to the carbon emissions from these premises using 'private wire' networks. However, the contribution of several building-integrated turbines in a development is likely to become significant in the next few years.

Appendix B-Fuel prices and emission factors

Table 12: Fuel prices, emission factors and primary energy factors

Fuel	Standing charge, £ ^(a)	Unit price p/kWh	Emissions kg CO ₂ per kWh ^(b)	Primary energy factor	Fuel code
Gas:					
mains gas	120	3.48	0.216	1.22	1
bulk LPG	70	7.60	0.241	1.09	2
bottled LPG		10.30	0.241	1.09	3
LPG subject to Special Condition 18 ^(c)	120	3.48	0.241	1.09	9
biogas (including anaerobic digestion)	70	7.60	0.098	1.10	7
Oil:					
heating oil		5.44	0.298	1.10	4
biodiesel from any biomass source ^(d)		7.64	0.123	1.06	71
biodiesel from vegetable oil only ^(e)		7.64	0.083	1.01	73
appliances able to use mineral oil or biodiesel		5.44	0.298	1.10	74
B30K ^(f)		6.10	0.245	1.09	75
bioethanol from any biomass source		47.0	0.140	1.08	76
Solid fuel: ^(g)					
house coal		3.67	0.394	1.00	11
anthracite		3.64	0.394	1.00	15
manufactured smokeless fuel		4.61	0.433	1.21	12
wood logs		4.23	0.019	1.04	20
wood pellets (in bags for secondary heating)		5.81	0.039	1.26	22
wood pellets (bulk supply for main heating)		5.26	0.039	1.26	23
wood chips		3.07	0.016	1.12	21
dual fuel appliance (mineral and wood)		3.99	0.226	1.02	10
Electricity: ^(a)					
standard tariff	54	13.19	0.519	3.07	30
7-hour tariff (high rate) ^(h)	24	15.29	0.519	3.07	32
7-hour tariff (low rate) ^(h)		5.50	0.519	3.07	31
10-hour tariff (high rate) ^(h)	23	14.68	0.519	3.07	34
10-hour tariff (low rate) ^(h)		7.50	0.519	3.07	33
18-hour tariff (high rate) ^(h)	40	13.67	0.519	3.07	38
18-hour tariff (low rate) ^(h)		7.41	0.519	3.07	40
24-hour heating tariff	70	6.61	0.519	3.07	35
electricity sold to grid		13.19 ⁽ⁱ⁾	0.519	3.07	36
electricity displaced from grid			0.519 ⁽ⁱ⁾	3.07 ⁽ⁱ⁾	37
electricity, any tariff ⁽ⁱ⁾					39
Community heating schemes: ^(k)	120 ^(l)				
heat from boilers – mains gas		4.24	0.216	1.22	51
heat from boilers – LPG		4.24	0.241	1.09	52
heat from boilers – oil		4.24	0.331 ^(m)	1.10	53
heat from boilers that can use mineral oil or biodiesel		4.24	0.331	1.10	56
heat from boilers using biodiesel from any biomass source		4.24	0.123	1.06	57
heat from boilers using biodiesel from vegetable oil only		4.24	0.083	1.01	58
heat from boilers – B30D ^(f)		4.24	0.269	1.09	55
heat from boilers – coal		4.24	0.380 ⁽ⁿ⁾	1.00	54
heat from electric heat pump		4.24	0.519	3.07	41
heat from boilers – waste combustion		4.24	0.047	1.23	42
heat from boilers – biomass		4.24	0.031 ^(o)	1.01	43
heat from boilers – biogas (landfill or sewage gas)		4.24	0.098	1.10	44
waste heat from power station		2.97	0.058 ^(p)	1.34	45
geothermal heat source		2.97	0.041	1.24	46
heat from CHP		2.97	as above ^(q)	as above ^(q)	48
electricity generated by CHP			0.519 ⁽ⁱ⁾	3.07 ⁽ⁱ⁾	49
electricity for pumping in distribution network			0.519	3.07	50

Appendix C, D, E and F

This appendix contains the following reports used in producing the content of this Energy and Sustainability Statement.

Appendix C – Part L 2021 GLA (carbon emission reporting spreadsheet)

Appendix D- Floor plan and elevations used to produce SAP Calculation for this development.

Appendix E- SAP 2021 calculation reports for the selected units that were used to base the calculations on for this report.

Appendix F-Example water calculation

Part I. 2021 Performance	
Residential	Non-residential

	Carbon Dioxide Emissions for residential buildings (Tonnes CO ₂ per annum)	
	Regulated	Unregulated
Baseline: Part L 2001 of the Building Regulations <i>Controlled Development</i>	2.3	
after energy demand reduction (the lean)	1.6	
after heat network connection (the clever)	1.6	
after renewable energy (the green)	0.8	

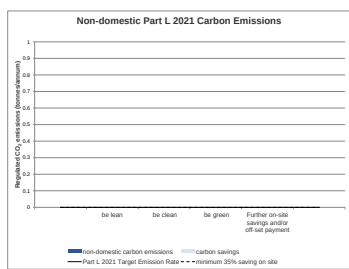
Table 2: Regulated Carbon Dioxide savings from each stage of the Energy Hierarchy for residential buildings

	Carbon Dioxide Emissions for non-residential buildings (Tonnes CO ₂ per annum)	
	regulated	unregulated
Baseline: Part L 2021 of the Building Regulations	0.0	
Committed Development		
After energy demand reduction (be lean)	0.0	
After heat network connection (be clean)	0.0	
After renewable energy (be green)	0.0	

Table 4: Regulated Carbon Dioxide savings from each stage of the Energy Hierarchy for non-residential buildings

	Regulated non-residential carbon dioxide savings	
	(Tonnes CO ₂ per annum)	(%)
Be lean: savings from energy demand reduction	0.0	0%
Be clean: savings from heat network	0.0	0%
Be green: savings from renewable energy	0.0	0%
Total Cumulative Savings	0.0	0%
Annual savings from off-set payment	0.0	-
	(Tonnes CO ₂)	
Cumulative savings for off-set payment	0	-
Cash in-lieu contribution (B)	0	

*carbon price is based on GLA recommended price of £95 per tonne of carbon dioxide unless Local Planning Authority price is inputted in the 'Development Information' tab



SITE-WIDE			
	Total regulated emissions (Tanneries CO ₂ / year)	CO ₂ savings (Tanneries CO ₂ / year)	Percentage savings (%)
Part I, 2021 baseline	2.3		
No lean	1.6	0.7	30%
No clean	1.6	0.0	0%
No green	0.8	0.8	30%
Total Savings	-	1.5	60%
	-	CO ₂ savings off-net (Tanneries CO ₂)	-
Off-net	-	23.6	-

	Target Fabric Energy Efficiency (kWh/m²)	Dwelling Fabric Energy Efficiency (kWh/m²)	Improvement (%)
Development total	43.29	44.83	-4%

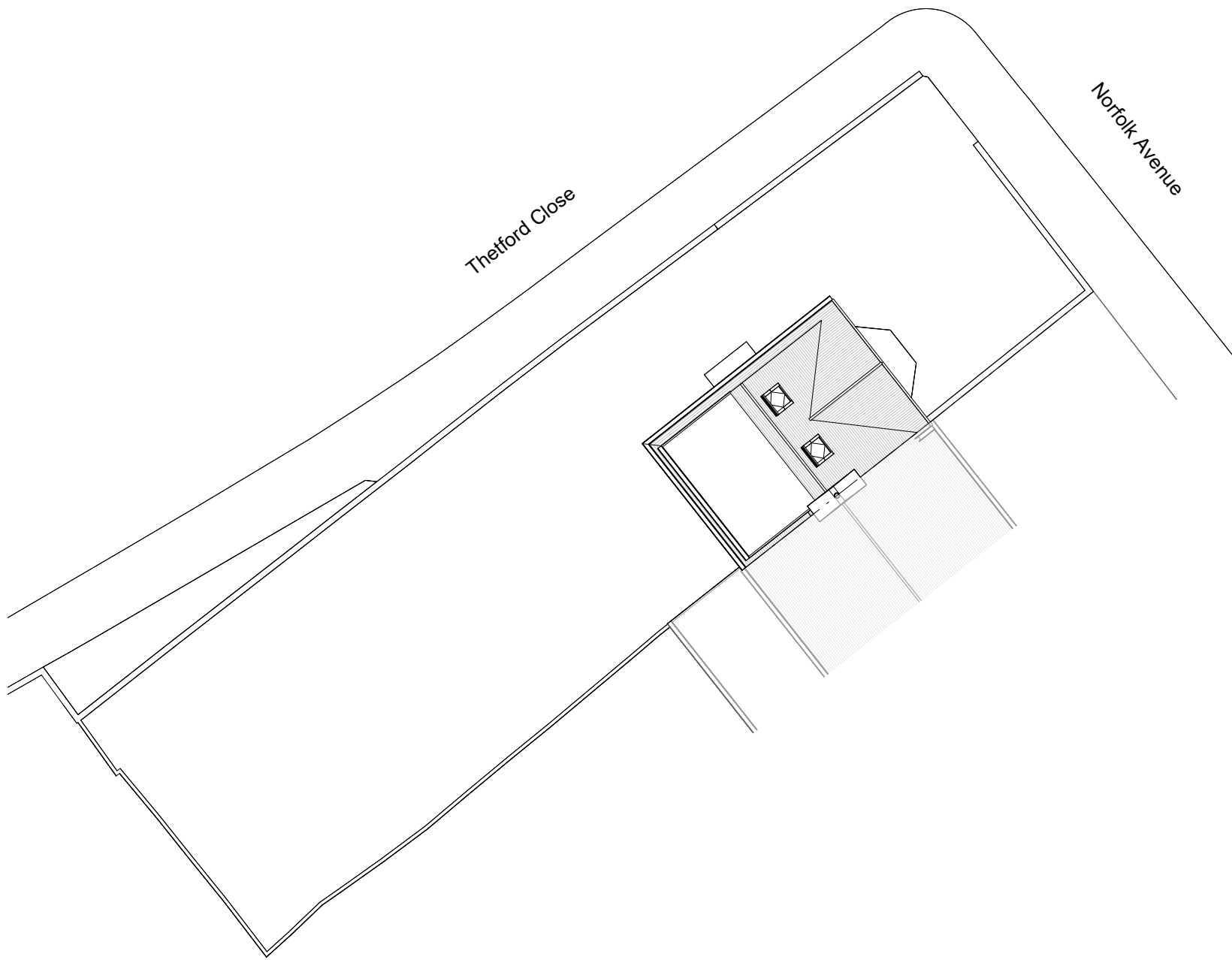
	Area weighted non-residential cooling demand (MJ/m ²)	Total non-residential cooling demand (MJ/year)
Actual	0	0
Notional	0	0

EUI & space heating demand (predicted energy use)

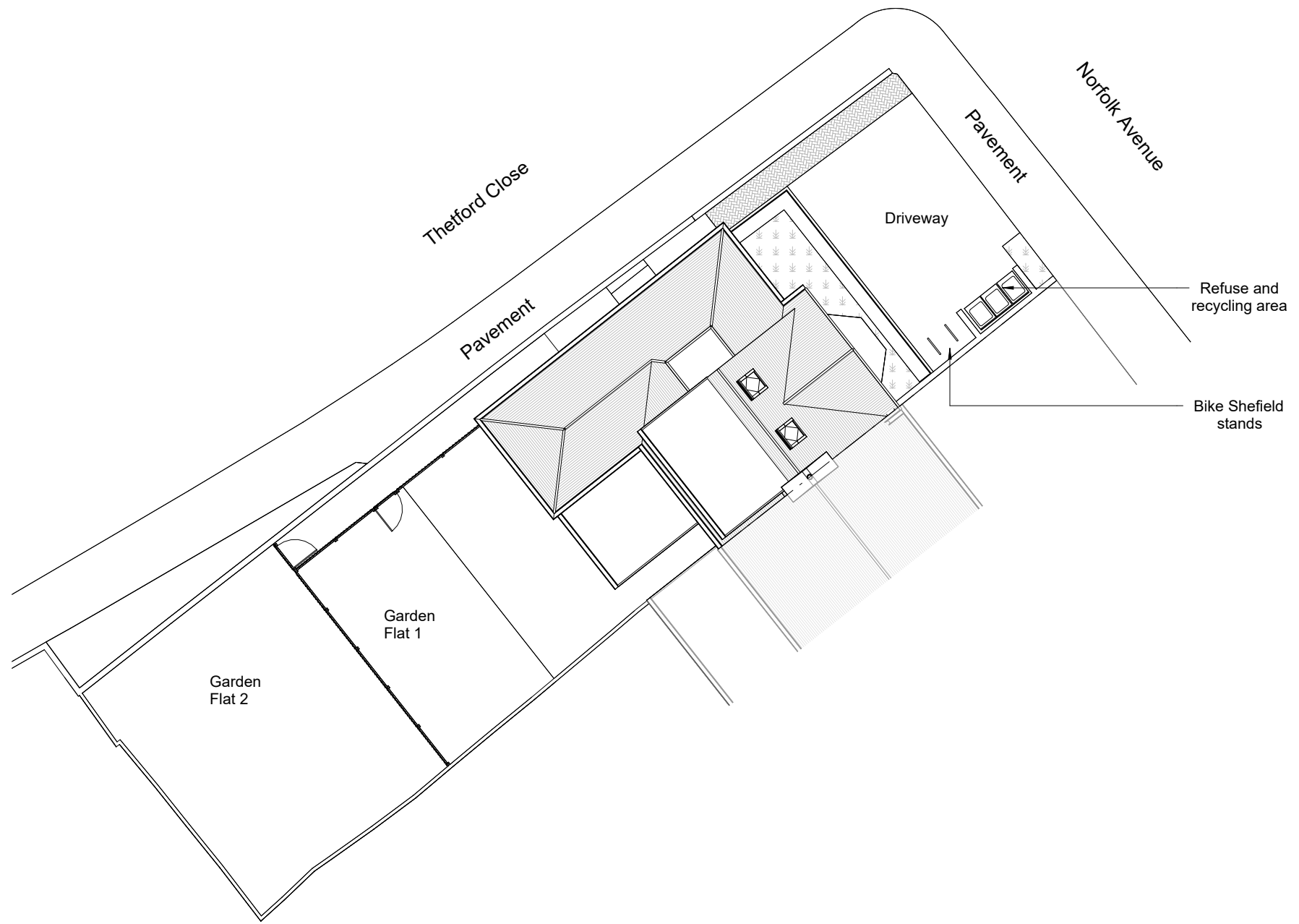
Residential						
Building type	ELC (kWh/m ² /year) (excluding renewable energy)	Space heating demand (kWh/m ² /year) (excluding renewable energy)	ELC value from Table 4 of the guidance (kWh/m ² /year) (excluding renewable energy)	Space heating demand from Table 4 of the guidance (kWh/m ² /year) (excluding renewable energy)	Methodology used (e.g. 'as seen' methodology or an energy modelling methodology)	Explanatory notes (If expected performance differs from Table 4 values in the guidance)
Residential	7.025567049	22.9447353	35	15	Part L1: SAP 10.2 & Other (provide details in column 7) Develop & Landlord Circulation	Figures are based on sample unit tested for Dwelling Primary Energy Rate (PER) Part 2023 compliance, area entered is for total ELC of all units & There are no heated communal spaces

Non-residential

[illegible]

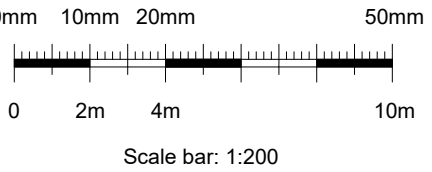


Site Plan as Existing
1 : 200



Site Plan as Proposed
1 : 200

Issue: Planning



No scaled dimensions to be taken from this drawings. All dimensions to be site checked.

