Energy & Sustainability Statement

Coal House, Branch Hill House, Camden

Prepared for Almax Group

21st June 2023

Revision	Date
A	20th June 2023
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EXECUTIVE SUMMARY

1. This Sustainability and Energy Statement has been prepared by Envision on behalf of Almax Group (The Applicant) and is submitted in support of a full planning application for the construction of a single 3 bed dwelling (C3) comprising 3 floors + basement known as the 'Coal House' on land at Branch Hill House, Branch Hill, London. NW3 7LS.

2. This report is submitted in support of a full planning application for a single family dwelling. The primary purpose of this document is to explain how the scheme can meet with London Borough of Camden energy and sustainability policies, along with those found within the London Plan (2021).

3. In addition, the report also sets out how the proposals will complement the main Branch Hill House planning permission and how the application proposals have been designed to ensure that the proposals will not prejudice the delivery of the Branch Hill permission.

4. Envision has undertaken a review of the relevant policies and worked with the design team to determine and agree the relevance and approach that should be taken to fulfil each policy.

Summary of Sustainability Strategy

5. The scheme will deliver a series of sustainability measures which are compatible with the GLA and the London Borough of Camden's requirements for sustainable design and construction:

- SuDs strategy to achieve a run-off rate of 2 l/s during all events up to and including the 1:100 AEP event, including a 40% allowance for climate change
- A comprehensive ecological strategy to deliver a net gain in biodiversity and the Protection, conservation and enhancement of the Site of Importance for Nature Conservation (SINC);
- Sustainable material selections with timber to be procured with Forest Stewardship Council accreditation;
- Incorporation of climate adaptation measures, including permeable paving, landscaping and passive building design including MVHR;
- Water conservation measures within the units to comply with 110 litres / bedspace per day and the provision of an external rainwater harvesting tank for irrigation purposes.

Summary of Energy Strategy

6. This statement additionally illustrates how the scheme complies with the nationally recognised *Energy Hierarchy* and follows passive and efficiency improvements before the application of any Low or Zero Carbon (LZC) sources.

7. Envision has produced Part L 2021 compliant SAP calculations in order to determine the energy and CO_2 emissions for the proposed development.

8. To minimise energy consumption by the development and to ensure compliance with relevant energy policies, the following design measures are recommended and will need to be incorporated into the detailed design;

   - Building fabric construction U-values significantly improved compared with standard Building Regulations U-values;
   - Reduced Air Permeability, lower than standard Buildings Regulations, and in accordance with prospective development building occupiers;
   - A high-efficiency ground-source heat pump providing efficient space and water heating to the dwelling;
   - HVAC system controls ensure installed equipment will be operating efficiently and to include automatic monitoring and targeting with alarms for out of range values;
   - High efficiency LED lighting utilizing low-energy control systems such as daylight dimming and occupancy sensing;
   - Mechanical Ventilation Heat Recovery (MVHR), ensuring space heating loads are kept to a minimum;
   - Reduction in solar gain through the use of lower g-values.

9. The figures used as the basis for this assessment are discussed further in Section 5 of this report.

New-Build Residential - Carbon Savings Predicted

10. As seen in the table below, in total the new-build portion of the development reduces CO_2 emissions by **1.61 tonnes.CO_2.year**, equal to a **67.87%** saving beyond the Part L 2021 baseline (using SAP 10 emission factors), thereby complying with adopted and emerging London Borough of Camden and London Plan energy policies with regards to minimum CO_2 emission reductions for major residential developments.

Table A.1 – Final New Build CO_2 reductions Chart

	Carbon Dioxide Emissions for domestic buildings (Tonnes CO_2 per annum)	
	Primary	Unregulated
Baseline: Part L 2021 of the Building Regulations Compliant Development	2.37	0.96
After energy demand reduction	2.20	0.96
After heat network / CHP	2.20	n/a
After renewable energy	0.76	0.96
	Primary domestic carbon dioxide savings	
	(Tonnes CO_2 per annum)	(%)
Savings from energy demand reduction	0.17	7.07%
Savings from renewable energy	1.44	60.79%
Cumulative on-site savings	1.61	67.87%

1 INTRODUCTION

1.1 Envision has been appointed by Almax Group (the Applicant) to produce a Sustainability and Energy Statement in support of a full planning application for the construction of a single 3 bed dwelling (C3) comprising 3 floors + basement known as the 'Coal House' on land at Branch Hill House, Branch Hill, London. NW3 7LS.

Scope

1.2 The primary purpose of this statement is to explain how best practice sustainable design and construction measures would be incorporated in the proposed development to ensure alignment with local planning policy.

1.3 Section 5 (Energy Statement) sets the parameters of detailed design, but remains at a strategic level. The calculations in this document are an indication of system size and carbon emissions based on guidance documents, approved software and practical experience. They are not design calculations but establish the viability and feasibility of various technologies for the proposed development.

1.4 This statement is structured as follows:

- Section 2 provides a description of the site and the development proposals;
- Section 3 provides a description of the main energy and sustainability policies relevant to the application;
- Section 4 provides a summary of the sustainable design measures incorporated into the design;
- Section 5 provides an energy assessment, structured against the requirements of the policies examined in Section 3;
- Section 6 provides a concluding summary.

2 CONTEXT AND PROPOSALS

Site Location

2.1 Branch Hill House is an unlisted building located in the London Borough of Camden in the Hampstead Conservation Area.

2.2 The current site arrangement comprises a 3-storey (+1 storey basement) masonry residential manor house constructed circa 1870s, with an abutting 2-storey concrete frame residential block constructed circa 1960s. The site has formerly been used as a residential facility for senior-citizens but is currently occupied by building guardians. The site is set back from the main Branch Hill road, with access via a driveway (Spedan Close).

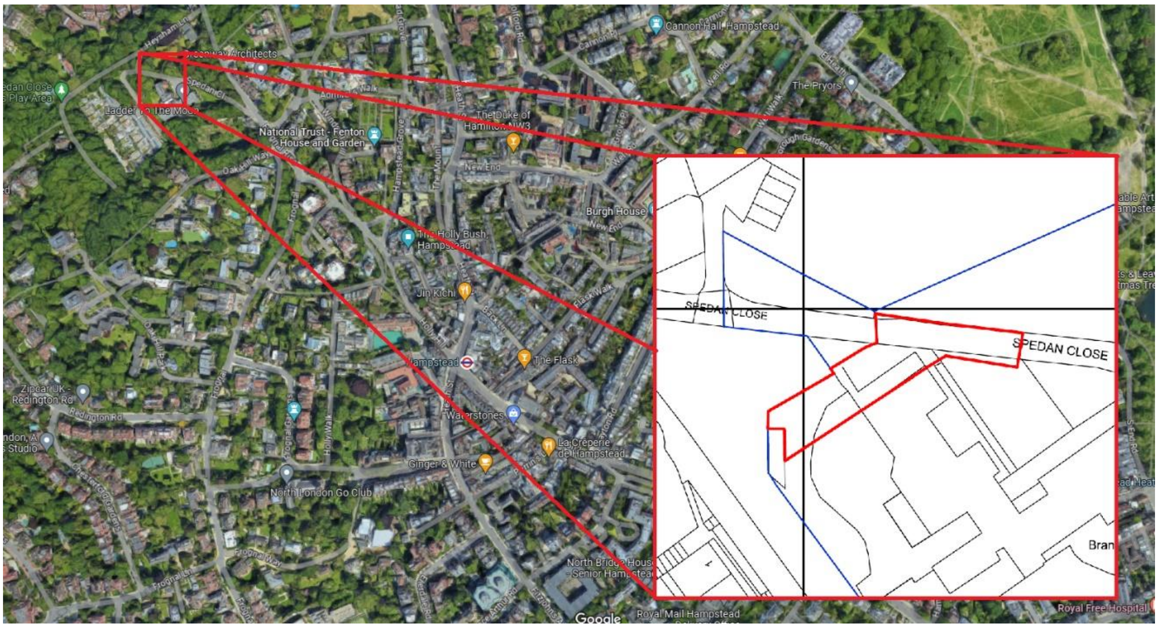


Fig 2.1 – Site Location

The Proposed Development

2.3 The proposals are for a single residential dwelling that will complement and form part of the wider development proposals of the former Branch Hill Care Home that was granted full planning permission on 11 August 2021 (Ref.2019/6354/P) for:

> *"Change of use of Branch Hill House from care home (Use Class C2) to residential (Use Class C3) and associated external alterations, demolition of the 1960s care home extension and erection of replacement building, including basement, comprising residential accommodation (Use Class C3), ancillary plant, access and servicing and car parking".*

2.4 A subsequent minor material amendment (s73) application (2021/5377/P granted 30 August 2022) for the Variation of Condition 2 (Approved Plans), Condition 13 (Cycle Parking) and Condition 24 (Housing). The proposed amendments included revisions to:

- basement layout;

- internal layout of flats, including the amalgamation of four flats to create two larger 3beds;
- levels shown on drawings (following detailed surveys)
- massing, including realignment of external walls and various design refinements;
- various exterior design refinements; and
- relocation of substation

2.5 This report is submitted in support of a full planning application for a single family dwelling. This report sets out how the proposals have been designed to meet adopted development plan policies, including Camden Local Plan and London Plan and Camden's supplementary planning guidance.

2.6 In addition, the report also sets out how the proposals will complement the main Branch Hill House planning permission and how the application proposals have been designed to ensure that the proposals will not prejudice the delivery of the Branch Hill permission.

2.7 In parallel with this application, a s96A NMA application has also been submitted that seeks minor internal changes to the main Branch Hill planning permission. These changes are being sought in order to facilitate the proposals that form the scope of this application.

Fig 2.2 – Ground Floor Arrangement

3 SUSTAINABILITY & ENERGY POLICY CONTEXT

3.1 Many definitions of sustainable development exist, although the common objective for all is the integration of economic, social and environmental issues to ensure a better quality of life for people today, without compromising the needs of future generations. A key mechanism for delivering the principles of sustainable development lies within the UK planning system, which is implemented through national guidance and local planning policies. A review of all the relevant policy documents was undertaken in order to gain an understanding of the guiding policies for sustainability.

National Planning Policy Framework

3.2 The revised National Planning Policy Framework (NPPF) was released on 20th July 2021. This replaces the previous National Planning Policy Framework published in March 2012, revised in July 2018 and updated in February 2019. It sets out the framework for all planning policy in England and how these policies are expected to be applied. At a very high level, the objective of sustainable development can be summarised as meeting the needs of the present without compromising the ability of future generations to meet their own needs. At a similarly high level, members of the United Nations – including the United Kingdom – have agreed to pursue the 17 Global Goals for Sustainable Development in the period to 2030. These address social progress, economic well-being and environmental protection.

3.3 The NPPF sets out a presumption in favour of sustainable development, and the need to support economic growth through the planning system. Achieving sustainable development means that the planning system has three overarching objectives, which are interdependent and need to be pursued in mutually supportive ways (so that opportunities can be taken to secure net gains across each of the different objectives):

1. an economic objective – to help build a strong, responsive and competitive economy, by ensuring that sufficient land of the right types is available in the right places and at the right time to support growth, innovation and improved productivity; and by identifying and coordinating the provision of infrastructure;
2. a social objective – to support strong, vibrant and healthy communities, by ensuring that a sufficient number and range of homes can be provided to meet the needs of present and future generations; and by fostering well-designed, beautiful and safe places, with accessible services and open spaces that reflect current and future needs and support communities' health, social and cultural well-being; and
3. an environmental objective – to protect and enhance our natural, built and historic environment; including making effective use of land, improving biodiversity, using natural resources prudently, minimising waste and pollution, and mitigating and adapting to climate change, including moving to a low carbon economy.

3.4 Planning plays a key role in helping shape places to radical reductions in greenhouse gas emissions, minimising vulnerability and providing resilience to the impacts of climate change, and supporting the delivery of renewable and low carbon energy and associated infrastructure. This is central to the economic, social and environmental dimensions of sustainable development. The NPPF does not include detailed measures on sustainable design codes and standards to apply, although expects that when setting any local requirement for a building's sustainability, local planning authorities should do so in a way consistent with the national technical standards.

London Plan Policy

3.5 The London Plan (2021) sets out the Mayor's vision for London. In accordance with the NPPF, it promotes economic development, and endorses the principles of sustainable development. It is the main vehicle for strategic decision-making on London's development, including development decisions. The Plan contains a number of policies directly related to a development's sustainable design and energy reduction, including:

- Policy G1 Green Infrastructure;
- Policy G5 Urban Greening;
- Policy G 6 Biodiversity and Access to Nature;
- Policy SI 1 Improving Air Quality;
- Policy SI 2 Minimising greenhouse gas emissions;
- Policy SI 3 Energy Infrastructure;
- Policy SI 4 Managing heat risk;
- Policy SI 7 Reducing Waste and supporting the circular economy;
- Policy SI 12 Flood Risk Management;
- Policy SI 13 Sustainable Drainage; and
- Policy T 5 Cycling.
- Policy T6.1 Residential Parking.

3.6 Of particular importance to the CO_2 and Energy reductions required for a development is *Policy SI-2: Minimising carbon dioxide emissions.*

3.7 Policy SI2 requires that development proposals should make the fullest contribution to minimising carbon dioxide emissions in accordance with the following energy hierarchy:

1. Be Lean: use less energy and manage demand during operation;
2. Be Clean: exploit local energy resources (such as secondary heat) and supply energy efficiently and cleanly; and
3. Be Green: maximise opportunities for renewable energy by producing, storing and using renewable energy on-site.

London Borough of Camden Planning Policy

3.8 The most relevant policies which need to be considered when assessing the scheme's compliance to sustainability policy are those provided within local development documents.

3.9 The London Borough of Camden's adopted Local Plan (2016-2031) provides the planning framework for the Borough until 2031 and includes a suite of planning policies and strategic site allocations and supersedes the previous Core Strategy and Development Policies planning documents (adopted in 2010).

Camden Local Plan (2016 – 2031)

3.10 Policies relevant to the energy & sustainability of new development contained within the Camden Local Plan include:

1. **Policy CC1 – Climate Change Mitigation**

   The Council will require all development to minimise the effects of climate change and encourage all developments to meet the highest feasible environmental standards that are financially viable during construction and occupation. We will:

   (a) promote zero carbon development and require all development to reduce carbon dioxide emissions through following the steps in the energy hierarchy;

   (b) require all major development to demonstrate how London Plan targets for carbon dioxide emissions have been met;

   (c) ensure that the location of development and mix of land uses minimise the need to travel by car and help to support decentralised energy networks;

   (d) support and encourage sensitive energy efficiency improvements to existing buildings;

   (e) require all proposals that involve substantial demolition to demonstrate that it is not possible to retain and improve the existing building; and

   (f) expect all developments to optimise resource efficiency.

   Key additional targets under Policy CC1 include the requirement for development to achieve a 20% reduction in CO_2 emissions through the use of on-site renewable energy generation (which can include sources of site related decentralised renewable energy)

2. **Policy CC2 (a) – Adapting to climate change**

   All development should adopt appropriate climate change adaptation measures such as:

   (a) the protection of existing green spaces and promoting new appropriate green infrastructure;

   (b) not increasing, and wherever possible reducing, surface water runoff through increasing permeable surfaces and use of Sustainable Drainage Systems;

   (c) incorporating bio-diverse roofs, combination green and blue roofs and green walls where appropriate; and

(d) measures to reduce the impact of urban and dwelling overheating, including application of the cooling hierarchy.

3. Policy CC2 (b) – Sustainable design & construction measures

All development should adopt appropriate climate change adaptation measures such as:

(a) ensuring development schemes demonstrate how adaptation measures and sustainable development principles have been incorporated into the design and proposed implementation;

(b) encourage new build residential development to use the Home Quality Mark and Passivhaus design standards;

4. Policy CC3 – Water & Flooding

We will require development to:

(a) incorporate water efficiency measures;

(b) avoid harm to the water environment and improve water quality;

(c) consider the impact of development in areas at risk of flooding (including drainage);

(d) incorporate flood resilient measures in areas prone to flooding;

(e) utilise Sustainable Drainage Systems (SuDS) in line with the drainage hierarchy to achieve a greenfield run-off rate where feasible; and f. not locate vulnerable development in flood-prone areas

Key additional targets under Policy CC3 include the requirement for new residential development to meet a requirement of 110 litres per person per day water use. Refurbishment will be required to meet BREEAM water efficiency credits. Major developments and high or intense water use developments, such as hotels, hostels and student housing, should include a grey water and rainwater harvesting system. Where such a system is not feasible or practical, developers must demonstrate to the Council's satisfaction that this is the case.

5. Policy CC4 – Air Quality

The Council will ensure that the impact of development on air quality is mitigated and ensure that exposure to poor air quality is reduced in the borough.

The Council will take into account the impact of air quality when assessing development proposals, through the consideration of both the exposure of occupants to air pollution and the effect of the development on air quality. Consideration must be taken to the actions identified in the Council's Air Quality Action Plan.

Air Quality Assessments (AQAs) are required where development is likely to expose residents to high levels of air pollution. Where the AQA shows that a development would cause harm to air quality, the Council will not grant planning permission unless measures are adopted to mitigate the impact. Similarly, developments that introduce sensitive receptors (i.e. housing, schools) in locations of poor air quality will not be acceptable unless designed to mitigate the impact.

Development that involves significant demolition, construction or earthworks will also be required to assess the risk of dust and emissions impacts in an AQA and include appropriate mitigation measures to be secured in a Construction Management Plan

6. Policy CC5 – Waste

This policy requires developments to include facilities for the storage and collection of waste and recycling.

4 SUSTAINABILITY STATEMENT

4.1 This section provides an account of the sustainability benefits of the proposed development, and how relevant policy will be addressed in the development proposals. The section is structured against the applicable policies in the London Borough of Camden's Local Plan and the London Plan (2021).

Energy and CO_2 Reduction

4.2 An Energy Assessment has been prepared and is included in Section 5 which explains how the energy hierarchy identified above has been implemented.

4.3 The energy assessment has been undertaken using software recognised under the National Calculation Method (NCM) which have been applied by Envision to consider how the relevant targets can be met. Further details of the energy assessment are given in Section 5.

4.4 In total the new-build portion of the development reduces CO_2 emissions by a **67.78%** saving beyond the Part L 2021 baseline (using SAP 10.2 emission factors), thereby complying with adopted and emerging London Borough of Camden and London Plan energy policies with regards to minimum CO_2 emission reductions for residential developments.

