Sustainability & Energy Statement

Land at Carpenders Park Farm, Oxhey Lane, Watford

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Executive Summary

This Sustainability and Energy Statement has been prepared in support of an outline planning application for the construction of up to 257 dwellings (including a Children's Home) and a 'housing with care' building with all matters reserved except for vehicular access on land at Carpenders Park Farm, Oxhey Lane, Watford.

The Statement includes an energy demand assessment showing which selected energy efficiency, low-carbon and renewable energy measures have been considered and those, could be incorporated into the development.

For the purposes of estimating carbon emissions from the homes and housing with care building an indicative accommodation schedule has been assumed and by using an indicative construction specification the carbon emissions from the site can be estimated. The Statement demonstrates how the buildings will significantly exceed the requirements of the Building Regulations Part L (2021) and the objectives of the planning policy.

The carbon emissions have been estimated by using SAP calculations prepared for homes of a similar scale, design and specification to those proposed. The results have been aggregated across similar unit types to provide an accurate assessment of the total site emissions. A BRUKL calculation for a similar building to the housing with care unit has been used to estimate the emissions from this building.

The calculations have been based on the installation of exhaust air heat pumps to the apartments and maisonettes and air source heat pumps to the houses and the housing with care building.

All space heating and hot water will be provided to the buildings from renewable technologies and there will be no NO_x or CO_2 directly from the homes or housing with care building.

The Summary SAP Reports for the modelled homes are attached as Appendix 1.

The total reduction in site carbon dioxide emissions from energy efficiency measures and low-carbon and renewable technologies can be summarised as follows;

	Total Emissions	% Reduction
	kg CO_2 per year	
Baseline (Building Regulations TER)	297,838	
Be Green - after energy efficiency and Heat Pumps (DER)	156,748	**47.37%**

The water efficiency measures incorporated within the homes will ensure the water use is less than 110 litres per person per day and achieves the enhanced standard required by the Building Regulations (includes 5 l/p/d for external water use).

The key sustainability findings can be summarised as;

- Reduction in carbon dioxide emissions compared to the maximum permissible by the Building Regulations (Part L - 2021) through energy efficiency measures;
- A total reduction in (TER) carbon dioxide emissions of at least 45% from energy efficiency, low-carbon and renewable technologies will be achieved (based on Part L – 2021);
- The water use to each residential unit will achieve a standard of 110 litres per person per day;
- The affordable homes will be designed to be indistinguishable from other homes;
- Outdoor space in the form of private gardens and private communal spaces as well as enhanced public open space;
- High standards of environmental construction with compliance to the Considerate Constructors Scheme, a Site Waste Management Plan and other construction management principles;
- Secured by Design principles will be followed;
- All dwellings will be built in accordance with Part M4(1) of the Building Regulations.

1.0 Introduction

This report has been commissioned by the Burlington Property Group and provides a Sustainability and Energy Statement in support of an outline planning application for the construction of up to 257 dwellings (including a Children's Home) and a 'housing with care' building with all matters reserved except for vehicular access on land at Carpenders Park Farm, Oxhey Lane, Watford.

The Statement describes the methodology used in assessing the buildings and the initiatives proposed.

The homes and housing with care building will be designed and constructed to reduce energy demand and carbon dioxide emissions.

The objective has been to reduce the energy demand to an economic minimum by making investments in the parts of the buildings that have the greatest impact on energy demand and are the most difficult and costly to change in the future, namely the building fabric.

Once cost-effective structures have been designed, low-carbon and renewable technologies have been considered to provide heat and/or electricity.

The following hierarchy has been followed:

- Lean reduce demand and consumption
- Clean increase energy efficiency
- Green provide low carbon renewable energy sources

The report has been prepared by Ivan Ball of Bluesky Unlimited who are sustainability consultants.

2.0 Planning Policy Context

National Policy

The UK Government published its sustainable development strategy in 1999 entitled "A better quality of life: A strategy for sustainable development in the UK". This sets out four main objectives for sustainable development in the UK:

- Social progress that recognises the needs of everyone.
- Effective protection of the environment.
- Prudent use of natural resources.
- Maintenance of high stable levels of economic growth and employment.

Sustainable Communities: Building for the Future, known colloquially as the Communities Plan was published in 2003. The Plan sets out a long-term programme of action for delivering sustainable communities in both urban and rural areas. It aims to tackle housing supply issues in parts of the country, low demand in other parts and the quality of our public spaces. The Communities Plan describes sustainable communities as: Active, inclusive and safe, well run, environmentally sensitive, well designed and built, well connected, thriving, well served and fair for everyone.

The most relevant national planning policy guidance on sustainability is set out in:

- National Planning Policy Framework – December 2024

Paragraph 161 states;

'The planning system should support the transition to net zero by 2050 and take full account of all climate impacts including overheating, water scarcity, storm and flood risks and coastal change. It should help to: shape places in ways that contribute to radical reductions in greenhouse gas emissions, minimise vulnerability and improve resilience; encourage the reuse of existing resources, including the conversion of existing buildings; and support renewable and low carbon energy and associated infrastructure.'

Local Policy

The Three Rivers Core Strategy (2011) and the **Development Management Policies LDD (2013)** provides the policy framework for the site.