Revisions			
Rev.	Description	Date	By

CG ARCHITECTS

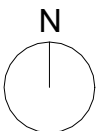
36 CANNON HILL, LONDON N14 6LG
T. 020 8449 5100

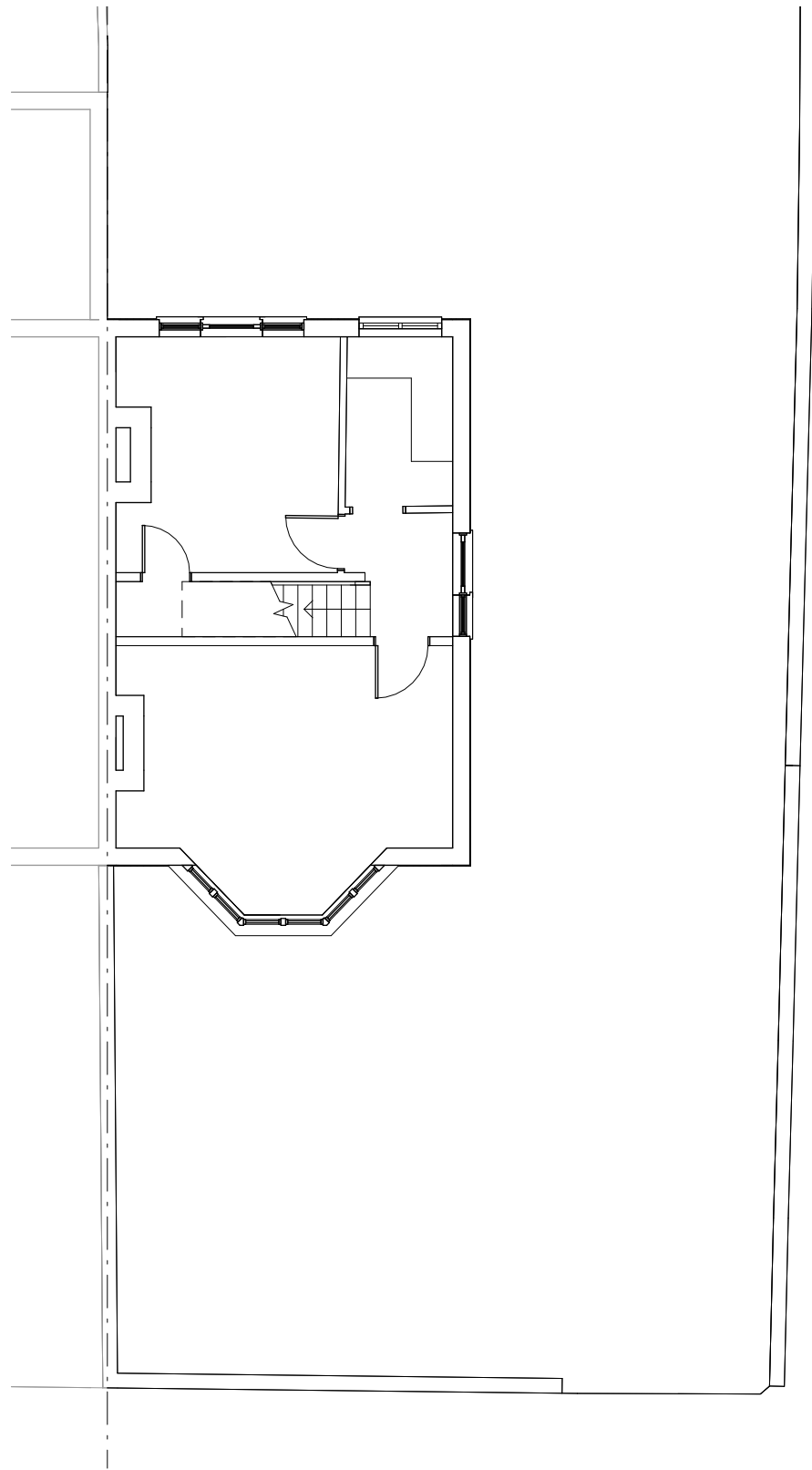
Client:
Mr. Steven Antoniou

Site:
116 Norfolk Avenue
London, N13 6AJ

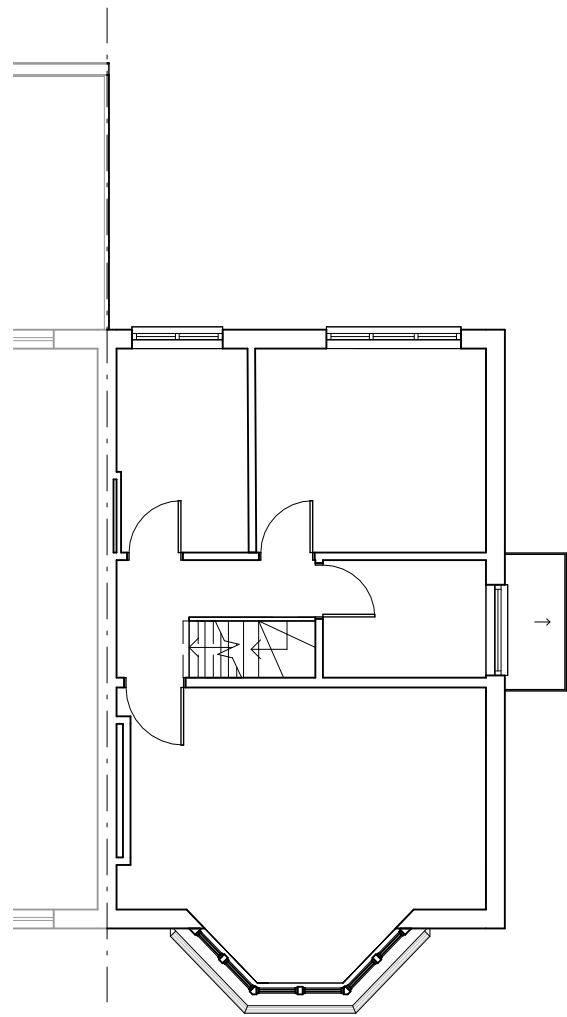
Title:
Site Plan as Existing and as Proposed

Scale: 1 : 200(@ A2)	Drawn: -	Checked: CG
Date: April 2023		
Drg No 1653/02	REV	



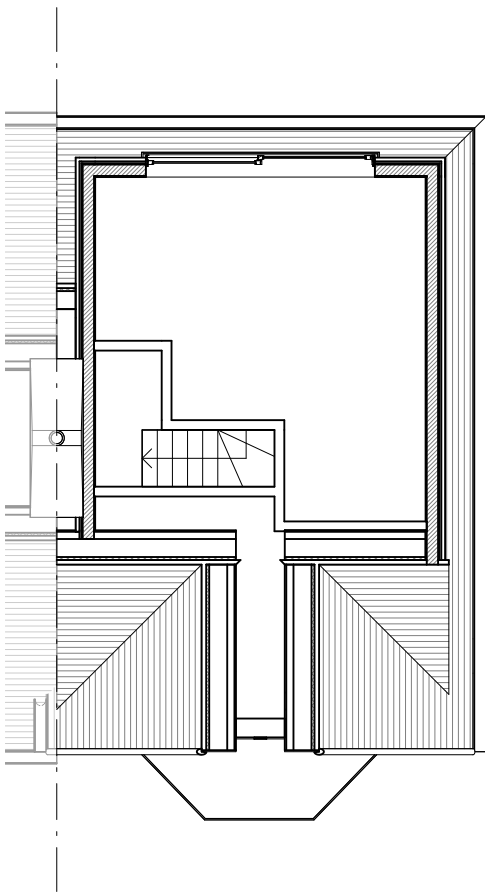


Ground Floor Plan as Existing
1 : 100

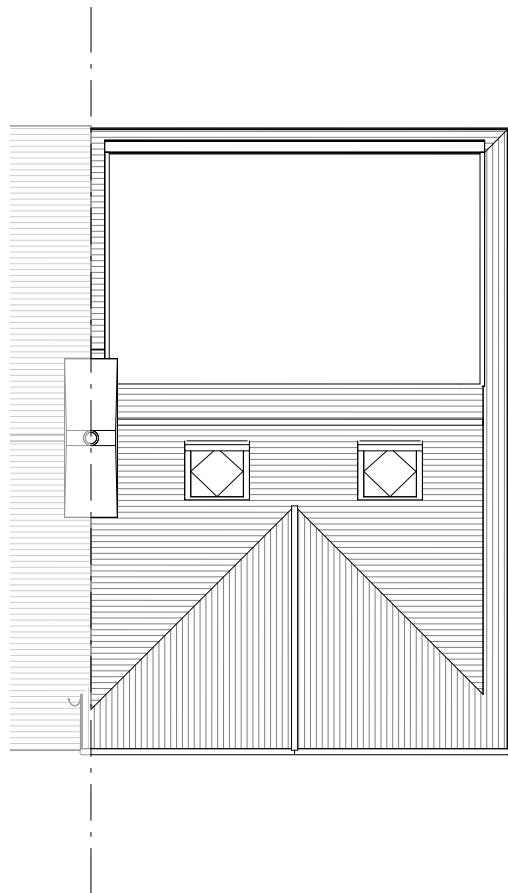


First Floor Plan as Existing
1 : 100

ROOF EXTENSION INVOLVING HIP TO GABLE, REAR DORMER WINDOW WITH JULIETTE BALCONY AND FRONT FACING ROOFLIGHTS: APPROVED UNDER PERMITTED DEVELOPMENT
Ref.: HGY/2021/2020



Second Floor Plan as Existing
1 : 100



Roof Plan as Existing
1 : 100



Front (East) Elevation as Existing
1 : 100

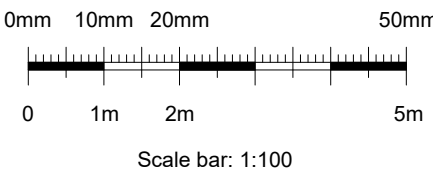


Rear (West) Elevation as Existing
1 : 100



Flank (North) Elevation as Existing
1 : 100

Issue:
Planning



No scaled dimensions to be taken from this drawings. All dimensions to be site checked.

Revisions			
Rev.	Description	Date	By

CG ARCHITECTS

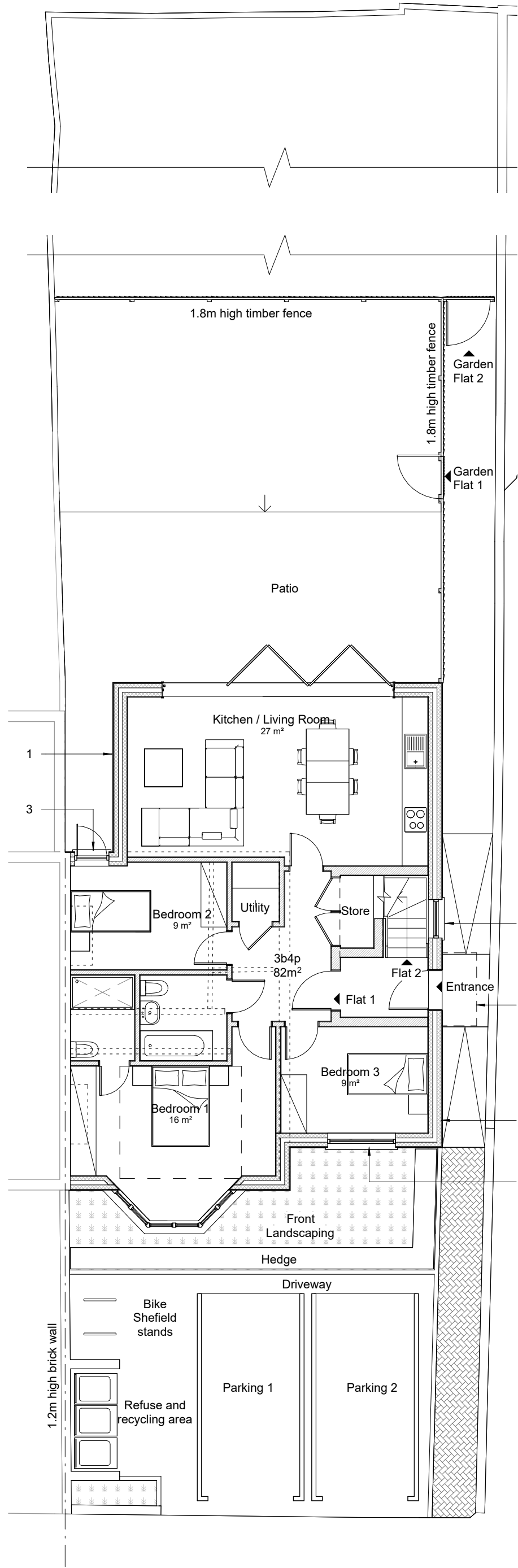
36 CANNON HILL, LONDON N14 6LG
T. 020 8449 5100