4.5 The CO_2 reduction strategy for the development will follow the London Plan's 'Energy Hierarchy – Be Lean, Be Clean and Be Green' and the reductions proposed for the development are attributed to design features which reduce the consumption of energy. These outlined further in the appended Energy Statement, but include;

1. Optimised glazing;
2. Thermally efficient building fabrics;
3. Efficient lighting;
4. Low air permeability;
5. The use of Mechanical Ventilation Heat Recovery (MVHR); and
6. Use of a shared ground loop array providing efficient space and water heating.

Ecology & Green Infrastructure

4.6 Green spaces can contribute to the aesthetics and vitality of built-up urban areas. As Camden and the wider London area becomes more compact, dense and intensive in its built environment, the value of 'green' and 'amenity' space will increase. However, a balance must be struck between maximising the footprint of a site and providing an element of bio-diversity.

4.7 A Preliminary Ecological Appraisal (PEA) was undertaken in May 2018 by an experienced consultant ecologist, which determined that:

1. The woodland and notable tree specimens will need to be afforded suitable protection during the construction phase. All protective measures should accord with approved plans

and BS 5837 (2012) Trees in Relation to Design, Demolition and Construction – Recommendations.

2. Branch Hill House was assigned 'high' bat roost potential due to the close proximity to Hampstead Heath, presence of loft voids and external crevices. Three dedicated emergence/re-entry surveys were recommended in the PEA, and subsequently undertaken. No roosts were identified. Spedan Close was identified as a commuting corridor for low numbers of common pipistrelle bats. Foraging activity is focused around groups of trees and the woodland edge. Lighting will be controlled to ensure this behaviour continues.
3. Trees on/bordering the site are likely to support breeding birds March-August inclusive. It is recommended that tree work avoids this period wherever practically possible. Where this is not possible, nest checks will be required immediately before work commences.
4. The grassland to the west of Branch Hill House has potential to attract transient reptiles if left unmanaged. Precautionary measures and habitat management recommendations are included in this report.
5. Japanese knotweed was identified in a localised position on the bank rear of Branch Hill House. This plant was subsequently remediated by a licensed contractor. It is recommended that contractors remain vigilant and any further Japanese knotweed is identified and treated appropriately.

4.8 In accordance with Local Plan Policy A3 and the NPPF Section 4.3.3, the following ecological enhancement measures are proposed for the scheme:

1. Protection, conservation and enhancement of the Site of Importance for Nature Conservation (SINC) to the north of the site;
2. Introduction of native species, bird nest boxes and bat boxes will be provided to the woodland to improve on-site biodiversity;
3. Development of a Residential Play strategy to include; play space, a woodland trail, a woodland glade and a Jekyll Gatden;
4. Softworks strategy to remainder of site to include a range of native & non-native species.

Flood Risk & SuDs

4.9 Policy CC3 of the Camden Local Plan requires developments to undertake a Flood Risk Assessment and to Incorporate sustainable drainage systems and avoid non-permeable hard standings with the aim of achieving greenfield runoff rates

4.10 As detailed in the Level 2 Flood Risk Assessment prepared by Ridge for the development, the site is located within Flood Zone 1. This is defined as having a low chance of tidal or fluvial flooding (less than 1:1000 year probability). As the site falls into this zone, it is defined as suitable for all development classes. In addition, the risk of flooding from additional sources has been identified as follows:

- The risk of pluvial (surface water) flooding is considered to be very low;

- The risk of sewer flooding to be moderate;
- The risk of groundwater flooding is considered to be low;

4.11 The SuDs strategy prepared by Ridge confirms that in order to reduce the post-development surface water run-off rate to a maximum rate of 2 l/s during all events up to and including the 1:100 AEP event, including a 40% allowance for climate change, the following SuDs measures will be incorporated:

1. Reducing surface water run-off through the installation of permeable surfaces;
2. Installation of a shallow below ground geocellular attenuation tank(s) within the site curtilage. The tank(s) will be appropriately sized to accommodate the attenuated volume of surface water generated by the Application Site during the 1:100yr event plus the pre-determined allowance for climate change.

Water Conservation

4.12 The Mayor of London has published his Water Strategy – Securing London's Water Future (2011), which sets out how water efficiency will be implemented across London. This guides development towards reducing demand for water. Policy CC3 includes the requirement for new residential development to meet a requirement of 110 litres per person per day water use. As part of this, the council requires the consideration of grey water, and rainwater harvesting systems. In accordance with Policy CC3, the following section examines the water efficiency within the development to meet the relevant targets.

Table 4.1 – Water consumption specifications

	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6
Strategy, Code level	Fittings-based, Code level 3/4	Fittings-based, Code level 3/4	Fittings-based, Code level 3/4	Fittings-based, Code level 3/4	Fittings-based, Code level 5/6	Recycling-based, Code level 5/6
WC	4 (single flush)	4/2.6 (dual flush)	5/3 (dual flush)	6/4 (dual-flush toilet)	4/2.6 (dual flush)	6 (supplied by greywater)
Taps (excluding kitchen taps)	4	5	4	4	1.6	3
Bath	180	155	180	180	155	155
Shower	8	8	8	8	6	7
Kitchen sink taps	6	8	6	6	3	4
Washing machine	8.17 (not supplied)	8.17 (not supplied)	8.17 (not supplied)	6.14 (supplied)	6.14	8.17 (not supplied)
Dishwasher	1.25 (not supplied)	1.25 (not supplied)	1.25 (not supplied)	1.25 (not supplied)	0.67	1.25 (not supplied)
Water Recycling	0 (not supplied)	0 (not supplied)	0 (not supplied)	0 (not supplied)	0 (not supplied)	26.52 (greywater supplying toilet)
Predicted per capita consumption (Code)	104.65	99.81	103.28	103.43	79.99	79.84

4.13 Table 4.1 illustrates the various fittings-based water consumption levels to achieve scenarios. In this case, Scenario 1 specification demonstrate consumption of less than 110 litres/person/day.

4.14 The development will include a dedicated external communal rainwater harvesting tank, for use by residents (if desired), but primarily for irrigation use by the groundsman tending to the wider landscaped areas. The size and location of this tank will be agreed at the detail-design stage.

Pollution

4.15 Any new development can potentially lead to detrimental environmental effects; as is the nature of construction. These potential effects have been considered during the planning stages of this proposal. The development is not of the scale that would require an Environmental Impact Assessment (EIA), however the measures as outlined in this section, and subsequently implemented, will ensure that any potential impacts can be appropriately controlled in order to demonstrate compliance with Local Plan Policy A4 (Noise) and CC4 (Air Quality).

Noise

4.16 Hepworth Acoustics have prepared a Noise Impact Assessment for the wider consented scheme. The assessment measured background noise levels on site, and determined that no specific noise mitigation measures are required for the development. In addition, as no external plant is proposed, there is no mitigation required for plant.

Air Quality

4.17 With regards to air quality, the entire Borough of Camden was designated as an Air Quality Management Area in 2002, declared for exceedance of PM10 and NO2. Since then Camden have produced a number of Air Quality Action plans along with annual reports to Defra. Policy CC4 of the Camden Local Plan requires that "Air Quality Assessments (AQAs) are required where development is likely to expose residents to high levels of air pollution." The energy strategy at Branch Hill House is proposing no on-site fossil fuel combustion as all space and water heating will be provided by an electric-led ground-source heat pump, alongside electric cooking.

External Lighting

4.18 The development's lighting strategy will ensure that it does not have adverse effects at night-time. Although a detailed lighting scheme for the site that ensures it minimises light pollution has not yet been undertaken the following measure are expected to be incorporated:

1. External lighting will be designed in compliance with Table 1 and accompanying notes of ILE Guidance Note for reduction of obtrusive light.
2. All non-safety/security lighting will be automatically switched off between 2300hrs and 0700hrs.

Waste

4.19 This section has considered all the requirements set out under Camden Local Plan Policy CC5 which requires development proposals to; "make sure that developments include facilities for the storage and collection of waste and recycling.

4.20 Residential waste storage space would take account of the requirement of BS5906:2005. This requires that suitable refuse and recycling space provision is allocated for the residential unit in a centralised waste store. The necessary provision is as follows:

- 100 litres for first bed/1 bed;
- 70 litres for each bedroom after that.

4.21 In accordance with storage requirements in BS5906:2005, 50% of this quantity of waste arisings should be for recyclable waste and 75% of the quantity should be for general municipal waste. This over provision of storage capacity will ensure that sufficient space is always allocated to cater for waste volumes.

4.22 Adequate storage for refuse and recycling has been provided in accessible locations and sufficient space will be provided in each collection location/area for refuse vehicles to manoeuvre so that they can enter and exit in forward gear. The development layout has been checked to ensure refuse and delivery vehicles can access the development as required.

Sustainable Transport

4.23 The development is bringing forward measures that are in line with Local Plan policies T1 to T4 and Chapter 5 of the London Plan. A summary of the measures is provided below.

4.24 The development site currently has a poor level of public transport with a PTAL rating of 1b, however the site is accessible by all modes of transport, with Hampstead Underground station and local bus services accessible within 650 metres of the site (8-minute walk). The site is therefore accessible to non-car modes of travel.

4.25 To encourage walking and cycling as sustainable modes of travel to/from the development, information will be provided to residents on the local facilities and amenities in the area including local pedestrian and cycle routes to and from the site.

Cycle Parking

4.26 The cycle parking for the two elements of the proposed scheme has been considered with regards to Camden Planning Guidance on Transport (March 2019) and the London Plan cycle parking minimum standards. The location of cycle parking has been considered for both short- and long-term use.

4.27 Three long stay cycle spaces will be provided I the basement of the wider consented scheme, in accordance with the requirements of the Camden Planning Guidance (CPG) on transport. A short stay visitor cycle parking will be provided next to the entrance to the coal house.

Car Parking

4.28 The development will be car-free with deliveries and servicing, including refuse collection, and emergency vehicle access will be from Spedan Close, via Branch Hill

4.29 With regards to car sharing clubs, there are a number of clubs located in the vicinity of the site. The nearest car club is available on Lower Terrace circa 40 metres east of the site.

Sustainable Construction

4.30 The construction phase of the development can have a significant effect on the quality of the site and its surroundings, including the local environment, neighbouring residents, surrounding employees and the general public. Sustainable construction involves the prudent use of existing and new resources, the efficient management of the construction process, and consideration of potential adverse environmental impacts on local sensitive receptors.

4.31 It is not considered that the construction phase will yield an adverse level of disturbance, particularly given the surrounding land uses, although various measures adopted by the contractor will ensure that any potential disturbance is minimised. The principal contractor will be required to deliver high standards of sustainable construction, which will be achieved through the following:

- Registering the site against the Considerate Constructors Scheme;
- Managing the construction site to reduce environmental effects, this will include adopting best practice measures to protect water and air quality, monitoring water and energy use from construction activities;

Materials

4.32 Maximising the sustainability of all the materials used in the build will be an important factor from the outset. The re-use of a number of major existing building elements will add to the material environmental performance of the scheme.

4.33 The development will be designed and constructed as to maximise the sustainability of materials. The client will ensure the following standards are met in the development:

1. At least three of the key elements of the building envelope (external walls, windows roof, upper floor slabs, internal walls, floor finishes/coverings) are to achieve a rating of A+ to C in the Building Research Establishment (BRE) The Green Guide of specification;
2. 100% of timber is to be sourced from accredited Forest Stewardship Council (FSC) or Programme for the Endorsement of Forestry Certification (PEFC) scheme.
3. 50% of timber products are to be sourced from accredited Forest Stewardship Council (FSC) or Programme for the Endorsement of Forestry Certification (PEFC) scheme.
4. No construction or insulation materials are to be used which will release toxins into the internal and external environment, including those that deplete stratospheric ozone.

5 ENERGY STATEMENT

5.1 In pursuing compliance with the Energy Policy in the London Borough of Camden, Envision has followed guidance from the Borough's Local Plan, namely Policy CC1 Energy & Carbon Reduction – which directs the user to seek guidance from the requirements of the London Plan for major development.

5.2 Policy CC1 refers to the requirements of the current London Plan 2021 and in particular Policy SI 2 which has a requirement that all new buildings should make the fullest contribution to minimising carbon dioxide (CO_2) emissions in accordance with the following energy hierarchy:

1. Step 1 – Reducing Energy Requirements;
2. Step 2 – Supplying the energy that is required more efficiently;
3. Step 3 – Meeting remaining energy requirements through renewable and low carbon energy.

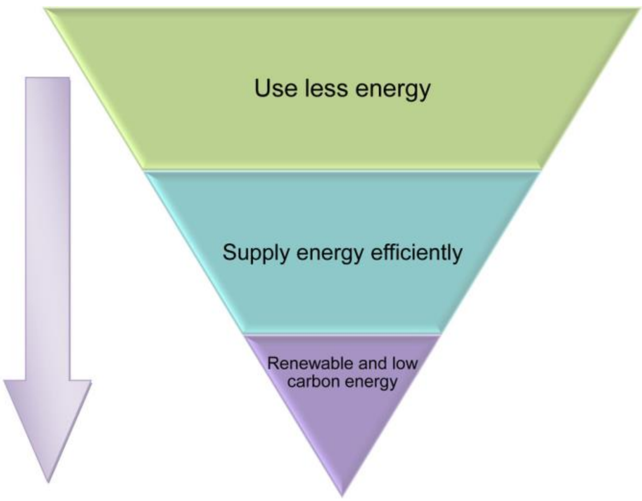


Fig 5.1 - 'Energy Hierarchy'

Methodology

5.3 In accordance with NCM guidance, the appropriate methodology for calculating the energy performance of the new-build dwelling is "The Government's Standard Assessment Procedure for Energy Rating of Dwellings". This procedure was undertaken using Stroma FSAP 10.2 version 1.0.78 which is a Department of Communities and Local Government (DCLG) approved methodology and software for undertaking Part L 2021 SAP assessments.

5.4 The GLA carbon emissions reporting spreadsheet has bene provided which ensures the notional PV savings are added to the Be-Lean and Be-Clean results.

Establishing the Target Emission Rate (TER)

5.5 The total emissions savings calculated in this report are expressed against a Building Regulation 2021 Target Emission Rate. This is the Baseline against which the measures implemented must show an improvement.

5.6 The Target Emission Rates for the development have been established using DCLG approved methodology and software.

5.7 The calculated carbon emissions and total energy demand for the Target Emission Rate are illustrated below. The calculated figure demonstrates a Part L1A Building Regulations 2013 compliant model – arrived at using SAP 10 carbon factors.

Table 5.1 – Target CO_2 emissions

Unit	Total Floor Area (m²)	TER	Total Target CO2 (tn.CO2.yr)	TPER	Target Primary Energy (kWh.yr)
Coal House	193.4	12.23	2.37	64.45	12,464.63
		Total =	2.37		12,464.63

5.8 The figure of **2.37 $tn.CO_2.yr$** the targets that must be reached and improved upon by the proposals in this Energy Assessment in order to comply with Building Regulations Part L 2021. This will be achieved through the implementation of fabric efficiency, energy-reduction and carbon-saving measures as outlined in the ensuing sections.

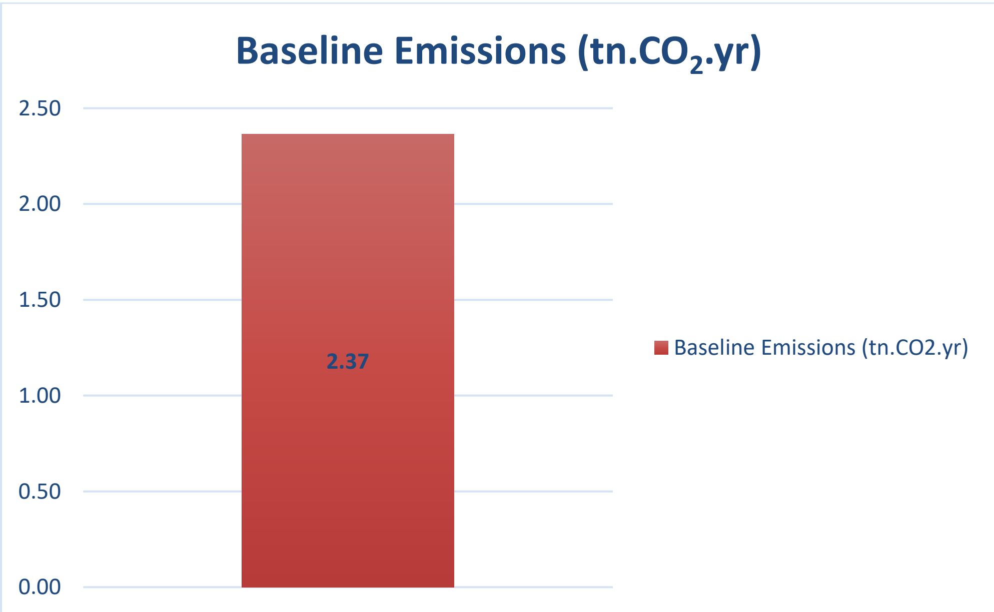


Fig 5.2 – Target CO_2 emissions for New-Build Portion

Applying the London Plan Energy Hierarchy: Stage 1 – Be Lean

5.9 The Greater London Authority seeks a 'fabric first' approach to reducing the carbon footprint of London's built environment. This is achieved through buildings using less energy by improving u-values, air-tightness and lighting efficiency amongst others. This is the first step to consider in reducing a building's carbon emissions before the efficient delivery of power, heat or renewables are considered by a design-team.

Fabric Efficiency

5.10 U-Values, are used to measure how effective elements of a buildings fabric are as insulators. That is, how effective they are at preventing heat from transmitting between the inside and the outside of a building. Very broadly, the better (i.e. lower) the U-value of a buildings fabric, the less energy is required to maintain comfortable conditions inside the building. The following U-Values are proposed for the development;

Table 5.2 – Proposed U-Values

Elements	New Building Elements: U-Values – W/m^2 K	Comment
External Wall	0.13	n/a
Ground Floor	0.1	n/a
Roof (Flat & Pitched)	0.11	n/a
External Windows	1.1 (G-Value 0.4)	Assumed as double-glazed
External Solid Doors	1.2	n/a
Party Walls	0	Assumed as fully-filled cavity with effective edge sealing
Thermal Bridging	Y= 0.08	To be calculated at detailed design

Air Permeability

5.11 The designed Air Permeability Rate (APR) has been set at 4 m^3/h.m^2 @ 50Pa for the new-build portion of the development.