Client:
Mr. Steven Antoniou

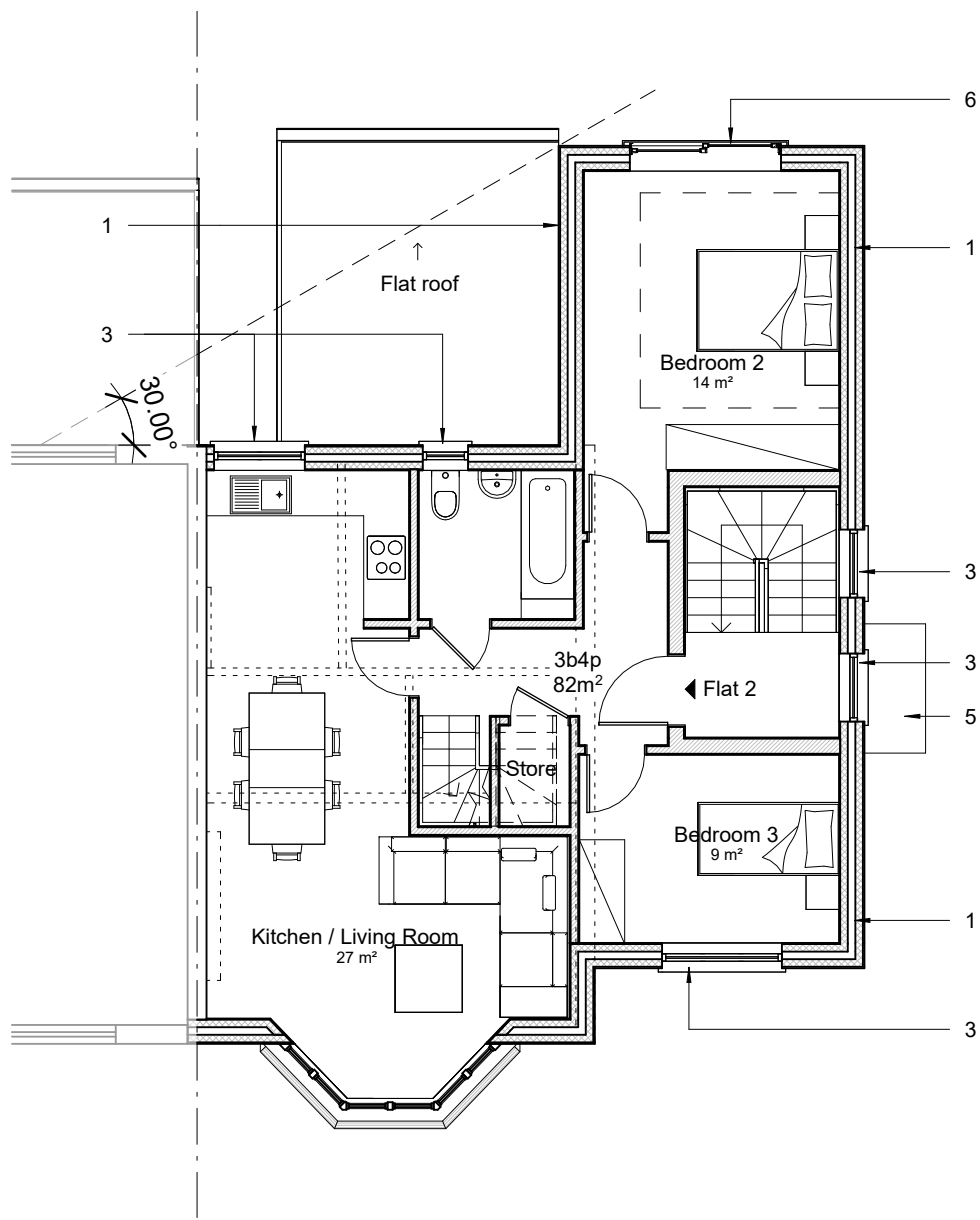
Site:
116 Norfolk Avenue
London, N13 6AJ

Title:
Floor Plans and Elevations as Existing

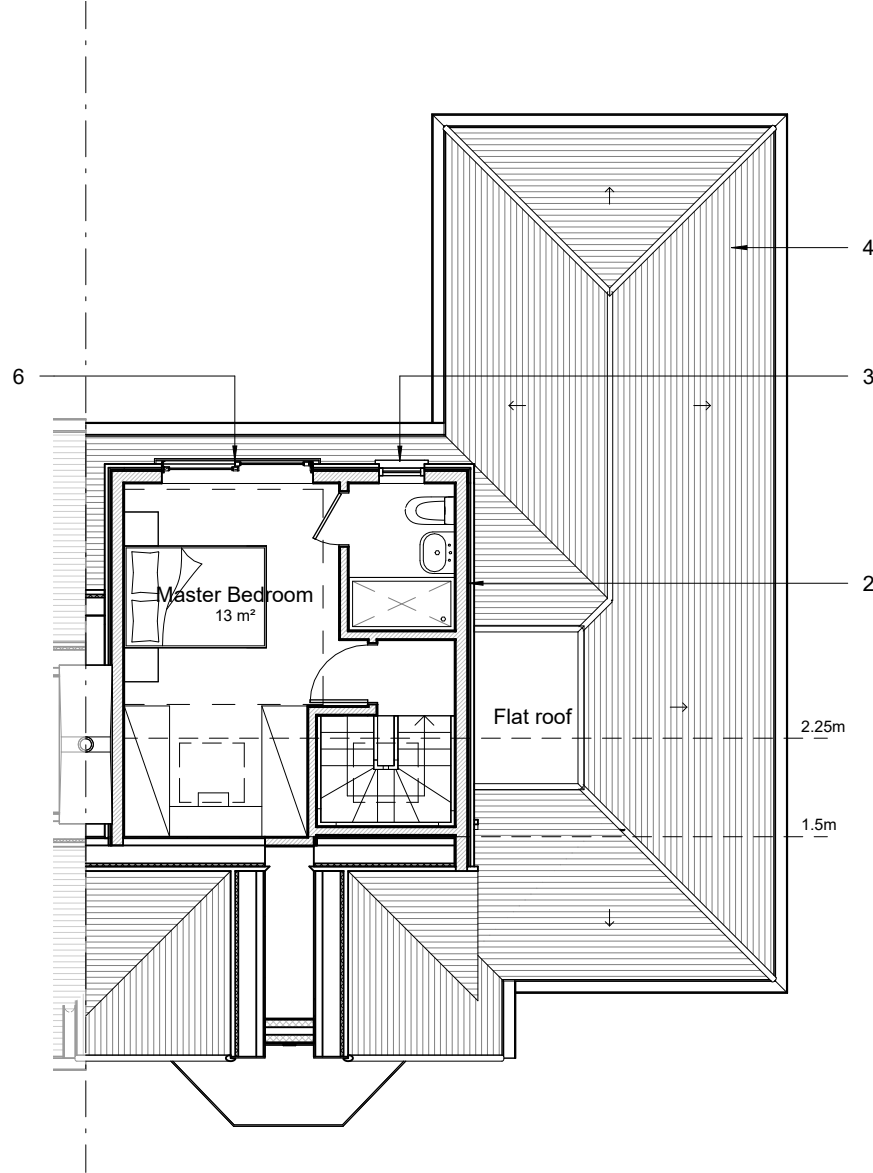
Scale: 1 : 100(@ A2)	Drawn: Author	Checked: Checker
Date: April 2023	REV	
Drg No 1653/03		



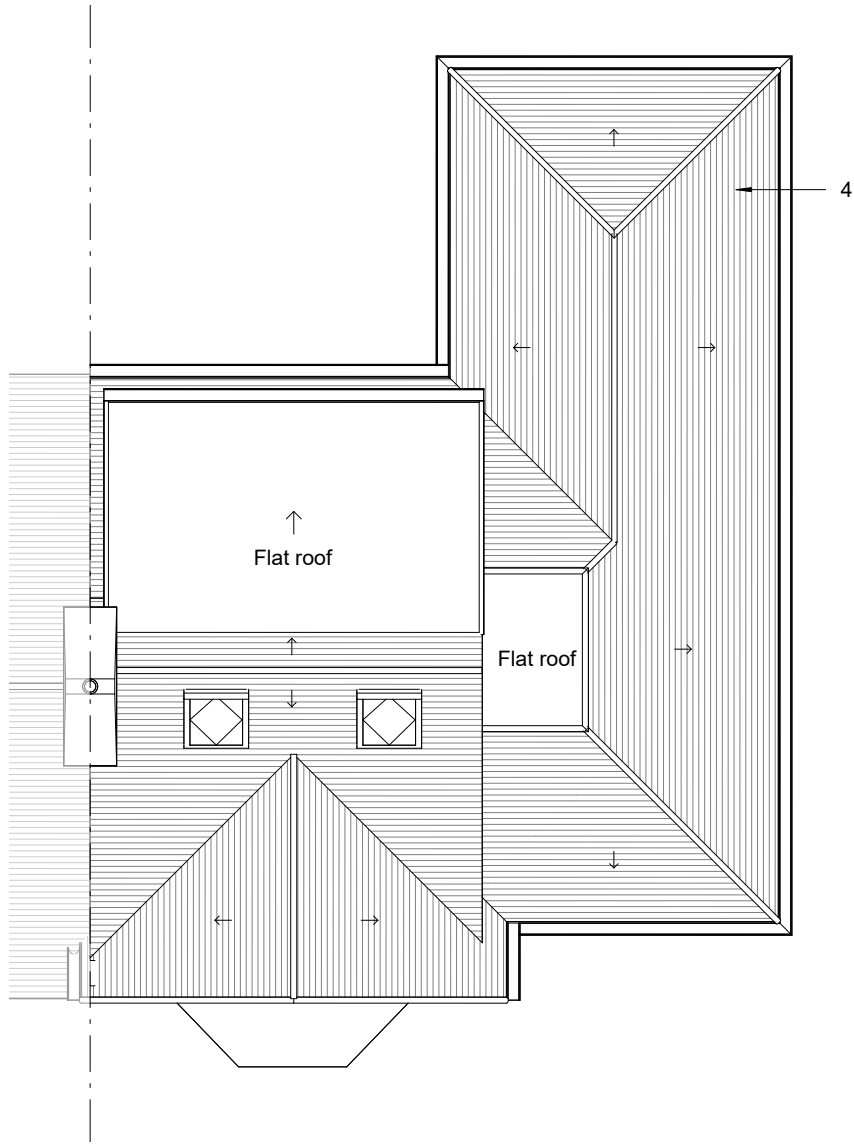
Ground Floor Plan as Proposed
1 : 100



First Floor Plan as Proposed
1 : 100



Second Floor Plan as Proposed
1 : 100



Roof Plan as Proposed
1 : 100

Issue:

Planning

Key

Existing

Demolished

New Wall in Cavity with external render

Dormer wall with hanging tiles

Internal Partition

1. New Wall in Cavity with external render

2. Dormer Wall with hanging tiles

3. uPVC frame Double glazed Windows

4. Pitched roof with tiles

5. CHERWELL Overdoor canopy

6. Juliette Balcony

0mm10mm20mm50mm

01m2m5m

Scale bar: 1:100

No scaled dimensions to be taken from this drawings. All dimensions to be site checked.

Revisions

Rev.	Description	Date	By

CG ARCHITECTS

36 CANNON HILL, LONDON N14 6LG
T. 020 8449 5100

Client:
Mr. Steven Antoniou

Site:
116 Norfolk Avenue
London, N13 6AJ

Title:
Floor Plans as Proposed

Scale:
As indicated(@ A2)

Date:
April 2023

Drg No
1653/04

Drawn:
-

REV

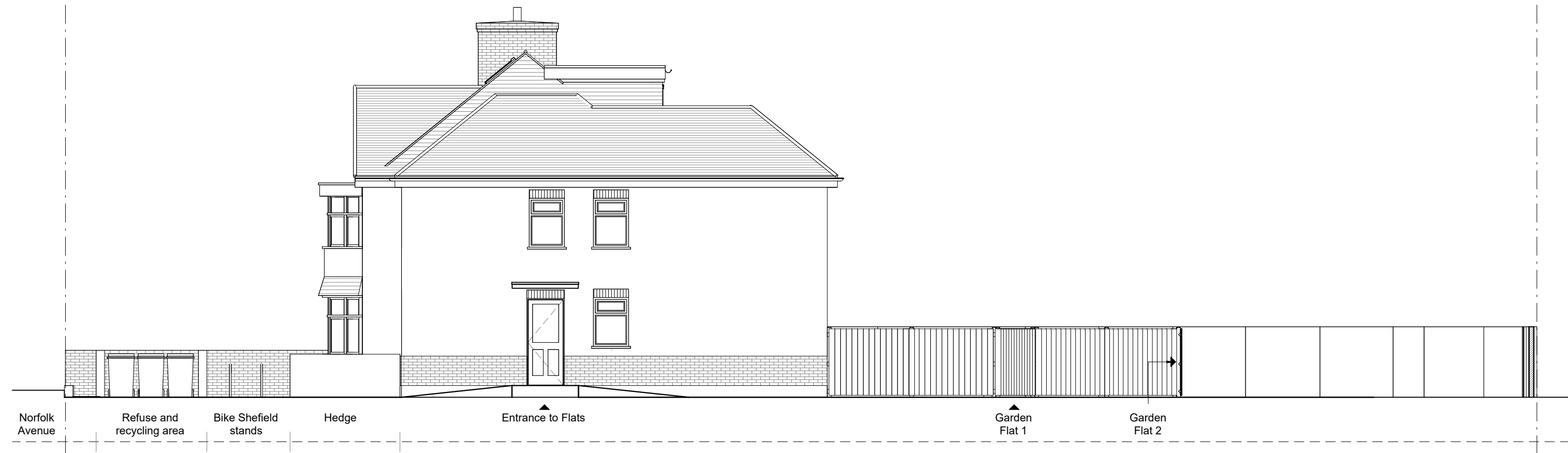
Checked:
CG



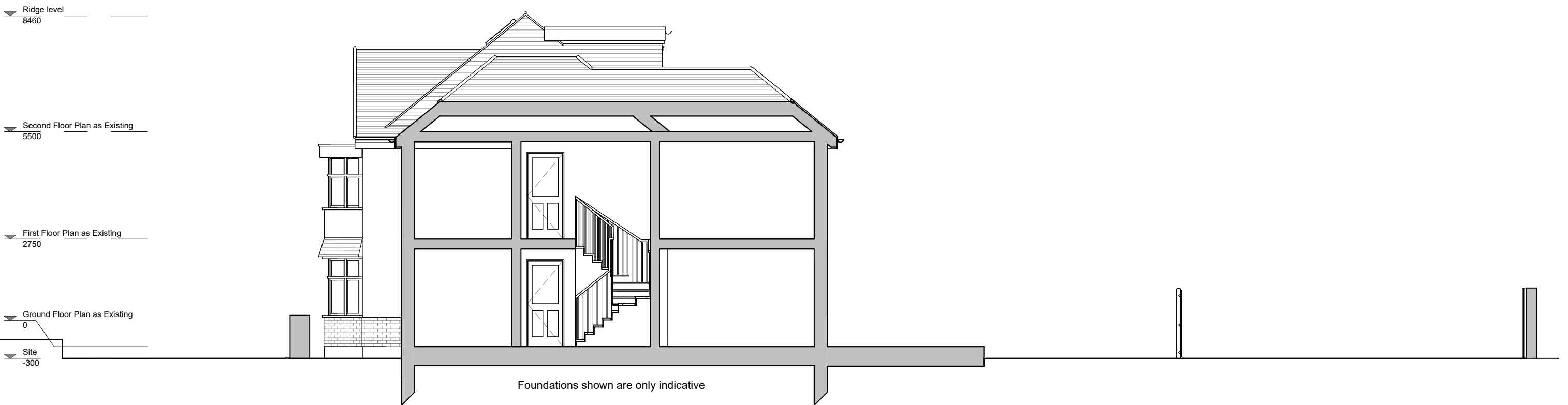
Front (East) Elevation as Proposed
1 : 100



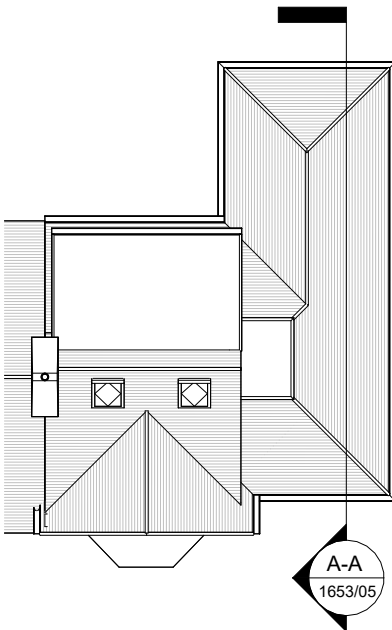
Rear (West) Elevation as Proposed
1 : 100



Flank (North) Elevation as Proposed
1 : 100

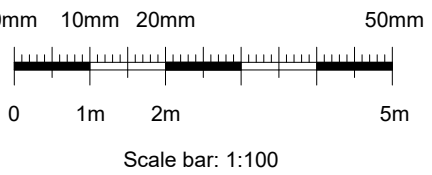


Section A-A as Proposed
1 : 100



Issue: Planning

- Key**
- Existing
 - Demolished
 - New Wall in Cavity with external render
 - Dormer wall with hanging tiles
 - Internal Partition
1. New Wall in Cavity with external render
2. Dormer Wall with hanging tiles
3. uPVC frame Double glazed Windows
4. Pitched roof with tiles
5. CHERWELL Overdoor canopy
6. Juliette Balcony



No scaled dimensions to be taken from this drawings. All dimensions to be site checked.