Lighting

5.12 Light fittings will be specified as LED, low-energy with local manual switching and if appropriate, occupancy sensing. The light fittings have been specified as to have a 100 lm/W efficiency.

Ventilation Strategy

5.13 The ventilation strategy has been designed to meet with occupant and client requirements across the varied activity zones in the development, whilst maintaining the energy efficiency needed to lower carbon emissions. A balanced whole-house mechanical ventilation system with heat recovery is proposed. A Nuaire MRXBOX90L system has been assumed.

Space & Water Heating

5.14 In line with the 'GLA guidance on preparing Energy Assessments', the heating system for the dwelling assumed at 'Be-Lean' stage is an individual gas-fired heating system, with the efficiency in line with the notional building boiler efficiency (91%).

5.15 The dwelling will be provided with domestic hot water storage of 305 litre cylinder with 1.63 kwh/day heat loss.

5.16 The SAP assessment assumes the pipework will be fully insulated and the water heating will be timed separately.

Be Lean Stage CO_2 Reductions

5.17 The following tables and graphs represent the Be-Lean improvements over the Target Emission Rate (TER) baseline emissions;

Table 5.3 – New-Build Be-Lean Emissions

Unit	Total Floor Area (m^2)	SAP 10 DER[1]	Total CO_2 (tn.CO2.yr)	DPER	Target Primary Energy (kWh.yr)
Coal House	193.4	11.37	2.20	80.39	15,547.43
		Total =	**2.20**		**15,547.43**
		Difference over Baseline	0.16		- 3,082.80
		% Difference	**7.07%**		**-24.73%**

5.18 As detailed above, the measures as taken at 'Be-Lean' stage would result in a **7.07%** reduction in new-build regulated CO_2 emissions over the Part L 2021 Target Emission Rate, calculated using SAP 10 emission factors.

[1] DER manually adjusted as per GLA carbon emissions reporting sheet.

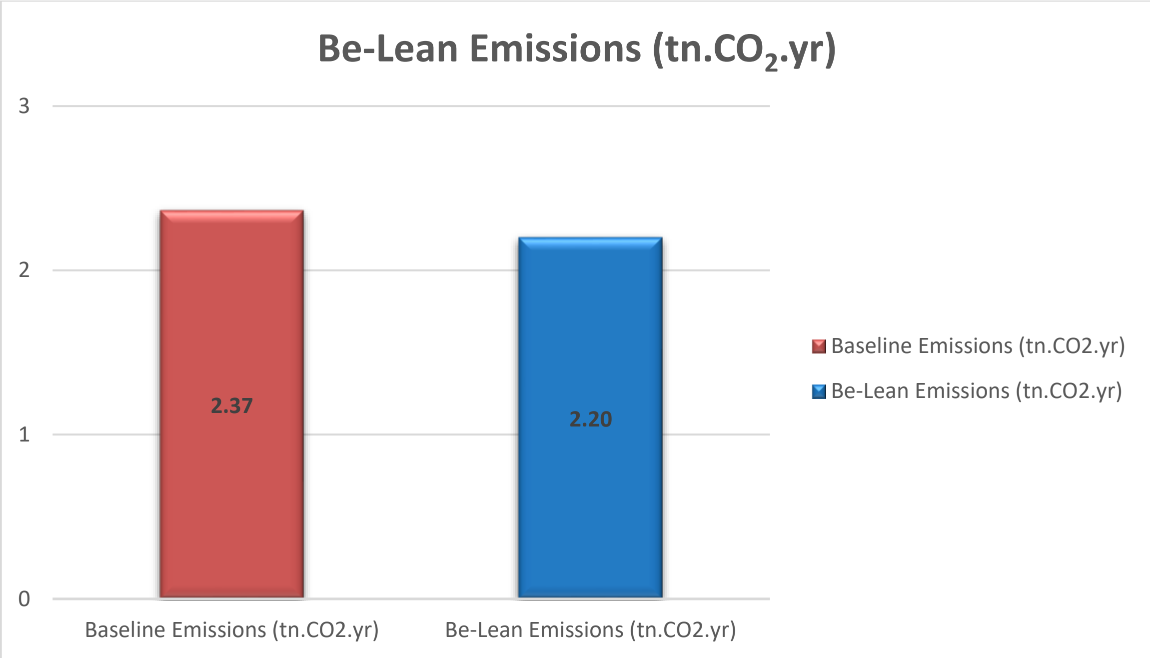


Fig 5.3 –Be-Lean Stage Reductions

Cooling & Overheating

5.19 Policy SI 4 of the London Plan (2021) seeks to reduce the impact of the urban heat island effect in London and encourages the design of places and spaces to avoid overheating and excessive heat generation, and to reduce overheating due to the impacts of climate change and the urban heat island effect on an area wide basis.

5.20 Applicants should apply the cooling hierarchy as detailed in Policy SI 2 with the development at Branch Hill House to incorporate the following measures;

Table 5.4 – Cooling Methods

Cooling Method	Measures Employed
Minimising internal heat generation through energy efficient design	• The g-value of all installed glazing will be as low as feasible possible (currently assumed as 0.25) in order to reduce internal solar gain. • Mechanical service risers to be ventilated at low level and at roof level to ensure risers do not create nuisance heat load in summer operation.
Reducing the amount of heat entering the building in summer	• The building form is on a beneficial south-west to north-east axis, reducing the risk of overheating from low lying morning and evening sun. To the direct south of the new-build portion is the existing Branch Hill House which will offer a significant level of shading. • Internal blinds will be provided to all bedrooms to reduce evening sun, although it is acknowledged very few bedrooms have a western orientation which are most at risk from evening overheating.
Use of thermal mass and high ceilings to manage the heat within the building	• All floor-to-ceiling heights are maintained at a minimum 2500mm, with the majority at 2700mm. This relative increase in exposed surface will help to lower indoor air temperatures.
Passive ventilation	• The dwelling has been designed with, a shallow floor plate, openable windows and a number allow for cross-ventilation.
Mechanical ventilation	• An MVHR system is proposed for the dwelling. Theis will facilitate a sufficient amount of air changes per hour to ensure there is no stagnant air and will help in lowering the overall indoor air temperature.

Unregulated CO_2 Emissions

5.21 Policy SI 2 (E) of the London Plan 2021 requires major development to calculate and minimise carbon emissions from any other part of the development, including plant or equipment, that are not covered by Building Regulations, i.e. unregulated emissions.

5.22 Unregulated loads (plug-in and specialist process equipment) can contribute to a significant quantum of the overall CO_2 emissions of any development. At each stage of the 'Energy Hierarchy' in this report, unregulated CO_2 emissions are reported for the development, relating to unregulated energy use within all dwellings

5.23 Unregulated CO_2 emissions associated with other landlord areas of the development have not been reported, therefore the following measures and opportunities will be explored and included in a residents/tenant user guide where appropriate;

Table 5.5 – Unregulated load opportunities

Unregulated load opportunity	Measures Employed
Energy Efficient Lifts	- LED lights in lift cars; - Variable voltage drives; - Regenerative lift motors to be considered.
External Lighting	- Energy efficient lamps (>75 lamp lumens/circuit watt); - Photocell dimming/time clock controls to avoid unnecessary use
White Goods (if developer specified)	- All white goods will be minimum A rated.
Home User Guide	- Production of Home User Guide for each tenant detailing energy saving opportunities.

Applying the London Plan Energy Hierarchy: Stage 2 – Be Clean

5.24 Policy SI 3 (D) of the London Plan (2021) requires major development located in Heat Network Priority Areas to install a communal low-temperature hot water system.

5.25 The heat source for the communal heating system should be selected in accordance with the following heating hierarchy:

1. connect to local existing or planned heat networks;
2. use zero-emission or local secondary heat sources (in conjunction with heat pump, if required);
3. use low-emission combined heat and power (CHP) (only where there is a case for CHP to enable the delivery of an area-wide heat network, meet the development's electricity demand and provide demand response to the local electricity network), or;
4. use ultra-low NOx gas boilers

1) Connection to existing heating or cooling networks

5.26 As seen on the map adjacent, there are no existing or planned heat networks in the vicinity of Branch Hill House.

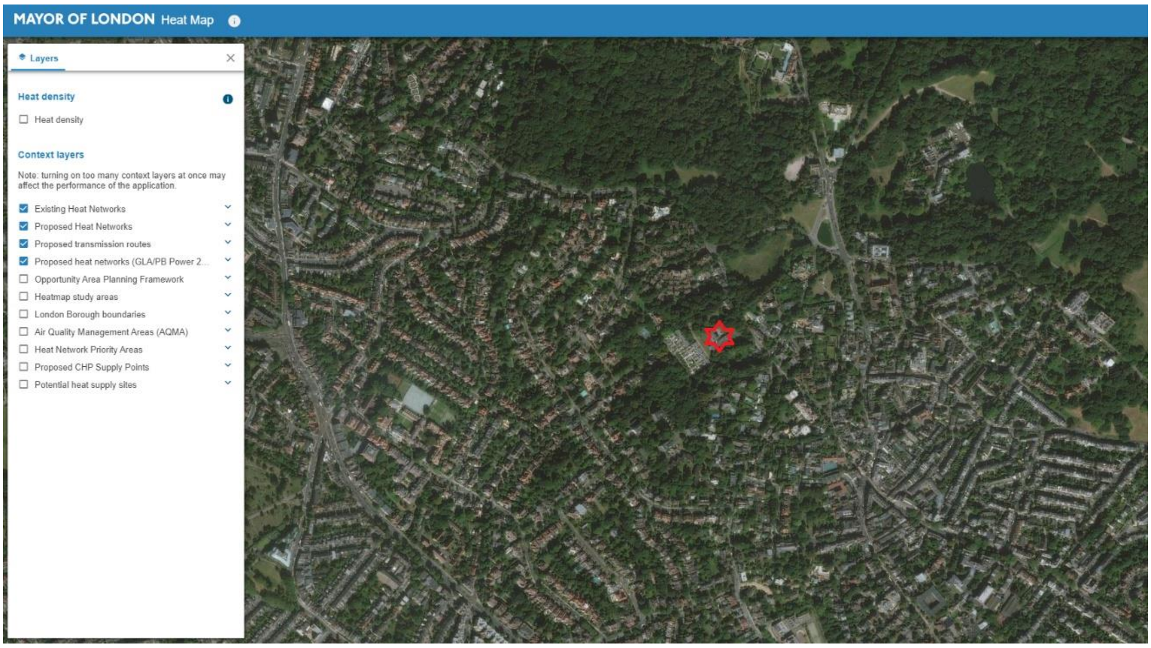


Fig 5.4 - Local Heat Map

5.27 The proposals are for a single residential dwelling that will complement and form part of the wider development proposals of the former Branch Hill Care Home that was granted full planning permission on 11 August 2021 (Ref.2019/6354/P) for:

"Change of use of Branch Hill House from care home (Use Class C2) to residential (Use Class C3) and associated external alterations, demolition of the 1960s care home extension and erection of replacement building, including basement, comprising residential accommodation (Use Class C3), ancillary plant, access and servicing and car parking".

5.28 The consented scheme includes the proposed installation of a shared ground loop array which will deliver low-carbon space and water heating to each dwelling, effectively meeting with the objective of Policy SI 5 (D-1b) of the London Plan (2021). This system provides an individual ground source heat pump to each dwelling but the entire site utilises a shared borehole system, known as a *shared ground loop array* (SGLA).

5.29 As detailed in the 'Be-Green' section, this application proposes an individual ground source heat pump. To ensure effective installation, the on-site network would be delivered under two scenarios:

1. **Coal House application delivered standalone** – sufficient boreholes will be constructed for the dwelling's ground source heat pump and will connect to a manifold with future provision for a larger array to connect. When the wider site is brought forward the entire SGLA will connect via the already installed manifold thereby completing an on-site network connecting all dwellings.
2. **Entire site built at once** – the entire site (including the Coal House) will be connected via the SGLA with individual heat pumps per dwelling.

Applying the London Plan Energy Hierarchy: Stage 3 – Be Green

5.30 An analysis of low carbon/renewable technologies was undertaken to determine which would be suitable for application in a development of this size and nature. This analysis has been appended to this document in Appendix I.

5.31 During the design-development period for this scheme, multiple low carbon/renewable systems were examined for both their feasibility and ability to lower carbon emissions insofar as possible. As per the analysis contained in Appendix I, the renewable systems deemed to be the most viable for the development is the installation of a ground loop array closed system connecting to individual ground-source heat pumps in the dwelling, providing efficient space and water heating to the dwelling.

Renewable Energy / Low Carbon Technology – Ground Source Heat Pump

5.32 The Coal House is intending to make use of a ground source heat pump as its primary source of space and water heating.

Overview of System

5.33 Mimicking a traditional gas framework, a series of ground boreholes (120 – 240 meters deep) are installed acting as a heat energy source to the dwelling. The ground loop system transfers ambient temperature low grade heat energy from the ground (-5°C to 20°C) to individual ground source heat pumps (GSHP) located inside the dwelling. Each GSHP then upgrades the ground's heat energy to provide independently controllable heat and hot water to the property.

Outline system design

5.34 The dwelling will make use of a Kensa EVO 13kW ground source heat pump, with an averaged COP of 4.14. The system will be complemented with the cylinder outlined at the 'Be-Lean' stages.

5.35 Note – further heat demand modelling will be undertaken at Stage 3 detail design to verify system capacity can serve space & DHW demand, and if required system capacities will be adjusted accordingly.

5.36 **A detailed overview of the system is provided in Appendix III**

Be-Green CO_2 Reductions

5.37 The following tables and graphs represent the Be-Green improvements for the new-build portion over the Target Emission Rate (TER) baseline emissions;

Table 5.6 – Be-Green Improvement over TER

Unit	Total Floor Area (m^2)	SAP 10 DER	Total CO_2 (tn.CO2.yr)	DPER	Target Primary Energy (kWh.yr)
Coal House	193.4	3.93	0.76	41.15	7,958.41
		Total =	**0.76**		**7,958.41**
		Be-Green Savings	1437.94		0.00
		% Difference	**65.42%**		**0.00%**
		Difference over Baseline	1605.22		4506.22
		% Difference	**67.87%**		**36.15%**

5.38 As detailed above, the measures as taken at this stage would result in a **67.87%** reduction in the new-build regulated CO_2 emissions over the Building Regulations Part L 2021 Target Emission Rate, calculated using SAP 10 emission factors.

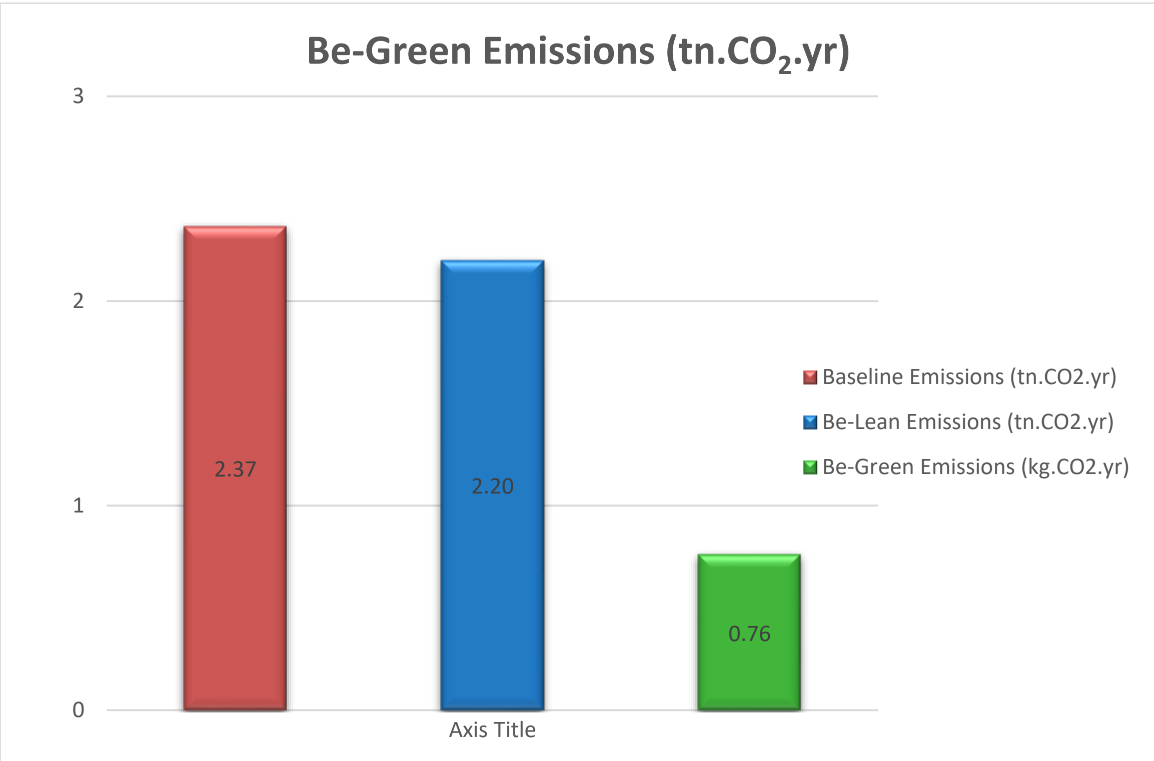


Fig 5.5 – Be-Green Reductions

Final Residential CO_2 Reduction Charts & Carbon Offset Payment

5.39 In accordance with the 'GLA guidance on preparing energy assessments', the final carbon emissions and predicted savings are presented below for the entire development.

Table 5.7 – Final New-Build Residential CO_2 reductions

	Carbon Dioxide Emissions for domestic buildings (Tonnes CO_2 per annum)	
	Primary	**Unregulated**
Baseline: Part L 2021 of the Building Regulations Compliant Development	2.37	0.96
After energy demand reduction	2.20	0.96
After heat network / CHP	2.20	n/a
After renewable energy	0.76	0.96
	Primary domestic carbon dioxide savings	
	(Tonnes CO_2 per annum)	**(%)**
Savings from energy demand reduction	0.17	7.07%
Savings from renewable energy	1.44	60.79%
Cumulative on-site savings	1.61	67.87%

Minimising Estimated Energy Costs to Occupants

5.40 Consideration towards end-user costs was one of the determining factors in system selection for the residential element. Kensa ground source heat pump monobloc system supplying efficient space and water heating to all residential units on site have been selected with a SCOP of ranging from 3-4, i.e. 300-400% efficient.