Revisions			
Rev.	Description	Date	By

CG ARCHITECTS

36 CANNON HILL, LONDON N14 6LG
T. 020 8449 5100

Client:
Mr. Steven Antoniou

Site:
116 Norfolk Avenue
London, N13 6AJ

Title:
Elevations and Sections as Proposed

Scale: As indicated(@ A2)	Drawn: -	Checked: CG
Date: April 2023	REV	
Drg No 1653/05		

Building Regulations England Part L (BREL) Compliance Report

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

Date: Thu 21 Dec 2023 10:43:19

Project Information			
Assessed By	Rajohn Ali	Building Type	Flat, End-terrace
OCDEA Registration	EES/021452	Assessment Date	2023-12-21

Dwelling Details			
Assessment Type	As designed	Total Floor Area	84 m ²
Site Reference	Flat 02	Plot Reference	01-BE LEAN & CLEAN
Address	116 Flat 02, Land at Norfolk Avenue, London , N13 6AJ		

Client Details	
Name	Chris Georgiou
Company	-
Address	-, -, -

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	Mains gas		
Target carbon dioxide emission rate	14.37 kgCO ₂ /m ²		
Dwelling carbon dioxide emission rate	11.91 kgCO ₂ /m ²		OK
1b Target primary energy rate and dwelling primary energy			
Target primary energy	75.71 kWh _{PE} /m ²		
Dwelling primary energy	75.56 kWh _{PE} /m ²		OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency			
Target fabric energy efficiency	44.8 kWh/m ²		
Dwelling fabric energy efficiency	43.3 kWh/m ²		OK

2a Fabric U-values				
Element	Maximum permitted average U-Value [W/m ² K]	Dwelling average U-Value [W/m ² K]	Element with highest individual U-Value	
External walls	0.26	0.17	Walls (1) (0.17)	OK
Party walls	0.2	0	Party Wall (1) (0)	N/A
Curtain walls	1.6	0	N/A	N/A
Floors	0.18	N/A	N/A	N/A
Roofs	0.16	0.12	Roof (1) (0.15)	OK
Windows, doors, and roof windows	1.6	1.31	Opening 1 (1.4)	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 ² K]
Sheltered wall: Walls (1)	18.764	0.17
Exposed wall: Walls (2)	84.2598	0.17
Sheltered wall: Walls (3)	11.45	0.17
Party wall: Party Wall (1)	18.13	0 (!)
Exposed roof: Roof (1)	18.02	0.15
Exposed roof: Roof (2)	40.73	0.1 (!)
Exposed roof: Roof (3)	5.676	0.15

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	Area [m ²]	Orientation	Frame factor	U-Value [W/m ² K]
Opening 1, New D to Corridor	2.016	North West	N/A	1.4
Opening 2, New Windows	1.4577	North East	0.7	1.3
Opening 3, New Windows	1.3287	North	0.7	1.3
Opening 4, New Windows	1.3287	East	0.7	1.3
Opening 5, New Windows	2.0511	North East	0.7	1.3
Opening 6, New Windows	1.392	South West	0.7	1.3
Opening 6, New Windows	0.696	South West	0.7	1.3
Opening 7, New Windows	4.04	South West	0.7	1.3
Opening 8, New Windows	4.04	South West	0.7	1.3
Opening 8, New Windows	0.696	South West	0.7	1.3

Name	Area [m ²]	Orientation	Frame factor	U-Value [W/m ² K]
Opening 9, New RL	0.427	North East	0.7	1.3
Opening 9, New RL	0.427	North East	0.7	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))

Building part 1 - Main Dwelling: Thermal bridging calculated from linear thermal transmittances for each junction

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.016 (!)	RECOGN.CON STR.DETAILS
External wall	E3: Sill	Calculated by person with suitable expertise	0.02 (!)	RECOGN.CON STR.DETAILS
External wall	E4: Jamb	Calculated by person with suitable expertise	0.015 (!)	RECOGN.CON STR.DETAILS
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.044	RECOGN.CON STR.DETAILS
External wall	E10: Eaves (insulation at ceiling level)	Calculated by person with suitable expertise	0.073	RECOGN.CON STR.DETAILS
External wall	E24: Eaves (insulation at ceiling level - inverted)	SAP table default	0.15	
External wall	E12: Gable (insulation at ceiling level)	Calculated by person with suitable expertise	0.096	RECOGN.CON STR.DETAILS
External wall	E13: Gable (insulation at rafter level)	Calculated by person with suitable expertise	0.06	RECOGN.CON STR.DETAILS
External wall	E14: Flat roof	SAP table default	0.16	
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.044	RECOGN.CON STR.DETAILS
External wall	E17: Corner (inverted - internal area greater than external area)	Calculated by person with suitable expertise	-0.073	RECOGN.CON STR.DETAILS
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.055	RECOGN.CON STR.DETAILS
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	SAP table default	0 (!)	
Party wall	P4: Roof (insulation at ceiling level)	Calculated by person with suitable expertise	0.101	RECOGN.CON STR.DETAILS
Roof	R1: Head of roof window	SAP table default	0.24	
Roof	R2: Sill of roof window	SAP table default	0.24	
Roof	R3: Jamb of roof window	SAP table default	0.24	
Roof	R4: Ridge (vaulted ceiling)	SAP table default	0.12	
Roof	R5: Ridge (inverted)	SAP table default	0.12	
Roof	R8: Roof to wall (rafter)	SAP table default	0.12	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))

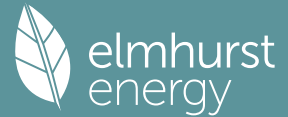
Maximum permitted air permeability at 50Pa	8 m ³ /hm ²	
Dwelling air permeability at 50Pa	3 m ³ /hm ² , Design value (!)	OK
Air permeability test certificate reference		

4 Space heating

Main heating system 1: Boiler with radiators or underfloor heating - Mains gas	
Efficiency	89.2%
Emitter type	Radiators
Flow temperature	35°C
System type	Combi boiler
Manufacturer	Bosch Thermotechnology
Model	Greenstar
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water		
Cylinder/store - type: N/A		
Capacity	N/A	
Declared heat loss	N/A	
Primary pipework insulated	N/A	
Manufacturer		
Model		
Commissioning		
Waste water heat recovery system 1 - type: N/A		
Efficiency		
Manufacturer		
Model		
6 Controls		
Main heating 1 - type: Time and temperature zone control by arrangement of plumbing and electrical services		
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	75 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	0.92 W/(l/s)	OK
Minimum permitted heat recovery efficiency	73%	
Heat recovery efficiency	91%	OK
Manufacturer/Model	MRXBOX95-Wall	
Commissioning		
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		

Full SAP Calculation Printout



Property Reference	Flat 02			Issued on Date	21/12/2023
Assessment Reference	01-BE LEAN & CLEAN	Prop Type Ref	PR10687		
Property	Flat 02, Land at, 116, Norfolk Avenue, London , N13 6AJ				
SAP Rating	80 C	DER	11.91	TER	14.37
Environmental	90 B	% DER < TER			17.12
CO ₂ Emissions (t/year)	0.83	DFEE	43.29	TFEE	44.83
Compliance Check	See BREL	% DFEE < TFEE			3.44
% DPER < TPER	0.20	DPER	75.56	TPER	75.71
Assessor Details	Mr. Nikolas Koutsorizof			Assessor ID	U127-0001
Client					

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	64.1700 (1b)	x 2.5000 (2b)	= 160.4250 (1b) - (3b)
First floor	20.1500 (1c)	x 2.3600 (2c)	= 47.5540 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.3200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 207.9790 (5)

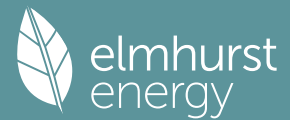
2. Ventilation rate

	m3 per hour											
Number of open chimneys	0 * 80 = 0.0000 (6a)											
Number of open flues	0 * 20 = 0.0000 (6b)											
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)											
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)											
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)											
Number of blocked chimneys	0 * 20 = 0.0000 (6f)											
Number of intermittent extract fans	0 * 10 = 0.0000 (7a)											
Number of passive vents	0 * 10 = 0.0000 (7b)											
Number of flueless gas fires	0 * 40 = 0.0000 (7c)											
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 0.0000 / (5) = 0.0000 (8)											
Pressure test	Yes											
Pressure Test Method	Blower Door											
Measured/design AP50	3.0000 (17)											
Infiltration rate	0.1500 (18)											
Number of sides sheltered	2 (19)											
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)											
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.1275 (21)											
Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation	0.5000 (23a)											
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)											
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	81.9000 (23c)											
Effective ac	0.2531	0.2499	0.2467	0.2307	0.2276	0.2116	0.2116	0.2084	0.2180	0.2276	0.2339	0.2403 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
New Windows (Uw = 1.30)			17.0400	1.2357	21.0570		(27)
New D to Corridor			2.0200	1.4000	2.8280		(26)
Opening 9			0.8500	1.2357	1.0504		(27a)
New Unh.W	20.7800	2.0200	18.7600	0.1700	3.1892	190.0000	3564.4000 (29a)
NEW EW	101.2900	17.0400	84.2500	0.1700	14.3225	110.0000	9267.5000 (29a)
Per. W	11.4500		11.4500	0.1700	1.9465	9.0000	103.0500 (29a)
New Flat R	18.0200		18.0200	0.1500	2.7030	9.0000	162.1800 (30)
New Rins@Joists	40.7300		40.7300	0.1000	4.0730	9.0000	366.5700 (30)
New R ins@Rafters	6.5300	0.8500	5.6800	0.1500	0.8520	9.0000	51.1200 (30)
Total net area of external elements Aum(A, m ²)			198.8000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		52.0216		(33)
Party Wall 1			18.1300	0.0000	0.0000	180.0000	3263.4000 (32)
Party Floor 1			64.1700			80.0000	5133.6000 (32d)
Internal Wall 1			131.3900			100.0000	13139.0000 (32c)

Full SAP Calculation Printout



Internal Floor 1	20.1500	18.0000	362.7000 (32d)
Internal Ceiling 1	20.1500	9.0000	181.3500 (32e)

Heat capacity $C_m = \text{Sum}(A \times k)$ (28)...(30) + (32) + (32a)...(32e) = 35594.8700 (34)
Thermal mass parameter (TMP = C_m / TFA) in $\text{kJ/m}^2\text{K}$ 422.1403 (35)

List of Thermal Bridges	Length	Psi-value	Total
K1 Element	12.1400	0.0160	0.1942
E2 Other lintels (including other steel lintels)	11.1800	0.0200	0.2236
E3 Sill	26.9600	0.0150	0.4044
E4 Jamb	33.3400	0.0440	1.4670
E7 Party floor between dwellings (in blocks of flats)	33.4900	0.0730	2.4448
E10 Eaves (insulation at ceiling level)	22.0900	0.1500	3.3135
E24 Eaves (insulation at ceiling level - inverted)	2.2100	0.0960	0.2122
E12 Gable (insulation at ceiling level)	2.7600	0.0600	0.1656
E13 Gable (insulation at rafter level)	18.7100	0.1600	2.9936
E14 Flat roof	29.4400	0.0440	1.2954
E16 Corner (normal)	15.0000	-0.0730	-1.0950
E17 Corner (inverted - internal area greater than external area)	5.0000	0.0550	0.2750
E18 Party wall between dwellings	7.2500	0.0000	0.0000
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	7.2500	0.1010	0.7323
P4 Party wall - Roof (insulation at ceiling level)	1.4000	0.2400	0.3360
R1 Head of roof window	1.4000	0.2400	0.3360
R2 Sill of roof window	2.4400	0.2400	0.5856
R3 Jamb of roof window	18.1700	0.1200	2.1804
R4 Ridge (vaulted ceiling)	7.2600	0.1200	0.8712
R5 Ridge (inverted)	4.3700	0.1200	0.5244
R8 Roof to wall (rafter)			

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 17.4600 (36)
Point Thermal bridges 0.0000
Total fabric heat loss (33) + (36) + (36a) = 69.4817 (37)

Ventilation heat loss calculated monthly (38)m = $0.33 \times (25)\text{m} \times (5)$	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	17.3685	17.1497	16.9309	15.8371	15.6183	14.5245	14.5245	14.3057	14.9620	15.6183	16.0558	16.4934 (38)
Heat transfer coeff	86.8501	86.6313	86.4126	85.3187	85.1000	84.0061	84.0061	83.7874	84.4437	85.1000	85.5375	85.9750 (39)
Average = Sum(39)m / 12 =												85.2640
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0300	1.0274	1.0248	1.0118	1.0093	0.9963	0.9963	0.9937	1.0015	1.0093	1.0144	1.0196 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

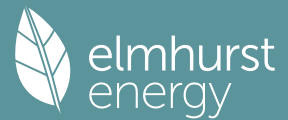
4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5397 (42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths	28.8506	28.4221	27.8188	26.7062	25.8732	24.9495	24.4505	25.0497	25.7021	26.6905	27.8259	28.7531 (42b)
Hot water usage for other uses	40.6395	39.1617	37.6839	36.2061	34.7283	33.2505	33.2505	34.7283	36.2061	37.6839	39.1617	40.6395 (42c)
Average daily hot water use (litres/day)												63.6940 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	69.4901	67.5838	65.5026	62.9123	60.6015	58.2000	57.7010	59.7780	61.9081	64.3743	66.9876	69.3925 (44)
Energy content (annual)	110.0553	96.2384	100.6751	86.1238	81.5812	71.5636	69.7844	74.0176	76.3389	87.3554	95.4361	108.6519 (45)
Distribution loss (46)m = $0.15 \times (45)\text{m}$	16.5083	14.4358	15.1013	12.9186	12.2372	10.7345	10.4677	11.1026	11.4508	13.1033	14.3154	16.2978 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	29.6075	26.7362	29.5917	28.6227	29.5669	28.6039	29.5532	29.5591	28.6123	29.5771	28.6373	29.6059 (61)
Total heat required for water heating calculated for each month	139.6628	122.9746	130.2668	114.7465	111.1482	100.1675	99.3375	103.5768	104.9512	116.9325	124.0734	138.2578 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	139.6628	122.9746	130.2668	114.7465	111.1482	100.1675	99.3375	103.5768	104.9512	116.9325	124.0734	138.2578 (64)
12Total per year (kWh/year)												1406.0956 (64)
Electric shower(s)	51.7722	46.1294	50.3716	48.0690	48.9710	46.7135	48.2707	48.9710	48.0690	50.3716	49.4244	51.7722 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												588.9054 (64a)
Heat gains from water heating, kWh/month	56.9383	50.2157	53.4653	47.8091	46.7602	42.6243	42.6593	44.2434	44.5530	49.0328	51.2479	56.4713 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	126.9869	126.9869	126.9869	126.9869	126.9869	126.9869	126.9869	126.9869	126.9869	126.9869	126.9869	126.9869 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	115.2890	127.6414	115.2890	119.1320	115.2890	119.1320	115.2890	115.2890	119.1320	115.2890	119.1320	115.2890 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	228.2321	230.6004	224.6323	211.9268	195.8885	180.8147	170.7445	168.3762	174.3443	187.0498	203.0881	218.1619 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.6987	35.6987	35.6987	35.6987	35.6987	35.6987	35.6987	35.6987	35.6987	35.6987	35.6987	35.6987 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-101.5895	-101.5895	-101.5895	-101.5895	-101.5895	-101.5895	-101.5895	-101.5895	-101.5895	-101.5895	-101.5895	-101.5895 (71)
Water heating gains (Table 5)	76.5300	74.7257	71.8619	66.4015	62.8498	59.2004	57.3377	59.4669	61.8792	65.9043	71.1777	75.9023 (72)
Total internal gains	484.1471	497.0636	475.8793	461.5564	438.1234	420.2432	404.4674	404.2282	416.4516	432.3392	457.4938	473.4492 (73)

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6. Solar gains

[Jan]			Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North			1.3300	10.6334	0.6300	0.7000	0.7700	4.3221 (74)
Northeast			3.5100	11.2829	0.6300	0.7000	0.7700	12.1032 (75)
East			1.3300	19.6403	0.6300	0.7000	0.7700	7.9831 (76)
Southwest			10.8700	36.7938	0.6300	0.7000	0.7700	122.2296 (79)
Northeast			0.8500	16.8560	0.6300	0.7000	1.0000	5.6866 (82)
Solar gains	152.3247	268.5089	390.9093	522.9718	620.4306	631.0320	436.3512	129.2781 (83)
Total gains	636.4718	765.5725	866.7886	984.5282	1058.5540	1051.2751	852.8028	602.7274 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	113.8452	114.1326	114.4216	115.8885	116.1865	117.6993	117.6993	118.0066	117.0895	116.1865	115.5921	115.0039
alpha	8.5897	8.6088	8.6281	8.7259	8.7458	8.8466	8.8466	8.8671	8.8060	8.7458	8.7061	8.6669
util living area	0.9995	0.9974	0.9868	0.9171	0.7319	0.5108	0.3672	0.4137	0.6755	0.9599	0.9979	0.9997 (86)
MIT	20.3201	20.4728	20.6678	20.8917	20.9860	20.9994	21.0000	20.9999	20.9945	20.8501	20.5409	20.2962 (87)
Th 2	20.0584	20.0606	20.0627	20.0735	20.0756	20.0864	20.0864	20.0886	20.0821	20.0756	20.0713	20.0670 (88)
util rest of house	0.9993	0.9960	0.9796	0.8821	0.6663	0.4382	0.2910	0.3318	0.5899	0.9336	0.9964	0.9995 (89)
MIT 2	19.2734	19.4701	19.7165	19.9824	20.0676	20.0862	20.0864	20.0886	20.0799	19.9470	19.5665	19.2498 (90)
Living area fraction									fLA = Living area /	(4) =		0.3178 (91)
MIT	19.6061	19.7888	20.0189	20.2714	20.3595	20.3765	20.3768	20.3782	20.3706	20.2341	19.8762	19.5824 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.4561	19.6388	19.8689	20.1214	20.2095	20.2265	20.2268	20.2282	20.2206	20.0841	19.7262	19.4324 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9990	0.9951	0.9777	0.8842	0.6761	0.4494	0.3027	0.3444	0.6031	0.9339	0.9956	0.9994 (94)
Useful gains	635.8313	761.7947	847.4194	870.5223	715.6816	472.4384	304.6671	320.7420	514.3508	686.8771	638.7876	602.3368 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1316.3072	1276.8410	1155.2371	957.3962	724.1590	472.6593	304.6725	320.7585	516.8443	807.0942	1080.0153	1309.6047 (97)
Space heating kWh	506.2741	346.1111	229.0164	62.5492	6.3071	0.0000	0.0000	0.0000	0.0000	89.4415	317.6840	526.2073 (98a)
Space heating requirement - total per year (kWh/year)												2083.5907
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	506.2741	346.1111	229.0164	62.5492	6.3071	0.0000	0.0000	0.0000	0.0000	89.4415	317.6840	526.2073 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2083.5907
Space heating per m2										(98c) / (4) =		24.7105 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												89.2000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	506.2741	346.1111	229.0164	62.5492	6.3071	0.0000	0.0000	0.0000	0.0000	89.4415	317.6840	526.2073 (98)
Space heating efficiency (main heating system 1)	89.2000	89.2000	89.2000	89.2000	89.2000	0.0000	0.0000	0.0000	0.0000	89.2000	89.2000	89.2000 (210)
Space heating fuel (main heating system)	567.5719	388.0170	256.7448	70.1224	7.0708	0.0000	0.0000	0.0000	0.0000	100.2708	356.1480	589.9185 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	139.6628	122.9746	130.2668	114.7465	111.1482	100.1675	99.3375	103.5768	104.9512	116.9325	124.0734	138.2578 (64)
Efficiency of water heater	88.7149	88.6126	88.3896	87.7637	87.1154	87.0000	87.0000	87.0000	87.0000	87.9400	88.5709	87.0000 (216)
Fuel for water heating, kWh/month	157.4287	138.7779	147.3780	130.7449	127.5873	115.1351	114.1811	119.0537	120.6336	132.9685	140.0836	155.8131 (219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	35.0606	31.6676	35.0606	33.9296	35.0606	33.9296	35.0606	35.0606	33.9296	35.0606	33.9296	35.0606 (231)
Lighting	32.9082	26.4001	23.7704	17.4152	13.4520	10.9904	12.2714	15.9508	20.7185	27.1838	30.7040	33.8228 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)

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Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)	
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)	
Annual totals kWh/year													
Space heating fuel - main system 1												2335.8641	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												87.0000	
Water heating fuel used												1599.7854	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.2880)													
mechanical ventilation fans (SFP = 1.2880)												326.8099	(230a)
central heating pump												41.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												412.8099	(231)
Electricity for lighting (calculated in Appendix L)												265.5876	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												0.0000	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												5202.9523	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2335.8641	0.2100	490.5315	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1599.7854	0.2100	335.9549	(264)
Energy for instantaneous electric shower(s)	588.9054	0.1391	81.9298	(264a)
Space and water heating			826.4864	(265)
Pumps, fans and electric keep-hot	412.8099	0.1387	57.2618	(267)
Energy for lighting	265.5876	0.1443	38.3325	(268)
Total CO2, kg/year			1004.0105	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			11.9100	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2335.8641	1.1300	2639.5264	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1599.7854	1.1300	1807.7575	(278)
Energy for instantaneous electric shower(s)	588.9054	1.5143	891.7995	(278a)
Space and water heating			4447.2839	(279)
Pumps, fans and electric keep-hot	412.8099	1.5128	624.4988	(281)
Energy for lighting	265.5876	1.5338	407.3672	(282)
Total Primary energy kWh/year			6370.9494	(286)
Dwelling Primary energy Rate (DPER)			75.5600	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)

CALCULATION OF TARGET EMISSIONS

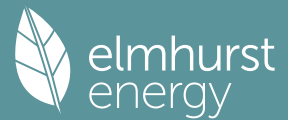
1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)	
Ground floor	64.1700 (1b)	x 2.5000 (2b)	= 160.4250 (1b) - (3b)	
First floor	20.1500 (1c)	x 2.3600 (2c)	= 47.5540 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)... (1n)	84.3200		(4)	
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e) ... (3n)	= 207.9790 (5)	

2. Ventilation rate

	m ³ per hour	
Number of open chimneys	0 * 80 = 0.0000 (6a)	
Number of open flues	0 * 20 = 0.0000 (6b)	
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)	
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)	
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)	
Number of blocked chimneys	0 * 20 = 0.0000 (6f)	
Number of intermittent extract fans	3 * 10 = 30.0000 (7a)	
Number of passive vents	0 * 10 = 0.0000 (7b)	
Number of flueless gas fires	0 * 40 = 0.0000 (7c)	
Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) = 0.1442 (8)	
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000 (17)	
Infiltration rate	0.3942 (18)	

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Number of sides sheltered

2 (19)

Shelter factor

$$(20) = 1 - [0.075 \times (19)] = 0.8500 \quad (20)$$

Infiltration rate adjusted to include shelter factor

$$(21) = (18) \times (20) = 0.3351 \quad (21)$$

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate													
Effective ac	0.4273	0.4189	0.4105	0.3686	0.3602	0.3184	0.3184	0.3100	0.3351	0.3602	0.3770	0.3938	(22b)
	0.5913	0.5877	0.5843	0.5679	0.5649	0.5507	0.5507	0.5480	0.5561	0.5649	0.5711	0.5775	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.0200	1.0000	2.0200			(26)
TER Opening Type (Uw = 1.20)			17.0400	1.1450	19.5115			(27)
Opening 9			0.8500	1.5038	1.2782			(27a)
New Unh.W	20.7800	2.0200	18.7600	0.1800	3.3768			(29a)
NEW EW	101.2900	17.0400	84.2500	0.1800	15.1650			(29a)
Per. W	11.4500		11.4500	0.1800	2.0610			(29a)
New Flat R	18.0200		18.0200	0.1100	1.9822			(30)
New Rins@Joists	40.7300		40.7300	0.1100	4.4803			(30)
New R ins@Rafters	6.5300	0.8500	5.6800	0.1100	0.6248			(30)
Total net area of external elements Aum(A, m2)			198.8000					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	50.4997		(33)
Party Wall 1			18.1300	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K

422.1403 (35)

List of Thermal Bridges

	Length	Psi-value	Total	
K1 Element	12.1400	0.0500	0.6070	
E2 Other lintels (including other steel lintels)	11.1800	0.0500	0.5590	
E3 Sill	26.9600	0.0500	1.3480	
E4 Jamb	33.3400	0.0700	2.3338	
E7 Party floor between dwellings (in blocks of flats)	33.4900	0.0600	2.0094	
E10 Eaves (insulation at ceiling level)	22.0900	0.2400	5.3016	
E24 Eaves (insulation at ceiling level - inverted)	2.2100	0.0600	0.1326	
E12 Gable (insulation at ceiling level)	2.7600	0.0800	0.2208	
E13 Gable (insulation at rafter level)	18.7100	0.0800	1.4968	
E14 Flat roof	29.4400	0.0900	2.6496	
E16 Corner (normal)	15.0000	-0.0900	-1.3500	
E17 Corner (inverted - internal area greater than external area)	5.0000	0.0600	0.3000	
E18 Party wall between dwellings	7.2500	0.0000	0.0000	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	7.2500	0.1200	0.8700	
P4 Party wall - Roof (insulation at ceiling level)	1.4000	0.0800	0.1120	
R1 Head of roof window	1.4000	0.0600	0.0840	
R2 Sill of roof window	2.4400	0.0800	0.1952	
R3 Jamb of roof window	18.1700	0.0800	1.4536	
R4 Ridge (vaulted ceiling)	7.2600	0.0400	0.2904	
R5 Ridge (inverted)	4.3700	0.0600	0.2622	
R8 Roof to wall (rafter)				

Thermal bridges (Sum(L x Psi) calculated using Appendix K)

Point Thermal bridges	(36a) =	18.8760	(36)
Total fabric heat loss	(33) + (36) + (36a) =	69.3757	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

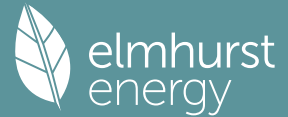
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	40.5812	40.3379	40.0994	38.9795	38.7699	37.7945	37.7945	37.6138	38.1702	38.7699	39.1938	39.6370	(38)
Heat transfer coeff	109.9569	109.7136	109.4752	108.3552	108.1457	107.1702	107.1702	106.9896	107.5459	108.1457	108.5696	109.0128	(39)
Average = Sum(39)m / 12 =												108.3542	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3040	1.3012	1.2983	1.2850	1.2826	1.2710	1.2710	1.2689	1.2755	1.2826	1.2876	1.2928	(40)
HLP (average)												1.2850	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.5397 (42)
Hot water usage for mixer showers	66.8028	65.7989	64.3360	61.5370	59.4714	57.1679	55.8585	57.3104	58.9018	61.3751	64.2342	66.5468 (42a)	
Hot water usage for baths	28.8506	28.4221	27.8188	26.7062	25.8732	24.9495	24.4505	25.0497	25.7021	26.6905	27.8259	28.7531 (42b)	
Hot water usage for other uses	40.6395	39.1617	37.6839	36.2061	34.7283	33.2505	33.2505	34.7283	36.2061	37.6839	39.1617	40.6395 (42c)	
Average daily hot water use (litres/day)												125.2840 (43)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	136.2929	133.3827	129.8386	124.4493	120.0728	115.3678	113.5595	117.0883	120.8100	125.7495	131.2218	135.9394 (44)	
Energy content (annual)	215.8546	189.9352	199.5571	170.3648	161.6411	141.8582	137.3404	144.9798	148.9708	170.6408	186.9495	212.8482 (45)	
Distribution loss (46)m = 0.15 x (45)m	32.3782	28.4903	29.9336	25.5547	24.2462	21.2787	20.6011	21.7470	22.3456	25.5961	28.0424	31.9272 (46)	
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)	
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)	
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)	
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589 (61)	
Total heat required for water heating calculated for each month	266.8135	235.9626	250.5160	219.6799	212.6000	191.1732	188.2993	195.9387	198.2858	221.5997	236.2646	263.8071 (62)	
WWHRS	-30.5394	-27.0093	-28.2826	-23.4191	-21.8258	-18.6765	-17.5062	-18.6161	-19.3234	-22.7802	-25.8072	-29.9739 (63a)	
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)	
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)	
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)	
Output from w/h	236.2740	208.9532	222.2334	196.2608	190.7742	172.4968	170.7931	177.3226	178.9624	198.8196	210.4574	233.8332 (64)	
Total per year (kWh/year)	Total per year (kWh/year) = Sum(64)m =											2397.1808 (64)	
												2397 (64)	