5.41 This system selection, coupled with low u-values, high efficiency mechanical ventilation heat recovery systems and LED lighting results in the following monthly operating costs, based on estimated regulated energy consumption taken from the SAP worksheets:

Table 5.8 – Operating Costs

Unit	Annual Operating Cost (regulated energy[2])	Monthly Operating Cost (Regulated Energy)
Coal House	£849.24	£70.77

5.42 As detailed above, considering the luxury nature of the development, the predicted regulated energy operating costs are generally low, protecting the consumer from high prices.

[2] Electricity usage assumed at £0.20/kWh.

5.43 In order guarantee that the actual operating costs will remain a consideration throughout the lifetime of the development, the applicant has installed a system that although mimics a communal heating system via a shared ground loop array, allows occupants to control their own billing arrangements through individual heat pump systems. This allows occupants flexibility and choice in electricity supplier, unlike a centralised billing structure when heating is provided from a dedicated energy centre, with no choice of supplier and therefore tariff.

5.44 The calculation for operating cost is based on predicted consumed regulated electricity – at this point the cost for ongoing maintenance and plant replacement (after approximately 15 years) is not included as this will be determined by the developer post-planning.

6 CONCLUSION

6.1 This Sustainability and Energy Statement has been prepared by Envision on behalf of Almax Group (The Applicant) and is submitted in support of a full planning application for the construction of a single 3 bed dwelling (C3) comprising 3 floors + basement known as the 'Coal House' on land at Branch Hill House, Branch Hill, London. NW3 7LS.

6.2 The scheme will deliver a series of sustainability measures which are compatible with the GLA and London Borough of Camden's requirements for sustainable design and construction, including:

- SuDs strategy to achieve a run-off rate of 2 l/s during all events up to and including the 1:100 AEP event, including a 40% allowance for climate change
- A comprehensive ecological strategy to deliver a net gain in biodiversity and the Protection, conservation and enhancement of the Site of Importance for Nature Conservation (SINC);
- Sustainable material selections with timber to be procured with Forest Stewardship Council accreditation;
- Incorporation of climate adaptation measures, including permeable paving, landscaping and passive building design including MVHR;
- Water conservation measures within the units to comply with 110 litres / bedspace per day and the provision of communal external rainwater harvesting tank for irrigation purposes;
- New play space and public realm.

6.3 To minimise energy consumption by the development and to ensure compliance with relevant energy policies, the following design measures are proposed:

- Building fabric construction U-values significantly improved compared with standard Building Regulations U-values;
- Reduced Air Permeability, lower than standard Buildings Regulations, and in accordance with prospective development building occupiers;
- A high-efficiency ground-source heat pump providing efficient space and water heating to the dwelling;
- HVAC system controls ensure installed equipment will be operating efficiently and to include automatic monitoring and targeting with alarms for out of range values;
- High efficiency LED lighting utilizing low-energy control systems such as daylight dimming and occupancy sensing;
- Mechanical Ventilation Heat Recovery (MVHR), ensuring space heating loads are kept to a minimum;
- Reduction in solar gain through the use of lower g-values.

6.4 The strategy proposed follows the three-step 'Energy Hierarchy' and meets all policies as outlined in Section 3 of the report, with the development expected to perform as follows:

1. The new-build house achieves an overall reduction in carbon emissions over the Part L 2021 (using SAP 10.2 emission figures) baseline is **67.87%** therefore complying with LB Camden policy on CO_2 reductions.

6.5 Further optimising of the ground source heat pump installation will be assessed at the detail-design phase. For this Energy Report, the solutions have been optimised to suit the predicted energy consumption and carbon emissions as per Envision's calculations.

6.6 The development is therefore considered to comply with the sustainability & energy requirements outlined by Camden and GLA sustainability and energy policies.

APPENDIX I – RENEWABLE TECHNOLOGY ANALYSIS

Renewable Technology	Rating (out of 5)	Comment
Photovoltaics	***	The roof layout is not optimal for the inclusion of PV given the many ridge and gable end roofs. In addition, given the CO_2 reductions already achieved on-site their inclusion is deemed extraneous. In addition, the CO_2 offset offered by PV using SAP 10.2 emission factors is halved when compared to previous Part L emission factors, meaning a significant quantum is required to lower CO_2 emissions meaningfully.
Solar Thermal	*	The proposed DHW system (on-site Ground Source Heat Pump) will already provide hot water – the use of a solar thermal system would be an over-design, especially given the limited roof space already allocated for the PV array. They also have a shorter lifespan than PV systems.
Wind Turbine	*	The restricted nature of the site, coupled with the noise, aesthetic (planning) and building vibrations arising from their installation means this system is impractical.
Ground Source Heat Pump	*****	A GSHP solution has been identified as a viable renewable technology for providing space & water heating to the development as; • The site has been identified as suitable for the installation of the boreholes required for this system; • The system offers high COPs • Tenants can manage their own metering and billing
Air Source Heat Pump	***	ASHPs are potentially viable for the development and are capable of providing a significant portion of the building's energy from effectively a renewable source, as for each kW of electricity in excess of 3kW of heating will be extracted. Two ASHP solutions were examined for inclusion in the design but were rejected for the following reasons; • **Individual ASHP** – these offer high COPs but each ASHP would need to be located on the roof (no space) as a condenser farm at ground level would not be suitable. • **Communal ASHP** – these offer lower COPs than individual ASHPs which would require a larger amount of PV than currently specified**. Also space considerations are an issue.**
Biomass Communal Boiler	*	The significant plant and in particular, storage space required for a biomass boiler is unsuitable for a development of this size.

APPENDIX II – GLA COMPLIANCE SHEET (BE-LEAN ADJUSTED)

The applicant should complete all the light blue cells including information on the modelled units, the area per unit, the number of units, the TER/DER/BER and the TFEE/DFEE.

RESIDENTIAL CO_2 ANALYSIS (PART L1)

				Baseline		'Be Lean'	'Be Clean'	'Be Green'	Fabric Energy Efficiency (FEE)		Baseline		'Be Lean'			'Be Clean'			'Be Green'	
Unit identifier (e.g. plot number, dwelling type etc.)	Model total floor area (m²) (Row 4)	Number of units	Total area represented by model (m²)	TER ($kgCO_2$ / m²) (Row 273)	Energy saving/generation technologies (-) ($kgCO_2$ p.a.) (Row 269)	DER ($kgCO_2$ / m²) (Row 273 or 384)	DER ($kgCO_2$ / m²) (Row 273 or 384)	DER ($kgCO_2$ / m²) (Row 273 or 384)	Target Fabric Energy Efficiency (kWh/m²)	Dwelling Fabric Energy Efficiency (kWh/m²)	Part L 2021 CO_2 emissions ($kgCO_2$ p.a.)	Energy saving/generation technologies ($kgCO_2$ p.a.)	Part L 2021 CO_2 emissions ($kgCO_2$ p.a.)	Part L 2021 CO_2 emissions with Notional PV savings included ($kgCO_2$ p.a.)	'Be Lean' savings ($kgCO_2$ p.a.)	Part L 2021 CO_2 emissions ($kgCO_2$ p.a.)	Part L 2021 CO_2 emissions with Notional PV savings included ($kgCO_2$ p.a.)	'Be Clean' savings ($kgCO_2$ p.a.)	Part L 2021 CO_2 emissions ($kgCO_2$ p.a.)	'Be Green' savings ($kgCO_2$ p.a.)
20 Crediton Hill	*193.4*	*1*	*193.4*	12.23	-459.07	13.74	3.93	3.93			2,365	-459	2,657	2,198	167	760	301	1,897	760	-459
Sum		1	193	12.2	-459.1	13.7	3.9	3.9	0.0	0.0	*2,365*	*-459*	*2,657*	*2,198*	*167*	*760*	*301*	*1,897*	*760*	*-459*

NON-RESIDENTIAL CO_2 ANALYSIS (PART L2)

				Baseline		'Be Lean'	'Be Clean'	'Be Green'			Baseline		'Be Lean'			'Be Clean'			'Be Green'	
Building Use	Model Area (m²)	Number of units	Total area represented by model (m²)	BRUKL TER ($kgCO_2$ / m²)	BRUKL Displaced electricity (-) (kWh / m²)	BRUKL BER ($kgCO_2$ / m²)	BRUKL BER ($kgCO_2$ / m²)	BRUKL BER ($kgCO_2$ / m²)			Part L 2021 CO_2 emissions ($kgCO_2$ p.a.)	Energy saving/generation technologies ($kgCO_2$ p.a.)	Part L 2021 CO_2 emissions ($kgCO_2$ p.a.)	Part L 2021 CO_2 emissions with Notional PV savings included ($kgCO_2$ p.a.)	'Be Lean' savings ($kgCO_2$ p.a.)	Part L 2021 CO_2 emissions ($kgCO_2$ p.a.)	Part L 2021 CO_2 emissions with Notional PV savings included ($kgCO_2$ p.a.)	'Be Clean' savings ($kgCO_2$ p.a.)	Part L 2021 CO_2 emissions ($kgCO_2$ p.a.)	'Be Green' savings ($kgCO_2$ p.a.)
Sum		0	0	0.0	0.0	0.0	0.0	0.0			*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*

SITE-WIDE ENERGY CONSUMPTION AND CO_2 ANALYSIS

Total Sum	**193**	-	-	-	-	-			*2,365*	*-459*	*2,657*	*2,198*	*167*	*760*	*301*	*1,897*	*760*	*-459*

APPENDIX III – GROUND SOURCE HEAT PUMP DATA

External Design Requirements

6.7 The typical diameter of each borehole is approximately 150mm. Within the finished borehole there are flow and return pipes for the ground array (40mm diameter each) and a sacrificial pipe that is used to install the grout in the borehole (also 40mm diameter). The top of the borehole is terminated approximately 1m below ground level.

6.8 During detailed design, boreholes will be located exactly within the modelling software to understand how they interact with each other.

6.9 The boreholes themselves are fully covered by ground and do not need to be accessed. There will be a flow and return pipe running at about 1m below ground level from the top of each borehole back to a subterranean manifold, which has a manhole cover to enable access in future.[3] From this manifold, each individual borehole can be isolated and flushed/purged/filled. The ground array does not require any annual maintenance. Approximately every 20 years or so, the antifreeze will need to be changed from the manifold.

Internal Design Requirements

6.10 The Coal House will require the larger EVO GSHP, with DHW cylinder capacity in line with the details in the 'Be-Lean' section.

6.11 Datasheets for the GSHP units and cylinders are provided within this section.

6.12 Although there is a shared ground loop array, as each dwelling has an individual heat pump, enabling occupants to manage their own electricity supply and therefore have a choice of energy supplier. This is typically not possible in a traditional District Heating (DH) network as metering and billing is managed by one ESCO/management company.

Environmental & Geological Considerations

6.13 The proposed shared ground loop array is a 'closed-loop' system, in which a mixture of water and antifreeze flows through a closed network of pipes (known as the ground loop). In one part of the circuit, it exchanges heat with the ground. In the other part, it exchanges that heat with the evaporator of the heat pump. There is no contact between the working fluid and the ground and between the working fluid and the fluid of the heat pump at any point.

6.14 This as opposed to an 'open-loop' system which extract heat from ground water, usually abstracted from an aquifer via a borehole.

[3] Note – this can also be located in a plant room.

6.15 Section 3.1 of the Environment Agency's 'Ground Source Heat Pump – Good Practice Guide' confirms; "Closed loop ground source heating and cooling systems do not currently require any form of permission from us".

6.16 This is further confirmed in an email in Appendix V from Kensa Engineering (the proposed manufacturer), which confirms:

1. When drilling closed loop boreholes, no permission is required from the EA;
2. With regards to the local geological suitability for a SGLA, Kensa's Certified Geoexchange Designer has confirmed they are confident the ground will be suitable for installation and will likely consist of:
   (a) Sand and gravel for approximately 20 metres
   (b) Clay and gravel for approximately a further 30 metres
   (c) Chalk with flints to depth from point onwards

Evidence that industry quality assurance standards are proposed for the design and installation, e.g. the GSHPA Technical Standards for Vertical Boreholes.

6.17 Kensa Contracting employs a Certified GeoExchange Designer to carry out all its GSHP designs. This is a qualification from the International Ground Source Heat Pump Association (IGSHPA). There are only a handful of such designers in the UK.

6.18 In addition, Kensa Contracting Ltd is an MCS (microgeneration certification scheme) accredited heat pump installer and so all aspects of the design will comply with this UK quality standard.

6.19 During the design and installation of our GSHP projects, Kensa and its partners always make reference to the following quality and standards publications that are specifically applicable to GSHP installations:

1. IGSHPA: General code of practice for closed loop installations
2. GSHPA: Vertical Borehole Standards
3. Environment Agency: Environmental good practice guide for ground source heating and cooling
4. MCS: MIS 3005 Heat Pump Systems
5. BDA (British Drilling Association): Code of Safe Drilling Practice; Guidance on Managing the Risk of Hazardous Gases when drilling or piling near coal

Lifetime operation, maintenance and management plan

6.20 It is expected that the ground array will be owned by the management company responsible for the maintenance and servicing of all communal areas of the development. As there are no moving mechanical parts in the ground array, servicing and maintenance requirements are very low.

Typically, the glycol in the array should be checked on a regular basis (e.g. every two to five years). Other than that, there is very little that is required. The management company could appoint Kensa Contracting Ltd to carry out this servicing or use any other competent company.

6.21 The equipment inside the dwelling is likely to be the responsibility of the homeowners (in much the same way that a gas boiler in a house is the responsibility of the home owner). Like any heating system, these will benefit from regular servicing but this is not mandatory to maintain the standard product warranty from Kensa Heat Pumps. At the point of purchase, it might be possible to provide the homeowners with an option to purchase a servicing/maintenance plan if this is desired.

Proposed heat distribution systems - details of GSHP-compatible radiators or underfloor heating

6.22 The GSHP system is compatible with any suitable wet-based heat emitter system, e.g. underfloor heating, radiators or fan-coil unit. At this point, underfloor heating has been assumed. During Stage 3 detail-design, the chosen heat emitter will be designed to provide sufficient heat to the rooms on the coldest day of the year to maintain comfortable internal temperatures at these water flow temperatures. This will all be designed in line with CIBSE & MCS requirements.

Kensa Evo Heat Pump Series

Features & Benefits

- Available in 7kW, 9kW, 13kW,15kW and 17kW
- 15% gain in efficiency*
- ERP A+++ rated series
- Increased SCOP performance*
- 60°C heat pump output (excluding 17kW model)
- Significantly reduced noise outputs*
- Custom built control panel
- Designed for easy installation
- UK manufactured

Product Description

The ERP A+++ rated Evo series delivers heating and hot water efficiencies of SCOPs up to 4.7 at 35°C along with significantly reduced noise outputs, packaged in a contemporary contoured gunmetal and gloss-white finish, punctuated by a custom built control panel unique to the Kensa series.

Performance: Each model in the Kensa Evo series has optimised sized stainless steel heat exchangers, which allows the compressor to respond more efficiently, increasing SCOP performance and delivering up to 60°C from the heat pump. (Excluding the 17kW which is designed solely for space heating)

Appearance: The ergonomic steel casing has been designed with a focus on ease of access, whilst providing sturdy yet stylish protection from ageing and wear and tear.

Installation: The Evo has been designed to be easy to handle and install. With cross head screws in its unique bevelled front panel, the Evo's electrical component and wiring terminals are easily accessible.

The heat pump has four rear water connections, two for the ground collectors and two for the property's heating distribution system. The connections consist of four 28mm straight brass fittings designed with tight tolerances, ensuring compatibility with easy to install push fittings.

The external side panels feature a curved cut-out offering the installer an extra level of flexibility to install the Evo according to the demands of the site, with vertical and horizontal pipework exit points from the sides and top of the unit.

Controls: Kensa has developed its own control board which is the brain of the new Evo heat pump. The customer interface is an intuitive touch screen that facilitates commissioning and parameter settings, and provides live status readings supported by LED light indicators.

The custom built software also permits the control board to pre-empt system irregularities using warning safety levels, which may previously have resulted in a fault if left unchecked. This pro-active system will ultimately reduce costs and call outs and enable better diagnostics and system resolution, aided by Kensa's technical support and UK wide installation network.