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Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month	84.5114	74.6603	79.0925	68.9751	66.4854	59.4966	58.4054	60.9455	61.8616	69.4778	74.4895	83.5118 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	126.9869	126.9869	126.9869	126.9869	126.9869	126.9869	126.9869	126.9869	126.9869	126.9869	126.9869	126.9869	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	115.2890	127.6414	115.2890	119.1320	115.2890	119.1320	115.2890	115.2890	119.1320	115.2890	119.1320	115.2890	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	228.2321	230.6004	224.6323	211.9268	195.8885	180.8147	170.7445	168.3762	174.3443	187.0498	203.0881	218.1619	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.6987	35.6987	35.6987	35.6987	35.6987	35.6987	35.6987	35.6987	35.6987	35.6987	35.6987	35.6987	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-101.5895	-101.5895	-101.5895	-101.5895	-101.5895	-101.5895	-101.5895	-101.5895	-101.5895	-101.5895	-101.5895	-101.5895	(71)
Water heating gains (Table 5)	113.5906	111.1016	106.3071	95.7987	89.3621	82.6342	78.5019	81.9160	85.9188	93.3841	103.4576	112.2470	(72)
Total internal gains	521.2077	533.4395	510.3244	490.9536	464.6357	443.6770	425.6315	426.6773	440.4912	459.8190	489.7738	509.7940	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W		
North					1.3300	10.6334	0.6300	0.7000	0.7700	4.3221 (74)		
Northeast					3.5100	11.2829	0.6300	0.7000	0.7700	12.1032 (75)		
East					1.3300	19.6403	0.6300	0.7000	0.7700	7.9831 (76)		
Southwest					10.8700	36.7938	0.6300	0.7000	0.7700	122.2296 (79)		
Northeast					0.8500	16.8560	0.6300	0.7000	1.0000	5.6866 (82)		
Solar gains	152.3247	268.5089	390.9093	522.9718	620.4306	631.0320	602.1148	527.2034	436.3512	303.1502	184.1088	129.2781 (83)
Total gains	673.5324	801.9484	901.2337	1013.9254	1085.0663	1074.7090	1027.7463	953.8808	876.8424	762.9692	673.8826	639.0721 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	21.0000 (85)											
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	89.9213	90.1206	90.3169	91.2505	91.4273	92.2594	92.2594	92.4152	91.9371	91.4273	91.0703	90.7001
alpha	6.9948	7.0080	7.0211	7.0834	7.0952	7.1506	7.1506	7.1610	7.1291	7.0952	7.0714	7.0467
util living area	0.9994	0.9978	0.9918	0.9580	0.8408	0.6287	0.4579	0.5138	0.7930	0.9786	0.9981	0.9996 (86)
MIT	20.0596	20.2186	20.4389	20.7247	20.9242	20.9917	20.9992	20.9983	20.9621	20.6935	20.3224	20.0345 (87)
Th 2	19.8377	19.8399	19.8421	19.8526	19.8545	19.8636	19.8636	19.8653	19.8601	19.8545	19.8506	19.8464 (88)
util rest of house	0.9991	0.9966	0.9868	0.9337	0.7698	0.5224	0.3402	0.3884	0.6880	0.9610	0.9968	0.9994 (89)
MIT 2	18.7633	18.9682	19.2491	19.6029	19.8060	19.8608	19.8635	19.8650	19.8432	19.5762	19.1099	18.7380 (90)
Living area fraction	19.1753	19.3656	19.6272	19.9595	20.1614	20.2203	20.2245	20.2252	20.1988	19.9313	19.4953	19.1501 (92)
MIT	19.1753	19.3656	19.6272	19.9595	20.1614	20.2203	20.2245	20.2252	20.1988	19.9313	19.4953	19.1501 (93)
Temperature adjustment												0.0000
adjusted MIT	19.1753	19.3656	19.6272	19.9595	20.1614	20.2203	20.2245	20.2252	20.1988	19.9313	19.4953	19.1501 (93)

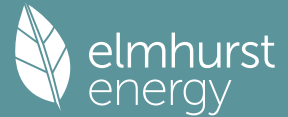
8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	672.7326	798.6158	888.2326	949.4582	857.8774	598.0713	388.2065	408.7138	632.8682	734.4067	671.3448	638.5417 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1635.6429	1587.0784	1437.1055	1198.3501	915.0674	602.3236	388.4365	409.2601	655.9046	1009.1419	1345.7476	1629.7511 (97)
Space heating kWh	716.4053	529.8469	408.3614	179.2021	42.5494	0.0000	0.0000	0.0000	0.0000	204.4031	485.5700	737.4598 (98a)
Space heating requirement - total per year (kWh/year)	3303.7979											
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)	0.0000											
Space heating kWh	716.4053	529.8469	408.3614	179.2021	42.5494	0.0000	0.0000	0.0000	0.0000	204.4031	485.5700	737.4598 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	3303.7979											
Space heating per m ²	(98c) / (4) = 39.1817 (99)											

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)											
Fraction of space heat from main system(s)	1.0000 (202)											
Efficiency of main space heating system 1 (in %)	92.4000 (206)											
Efficiency of main space heating system 2 (in %)	0.0000 (207)											
Efficiency of secondary/supplementary heating system, %	0.0000 (208)											
Space heating requirement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
716.4053	529.8469	408.3614	179.2021	42.5494	0.0000	0.0000	0.0000	0.0000	0.0000	204.4031	485.5700	737.4598 (98)
Space heating efficiency (main heating system 1)	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000 (210)
Space heating fuel (main heating system)	775.3304	573.4273	441.9496	193.9417	46.0491	0.0000	0.0000	0.0000	0.0000	221.2154	525.5087	798.1167 (211)

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Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	236.2740	208.9532	222.2334	196.2608	190.7742	172.4968	170.7931	177.3226	178.9624	198.8196	210.4574	233.8332	(64)
Efficiency of water heater (217)m	86.5998	86.2864	85.6666	84.1870	81.7420	80.3000	80.3000	80.3000	80.3000	84.4409	86.1114	86.6655	(216)
Fuel for water heating, kWh/month	272.8345	242.1625	259.4165	233.1247	233.3857	214.8154	212.6938	220.8251	222.8673	235.4542	244.4013	269.8113	(217)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(219)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(221)
Lighting	23.9548	19.2174	17.3032	12.6770	9.7921	8.0002	8.9327	11.6110	15.0816	19.7879	22.3503	24.6206	(223)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-28.4071	-41.1963	-60.8924	-70.4635	-77.6966	-73.1304	-72.2168	-67.3213	-58.9844	-47.9812	-31.6296	-24.4261	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	-12.7465	-27.1323	-54.5246	-82.7749	-110.3186	-111.1743	-109.8831	-92.6557	-67.3996	-39.1122	-17.1174	-10.0574	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1													3575.5389 (211)
Space heating fuel - main system 2													0.0000 (213)
Space heating fuel - secondary													0.0000 (215)
Efficiency of water heater													80.3000
Water heating fuel used													2861.7922 (219)
Space cooling fuel													0.0000 (221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year													86.0000 (231)
Electricity for lighting (calculated in Appendix L)													193.3288 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation													-1389.2424 (233)
Wind generation													0.0000 (234)
Hydro-electric generation (Appendix N)													0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)													0.0000 (235)
Appendix Q - special features													
Energy saved or generated													-0.0000 (236)
Energy used													0.0000 (237)
Total delivered energy for all uses													5327.4175 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3575.5389	0.2100	750.8632 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2861.7922	0.2100	600.9764 (264)
Space and water heating			1351.8395 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	193.3288	0.1443	27.9033 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-654.3458	0.1340	-87.6813
PV Unit electricity exported	-734.8966	0.1256	-92.2872
Total			-179.9685 (269)
Total CO2, kg/year			1211.7036 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			14.3700 (273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	3575.5389	1.1300	4040.3589 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2861.7922	1.1300	3233.8252 (278)
Space and water heating			7274.1842 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	193.3288	1.5338	296.5342 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-654.3458	1.4952	-978.3794
PV Unit electricity exported	-734.8966	0.4609	-338.7463
Total			-1317.1257 (283)
Total Primary energy kWh/year			6383.6935 (286)
Target Primary Energy Rate (TPER)			75.7100 (287)

Building Regulations England Part L (BREL) Compliance Report

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

Date: Thu 21 Dec 2023 10:43:19

Project Information			
Assessed By	Rajohn Ali	Building Type	Flat, End-terrace
OCDEA Registration	EES/021452	Assessment Date	2023-12-21

Dwelling Details			
Assessment Type	As designed	Total Floor Area	84 m ²
Site Reference	Flat 02	Plot Reference	03-BE GREEN
Address	116 Flat 02, Land at Norfolk Avenue, London , N13 6AJ		

Client Details	
Name	Chris Georgiou
Company	-
Address	-, -, -

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	14.01 kgCO ₂ /m ²		
Dwelling carbon dioxide emission rate	4.77 kgCO ₂ /m ²		OK
1b Target primary energy rate and dwelling primary energy			
Target primary energy	73.76 kWh _{PE} /m ²		
Dwelling primary energy	50.47 kWh _{PE} /m ²		OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency			
Target fabric energy efficiency	44.8 kWh/m ²		
Dwelling fabric energy efficiency	43.3 kWh/m ²		OK

2a Fabric U-values				
Element	Maximum permitted average U-Value [W/m ² K]	Dwelling average U-Value [W/m ² K]	Element with highest individual U-Value	
External walls	0.26	0.17	Walls (1) (0.17)	OK
Party walls	0.2	0	Party Wall (1) (0)	N/A
Curtain walls	1.6	0	N/A	N/A
Floors	0.18	N/A	N/A	N/A
Roofs	0.16	0.12	Roof (1) (0.15)	OK
Windows, doors, and roof windows	1.6	1.31	Opening 1 (1.4)	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 ² K]
Sheltered wall: Walls (1)	18.764	0.17
Exposed wall: Walls (2)	84.2598	0.17
Sheltered wall: Walls (3)	11.45	0.17
Party wall: Party Wall (1)	18.13	0 (!)
Exposed roof: Roof (1)	18.02	0.15
Exposed roof: Roof (2)	40.73	0.1 (!)
Exposed roof: Roof (3)	5.676	0.15

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	Area [m ²]	Orientation	Frame factor	U-Value [W/m ² K]
Opening 1, New D to Corridor	2.016	North West	N/A	1.4
Opening 2, New Windows	1.4577	North East	0.7	1.3
Opening 3, New Windows	1.3287	North	0.7	1.3
Opening 4, New Windows	1.3287	East	0.7	1.3
Opening 5, New Windows	2.0511	North East	0.7	1.3
Opening 6, New Windows	1.392	South West	0.7	1.3
Opening 6, New Windows	0.696	South West	0.7	1.3
Opening 7, New Windows	4.04	South West	0.7	1.3
Opening 8, New Windows	4.04	South West	0.7	1.3
Opening 8, New Windows	0.696	South West	0.7	1.3

Name	Area [m ²]	Orientation	Frame factor	U-Value [W/m ² K]
Opening 9, New RL	0.427	North East	0.7	1.3
Opening 9, New RL	0.427	North East	0.7	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))

Building part 1 - Main Dwelling: Thermal bridging calculated from linear thermal transmittances for each junction

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.016 (!)	RECOGN.CON STR.DETAILS
External wall	E3: Sill	Calculated by person with suitable expertise	0.02 (!)	RECOGN.CON STR.DETAILS
External wall	E4: Jamb	Calculated by person with suitable expertise	0.015 (!)	RECOGN.CON STR.DETAILS
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.044	RECOGN.CON STR.DETAILS
External wall	E10: Eaves (insulation at ceiling level)	Calculated by person with suitable expertise	0.073	RECOGN.CON STR.DETAILS
External wall	E24: Eaves (insulation at ceiling level - inverted)	SAP table default	0.15	
External wall	E12: Gable (insulation at ceiling level)	Calculated by person with suitable expertise	0.096	RECOGN.CON STR.DETAILS
External wall	E13: Gable (insulation at rafter level)	Calculated by person with suitable expertise	0.06	RECOGN.CON STR.DETAILS
External wall	E14: Flat roof	SAP table default	0.16	
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.044	RECOGN.CON STR.DETAILS
External wall	E17: Corner (inverted - internal area greater than external area)	Calculated by person with suitable expertise	-0.073	RECOGN.CON STR.DETAILS
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.055	RECOGN.CON STR.DETAILS
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	SAP table default	0 (!)	
Party wall	P4: Roof (insulation at ceiling level)	Calculated by person with suitable expertise	0.101	RECOGN.CON STR.DETAILS
Roof	R1: Head of roof window	SAP table default	0.24	
Roof	R2: Sill of roof window	SAP table default	0.24	
Roof	R3: Jamb of roof window	SAP table default	0.24	
Roof	R4: Ridge (vaulted ceiling)	SAP table default	0.12	
Roof	R5: Ridge (inverted)	SAP table default	0.12	
Roof	R8: Roof to wall (rafter)	SAP table default	0.12	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))

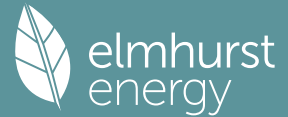
Maximum permitted air permeability at 50Pa	8 m ³ /hm ²	
Dwelling air permeability at 50Pa	3 m ³ /hm ² , Design value (!)	OK
Air permeability test certificate reference		

4 Space heating

Main heating system 1: Heat pump with radiators or underfloor heating - Electricity	
Efficiency	265.8%
Emitter type	Radiators
Flow temperature	45°C
System type	Heat Pump
Manufacturer	Mitsubishi Electric Europe B.V.
Model	Ecodan 8.5 kW
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water		
Cylinder/store - type: Cylinder		
Capacity	210 litres	
Declared heat loss	1.36 kWh/day	
Primary pipework insulated	Yes	
Manufacturer		
Model		
Commissioning		
Waste water heat recovery system 1 - type: N/A		
Efficiency		
Manufacturer		
Model		
6 Controls		
Main heating 1 - type: Time and temperature zone control by arrangement of plumbing and electrical services		
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	75 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	0.92 W/(l/s)	OK
Minimum permitted heat recovery efficiency	73%	
Heat recovery efficiency	91%	OK
Manufacturer/Model	MRXBOX95-Wall	
Commissioning		
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		

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Property Reference	Flat 02			Issued on Date	21/12/2023
Assessment Reference	03-BE GREEN	Prop Type Ref	PR10687		
Property	Flat 02, Land at, 116, Norfolk Avenue, London , N13 6AJ				
SAP Rating	80 C	DER	4.77	TER	14.01
Environmental	96 A	% DER < TER			65.95
CO ₂ Emissions (t/year)	0.36	DFEE	43.29	TFEE	44.83
Compliance Check	See BREL	% DFEE < TFEE			3.44
% DPER < TPER	31.57	DPER	50.47	TPER	73.76
Assessor Details	Mr. Rajohn Ali			Assessor ID	R582-0001
Client					

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	64.1700 (1b)	x 2.5000 (2b)	= 160.4250 (1b) - (3b)
First floor	20.1500 (1c)	x 2.3600 (2c)	= 47.5540 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.3200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 207.9790 (5)

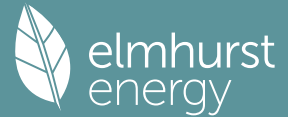
2. Ventilation rate

Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	
Pressure test	0.0000 / (5) =	
Pressure Test Method	Yes	
Measured/design AP50	Blower Door	
Infiltration rate	3.0000 (17)	
Number of sides sheltered	0.1500 (18)	
Shelter factor	2 (19)	
Infiltration rate adjusted to include shelter factor	(20) = 1 - [0.075 x (19)] =	
	(21) = (18) x (20) =	
	0.8500 (20)	
	0.1275 (21)	
Wind speed	Jan 5.1000	Feb 5.0000
Wind factor	Mar 4.9000	Apr 4.4000
Adj infilt rate	May 4.3000	Jun 3.8000
	Jul 3.8000	Aug 3.7000
	Sep 4.0000	Oct 4.3000
	Nov 4.5000	Dec 4.7000 (22)
	1.2750	1.1750 (22a)
	0.1626	0.1594
	0.1562	0.1403
	0.1371	0.1211
	0.1211	0.1179
	0.1275	0.1371
	0.1434	0.1498 (22b)
Balanced mechanical ventilation with heat recovery		
If mechanical ventilation	0.5000 (23a)	
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)	
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	81.9000 (23c)	
Effective ac	0.2531	0.2499
	0.2467	0.2307
	0.2276	0.2116
	0.2116	0.2084
	0.2180	0.2276
	0.2339	0.2403 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
New Windows (Uw = 1.30)			17.0400	1.2357	21.0570		(27)
New D to Corridor			2.0200	1.4000	2.8280		(26)
Opening 9			0.8500	1.2357	1.0504		(27a)
New Unh.W	20.7800	2.0200	18.7600	0.1700	3.1892	190.0000	3564.4000 (29a)
NEW EW	101.2900	17.0400	84.2500	0.1700	14.3225	110.0000	9267.5000 (29a)
Per. W	11.4500		11.4500	0.1700	1.9465	9.0000	103.0500 (29a)
New Flat R	18.0200		18.0200	0.1500	2.7030	9.0000	162.1800 (30)
New Rins@Joists	40.7300		40.7300	0.1000	4.0730	9.0000	366.5700 (30)
New R ins@Rafters	6.5300	0.8500	5.6800	0.1500	0.8520	9.0000	51.1200 (30)
Total net area of external elements Aum(A, m ²)			198.8000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		52.0216		(33)
Party Wall 1			18.1300	0.0000	0.0000	180.0000	3263.4000 (32)
Party Floor 1			64.1700			80.0000	5133.6000 (32d)
Internal Wall 1			131.3900			100.0000	13139.0000 (32c)

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Internal Floor 1	20.1500	18.0000	362.7000 (32d)
Internal Ceiling 1	20.1500	9.0000	181.3500 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K
(28)...(30) + (32) + (32a)...(32e) = 35594.8700 (34)
List of Thermal Bridges
422.1403 (35)

	Length	Psi-value	Total
K1 Element	12.1400	0.0160	0.1942
E2 Other lintels (including other steel lintels)	11.1800	0.0200	0.2236
E3 Sill	26.9600	0.0150	0.4044
E4 Jamb	33.3400	0.0440	1.4670
E7 Party floor between dwellings (in blocks of flats)	33.4900	0.0730	2.4448
E10 Eaves (insulation at ceiling level)	22.0900	0.1500	3.3135
E24 Eaves (insulation at ceiling level - inverted)	2.2100	0.0960	0.2122
E12 Gable (insulation at ceiling level)	2.7600	0.0600	0.1656
E13 Gable (insulation at rafter level)	18.7100	0.1600	2.9936
E14 Flat roof	29.4400	0.0440	1.2954
E16 Corner (normal)	15.0000	-0.0730	-1.0950
E17 Corner (inverted - internal area greater than external area)	5.0000	0.0550	0.2750
E18 Party wall between dwellings	7.2500	0.0000	0.0000
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	7.2500	0.1010	0.7323
P4 Party wall - Roof (insulation at ceiling level)	1.4000	0.2400	0.3360
R1 Head of roof window	1.4000	0.2400	0.3360
R2 Sill of roof window	2.4400	0.2400	0.5856
R3 Jamb of roof window	18.1700	0.1200	2.1804
R4 Ridge (vaulted ceiling)	7.2600	0.1200	0.8712
R5 Ridge (inverted)	4.3700	0.1200	0.5244
R8 Roof to wall (rafter)			

Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Point Thermal bridges
Total fabric heat loss
(33) + (36) + (36a) = 69.4817 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	17.3685	17.1497	16.9309	15.8371	15.6183	14.5245	14.5245	14.3057	14.9620	15.6183	16.0558	16.4934 (38)
Average = Sum(39)m / 12 =	86.8501	86.6313	86.4126	85.3187	85.1000	84.0061	84.0061	83.7874	84.4437	85.1000	85.5375	85.9750 (39)
												85.2640
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0300	1.0274	1.0248	1.0118	1.0093	0.9963	0.9963	0.9937	1.0015	1.0093	1.0144	1.0196 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

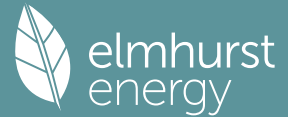
4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.5397 (42)
Hot water usage for mixer showers	66.8028	65.7989	64.3360	61.5370	59.4714	57.1679	55.8585	57.3104	58.9018	61.3751	64.2342	66.5468	(42a)
Hot water usage for baths	28.8506	28.4221	27.8188	26.7062	25.8732	24.9495	24.4505	25.0497	25.7021	26.6905	27.8259	28.7531	(42b)
Hot water usage for other uses	40.6395	39.1617	37.6839	36.2061	34.7283	33.2505	33.2505	34.7283	36.2061	37.6839	39.1617	40.6395	(42c)
Average daily hot water use (litres/day)													125.2840 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy content (annual)	136.2929	133.3827	129.8386	124.4493	120.0728	115.3678	113.5595	117.0883	120.8100	125.7495	131.2218	135.9394	(44)
Distribution loss (46)m = 0.15 x (45)m	215.8546	189.9352	199.5571	170.3648	161.6411	141.8582	137.3404	144.9798	148.9708	170.6408	186.9495	212.8482	(45)
Total = Sum(45)m =	32.3782	28.4903	29.9336	25.5547	24.2462	21.2787	20.6011	21.7470	22.3456	25.5961	28.0424	31.9272	2080.9406
Water storage loss:													
Store volume													210.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.3600 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													0.7344 (55)
Total storage loss	22.7664	20.5632	22.7664	22.0320	22.7664	22.0320	22.7664	22.7664	22.0320	22.7664	22.0320	22.7664	(56)
If cylinder contains dedicated solar storage	22.7664	20.5632	22.7664	22.0320	22.7664	22.0320	22.7664	22.7664	22.0320	22.7664	22.0320	22.7664	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	261.8834	231.5096	245.5859	214.9088	207.6699	186.4022	183.3692	191.0086	193.5148	216.6696	231.4935	258.8770	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	261.8834	231.5096	245.5859	214.9088	207.6699	186.4022	183.3692	191.0086	193.5148	216.6696	231.4935	258.8770	(64)
12Total per year (kWh/year)													2622.8926 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													0.0000 (64a)
Heat gains from water heating, kWh/month	108.5947	96.4130	103.1758	92.2815	90.5687	82.8030	82.4887	85.0288	85.1680	93.5611	97.7959	107.5951	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	126.9869	126.9869	126.9869	126.9869	126.9869	126.9869	126.9869	126.9869	126.9869	126.9869	126.9869	126.9869 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	115.2890	127.6414	115.2890	119.1320	115.2890	119.1320	115.2890	115.2890	119.1320	115.2890	119.1320	115.2890 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	228.2321	230.6004	224.6323	211.9268	195.8885	180.8147	170.7445	168.3762	174.3443	187.0498	203.0881	218.1619 (68)
Pumps, fans	35.6987	35.6987	35.6987	35.6987	35.6987	35.6987	35.6987	35.6987	35.6987	35.6987	35.6987	35.6987 (69)
Losses e.g. evaporation (negative values) (Table 5)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Water heating gains (Table 5)	-101.5895	-101.5895	-101.5895	-101.5895	-101.5895	-101.5895	-101.5895	-101.5895	-101.5895	-101.5895	-101.5895	-101.5895 (71)
Total internal gains	145.9606	143.4717	138.6771	128.1688	121.7321	115.0042	110.8719	114.2861	118.2889	125.7542	135.8277	144.6170 (72)

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550.5778 562.8096 539.6945 520.3237 494.0058 476.0470 458.0016 459.0474 472.8613 489.1891 519.1438 539.1640 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d	Gains W

North					1.3300	10.6334	0.6300	0.7000			0.7700	4.3221 (74)
Northeast					3.5100	11.2829	0.6300	0.7000			0.7700	12.1032 (75)
East					1.3300	19.6403	0.6300	0.7000			0.7700	7.9831 (76)
Southwest					10.8700	36.7938	0.6300	0.7000			0.7700	122.2296 (79)
Northeast					0.8500	16.8560	0.6300	0.7000			1.0000	5.6866 (82)

Solar gains	152.3247	268.5089	390.9093	522.9718	620.4306	631.0320	602.1148	527.2034	436.3512	303.1502	184.1088	129.2781 (83)
Total gains	702.9024	831.3184	930.6038	1043.2955	1114.4364	1107.0790	1060.1164	986.2508	909.2125	792.3392	703.2526	668.4421 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	113.8452	114.1326	114.4216	115.8885	116.1865	117.6993	117.6993	118.0066	117.0895	116.1865	115.5921	115.0039
alpha	8.5897	8.6088	8.6281	8.7259	8.7458	8.8466	8.8466	8.8671	8.8060	8.7458	8.7061	8.6669
util living area	0.9990	0.9953	0.9790	0.8924	0.6995	0.4852	0.3486	0.3907	0.6362	0.9397	0.9958	0.9993 (86)
Living	20.3752	20.5261	20.7143	20.9152	20.9900	20.9996	21.0000	21.0000	20.9965	20.8824	20.5912	20.3509
Non living	19.3439	19.5374	19.7724	20.0047	20.0700	20.0863	20.0864	20.0886	20.0807	19.9798	19.6299	19.3199
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	20.6804	20.5261	20.7143	20.9152	20.9900	20.9996	21.0000	21.0000	20.9965	20.8824	20.5912	20.4417 (87)
Th 2	20.0584	20.0606	20.0627	20.0735	20.0756	20.0864	20.0864	20.0886	20.0821	20.0756	20.0713	20.0670 (88)
util rest of house	0.9984	0.9928	0.9684	0.8523	0.6349	0.4162	0.2763	0.3134	0.5542	0.9051	0.9930	0.9989 (89)
MIT 2	19.7736	19.5374	19.7724	20.0047	20.0700	20.0863	20.0864	20.0886	20.0807	19.9798	19.6299	19.4545 (90)
Living area fraction	20.0618	19.8516	20.0718	20.2941	20.3624	20.3766	20.3768	20.3783	20.3718	20.2667	19.9354	19.7683 (92)
MIT	20.0618	19.8516	20.0718	20.2941	20.3624	20.3766	20.3768	20.3783	20.3718	20.2667	19.9354	19.7683 (93)
Temperature adjustment												0.0000
adjusted MIT	20.0618	19.8516	20.0718	20.2941	20.3624	20.3766	20.3768	20.3783	20.3718	20.2667	19.9354	19.7683 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9984	0.9920	0.9685	0.8627	0.6553	0.4382	0.2993	0.3380	0.5804	0.9134	0.9925	0.9988 (94)
Useful gains	701.7851	824.6807	901.3249	900.0999	730.3301	485.0843	317.2686	333.3130	527.7080	723.7195	697.9522	667.6263 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1368.9121	1295.2810	1172.7718	972.1276	737.1728	485.2691	317.2738	333.3276	529.6133	822.6326	1097.9097	1338.4818 (97)
Space heating kWh	496.3425	316.2434	201.9565	51.8599	5.0909	0.0000	0.0000	0.0000	0.0000	73.5913	287.9694	499.1165 (98a)
Space heating requirement - total per year (kWh/year)												1932.1705
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	496.3425	316.2434	201.9565	51.8599	5.0909	0.0000	0.0000	0.0000	0.0000	73.5913	287.9694	499.1165 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1932.1705
Space heating per m2										(98c) / (4) =		22.9147 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												265.7533 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	496.3425	316.2434	201.9565	51.8599	5.0909	0.0000	0.0000	0.0000	0.0000	73.5913	287.9694	499.1165 (98)
Space heating efficiency (main heating system 1)	265.7533	265.7533	265.7533	265.7533	265.7533	0.0000	0.0000	0.0000	0.0000	265.7533	265.7533	265.7533 (210)
Space heating fuel (main heating system)	186.7681	118.9989	75.9940	19.5143	1.9157	0.0000	0.0000	0.0000	0.0000	27.6916	108.3596	187.8119 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	261.8834	231.5096	245.5859	214.9088	207.6699	186.4022	183.3692	191.0086	193.5148	216.6696	231.4935	258.8770 (64)
Efficiency of water heater	181.2450	181.2450	181.2450	181.2450	181.2450	181.2450	181.2450	181.2450	181.2450	181.2450	181.2450	181.2450 (216)
Fuel for water heating, kWh/month	144.4914	127.7329	135.4994	118.5737	114.5797	102.8454	101.1720	105.3870	106.7697	119.5452	127.7241	142.8327 (219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	27.7565	25.0703	27.7565	26.8611	27.7565	26.8611	27.7565	27.7565	26.8611	27.7565	26.8611	27.7565 (231)
Lighting	32.9082	26.4001	23.7704	17.4152	13.4520	10.9904	12.2714	15.9508	20.7185	27.1838	30.7040	33.8228 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												

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(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												727.0541	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												181.2450	
Water heating fuel used												1447.1532	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.2880)													
mechanical ventilation fans (SFP = 1.2880)												326.8099	(230a)
Total electricity for the above, kWh/year												326.8099	(231)
Electricity for lighting (calculated in Appendix L)												265.5876	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												0.0000	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												2766.6048	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	727.0541	0.1580	114.8952	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1447.1532	0.1410	204.0283	(264)
Space and water heating			318.9236	(265)
Pumps, fans and electric keep-hot	326.8099	0.1387	45.3326	(267)
Energy for lighting	265.5876	0.1443	38.3325	(268)
Total CO2, kg/year			402.5886	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.7700	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	727.0541	1.5850	1152.3545	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1447.1532	1.5213	2201.5822	(278)
Space and water heating			3353.9368	(279)
Pumps, fans and electric keep-hot	326.8099	1.5128	494.3980	(281)
Energy for lighting	265.5876	1.5338	407.3672	(282)
Total Primary energy kWh/year			4255.7020	(286)
Dwelling Primary energy Rate (DPER)			50.4700	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF TARGET EMISSIONS

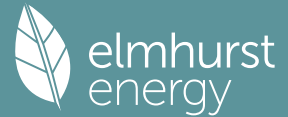
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Ground floor	64.1700 (1b)	x 2.5000 (2b)	= 160.4250 (1b) - (3b)	
First floor	20.1500 (1c)	x 2.3600 (2c)	= 47.5540 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.3200		(4)	
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 207.9790 (5)	

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	3 * 10 =	30.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Air changes per hour		