* against equivalent Kensa compact units

Technical (TIS)

TIS - Evo Heat Pump Single – 12

Single Phase					Three Phase
Nominal thermal kW rating	**7**	**9**	**13**	**17**	**15**
Part No.	K070-S1H	K090-S1H	K130-S1H	K170-S1H	K150-S3H
MCS Approved	BBA0055/41	BBA0055/42	BBA0055/43	BBA0055/44	BBA0055/39
Performance data—rated heating output at B0/W35 BS EN14511					
Power consumption	1.8	2.3	3.4	4.6	3.8
Coefficient of performance*	4.48	4.36	4.14	3.81	4.2
Immersion heater output	Kensa heat pumps do not feature back-up electric immersion heaters**				
Brine (primary) based on 0°C in, -4°C out					
Design flow rate kg/min	29.1	28.4	39.2	50.6	42.8
Pressure drop kPa at design flow rate	12	11	17	29.2	20.6
Max inlet temperature °C	15				
Min temperature °C (Outlet)	-5 (at standard settings)				
Heating water (secondary) based on 30°C in, 35°C out					
Design flow rate l/min	22.4	28.5	38.9	51.2	45.9
Pressure drop kPa at design flow rate	4	5.7	10.1	28.3	13.6
Max flow temperature °C***	64	63	63	50	62
Electrical Values @B0/W35					
Rated Voltage	220 – 240 V / 50-60 Hz				380-420V / 50-60 Hz
Power supply rating amps	25	25	40	50	16
Rated current (max) amps	18.5	20.6	31.1	35	11.8
Typical running current @ B0/W35 amps	8.4	11.4	16	23	7.3
Starting current amps****	18.2	28.7	41.3	45	44
ENA database Number	HP_0304	HP_0306	HP_0303	HP_0308	HP_0307

TIS - Evo Heat Pump Single – 12

Single Phase					Three Phase
Nominal thermal kW rating	**7**	**9**	**13**	**17**	**15**
Refrigerant circuit					
Process medium	R407C				
Fill volume kg	1.9	1.9	2	2.1	2
Compressor type	Scroll				
Dimensions					
Nominal H x W x L (mm)	1145 x 580 x 570				
Nominal Dry weight kg (Approx)	139	140	153	154	153
Operating pressure					
Brine circuit min (primary) bar g	Settable at commissioning				
Heating water circuit min (secondary) bar g	Settable at commissioning				
Low pressure reset bar g	Settable at commissioning				
Connection sizes					
Primary IN and OUT (brass stubs) mm	28				
Heating flow and return (brass stubs) mm	28				
Performance (based on Average Climate) at 35°C					
ErP rating	A+++	A+++	A++	A++	A++
SCOP	4.72	4.64	4.40	4.06	4.47
Seasonal space heating energy efficiency	181%	177%	168%	155%	171%
Performance (based on Average Climate) at 55°C					
ErP rating	A++	A++	A++	A+	A++
SCOP	3.7	3.62	3.48	3.16	3.58
Seasonal space heating energy efficiency	140%	137%	131%	118%	135%
Sound Power Level					
Sound Power Level (dB)	49.4	56.1	49.7	56.2	49.2

* The COP figure quoted is calculated as per EN14511.
** In-built immersion heaters will increase running costs and CO_2 emissions as they use direct electricity, because of this Kensa heat pumps do not include them.
*** By increasing the flow temperature from the heat pump the efficiency of the unit will drop and the COP decreases.
**** Kensa Evo heat pumps incorporate smart starts as standard to limit the starting current of the compressors. For full details on how the starting currents are calculated please contact Kensa.
Note: Design flowrates are for a ground temperature of 0 and –4°C and a load temperature of 30°C and 35°C

The 17kW is sold for space heating applications only.

Domestic Hot Water (DHW) Production

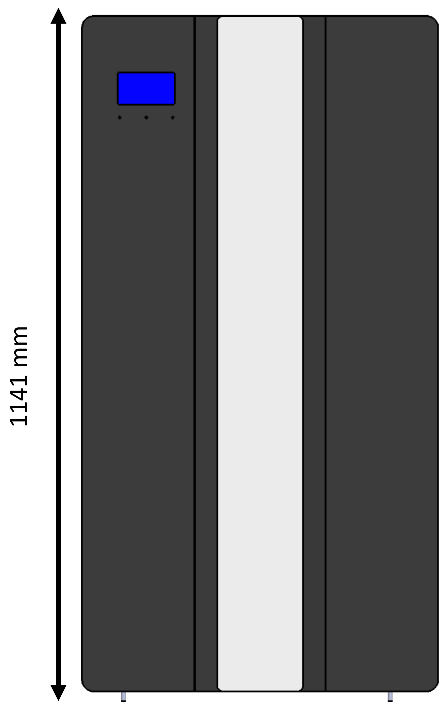
The DHW option needs to be specified at time of ordering. The 17kW Evo is designed for Space Heating only and not DHW unless specified and agreed.

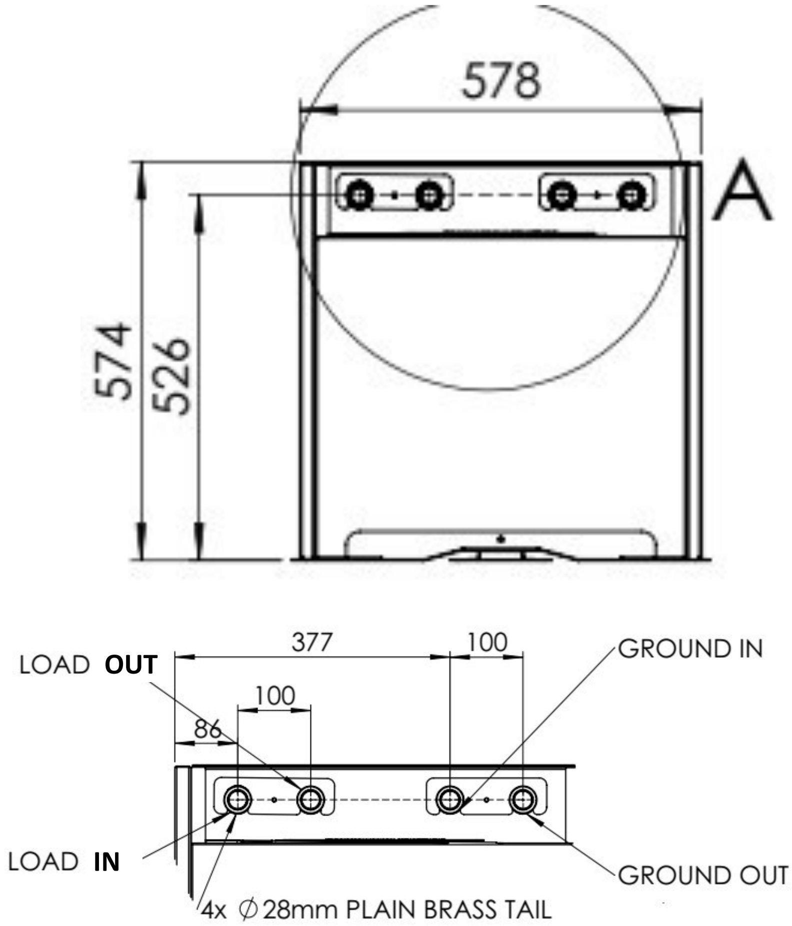
The maximum DHW temperature that the heat pump can achieve at the cylinder will be approximately 60°C. (Excluding the 17kW which is designed for space heating only). If 65°C is required all year round, it is recommended that an immersion heater is linked to Evo and the Evo is programmed to operate the immersion heater for a period immediately following the DHW production. This means that the majority of the heating load for the DHW is produced at a lower cost using the heat pump, as opposed to using only the direct immersion heater.

The EVO can be programmed to raise the temperature to 65°C once a week to provide pasteurisation.

Warning - when a heat pump solely is used for heating domestic hot water, it may not get the water hot enough to kill the dangerous Legionella that can breed in hot water cylinders. Alternative arrangements as above may therefore be required to ensure the cylinder is pasteurised regularly. The installer/end user should check if this pasteurisation is required by local regulations, bearing in mind that there are often different rules for installations in rented or commercial properties.

Nominal Dimensions and Connections





Single Coil Domestic Hot Water Cylinder

Features and Benefits

- Designed for heat pump applications
- Large coil to improve heat transfer
- Ease of installation
- Manufactured from Duplex stainless steel
- UK manufactured
- 25 year guarantee for the shell

Product Description

Kensa has partnered with a leading cylinder manufacturer (Advance Appliances) to design and produce an indirect hot water cylinder designed for use with heat pumps.

The cylinder has a coil specifically designed with a larger surface area to provide a better heat transfer from the heat pump into the cylinder. This improves the actual temperature reached by the domestic hot water and the time taken to reach this temperature.

The vessels are manufactured from corrosion resistant Duplex stainless steel which enables an industry leading 25 year guarantee for the shell of the cylinder.

Tanks installed on private water supplies are sold without a warranty.

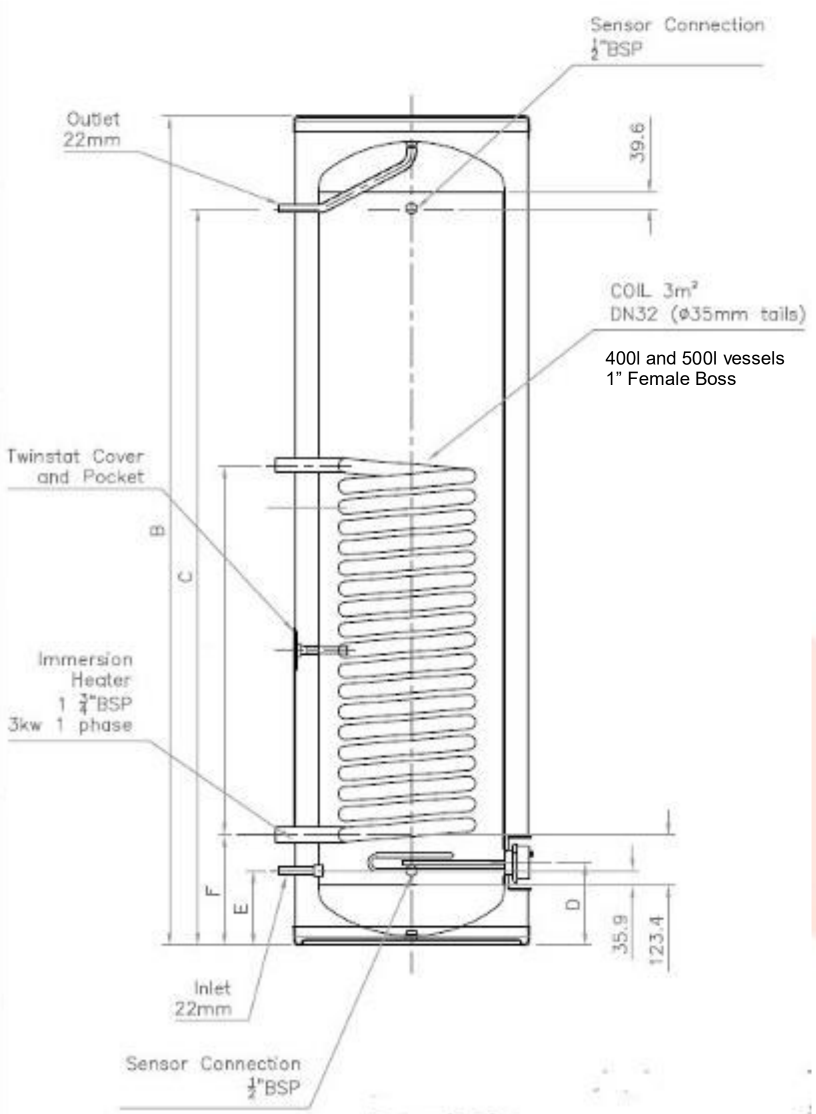
The cylinder is designed using the heat pump as the sole heat source and will provide at least 50°C domestic hot water from the cylinder.

The units meet current Building Regulations, are manufactured in the UK and guaranteed for 25 years (components 2 years).

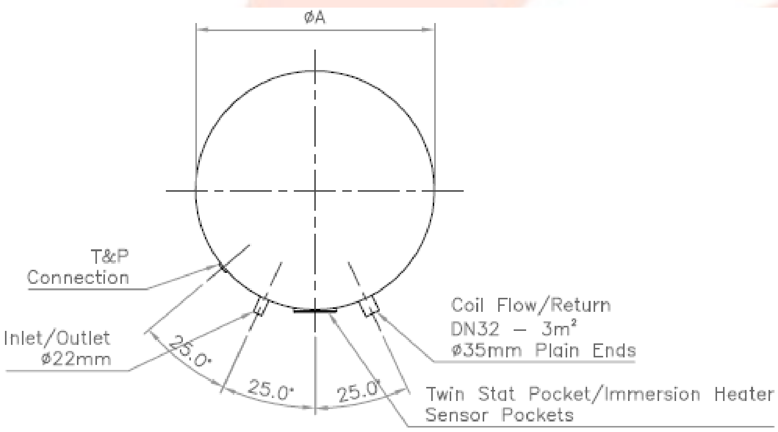
Also supplied: One 3kW immersion heater and G3 kit.

Single Coil Domestic Hot Water Cylinder (DN32 Coil)

Kensa Model No.	95-069A	95-070A	95-071A	95-072A
Volume (l)	255	305	400	500
Expansion Vessel capacity (l)	24	24	50	50
Heat Loss kWh/24hrs@55°C	1.49	1.63	2.25	2.38
ErP Rating	C	C	C	C



Material	Duplex Stainless Steel
Operating Pressure Tank and Coils	3 Bar—95°C
P & T Valve Rating	7 Bar—90°C
Pressure Reducing Valve	Max Pressure 12 Bar/ Control Pressure 3 Bar
Safety Relief Valve	6 Bar
Expansion Vessel Charge	3 Bar
Expansion Relief Valve	6 Bar
Flexible Hose for Expansion Vessel	Supplied Loose
Bracket for Expansion Vessel	Supplied Loose
Immersion Heater	13/4—240V-3kW
Tundish	1/2" x 22mm



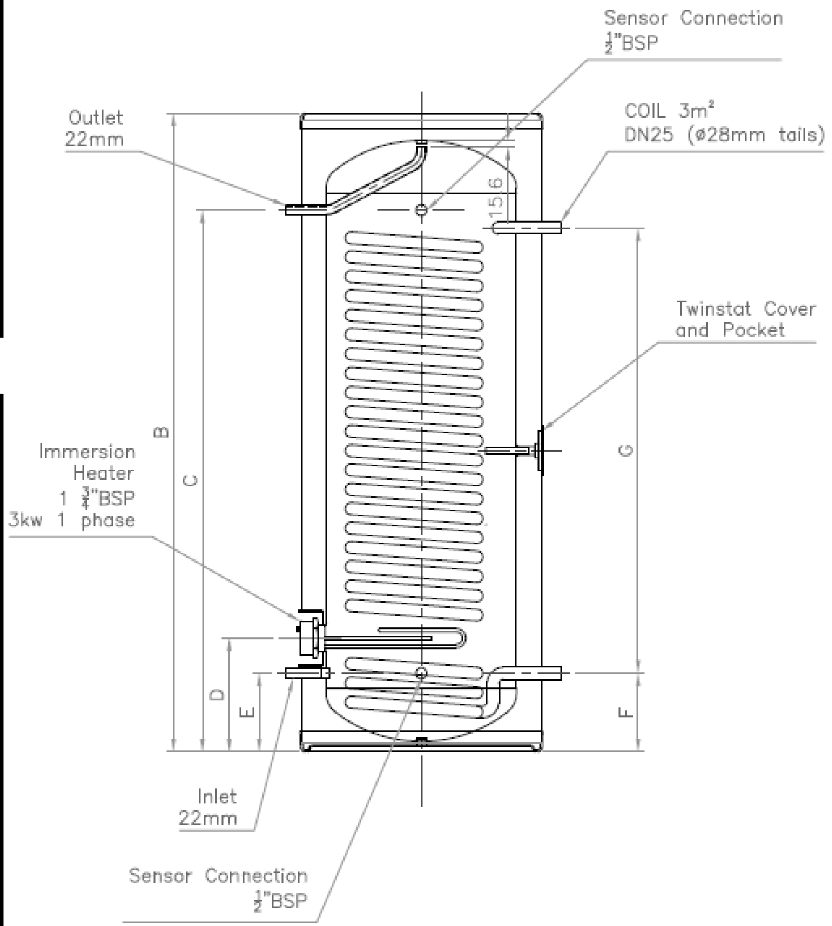
	A	B	C	D	E	F	G	Coil Size	Weight Full (kg)
255 (3m^2)	575	1750	1527	202	182	270	900	DN32	315
305 (3m^2)	575	2023	1800	202	182	270	900	DN32	365
400 (3m^2)	580	2190	1830	300	200	375	1080	DN32	485
500 (3m^2)	750	1999	1740	330	250	440	1080	DN32	605

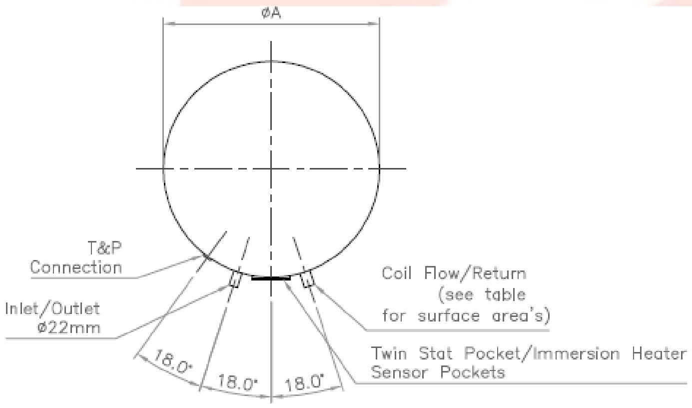
All Dimensions are nominal and in mm

Single Coil Domestic Hot Water Cylinder (DN25 Coil)

Kensa Model No.	95-060A	95-061A	95-062A	95-063A
Volume (l)	150	215	255	305
Expansion Vessel capacity (l)	12	18	24	24
Heat Loss kWh/24hrs@55°C	0.99	1.41	1.49	1.63
ErP Rating	B	C	C	C

Material	Duplex Stainless Steel
Operating Pressure Tank and Coils	3 Bar—95°C
P & T Valve Rating	7 Bar—90°C
Pressure Reducing Valve	Max Pressure 12 Bar/ Control Pressure 3 Bar
Safety Relief Valve	6 Bar
Expansion Vessel Charge	3 Bar
Expansion Relief Valve	6 Bar
Flexible Hose for Expansion Vessel	Supplied Loose
Bracket for Expansion Vessel	Supplied Loose
Immersion Heater	13/4—240V-3kW
Tundish	1/2" x 22mm





	A	B	C	D	E	F	G	Coil Size	Weight Full (kg)
150 ($2m^2$)	575	1083	860	264	182	182	675	DN25	195
215 ($3m^2$)	575	1485	1259	264	182	182	1035	DN25	270
255 ($3m^2$)	575	1750	1527	202	182	272	1035	DN25	310
305 ($3m^2$)	575	2023	1800	202	182	272	1035	DN25	370

All Dimensions are nominal and in mm

APPENDIX IV – CORRESPONDENCE WITH MANUFACTURER

Sam Wallis | Envision

From: Stuart Gadsden <stuart.gadsden@kensaengineering.com>
Sent: 13 September 2019 12:38
To: Sam Wallis | Envision
Cc: Ciaran Dorrity | Envision
Subject: Re: 190325: Branch Hill House - GSHP Information

Hi Sam,

Good to hear from you and great to hear the project is back on track.

Point 1: I can confirm that when drilling closed loop boreholes, no permission is required from the EA.

Point 2: I have discussed this site with our ground array designer (who is a Certified Geoexchange Designer - one of only 5 in the UK) to get his initial thoughts on underlying geology and suitability for closed loop drilling. The expected geology is very similar to a previous project we carried out for Enfield Council (which required 96 boreholes) and so we are very confident that the ground is suitable. We expect the geology to be approximately:

Sand and gravel for approximately 20 metres
Clay and gravel for approximately a further 30 metres
Chalk with flints to depth from point onwards

At this stage, no detailed assessments are available for peak heat loss, annual heating demand and annual hot water demand. However, based on some rules of thumb we estimated peak heat loss as 157kW, annual space heating demand as 168,369 kWh/year and annual DHW demand as 72,772 kWh/year. With the expected geology, the estimated borehole requirement is 3,357 metres. From looking at site plans, it appears there would be sufficient space on site for this borehole depth.

Of course, no detailed design has been carried out at this stage and everything is subject to change. However, our initial desktop study does show that we are very confident that a shared ground loop GSHP system can be installed at this site.

Point 3: No permit will be required as per Point 1.

Point 4: All manuals etc will be provided to householders. Kensa also operate a phone line that can be contacted at any time by householders. On-going maintenance would need to be agreed with each householder for their GSHP but it is possible to enter into service agreements with M&E contractors for this (Kensa does not do this). Long-term maintenance of the ground array would also be discussed with the owner of the site and Kensa can enter into an agreement to maintain this.

In terms of the householders, there is no real difference in control and operation to a standard gas boiler system and so not expecting any undue problems with this.

Hope this helps. Let me know if you need anything else.

As an interesting aside, I'm directly speaking to some of Camden Council's asset management team about retrofitting our solution into some of their own social housing. So hopefully the planning department will be keen to support a solution that may well end up in their own buildings!

Cheers
Stuart

On Thu, 12 Sep 2019 at 11:51, Sam Wallis | Envision <swallis@envisioneco.com> wrote:

Sam Wallis | Envision

From: Stuart Gadsden <stuart.gadsden@kensaengineering.com>
Sent: 29 January 2020 15:28
To: Sam Wallis | Envision

Subject: Re: 200122: Branch Hill House - GSHP Information

Sorry Sam. Missed my Monday afternoon deadline for this.

It's important to note that we haven't carried out detailed design for this project. Therefore, no detailed modelling exists. However, I've tried to provide as much information as possible. Also note that you may wish to add more detail about radiators/underfloor heating if you have it as that has been outside the scope of what I've looked at. Please also check you agree with what I've said about maintenance as this will depend on how the flats are finally managed. I suspect Camden Council wouldn't ask these questions if this was a gas boiler system!

The system design is a shared ground loop solution (sometimes referred to as an ambient loop or fifth generation district heating). Kensa Contracting have now installed over 2000 GSHP on shared ground loop arrays. The expected seasonal efficiencies are as follows:

- properties with 3kW Kensa Shoebox GSHP: 3.19 for space heating and 2.44 for DHW
- properties with 6kW Kensa Shoebox GSHP: 3.01 for space heating and 2.32 for DHW

The current modelled annual space heating demand for all properties combined is 168,369 kWh/year and the current modelled annual DHW demand for all properties combined is 72,772 kWh/year. The shared ground loop GSHP system is designed to provide all of this demand from GSHP with no other heating source.

Kensa Contracting employs a Certified GeoExchange Designer to carry out all its GSHP designs. This is a qualification from the International Ground Source Heat Pump Association (IGSHPA). There are only a handful of such designers in the UK.

In addition, Kensa Contracting Ltd is an MCS (microgeneration certification scheme) accredited heat pump installer and so all aspects of the design will comply with this UK quality standard.

During the design and installation of our GSHP projects, Kensa and its partners always make reference to the following quality and standards publications that are specifically applicable to GSHP installations:

- IGSHPA: General code of practice for closed loop installations
- GSHPA: Vertical Borehole Standards
- Environment Agency: Environmental good practice guide for ground source heating and cooling
- MCS: MIS 3005 Heat Pump Systems
- BDA (British Drilling Association): Code of Safe Drilling Practice; Guidance on Managing the Risk of Hazardous Gases when drilling or piling near coal

It is expected that the ground array will be owned by the management company responsible for the maintenance and servicing of all communal areas of the development. As there are no moving mechanical parts in the ground array, servicing and maintenance requirements are very low. Typically, the glycol in the array should be checked on a regular basis (e.g. every two to five years). Other than that, there is very little that is required. The management company could appoint Kensa Contracting Ltd to carry out this servicing or use any other competent company.

The equipment inside each flat is likely to be the responsibility of the homeowners (in much the same way that a gas boiler in a house is the responsibility of the home owner). Like any heating system, these will benefit from regular servicing but this is not mandatory to maintain the standard product warranty from Kensa Heat Pumps. At the point of purchase, it might be possible to provide the homeowners with an option to purchase a servicing/maintenance plan if this is desired.

The internal heating distribution system will be designed to operate efficiently with a ground source heat pump. The current proposal is that the design temperatures will be 45 deg C flow and 40 deg C return. The heat emitters will be designed to provide sufficient heat to the rooms on the coldest day of the year to maintain comfortable internal temperatures at these water flow temperatures. This will all be designed in line with MCS requirements. The GSHP system is compatible with any suitable wet based heat emitter system e.g. underfloor heating, radiators, fan coil units, etc.

Hope the above is helpful. Let me know if anything is unclear or you need further information. Happy to attend a meeting with Camden Council to allay their fears if that would be of help.

Cheers
Stuart

On Mon, 27 Jan 2020 at 12:58, Sam Wallis | Envision <swallis@envisioneco.com> wrote:

> Stuart,
>
> Perfect – many thanks
>
> Sam Wallis BSc (Hons) M Arch Sc OCDEA
>
> Associate
>
> T: 02074860680
>
> M: 07787 212659
>
> envision
>
> Lower Ground Floor, 24 Charlotte Street, Fitzrovia, London, W1T 2ND
>
> Unit 2 Lodge Farm Business Centre, Castlethorpe, Milton Keynes, MK19 7ES
>
> Howbery Business Park, Benson Ln, Wallingford, OX10 8BA
>
> www.envisioneco.com
>
> ____

From: Stuart Gadsden <stuart.gadsden@kensaengineering.com>
Sent: 27 January 2020 12:57
To: Sam Wallis | Envision <swallis@envisioneco.com>
Subject: Re: 200122: Branch Hill House - GSHP Information

Hi Sam,

Hoping to send answers back this afternoon. Was out of the office all of last week and slowly catching up!

Cheers

Stuart

On Mon, 27 Jan 2020 at 12:53, Sam Wallis | Envision <swallis@envisioneco.com> wrote:

> Hi Stuart,
>
> Just wondering if you have had a chance to review below?
>
> Kind regards,
>
> Sam Wallis BSc (Hons) M Arch Sc OCDEA
>
> Associate
>
> T: 02074860680
>
> M: 07787 212659

Lower Ground Floor, 24 Charlotte Street, Fitzrovia, London, W1T 2ND

Unit 2 Lodge Farm Business Centre, Castlethorpe, Milton Keynes, MK19 7ES

Howbery Business Park, Benson Ln, Wallingford, OX10 8BA

www.envisioneco.com

____

From: Sam Wallis | Envision
Sent: 22 January 2020 14:12
To: Stuart Gadsden <stuart.gadsden@kensaengineering.com>
Subject: 200122: Branch Hill House - GSHP Information

Hi Stuart,

I hope you are well and a belated Happy New Year. The planning application for Branch Hill House was submitted prior to Christmas and we have received back the following queries from LB Camden in relation to the Kensa GSHP system. Hopefully you can assist where possible?

Further action: Can we request more information at this stage on the ground source heat pumps, demonstrating the commitment to feasibility, in particular:

- Outline system design showing system seasonal efficiencies, seasonal COP, and modelled heat provision matched against demand profile
- Evidence that industry quality assurance standards are proposed for the design and installation, e.g. the GSHPA Technical Standards for Vertical Boreholes
- Lifetime operation, maintenance and management plan

- Proposed apartment heat distribution systems - details of GSHP-compatible radiators or underfloor heating

Kind regards,

Sam Wallis BSc (Hons) M Arch Sc OCDEA

Associate

T: 02074860680

M: 07787 212659

envision

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Stuart Gadsden | Director of Sales - South East

0750 800 5541 | stuart.gadsden@thekensagroup.com | www.kensacontracting.com

Kensa Contracting Limited | Kensa House | Mount Wellington | Chacewater | Truro | TR4 8RJ

Kensa Contracting Limited No. 08166502 | Kensa Heat Pumps Limited No. 03739805 | The Kensa Group Limited No. 05367753
Registered in England | VAT Group No. 945676771

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APPENDIX V – SAP WORKSHEETS

DER WORKSHEET

Dwelling Reference: ESL - 23 - 0347 Coal House
Dwelling Type: New Dwelling Design Stage
N16 5HQ

1. Overall dwelling dimensions

	Area(m²)			Av. Height(m)			Volume(m³)	
Basement	71.8	(1a)	x	3.1	(2a)	=	222.58	(3a)
Ground Floor	46.9	(1b)	x	3.6	(2b)	=	168.84	(3b)
First Floor	40.9	(1c)	x	3.8	(2c)	=	155.42	(3c)
2nd Floor	33.8	(1d)	x	3.3	(2d)	=	111.54	(3d)
Total floor area TFA							193.4	(4)
Dwelling volume							658.38	(5)

2. Ventilation Rate

Chimneys/Flues	0	x	80	=	0	(6a)
Open chimneys	0	x	20	=	0	(6b)
Chimneys / flues attached to closed fire	0	x	10	=	0	(6c)
Flues attached to solid fuel boiler	0	x	20	=	0	(6d)
Flues attached to other heater	0	x	35	=	0	(6e)
Number of blocked chimneys	0	x	20	=	0	(6f)
Number of intermittent extract fans	0	x	10	=	0	(7a)
Number of passive vents	0	x	10	=	0	(7b)
Number of flueless gas fires	0	x	40	=	0	(7c)

Air changes per hour

Number of storeys in the dwelling (ns)	0	0	(8)
Infiltration due to chimneys, flues, fans, PSVs, etc	0	0	(9)
Additional infiltration	0	0	(10)
Structural infiltration	0	0	(11)
Suspended wooden ground floor	0	0	(12)
No draught lobby	0	0	(13)
Percentage of windows and doors draught proofed	0	0	(14)
Window infiltration	0	0	(15)
Infiltration rate	0	0	(16)
Air permeability value, AP50, (m³/h/m²)	3	3	(17)
Air permeability value, AP4, (m³/h/m²)	0	0	(17a)
Air permeability value)	0.15	0.15	(18)
Number of sides on which dwelling is sheltered	0	0	(19)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	
Shelter factor													1	(20)
Infiltration rate incorporating shelter factor													0.15	(21)
Infiltration rate modified for monthly wind speed														(22)
Monthly average wind speed from Table U2	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7	52.5	(22)
Wind Factor	1.28	1.25	1.23	1.1	1.08	0.95	0.95	0.93	1	1.08	1.13	1.18	13.13	(22a)
Adjusted infiltration rate (allowing for shelter and wind speed)	0.19	0.19	0.18	0.17	0.16	0.14	0.14	0.14	0.15	0.16	0.17	0.18	1.97	(22b)
Calculate effective air change rate for the applicable case:													0.5	(23a)
													0.5	(23b)
													68.8	(23c)
a) If balanced mechanical ventilation with heat recovery (MVHR)	0.35	0.34	0.34	0.32	0.32	0.3	0.3	0.29	0.31	0.32	0.32	0.33		(24a)
b) If balanced mechanical ventilation without heat recovery (MV)	0	0	0	0	0	0	0	0	0	0	0	0		(24b)
c) If whole house extract ventilation or positive input ventilation from outside	0	0	0	0	0	0	0	0	0	0	0	0		(24c)
d) If natural ventilation or whole house positive input ventilation from loft	0	0	0	0	0	0	0	0	0	0	0	0		(24d)
Effective air change rate	0.35	0.34	0.34	0.32	0.32	0.3	0.3	0.29	0.31	0.32	0.32	0.33		(25)
Effective air change rate from PCDB:	0.35	0.34	0.34	0.32	0.32	0.3	0.3	0.29	0.31	0.32	0.32	0.33		(25)

3. Heat losses and heat loss parameter

Items in the table below are to be expanded as necessary to allow for all different types of element e.g. 4 wall types. The k -value

ELEMENT	A X U (W/K)	A X k kJ/K	
Doors	2.4		(26)
Windows	43.63		(27)
Roof window	6.46		(27a)
Basement floor	7.18	1436	(28)
Ground floor	0	0	(28a)
Exposed floor	0	0	(28b)
Basement wall	15.72	22971	(29)
External wall	24.34	35573.7	(29a)

Roof	9.79		801	(30)
Total area of external elements ∑A, m²			518.47	(31)
Party Wall	0		0	(32)
Party floor			0	(32a)
Party ceiling			0	(32b)
Internal wall **			0	(33c)
Internal floor			0	(32d)
Internal ceiling floor			0	(32e)
Fabric heat loss, W/K = ∑ (A x U)			109.52	(33)
Heat capacity Cm = ∑(A x k)			60781.7	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K			100	(35)
Linear Thermal bridges: ∑ (L x Ψ) calculated using Appendix K			41.48	(36)
Point Thermal bridges: ∑χ (W/K) if significant point thermal bridge present and values available			41.48	(36a)
Total fabric heat loss H = ∑(A × U) + ∑(L × Ψ) +∑χ			150.99	(37)

Ventilation heat loss calculated monthly

75.45	74.63	73.82	69.74	68.93	64.85	64.85	64.04	66.48	68.93	70.56	72.19		(38)

Heat transfer coefficient, W/K

226.44	225.63	224.81	220.74	219.92	215.85	215.85	215.03	217.48	219.92	221.55	223.18		(39)

Heat loss parameter (HLP), W/m²K

1.17	1.17	1.16	1.14	1.14	1.12	1.12	1.11	1.12	1.14	1.15	1.15		(40)

Number of days in month (Table 1a)

31	28	31	30	31	30	31	31	30	31	30	31		(41)

4. Water heating energy requirement

Assumed occupancy, N	2.99	(42)

Hot water usage in litres per day for mixer showers, Vd,shower (from Appendix J)

74.41	73.29	71.66	68.54	66.24	63.68	62.22	63.83	65.61	68.36	71.55	74.12		(42a)

Hot water usage in litres per day for baths, Vd,bath (from Appendix J)

32.12	31.64	30.97	29.73	28.81	27.78	27.22	27.89	28.62	29.72	30.98	32.01		(42b)

Hot water usage in litres per day for other uses, Vd,other (from Appendix J)

45.28	43.64	41.99	40.34	38.7	37.05	37.05	38.7	40.34	41.99	43.64	45.28		(42c)

Annual average hot water usage in litres per day Vd,average (from Appendix J)	139.75	(43)

Hot water usage in litres per day for each month Vd,m = (42a) + (42b) + (42c)

151.81	148.57	144.62	138.62	133.75	128.51	126.49	130.42	134.57	140.07	146.17	151.42	1675.02	(44)

Energy content of hot water used = 4.18 x Vd,m x nm x DTm / 3600 kWh/month (from Appendix J)

240.44	211.56	222.28	189.77	180.05	158.01	152.98	161.49	165.94	190.07	208.24	237.09	2317.91	(45)

Distribution loss (46) = 0.15 x (45)

36.07	31.73	33.34	28.46	27.01	23.7	22.95	24.22	24.89	28.51	31.24	35.56		(46)

Storage volume (litres) including any solar or WWHRS storage within same vessel	305	(47)

Water storage loss (or HIU loss)

a) If manufacturer’s declared loss factor is known (kWh/day):	1.63	(48)
Temperature factor from Table 2b	0.6	(49)
Energy lost from water storage, kWh/day (48) x (49) =	0.98	(50)
b) If manufacturer’s declared loss factor is not known :		
Hot water storage loss factor from Table 2 (kWh/litre/day)	0	(51)
Volume factor from Table 2a	0	(52)
Temperature factor from Table 2b	0	(53)
Energy lost from water storage, kWh/day	0	(54)
Enter (50) or (54) in (55)	0.98	(55)

Water storage (or HIU) loss calculated for each month (56) = (55) × (41)

30.32	27.38	30.32	29.34	30.32	29.34	30.32	30.32	29.34	30.32	29.34	30.32		(56)

If the vessel contains dedicated solar storage or dedicated WWHRS storage,
(57)m = (56)m ⍰ [(47) – Vs] ÷ (47), else (57)m = (56)m
where Vs is Vww from Appendix G3 or (H12) from Appendix H (as applicable).