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Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 30.0000 / (5) = 0.1442 (8)
Pressure test Yes
Pressure Test Method Blower Door
Measured/design AP50 5.0000 (17)
Infiltration rate 0.3942 (18)
Number of sides sheltered 2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.3351 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate													
	0.4273	0.4189	0.4105	0.3686	0.3602	0.3184	0.3184	0.3100	0.3351	0.3602	0.3770	0.3938	(22b)
Effective ac	0.5913	0.5877	0.5843	0.5679	0.5649	0.5507	0.5507	0.5480	0.5561	0.5649	0.5711	0.5775	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.0200	1.0000	2.0200			(26)
TER Opening Type (Uw = 1.20)			17.0400	1.1450	19.5115			(27)
Opening 9			0.8500	1.5038	1.2782			(27a)
New Unh.W	20.7800	2.0200	18.7600	0.1800	3.3768			(29a)
NEW EW	101.2900	17.0400	84.2500	0.1800	15.1650			(29a)
Per. W	11.4500		11.4500	0.1800	2.0610			(29a)
New Flat R	18.0200		18.0200	0.1100	1.9822			(30)
New Rins@Joists	40.7300		40.7300	0.1100	4.4803			(30)
New R ins@Rafters	6.5300	0.8500	5.6800	0.1100	0.6248			(30)
Total net area of external elements Aum(A, m2)			198.8000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	50.4997			(33)
Party Wall 1			18.1300	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 422.1403 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)	12.1400	0.0500	0.6070	
E3 Sill	11.1800	0.0500	0.5590	
E4 Jamb	26.9600	0.0500	1.3480	
E7 Party floor between dwellings (in blocks of flats)	33.3400	0.0700	2.3338	
E10 Eaves (insulation at ceiling level)	33.4900	0.0600	2.0094	
E24 Eaves (insulation at ceiling level - inverted)	22.0900	0.2400	5.3016	
E12 Gable (insulation at ceiling level)	2.2100	0.0600	0.1326	
E13 Gable (insulation at rafter level)	2.7600	0.0800	0.2208	
E14 Flat roof	18.7100	0.0800	1.4968	
E16 Corner (normal)	29.4400	0.0900	2.6496	
E17 Corner (inverted - internal area greater than external area)	15.0000	-0.0900	-1.3500	
E18 Party wall between dwellings	5.0000	0.0600	0.3000	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	7.2500	0.0000	0.0000	
P4 Party wall - Roof (insulation at ceiling level)	7.2500	0.1200	0.8700	
R1 Head of roof window	1.4000	0.0800	0.1120	
R2 Sill of roof window	1.4000	0.0600	0.0840	
R3 Jamb of roof window	2.4400	0.0800	0.1952	
R4 Ridge (vaulted ceiling)	18.1700	0.0800	1.4536	
R5 Ridge (inverted)	7.2600	0.0400	0.2904	
R8 Roof to wall (rafter)	4.3700	0.0600	0.2622	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 18.8760 (36)

Point Thermal Bridges

Total fabric heat loss (33) + (36) + (36a) = 69.3757 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

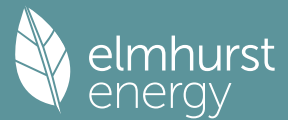
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	40.5812	40.3379	40.0994	38.9795	38.7699	37.7945	37.7945	37.6138	38.1702	38.7699	39.1938	39.6370	(38)
Heat transfer coeff	109.9569	109.7136	109.4752	108.3552	108.1457	107.1702	107.1702	106.9896	107.5459	108.1457	108.5696	109.0128	(39)
Average = Sum(39)m / 12 =												108.3542	

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	1.3040	1.3012	1.2983	1.2850	1.2826	1.2710	1.2710	1.2689	1.2755	1.2826	1.2876	1.2928	(40)
HLP (average)												1.2850	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.5397 (42)
Hot water usage for mixer showers													
	66.8028	65.7989	64.3360	61.5370	59.4714	57.1679	55.8585	57.3104	58.9018	61.3751	64.2342	66.5468	(42a)
Hot water usage for baths													
	28.8506	28.4221	27.8188	26.7062	25.8732	24.9495	24.4505	25.0497	25.7021	26.6905	27.8259	28.7531	(42b)
Hot water usage for other uses													
	40.6395	39.1617	37.6839	36.2061	34.7283	33.2505	33.2505	34.7283	36.2061	37.6839	39.1617	40.6395	(42c)
Average daily hot water use (litres/day)													125.2840 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	136.2929	133.3827	129.8386	124.4493	120.0728	115.3678	113.5595	117.0883	120.8100	125.7495	131.2218	135.9394	(44)
Energy conte	215.8546	189.9352	199.5571	170.3648	161.6411	141.8582	137.3404	144.9798	148.9708	170.6408	186.9495	212.8482	(45)
Energy content (annual)										Total = Sum(45)m =		2080.9406	
Distribution loss (46)m = 0.15 x (45)m													
	32.3782	28.4903	29.9336	25.5547	24.2462	21.2787	20.6011	21.7470	22.3456	25.5961	28.0424	31.9272	(46)
Water storage loss:													
Store volume													210.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.7016 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													0.9188 (55)
Total storage loss													
	28.4842	25.7277	28.4842	27.5653	28.4842	27.5653	28.4842	28.4842	27.5653	28.4842	27.5653	28.4842	(56)
If cylinder contains dedicated solar storage													
	28.4842	25.7277	28.4842	27.5653	28.4842	27.5653	28.4842	28.4842	27.5653	28.4842	27.5653	28.4842	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													

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WWHRS	267.6012	236.6740	251.3037	220.4422	213.3877	191.9355	189.0870	196.7264	199.0481	222.3874	237.0269	264.5948 (62)
PV diverter	-30.5394	-27.0093	-28.2826	-23.4191	-21.8258	-18.6765	-17.5062	-18.6161	-19.3234	-22.7802	-25.8072	-29.9739 (63a)
Solar input	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
12Total per year (kWh/year)	237.0617	209.6647	223.0211	197.0231	191.5619	173.2590	171.5808	178.1103	179.7247	199.6073	211.2197	234.6209 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Heat gains from water heating, kWh/month	113.1689	100.5445	107.7500	96.7082	95.1429	87.2297	87.0630	89.6031	89.5947	98.1354	102.2226	112.1693 (65)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												2406.4552 (64)
												2406 (64)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	126.9869	126.9869	126.9869	126.9869	126.9869	126.9869	126.9869	126.9869	126.9869	126.9869	126.9869	126.9869	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	115.2890	127.6414	115.2890	119.1320	115.2890	119.1320	115.2890	115.2890	119.1320	115.2890	119.1320	115.2890	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	228.2321	230.6004	224.6323	211.9268	195.8885	180.8147	170.7445	168.3762	174.3443	187.0498	203.0881	218.1619	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.6987	35.6987	35.6987	35.6987	35.6987	35.6987	35.6987	35.6987	35.6987	35.6987	35.6987	35.6987	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-101.5895	-101.5895	-101.5895	-101.5895	-101.5895	-101.5895	-101.5895	-101.5895	-101.5895	-101.5895	-101.5895	-101.5895	(71)
Water heating gains (Table 5)	152.1088	149.6198	144.8253	134.3169	127.8803	121.1524	117.0201	120.4342	124.4370	131.9024	141.9758	150.7652	(72)
Total internal gains	559.7259	571.9577	548.8426	529.4718	503.1539	482.1952	464.1497	465.1955	479.0094	498.3372	528.2920	548.3122	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North				1.3300	10.6334	0.6300	0.7000	0.7700	4.3221 (74)			
Northeast				3.5100	11.2829	0.6300	0.7000	0.7700	12.1032 (75)			
East				1.3300	19.6403	0.6300	0.7000	0.7700	7.9831 (76)			
Southwest				10.8700	36.7938	0.6300	0.7000	0.7700	122.2296 (79)			
Northeast				0.8500	16.8560	0.6300	0.7000	1.0000	5.6866 (82)			
Solar gains	152.3247	268.5089	390.9093	522.9718	620.4306	631.0320	602.1148	436.3512	303.1502	184.1088	129.2781 (83)	
Total gains	712.0506	840.4666	939.7519	1052.4436	1123.5845	1113.2272	1066.2645	992.3990	915.3606	801.4874	712.4008	677.5903 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	89.9213	90.1206	90.3169	91.2505	91.4273	92.2594	92.2594	92.4152	91.9371	91.4273	91.0703	90.7001	
alpha	6.9948	7.0080	7.0211	7.0834	7.0952	7.1506	7.1506	7.1610	7.1291	7.0952	7.0714	7.0467	
util living area	0.9992	0.9971	0.9896	0.9499	0.8229	0.6086	0.4415	0.4943	0.7687	0.9722	0.9974	0.9994	(86)
MIT	20.0906	20.2492	20.4681	20.7477	20.9342	20.9932	20.9994	20.9987	20.9688	20.7200	20.3531	20.0656	(87)
Th 2	19.8377	19.8399	19.8421	19.8526	19.8545	19.8636	19.8636	19.8601	19.8601	19.8545	19.8506	19.8464	(88)
util rest of house	0.9987	0.9955	0.9834	0.9222	0.7496	0.5048	0.3280	0.3734	0.6626	0.9506	0.9956	0.9991	(89)
MIT 2	18.8029	19.0071	19.2852	19.6278	19.8133	19.8614	19.8635	19.8651	19.8467	19.6060	19.1488	18.7778	(90)
Living area fraction									fLA = Living area / (4) =			0.3178	(91)
MIT	19.2122	19.4019	19.6611	19.9837	20.1696	20.2211	20.2246	20.2254	20.2033	19.9601	19.5316	19.1871	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2122	19.4019	19.6611	19.9837	20.1696	20.2211	20.2246	20.2254	20.2033	19.9601	19.5316	19.1871	(93)

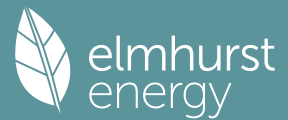
8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9983	0.9946	0.9821	0.9260	0.7715	0.5380	0.3641	0.4120	0.6968	0.9532	0.9948	0.9988	(94)
Ext temp.	710.8708	835.9116	922.9432	974.5616	866.8380	598.9670	388.2632	408.8537	637.7990	763.9773	708.7114	676.7863	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Space heating kWh	1639.6995	1591.0538	1440.8193	1200.9791	915.9504	602.4145	388.4438	409.2771	656.3880	1012.2526	1349.6929	1633.7867	(97)
Space heating requirement - total per year (kWh/year)	691.0486	507.4555	385.2998	163.0206	36.5396	0.0000	0.0000	0.0000	0.0000	184.7168	461.5067	712.0083	(98a)
Solar heating kWh												3141.5959	
Solar heating contribution - total per year (kWh/year)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Space heating kWh	691.0486	507.4555	385.2998	163.0206	36.5396	0.0000	0.0000	0.0000	0.0000	184.7168	461.5067	712.0083	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3141.5959	
Space heating per m ²										(98c) / (4) =		37.2580	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													92.3000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)

Full SAP Calculation Printout



Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	691.0486	507.4555	385.2998	163.0206	36.5396	0.0000	0.0000	0.0000	0.0000	184.7168	461.5067	712.0083 (98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000 (210)
Space heating fuel (main heating system)	748.6984	549.7893	417.4429	176.6204	39.5879	0.0000	0.0000	0.0000	0.0000	200.1265	500.0073	771.4066 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	237.0617	209.6647	223.0211	197.0231	191.5619	173.2590	171.5808	178.1103	179.7247	199.6073	211.2197	234.6209 (64)
Efficiency of water heater	86.3135	85.9654	85.2741	83.6381	81.1170	79.8000	79.8000	79.8000	79.8000	83.8863	85.7631	79.8000 (216)
Fuel for water heating, kWh/month	274.6518	243.8943	261.5343	235.5660	236.1552	217.1166	215.0135	223.1958	225.2189	237.9498	246.2829	271.5982 (217)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	23.9548	19.2174	17.3032	12.6770	9.7921	8.0002	8.9327	11.6110	15.0816	19.7879	22.3503	24.6206 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-28.4071	-41.1963	-60.8924	-70.4635	-77.6966	-73.1304	-72.2168	-67.3213	-58.9844	-47.9812	-31.6296	-24.4261 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)	-12.7465	-27.1323	-54.5246	-82.7749	-110.3186	-111.1743	-109.8831	-92.6557	-67.3996	-39.1122	-17.1174	-10.0574 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												3403.6792 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												79.8000
Water heating fuel used												2888.1775 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												86.0000 (231)
Electricity for lighting (calculated in Appendix L)												193.3288 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-1389.2424 (233)
Wind generation												0.0000 (234)
Hydro-electric generation (Appendix N)												0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)												0.0000 (235)
Appendix Q - special features												
Energy saved or generated												-0.0000 (236)
Energy used												0.0000 (237)
Total delivered energy for all uses												5181.9431 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3403.6792	0.2100	714.7726 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2888.1775	0.2100	606.5173 (264)
Space and water heating			1321.2899 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	193.3288	0.1443	27.9033 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-654.3458	0.1340	-87.6813
PV Unit electricity exported	-734.8966	0.1256	-92.2872
Total			-179.9685 (269)
Total CO2, kg/year			1181.1540 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			14.0100 (273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	3403.6792	1.1300	3846.1575 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2888.1775	1.1300	3263.6406 (278)
Space and water heating			7109.7981 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	193.3288	1.5338	296.5342 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-654.3458	1.4952	-978.3794
PV Unit electricity exported	-734.8966	0.4609	-338.7463
Total			-1317.1257 (283)
Total Primary energy kWh/year			6219.3074 (286)
Target Primary Energy Rate (TPER)			73.7600 (287)



Job no:	PR10687
Date:	08/08/2023
Assessor name:	Iraj Maghounaki
Registration no:	BRE400012
Development name:	Appendix of Energy Statement

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WATER EFFICIENCY CALCULATOR FOR NEW DWELLINGS - (BASIC CALCULATOR)

	House Type:	Type 1		Type 2		Type 3		Type 4		Type 5		Type 6		Type 7		Type 8		Type 9		Type 10	
	Description:	Typical Dwelling																			
Installation Type	Unit of measure	Capacity/ flow rate	Litres/ person/ day	Capacity/ flow rate	Litres/ person/ day	Capacity/ flow rate	Litres/ person/ day	Capacity/ flow rate	Litres/ person/ day	Capacity/ flow rate	Litres/ person/ day	Capacity/ flow rate	Litres/ person/ day	Capacity/ flow rate	Litres/ person/ day	Capacity/ flow rate	Litres/ person/ day	Capacity/ flow rate	Litres/ person/ day	Capacity/ flow rate	Litres/ person/ day
Is a dual or single flush WC specified?		Dual																			
WC	Full flush volume	6	8.76		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00
	Part flush volume	3	8.88		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00
Taps (excluding kitchen and external taps)	Flow rate (litres / minute)	6	11.06		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00
Are both a Bath & Shower Present?		Bath & Shower																			
Bath	Capacity to overflow	155	17.05		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00
Shower	Flow rate (litres / minute)	8	34.96		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00
Kitchen sink taps	Flow rate (litres / minute)	6	13.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00
Has a washing machine been specified?		No																			
Washing Machine	Litres / kg	7	17.16		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00
Has a dishwasher been specified?		No																			
Dishwasher	Litres / place setting	0.9	4.50		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00
Has a waste disposal unit been specified?			0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00
Water Softener	Litres / person / day		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00
Calculated Use		115.4			0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0
Normalisation factor		0.91			0.91		0.91		0.91		0.91		0.91		0.91		0.91		0.91		0.91
Code for Sustainable Homes		Total Consumption	105.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0
		Mandatory level	Level 3/4		-		-		-		-		-		-		-		-		-
Building Regulations 17.K	External use	5.0			5.0		5.0		5.0		5.0		5.0		5.0		5.0		5.0		5.0
	Total Consumption	110.0			0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0
	17.K Compliance?	Yes			-		-		-		-		-		-		-		-		-