30.32	27.38	30.32	29.34	30.32	29.34	30.32	30.32	29.34	30.32	29.34	30.32		(57)

Primary circuit loss for each month from Table 3
modified by factor from Table H4 if there is solar water heating and a cylinder thermostat, although not for DHW-only heat networks)

54.55	49.27	54.55	52.79	54.55	36.09	37.3	37.3	36.09	54.55	52.79	54.55		(59)

Combi loss for each month from Table 3a, 3b or 3c (enter 0 if not a combi boiler)

0	0	0	0	0	0	0	0	0	0	0	0		(61)

Total heat required for water heating calculated for each month (62) = 0.85 × (45) + (46) + (57) + (59) + (61)

325.31	288.22	307.15	271.9	264.92	223.45	220.6	229.11	231.37	274.95	290.37	321.96	3249.3	(62)

CWWHRS DHW input calculated using Appendix G (negative quantity) (enter 0 if no WWHRS contribution to water heating)

0	0	0	0	0	0	0	0	0	0	0	0		(63a)

PV diverter DHW input calculated using Appendix G (negative quantity) (enter 0 if no PV diverter contribution)

0	0	0	0	0	0	0	0	0	0	0	0		(63b)

Solar DHW input calculated using Appendix H (negative quantity) (enter 0 if no solar contribution to water heating)

0	0	0	0	0	0	0	0	0	0	0	0		(63c)

FGHRS DHW input calculated using Appendix G (negative quantity) (enter 0 if no FGHRS contribution to water heating)

0	0	0	0	0	0	0	0	0	0	0	0		(63d)

Output from water heater for each month, kWh/month (64) = (62) + (63a) + (63b) + (63c) + (63d)

325.31	288.22	307.15	271.9	264.92	223.45	220.6	229.11	231.37	274.95	290.37	321.96	3249.3	(64)

Output from water heater for each month, kWh/month (64) = (62) + (63a) + (63b) + (63c) + (63d)

0	0	0	0	0	0	0	0	0	0	0	0		(64a)

Heat gains from water heating, kWh/month 0.25 x [0.85 × (45) + (61) + (64a)] + 0.8 x [(46) + (57) + (59)]

147.84	131.67	141.81	128.8	127.76	104.89	104.96	107.79	107.52	131.1	134.95	146.73		(65)

include (57) m in calculation of (65) m only if hot water store is in the dwelling or hot water is from heat network

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

Metabolic gains (Table 5), watts

149.67	149.67	149.67	149.67	149.67	149.67	149.67	149.67	149.67	149.67	149.67	149.67		(66)

Lighting gains (calculated in Appendix L, equation L12 or L12a), also see Table 5

183.96	203.67	183.96	190.1	183.96	190.1	183.96	183.96	190.1	183.96	190.1	183.96	(67)

Appliances gains (calculated in Appendix L, equation L16 or L16a), also see Table 5

364.73	368.51	358.98	338.67	313.04	288.95	272.86	269.08	278.61	298.92	324.55	348.64	(68)

Cooking gains (calculated in Appendix L, equation L18 or L18a), also see Table 5

37.97	37.97	37.97	37.97	37.97	37.97	37.97	37.97	37.97	37.97	37.97	37.97	(69)

Pumps and fans gains (Table 5a)

0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5

-119.73	-119.73	-119.73	-119.73	-119.73	-119.73	-119.73	-119.73	-119.73	-119.73	-119.73	-119.73	(71)

Water heating gains (Table 5)

198.71	195.94	190.6	178.89	171.72	145.68	141.07	144.88	149.34	176.21	187.43	197.22	(72)

Total internal gains

815.31	836.03	801.44	775.56	736.63	692.63	665.8	665.82	685.94	726.99	769.97	797.72	(73)

6. Solar gains

Solar gains in watts, calculated for each month

218.62	421.17	697.8	1055.23	1346.45	1406.54	1327.18	1100.92	821.04	499.03	270.93	181.12	(83)

Total gains – internal and solar (watts)

1033.93	1257.2	1499.24	1830.79	2083.08	2099.16	1992.98	1766.73	1506.99	1226.01	1040.9	978.83	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, ⍰1,m (see Table 9a)

0.97	0.96	0.92	0.84	0.72	0.56	0.44	0.5	0.72	0.9	0.96	0.98	(86)

Mean internal temperature in living area T1 (follow steps 3 and 4 in Table 9c)

19.83	18.97	19.41	19.99	20.45	20.73	20.83	20.8	20.56	19.94	19.24	19	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

19.94	19.95	19.95	19.97	19.97	19.99	19.99	19.99	19.98	19.97	19.96	19.96	(88)

Roof Utilisation factor for gains for rest of dwelling, ⍰2,m (see Table 9a)

0.97	0.95	0.91	0.82	0.67	0.5	0.35	0.41	0.66	0.88	0.95	0.97	(89)

Roof Mean internal temperature in the rest of dwelling T2

18.86	17.58	18.12	18.86	19.4	19.71	19.81	19.79	19.55	18.82	17.93	17.7	(90)

Living area fraction 0.19 (91)

Mean internal temperature (for the whole dwelling)

19.04	17.84	18.36	19.07	19.59	19.9	20	19.98	19.74	19.03	18.17	17.95	(92)

Adjusted mean internal temperature:

19.04	17.84	18.36	19.07	19.59	19.9	20	19.98	19.74	19.03	18.17	17.95	(93)

8. Space heating requirement

Utilisation factor for gains,														
	0.97	0.93	0.89	0.79	0.66	0.49	0.35	0.41	0.65	0.85	0.94	0.96		(94)
Useful gains, mGm , W														
	998.77	1172.07	1330.51	1451.82	1365.66	1028.25	699.71	719.97	975.46	1045.69	974.27	944.26		(95)
Monthly average external temperature from Table U1														
	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat loss rate for mean internal temperature														
	3338.18	2918.51	2666.75	2244.29	1735.81	1144.67	732.98	769.77	1225.6	1853.33	2452.47	3067.74		(97)
Space heating requirement for each month														
	1740.52	1173.6	994.17	570.58	275.4	0	0	0	0	600.89	1064.3	1579.87		(98a)
Solar space heating calculated using Appendix H (negative quantity)														
	0	0	0	0	0	0	0	0	0	0	0	0		(98b)
Space heating requirement for each month after solar contribution														
	1740.52	1173.6	994.17	570.58	275.4	0	0	0	0	600.89	1064.3	1579.87		(98c)
Space heating requirement in kWh/m²/year													41.36	(99)

8c. Space Cooling requirement

Heat loss rate,														
	0	0	0	0	0	0	0	0	0	0	0	0		(100)
Utilisation factor for loss														
	0	0	0	0	0	0	0	0	0	0	0	0		(101)
Useful loss, mLm (watts)														
	0	0	0	0	0	0	0	0	0	0	0	0		(102)
Gains														
	0	0	0	0	0	0	0	0	0	0	0	0		(103)
Space cooling requirement for month, whole dwelling, continuous (kWh)														(104)
	0	0	0	0	0	0	0	0	0	0	0	0		(104)
Cooled fraction													0	(105)
Intermittency factor														
	0	0	0	0	0	0	0	0	0	0	0	0		(106)
Space cooling requirement for month								0					0	
	0	0	0	0	0	0	0	0	0	0	0	0		(107)
Space cooling requirement in kWh/m²/year													0	(108)

8f. Space heating requirement

Fabric Energy Efficiency,		0	0	(109)

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

Fraction of space heat from secondary/supplementary system, 0 0 (201)

Fraction of space heat from main system(s), 1 (202)

Fraction of main heating from main system 2, 0 (203)

Fraction of total space heat from main system 1, 1 (204)

Fraction of total space heat from main system 2, 0 (205)

Efficiency of main space heating system 1 (in %), 327.78 (206)

Efficiency of main space heating system 2 (in %), 0 (207)

Efficiency of secondary/supplementary heating system, %, 0 (208)

Cooling System Seasonal Energy Efficiency Ratio, 0 0 (209)

Space heating requirement (calculated above),

0 0 0 0 0 0 0 0 0 0 0 0 (210)

Space heating fuel (main heating system 1), kWh/month 0 0

531 358.04 303.3 174.07 84.02 0 0 0 0 183.32 324.7 481.99 (211)

Space heating fuel (main heating system 2), kWh/month 0 0

0 0 0 0 0 0 0 0 0 0 0 0 (213)

Space heating fuel (secondary), kWh/month 0 0

0 0 0 0 0 0 0 0 0 0 0 0 (215)

Output from water heater), 0 280.73 (216)

Efficiency of water heater

280.73 280.73 280.73 280.73 280.73 280.73 280.73 280.73 280.73 280.73 280.73 280.73 (217)

Fuel for water heating

115.88 102.67 109.41 96.86 94.37 79.6 78.58 81.61 82.42 97.94 103.44 114.69 1157.47 (219)

Space Cooling

0 0 0 0 0 0 0 0 0 0 0 0 (221)

Annual totals kWh/year kWh/year

Space heating fuel used, main system 1 2440.43 (211)

Space heating fuel used, main system 2 0 (213)

Space heating fuel used, secondary 0 (215)

Water heating fuel used 1157.47 (219)

Electricity for instantaneous electric shower(s) 0 (64a)

Space cooling fuel used 0 (221)

Electricity for pumps, fans and electric keep-hot

Mechanical vent fans - balanced, extract or positive input from outside 0 0 1265.08 (230a)

warm air heating system fans 0 (230b)

Heating circulation pump or water pump within warm air heating unit 0 (230c)

Oil boiler auxiliary (oil pump, flue fan, etc; excludes circulation pump) 0 (230d)

Gas boiler auxiliary (flue fan, etc; excludes circulation pump) 0 (230e)

Maintaining electric keep-hot facility for gas combi boiler 0 (230f)

Pump for solar water heating 0 (230g)

Pump for storage WWHRS 0 (230h)

Total electricity for the above 1265.08 (231)

Electricity for lighting 287.05 (232)

Energy saving/generation technologies (Appendices M, N) - Energy used in dwelling

Electricity generated by PVs (Appendix M) (negative quantity)

0	0	0	0	0	0	0	0	0	0	0	0	0	(233a)

Electricity generated by wind turbines (Appendix M) (negative quantity)

0	0	0	0	0	0	0	0	0	0	0	0	0	(234a)

Electricity generated by hydro-electric generators

0	0	0	0	0	0	0	0	0	0	0	0	0	(235a)

Electricity used or net electricity generated by micro-CHP

0	0	0	0	0	0	0	0	0	0	0	0	0	(235c)

Energy saving/generation technologies (Appendices M, N) - Energy exported

Electricity generated by PVs (Appendix M) (negative quantity)

0	0	0	0	0	0	0	0	0	0	0	0	0	(233b)

Electricity generated by wind turbines (Appendix M) (negative quantity)

0	0	0	0	0	0	0	0	0	0	0	0	0	(234b)

Electricity generated by hydro-electric generators

0	0	0	0	0	0	0	0	0	0	0	0	0	(235b)

Electricity used or net electricity generated by micro-CHP

0	0	0	0	0	0	0	0	0	0	0	0	0	(235d)

Appendix Q items: annual energy

	Fuel	kWh/year		
Appendix Q, <item 1 description>				
energy saved			0	(236a)
energy used			0	(237a)
Total delivered energy for all uses			5150.03	

10a. Fuel costs – Individual heating systems including micro-CHP

Fuel required	kWh/year	Fuel price	Fuel cost £/year	
Space heating - main system 1 (electric off-peak tariff				
High-rate fraction (Table 12a, or Appendix F for electric CPSU)	0		402.43	(240a)
Low-rate fraction	0		402.43	(240b)
High-rate cost	0		0	(240c)
Low-rate cost	0		0	(240d)
Space heating - main system 1 cost (other fuel)	0		0	(240e)
Space heating - main system 2 (electric off-peak tariff				
High-rate fraction (Table 12a, or Appendix F for electric CPSU)	0		402.43	(241a)
Low-rate fraction	0		402.43	(241b)
High-rate cost	0		0	(241c)
Low-rate cost	0		0	(241d)
Space heating - main system 2 cost (other fuel)	0		0	(241e)
Space heating - secondary (electric off-peak tariff)				
High-rate fraction (Table 12a, or Appendix F for electric CPSU)	0		402.43	(242a)

Low-rate fraction	0		402.43	(242b)
High-rate cost	0		0	(242c)
Low-rate cost	0		0	(242d)
Space heating - secondary cost (other fuel)	0		0	(242e)
Water heating (electric off-peak tariff)				
High-rate fraction (Table 12a, or Appendix F for electric CPSU)	0		0	(243)
Low-rate fraction	0		0	(242b)
High-rate cost	0		0	(242c)
Low-rate cost	0		0	(242d)
Water heating cost (other fuel)	0		190.87	(247)
(for a DHW-only heat network use (342a) or (342b) instead of (247)				
Energy For instantaneous electric shower(s)	0		0	(247a)
Space cooling	0		0	(248)
Pumps, fans And electric keep-hot	0		208.61	(249)
Energy For lighting	0		47.33	(250)
Additional standing charges	0		0	(251)
Energy saving/generation technologies	0		0	(252)
Appendix Q, <item 1 description>	Fuel	kWh/year		
energy saved Or generated	0		0	(253)
energy used	0		0	(254)
Total energy cost	0		849.24	(255)
11a. SAP rating – Individual heating systems including micro-CHP				
Energy cost deflator	0		0	(256)
Energy cost factor (ECF)	0		0	(257)
SAP rating	0		0	(258)

11a. SAP rating – Individual heating systems including micro-CHP

Energy cost deflator	0.36	(256)
Energy cost factor (ECF)	1.28	(257)
SAP rating	79.21	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy KWh/year	Emission factor kg	Emissions kg CO2/year	
Space heating - main system 1			378.75	(261)
Space heating - main system 2			0	(262)
Space heating - secondary			0	(263)
Energy for water heating			163.47	(264)
Energy for instantaneous electric shower(s)			0	(264a)

Space and water heating			0	(265)
Space cooling			0	(266)
Electricity for pumps, fans and electric keep			175.48	(267)
Electricity for lighting			41.43	(268)
energy saved or generated	0		0	(269b)
Appendix Q items				
energy saved	0		0	
energy used	0		0	
energy saved	0		0	(270b)
energy used			0	(271b)
Total CO2, kg/year			759.13	(272)
Dwelling CO2 Emission Rate			3.93	(273)
EI rating			96	(274)

13a. Primary Energy – Individual heating systems including micro-CHP

	Energy KWh/year	Emission factor kg	Emissionsr kg CO2/year	
Space heating - main system 1			3842.56	(275)
Space heating - main system 2			0	(276)
Space heating - secondary			0	(277)
Energy for water heating			1761.94	(278)
Energy for instantaneous electric shower(s)			0	(278a)
Space and water heating			0	(279)
Space cooling			0	(280)
Electricity for pumps, fans and electric keep			1913.81	(281)
Electricity for lighting			440.29	(282)
energy saved or generated	0		0	
Appendix Q items				
energy saved	0		0	
energy used	0		0	
energy saved	0		0	(284b)
energy used			0	(285b)
Total PE, kWh/year			7958.59	(286)
Dwelling PE Rate			41.15	(287)

DER WORKSHEET

Dwelling Reference: ESL - 23 - 0347 Coal House
Dwelling Type: New Dwelling Design Stage
N16 5HQ

1. Overall dwelling dimensions

	Area(m²)			Av. Height(m)			Volume(m³)	
Basement	71.8	(1a)	x	3.1	(2a)	=	222.58	(3a)
Ground Floor	46.9	(1b)	x	3.6	(2b)	=	168.84	(3b)
First Floor	40.9	(1c)	x	3.8	(2c)	=	155.42	(3c)
2nd Floor	33.8	(1d)	x	3.3	(2d)	=	111.54	(3d)
Total floor area TFA							193.4	(4)
Dwelling volume							658.38	(5)

2. Ventilation Rate

Chimneys/Flues	0	x	80	=	0	(6a)
Open chimneys	0	x	20	=	0	(6b)
Chimneys / flues attached to closed fire	0	x	10	=	0	(6c)
Flues attached to solid fuel boiler	0	x	20	=	0	(6d)
Flues attached to other heater	0	x	35	=	0	(6e)
Number of blocked chimneys	0	x	20	=	0	(6f)
Number of intermittent extract fans	0	x	10	=	0	(7a)
Number of passive vents	0	x	10	=	0	(7b)
Number of flueless gas fires	0	x	40	=	0	(7c)

Air changes per hour

Number of storeys in the dwelling (ns)	0	0	(8)
Infiltration due to chimneys, flues, fans, PSVs, etc	0	0	(9)
Additional infiltration	0	0	(10)
Structural infiltration	0	0	(11)
Suspended wooden ground floor	0	0	(12)
No draught lobby	0	0	(13)
Percentage of windows and doors draught proofed	0	0	(14)
Window infiltration	0	0	(15)
Infiltration rate	0	0	(16)
Air permeability value, AP50, (m³/h/m²)	3	3	(17)
Air permeability value, AP4, (m³/h/m²)	0	0	(17a)
Air permeability value)	0.15	0.15	(18)
Number of sides on which dwelling is sheltered	0	0	(19)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	
Shelter factor													1	(20)
Infiltration rate incorporating shelter factor													0.15	(21)
Infiltration rate modified for monthly wind speed														(22)
Monthly average wind speed from Table U2	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7	52.5	(22)
Wind Factor	1.28	1.25	1.23	1.1	1.08	0.95	0.95	0.93	1	1.08	1.13	1.18	13.13	(22a)
Adjusted infiltration rate (allowing for shelter and wind speed)	0.19	0.19	0.18	0.17	0.16	0.14	0.14	0.14	0.15	0.16	0.17	0.18	1.97	(22b)
Calculate effective air change rate for the applicable case:													0.5	(23a)
													0.5	(23b)
													68.8	(23c)
a) If balanced mechanical ventilation with heat recovery (MVHR)	0.35	0.34	0.34	0.32	0.32	0.3	0.3	0.29	0.31	0.32	0.32	0.33		(24a)
b) If balanced mechanical ventilation without heat recovery (MV)	0	0	0	0	0	0	0	0	0	0	0	0		(24b)
c) If whole house extract ventilation or positive input ventilation from outside	0	0	0	0	0	0	0	0	0	0	0	0		(24c)
d) If natural ventilation or whole house positive input ventilation from loft	0	0	0	0	0	0	0	0	0	0	0	0		(24d)
Effective air change rate	0.35	0.34	0.34	0.32	0.32	0.3	0.3	0.29	0.31	0.32	0.32	0.33		(25)
Effective air change rate from PCDB:	0.35	0.34	0.34	0.32	0.32	0.3	0.3	0.29	0.31	0.32	0.32	0.33		(25)

3. Heat losses and heat loss parameter

Items in the table below are to be expanded as necessary to allow for all different types of element e.g. 4 wall types. The k -value

ELEMENT	A X U (W/K)	A X k kJ/K	
Doors	2.4		(26)
Windows	43.63		(27)
Roof window	6.46		(27a)
Basement floor	7.18	1436	(28)
Ground floor	0	0	(28a)
Exposed floor	0	0	(28b)
Basement wall	15.72	22971	(29)
External wall	24.34	35573.7	(29a)

Roof	9.79	801	(30)
Total area of external elements ∑A, m²		518.47	(31)
Party Wall	0	0	(32)
Party floor		0	(32a)
Party ceiling		0	(32b)
Internal wall **		0	(33c)
Internal floor		0	(32d)
Internal ceiling floor		0	(32e)
Fabric heat loss, W/K = ∑ (A x U)		109.52	(33)
Heat capacity Cm = ∑(A x k)		60781.7	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K		100	(35)
Linear Thermal bridges: ∑ (L x Ψ) calculated using Appendix K		41.48	(36)
Point Thermal bridges: ∑χ (W/K) if significant point thermal bridge present and values available		41.48	(36a)
Total fabric heat loss H = ∑(A × U) + ∑(L × Ψ) +∑χ		150.99	(37)

Ventilation heat loss calculated monthly

75.45	74.63	73.82	69.74	68.93	64.85	64.85	64.04	66.48	68.93	70.56	72.19		(38)

Heat transfer coefficient, W/K

226.44	225.63	224.81	220.74	219.92	215.85	215.85	215.03	217.48	219.92	221.55	223.18		(39)

Heat loss parameter (HLP), W/m²K

1.17	1.17	1.16	1.14	1.14	1.12	1.12	1.11	1.12	1.14	1.15	1.15		(40)

Number of days in month (Table 1a)

31	28	31	30	31	30	31	31	30	31	30	31		(41)

4. Water heating energy requirement

Assumed occupancy, N	2.99	(42)

Hot water usage in litres per day for mixer showers, Vd,shower (from Appendix J)

74.41	73.29	71.66	68.54	66.24	63.68	62.22	63.83	65.61	68.36	71.55	74.12		(42a)

Hot water usage in litres per day for baths, Vd,bath (from Appendix J)

32.12	31.64	30.97	29.73	28.81	27.78	27.22	27.89	28.62	29.72	30.98	32.01		(42b)

Hot water usage in litres per day for other uses, Vd,other (from Appendix J)

45.28	43.64	41.99	40.34	38.7	37.05	37.05	38.7	40.34	41.99	43.64	45.28		(42c)

Annual average hot water usage in litres per day Vd,average (from Appendix J)	139.75	(43)

Hot water usage in litres per day for each month Vd,m = (42a) + (42b) + (42c)

151.81	148.57	144.62	138.62	133.75	128.51	126.49	130.42	134.57	140.07	146.17	151.42	1675.02	(44)

Energy content of hot water used = 4.18 x Vd,m x nm x DTm / 3600 kWh/month (from Appendix J)

240.44	211.56	222.28	189.77	180.05	158.01	152.98	161.49	165.94	190.07	208.24	237.09	2317.91	(45)

Distribution loss (46) = 0.15 x (45)

36.07	31.73	33.34	28.46	27.01	23.7	22.95	24.22	24.89	28.51	31.24	35.56		(46)

Storage volume (litres) including any solar or WWHRS storage within same vessel	0	(47)

Water storage loss (or HIU loss)

a) If manufacturer's declared loss factor is known (kWh/day):	1.63	(48)
Temperature factor from Table 2b	0.6	(49)
Energy lost from water storage, kWh/day (48) x (49) =	0.98	(50)
b) If manufacturer's declared loss factor is not known :		
Hot water storage loss factor from Table 2 (kWh/litre/day)	0	(51)
Volume factor from Table 2a	0	(52)
Temperature factor from Table 2b	0	(53)
Energy lost from water storage, kWh/day	0	(54)
Enter (50) or (54) in (55)	0.98	(55)

Water storage (or HIU) loss calculated for each month (56) = (55) × (41)

30.32	27.38	30.32	29.34	30.32	29.34	30.32	30.32	29.34	30.32	29.34	30.32	(56)

If the vessel contains dedicated solar storage or dedicated WWHRS storage,
(57)m = (56)m □ [(47) – Vs] ÷ (47), else (57)m = (56)m
where Vs is Vww from Appendix G3 or (H12) from Appendix H (as applicable).

30.32	27.38	30.32	29.34	30.32	29.34	30.32	30.32	29.34	30.32	29.34	30.32	(57)

Primary circuit loss for each month from Table 3
modified by factor from Table H4 if there is solar water heating and a cylinder thermostat, although not for DHW-only heat networks)

54.55	49.27	54.55	52.79	54.55	36.09	37.3	37.3	36.09	54.55	52.79	54.55	(59)

Combi loss for each month from Table 3a, 3b or 3c (enter 0 if not a combi boiler)

0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62) = 0.85 × (45) + (46) + (57) + (59) + (61)

325.31	288.22	307.15	271.9	264.92	223.45	220.6	229.11	231.37	274.95	290.37	321.96	3249.3	(62)

CWWHRS DHW input calculated using Appendix G (negative quantity) (enter 0 if no WWHRS contribution to water heating)

0	0	0	0	0	0	0	0	0	0	0	0	(63a)

PV diverter DHW input calculated using Appendix G (negative quantity) (enter 0 if no PV diverter contribution)

0	0	0	0	0	0	0	0	0	0	0	0	(63b)

Solar DHW input calculated using Appendix H (negative quantity) (enter 0 if no solar contribution to water heating)

0	0	0	0	0	0	0	0	0	0	0	0	(63c)

FGHRS DHW input calculated using Appendix G (negative quantity) (enter 0 if no FGHRS contribution to water heating)

0	0	0	0	0	0	0	0	0	0	0	0	(63d)

Output from water heater for each month, kWh/month (64) = (62) + (63a) + (63b) + (63c) + (63d)

325.31	288.22	307.15	271.9	264.92	223.45	220.6	229.11	231.37	274.95	290.37	321.96	3249.3	(64)

Output from water heater for each month, kWh/month (64) = (62) + (63a) + (63b) + (63c) + (63d)

0	0	0	0	0	0	0	0	0	0	0	0	(64a)

Heat gains from water heating, kWh/month 0.25 x [0.85 × (45) + (61) + (64a)] + 0.8 x [(46) + (57) + (59)]

147.84	131.67	141.81	128.8	127.76	104.89	104.96	107.79	107.52	131.1	134.95	146.73	(65)

include (57) m in calculation of (65) m only if hot water store is in the dwelling or hot water is from heat network

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

Metabolic gains (Table 5), watts

149.67	149.67	149.67	149.67	149.67	149.67	149.67	149.67	149.67	149.67	149.67	149.67	(66)

Lighting gains (calculated in Appendix L, equation L12 or L12a), also see Table 5

183.96 203.67 183.96 190.1 183.96 190.1 183.96 183.96 190.1 183.96 190.1 183.96 (67)

Appliances gains (calculated in Appendix L, equation L16 or L16a), also see Table 5

364.73 368.51 358.98 338.67 313.04 288.95 272.86 269.08 278.61 298.92 324.55 348.64 (68)

Cooking gains (calculated in Appendix L, equation L18 or L18a), also see Table 5

37.97 37.97 37.97 37.97 37.97 37.97 37.97 37.97 37.97 37.97 37.97 37.97 (69)

Pumps and fans gains (Table 5a)

3 3 3 3 3 0 0 0 0 3 3 3 (70)

Losses e.g. evaporation (negative values) (Table 5

-119.73 -119.73 -119.73 -119.73 -119.73 -119.73 -119.73 -119.73 -119.73 -119.73 -119.73 -119.73 (71)

Water heating gains (Table 5)

198.71 195.94 190.6 178.89 171.72 145.68 141.07 144.88 149.34 176.21 187.43 197.22 (72)

Total internal gains

818.31 839.03 804.44 778.56 739.63 692.63 665.8 665.82 685.94 729.99 772.97 800.72 (73)

6. Solar gains

Solar gains in watts, calculated for each month

218.62 421.17 697.8 1055.23 1346.45 1406.54 1327.18 1100.92 821.04 499.03 270.93 181.12 (83)

Total gains – internal and solar (watts)

1036.93 1260.2 1502.24 1833.79 2086.08 2099.16 1992.98 1766.73 1506.99 1229.01 1043.9 981.83 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, □1,m (see Table 9a)

0.97 0.96 0.92 0.84 0.72 0.56 0.44 0.5 0.72 0.9 0.96 0.98 (86)

Mean internal temperature in living area T1 (follow steps 3 and 4 in Table 9c)

18.1 18.46 19.03 19.81 20.42 20.79 20.92 20.89 20.56 19.75 18.81 18.06 (87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

19.94 19.95 19.95 19.97 19.97 19.99 19.99 19.99 19.98 19.97 19.96 19.96 (88)

Roof Utilisation factor for gains for rest of dwelling, □2,m (see Table 9a)

0.97 0.95 0.91 0.82 0.67 0.5 0.35 0.41 0.66 0.88 0.95 0.97 (89)

Roof Mean internal temperature in the rest of dwelling T2

16.54 16.99 17.72 18.69 19.41 19.82 19.94 19.92 19.6 18.64 17.45 16.5 (90)

Living area fraction 0.19 (91)

Mean internal temperature (for the whole dwelling)

16.83 17.26 17.96 18.9 19.6 20 20.12 20.1 19.78 18.84 17.7 16.79 (92)

Adjusted mean internal temperature:

16.83 17.26 17.96 18.9 19.6 20 20.12 20.1 19.78 18.84 17.7 16.79 (93)

8. Space heating requirement

Utilisation factor for gains,

0.95 0.93 0.88 0.79 0.66 0.5 0.36 0.42 0.65 0.85 0.93 0.96 (94)

Useful gains, mGm , W

986.6 1166.35 1321.72 1443.45 1366.7 1043.04 723.35 740.83 980.14 1040.5 970.52 939.57 (95)

Monthly average external temperature from Table U1

4.3 4.9 6.5 8.9 11.7 14.6 16.6 16.4 14.1 10.6 7.1 4.2 (96)

Heat loss rate for mean internal temperature

2836.61 2789.47 2577.29 2206.66 1736.35 1165.8 760.79 796.03 1235.33 1812.72 2348.98 2809.54 (97)

Space heating requirement for each month

1376.41 1090.74 934.14 549.51 275.02 0 0 0 0 574.53 992.49 1391.26 (98a)

Solar space heating calculated using Appendix H (negative quantity)

0 0 0 0 0 0 0 0 0 0 0 0 (98b)

Space heating requirement for each month after solar contribution

1376.41 1090.74 934.14 549.51 275.02 0 0 0 0 574.53 992.49 1391.26 (98c)

Space heating requirement in kWh/m²/year 37.15 (99)

8c. Space Cooling requirement

Heat loss rate,

0 0 0 0 0 0 0 0 0 0 0 0 (100)

Utilisation factor for loss

0 0 0 0 0 0 0 0 0 0 0 0 (101)

Useful loss, mLm (watts)

0 0 0 0 0 0 0 0 0 0 0 0 (102)

Gains

0 0 0 0 0 0 0 0 0 0 0 0 (103)

Space cooling requirement for month, whole dwelling, continuous (kWh) (104)

0 0 0 0 0 0 0 0 0 0 0 0 (104)

Cooled fraction 0 (105)

Intermittency factor

0 0 0 0 0 0 0 0 0 0 0 0 (106)

Space cooling requirement for month 0 0

0 0 0 0 0 0 0 0 0 0 0 0 (107)

Space cooling requirement in kWh/m²/year 0 (108)

8f. Space heating requirement

Fabric Energy Efficiency, 0 0 (109)

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

Fraction of space heat from secondary/supplementary system,													0		0	(201)
Fraction of space heat from main system(s),															1	(202)
Fraction of main heating from main system 2,															0	(203)
Fraction of total space heat from main system 1,															1	(204)
Fraction of total space heat from main system 2,															0	(205)
Efficiency of main space heating system 1 (in %),															91.9	(206)
Efficiency of main space heating system 2 (in %),															0	(207)
Efficiency of secondary/supplementary heating system, %,															0	(208)
Cooling System Seasonal Energy Efficiency Ratio,													0		0	(209)
Space heating requirement (calculated above),																
	0	0	0	0	0	0	0	0	0	0	0	0				(210)
Space heating fuel (main heating system 1), kWh/month													0		0	
	1497.72	1186.87	1016.48	597.95	299.26	0	0	0	0	625.17	1079.96	1513.88				(211)
Space heating fuel (main heating system 2), kWh/month													0		0	
	0	0	0	0	0	0	0	0	0	0	0	0				(213)
Space heating fuel (secondary), kWh/month													0		0	
	0	0	0	0	0	0	0	0	0	0	0	0				(215)
Output from water heater),													0		81.8	(216)
Efficiency of water heater																
	89.78	89.59	89.18	88.29	86.65	81.8	81.8	81.8	81.8	88.37	89.4	89.82				(217)
Fuel for water heating																
	362.34	321.72	344.44	307.96	305.73	273.16	269.68	280.08	282.85	311.14	324.8	358.47			3742.35	(219)
Space Cooling																
	0	0	0	0	0	0	0	0	0	0	0	0				(221)
Annual totals													kWh/year	kWh/year		
Space heating fuel used, main system 1															7817.29	(211)
Space heating fuel used, main system 2															0	(213)
Space heating fuel used, secondary															0	(215)
Water heating fuel used															3742.35	(219)
Electricity for instantaneous electric shower(s)															0	(64a)
Space cooling fuel used															0	(221)
Electricity for pumps, fans and electric keep-hot																
Mechanical vent fans - balanced, extract or positive input from outside													0	0	1265.08	(230a)
warm air heating system fans															0	(230b)
Heating circulation pump or water pump within warm air heating unit															41	(230c)
Oil boiler auxiliary (oil pump, flue fan, etc; excludes circulation pump)															0	(230d)
Gas boiler auxiliary (flue fan, etc; excludes circulation pump)															45	(230e)
Maintaining electric keep-hot facility for gas combi boiler															0	(230f)
Pump for solar water heating															0	(230g)
Pump for storage WWHRS															0	(230h)
Total electricity for the above															1351.08	(231)
Electricity for lighting															287.05	(232)

Energy saving/generation technologies (Appendices M, N) - Energy used in dwelling													
Electricity generated by PVs (Appendix M) (negative quantity)													
0	0	0	0	0	0	0	0	0	0	0	0	0	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
0	0	0	0	0	0	0	0	0	0	0	0	0	(234a)
Electricity generated by hydro-electric generators													
0	0	0	0	0	0	0	0	0	0	0	0	0	(235a)
Electricity used or net electricity generated by micro-CHP													
0	0	0	0	0	0	0	0	0	0	0	0	0	(235c)
Energy saving/generation technologies (Appendices M, N) - Energy exported													
Electricity generated by PVs (Appendix M) (negative quantity)													
0	0	0	0	0	0	0	0	0	0	0	0	0	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
0	0	0	0	0	0	0	0	0	0	0	0	0	(234b)
Electricity generated by hydro-electric generators													
0	0	0	0	0	0	0	0	0	0	0	0	0	(235b)
Electricity used or net electricity generated by micro-CHP													
0	0	0	0	0	0	0	0	0	0	0	0	0	(235d)

	Fuel	kWh/year		
Appendix Q items: annual energy				
Appendix Q, <item 1 description>				
energy saved			0	(236a)
energy used			0	(237a)
Total delivered energy for all uses			13197.77	

10a. Fuel costs – Individual heating systems including micro-CHP

Fuel required	kWh/year	Fuel price	Fuel cost £/year	
Space heating - main system 1 (electric off-peak tariff				
High-rate fraction (Table 12a, or Appendix F for electric CPSU)	0		284.55	(240a)
Low-rate fraction	0		284.55	(240b)
High-rate cost	0		0	(240c)
Low-rate cost	0		0	(240d)
Space heating - main system 1 cost (other fuel)	0		0	(240e)
Space heating - main system 2 (electric off-peak tariff				
High-rate fraction (Table 12a, or Appendix F for electric CPSU)	0		284.55	(241a)
Low-rate fraction	0		284.55	(241b)
High-rate cost	0		0	(241c)
Low-rate cost	0		0	(241d)
Space heating - main system 2 cost (other fuel)	0		0	(241e)
Space heating - secondary (electric off-peak tariff)				
High-rate fraction (Table 12a, or Appendix F for electric CPSU)	0		284.55	(242a)

Low-rate fraction	0		284.55	(242b)
High-rate cost	0		0	(242c)
Low-rate cost	0		0	(242d)
Space heating - secondary cost (other fuel)	0		0	(242e)
Water heating (electric off-peak tariff)				
High-rate fraction (Table 12a, or Appendix F for electric CPSU)	0		0	(243)
Low-rate fraction	0		0	(242b)
High-rate cost	0		0	(242c)
Low-rate cost	0		0	(242d)
Water heating cost (other fuel)	0		136.22	(247)
(for a DHW-only heat network use (342a) or (342b) instead of (247)				
Energy For instantaneous electric shower(s)	0		0	(247a)
Space cooling	0		0	(248)
Pumps, fans And electric keep-hot	0		222.79	(249)
Energy For lighting	0		47.33	(250)
Additional standing charges	0		92	(251)
Energy saving/generation technologies	0		0	(252)
Appendix Q, <item 1 description>	Fuel	kWh/year		
energy saved Or generated	0		0	(253)
energy used	0		0	(254)
Total energy cost	0		782.9	(255)
11a. SAP rating – Individual heating systems including micro-CHP				
Energy cost deflator	0		0	(256)
Energy cost factor (ECF)	0		0	(257)
SAP rating	0		0	(258)

11a. SAP rating – Individual heating systems including micro-CHP

Energy cost deflator	0.36	(256)
Energy cost factor (ECF)	1.18	(257)
SAP rating	80.84	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy KWh/year	Emission factor kg	Emissions kg CO2/year	
Space heating - main system 1			1641.63	(261)
Space heating - main system 2			0	(262)
Space heating - secondary			0	(263)
Energy for water heating			785.89	(264)
Energy for instantaneous electric shower(s)			0	(264a)

Space and water heating			2427.52	(265)
Space cooling			0	(266)
Electricity for pumps, fans and electric keep			187.41	(267)
Electricity for lighting			41.43	(268)
energy saved or generated	0		0	(269b)
Appendix Q items				
energy saved	0		0	
energy used	0		0	
energy saved	0		0	(270b)
energy used			0	(271b)
Total CO2, kg/year			2656.37	(272)
Dwelling CO2 Emission Rate			13.74	(273)
EI rating			85	(274)

13a. Primary Energy – Individual heating systems including micro-CHP

	Energy KWh/year	Emission factor kg	Emissionsr kg CO2/year	
Space heating - main system 1			8833.54	(275)
Space heating - main system 2			0	(276)
Space heating - secondary			0	(277)
Energy for water heating			4228.86	(278)
Energy for instantaneous electric shower(s)			0	(278a)
Space and water heating			13062.39	(279)
Space cooling			0	(280)
Electricity for pumps, fans and electric keep			2043.91	(281)
Electricity for lighting			440.29	(282)
energy saved or generated	0		0	
Appendix Q items				
energy saved	0		0	
energy used	0		0	
energy saved	0		0	(284b)
energy used			0	(285b)
Total PE, kWh/year			15546.59	(286)
Dwelling PE Rate			80.39	(287)