Of particular relevance to this Statement are the following policies, which have been edited for clarity:

Three Rivers District Council Core Strategy

CP1 – Overarching Policy on Sustainable Development

All development in Three Rivers will contribute to the sustainability of the District. This means taking into account the need to:

a) Tackle climate change by reducing carbon emissions, increasing energy and water efficiency of buildings, promoting the use of renewable energy systems, and using other natural resources wisely, including through the use of sustainable building materials
b) Avoid development in areas at risk from flooding
c) Minimising flood risk through the use of Sustainable Drainage Systems
d) Make efficient use of land by guiding development onto previously developed, brownfield land and incorporate mixed-use development wherever possible, recognising that some previously developed land can have significant biodiversity value
e) Reduce waste going to landfill by reducing materials used, reusing and recycling building materials and providing opportunities for recycling wherever possible
f) Protect and enhance our natural, built and historic environments from inappropriate development and improve the diversity of wildlife and habitats
g) Build mixed and sustainable communities by providing housing across a range of tenures and types including affordable housing
h) Maintain high levels of employment by attracting jobs and training opportunities for local people
i) Improve access to jobs, skills, services and facilities particularly within areas of deprivation in the District
j) Sustain the viability and vitality of the Principal Town, Key and Secondary Centres and Villages as identified in the Three Rivers Settlement Hierarchy
k) Protect and enhance existing community, leisure and cultural facilities and provide new facilities
l) Reduce the need to travel by locating development in accessible locations and promoting a range of sustainable travel modes
m) Provide necessary infrastructure to enable and/ or support development, including (but not limited to) transport, education, health, green infrastructure, utilities, waste facilities, waste water, leisure, cultural and community facilities
n) Promote buildings and public spaces of a high enduring design quality that respects local distinctiveness, is accessible to all and reduces opportunities for crime and anti-social behaviour
o) Manage and reduce risk of and from pollution in relation to quality of land, air and water and dealing with land contamination.

Requirements for Applicants *

Applications for all new residential development of one unit and above and for all new commercial development will be required to submit a 'CPLAN Energy and Sustainability Statement' demonstrating the extent to which sustainability principles have been incorporated into the location, design, construction and future use of proposals, and the expected carbon emissions.

Development Management Policies Local Development Document

DM4 – Carbon Dioxide Emissions and On-Site Renewable Energy

a) *From 2013, applicants will be required to demonstrate that development will produce 5% less carbon dioxide emissions than Building Regulations Part L requirements (2013) having regard to feasibility and viability. This may be achieved through a combination of energy efficiency measures, incorporation of on-site low carbon and renewable technologies, connection to a local, decentralised, renewable or low carbon energy supply.*

b) *From 2016, applications for new residential development will be required to demonstrate that the development will meet a zero carbon standard (as defined by central government). The same standard will be applied for non domestic buildings from 2019.*

c) *In line with Government policy, the Council will support a range of allowable solutions for dealing with the remaining carbon emissions. This may include payment into a Carbon Offset Fund which will be used to retrofit existing building stock with energy saving measures for the future. The approach will be set out in a further SPD.*

* The Council have confirmed; "The CPLAN Energy Statement and Sustainability Checklist will not be available from 21 March 2016. From this date applicants will be required to submit an Energy Statement demonstrating the extent to which their proposals meet the requirements of Policy DM4 of the Development Management Policies LDD. This policy sets out that developments must produce at least 5% less carbon dioxide emissions than Building Regulations Part L (2013) requirements having regard to feasibility and viability."

The Council have commenced work on their new **Local Plan** but this is at an early stage and there are currently no emerging policies to consider in the preparation of this Sustainability and Energy Statement.

3.0 Assessment Methodology and Targets

3.1 Methodology

The energy strategy uses a number of SAP calculations that have been prepared for other homes, which are similar to those proposed in scale, design and specification.

The results have been aggregated across similar unit types using the indicative accommodation schedule in order to estimate the total site emissions and allow different low-carbon and renewable technologies to be tested.

The emissions from the housing with care building have been estimated by using a BRUKL calculation prepared for a home of a similar design, scale and specification.

Emission Factors

The CO_2 emission factors, where applicable, used throughout this report have been taken from the Building Regulation Approved Document L - 2021.

	kg CO_2/kWh
Natural gas	0.210
Grid supplied and displaced electricity	0.136

3.2 Targets

The following targets have been crafted to enable compliance with current Building Regulations as well as National and Local planning policy.

Description of Target	Target/Scope
Climate Change	
Ensure that peak run off rates are no greater for the developed site than it was for the pre-development site.	Whole Site
In appropriate areas the use of porous surfaces and minimal hard ground surfaces will be implemented. All additional surface water generated will be attenuated and treated using SuDS prior to discharge.	Whole Site

Details are provided in the FRA and Surface Water Drainage Strategy, which accompanies the application.

Description of Target	Target/ Scope
Community	
All new units will be built in accordance with Part M4(1) of the Building Regulations.	All dwellings
Secured by Design principles will be followed. This will involve consultation with the Architectural Liaison Officer/ Crime Prevention Officer at the detailed design stage.	Whole Site

Description of Target	Target/ Scope
Transport and Movement	
Information will be provided in Home Owners Guide, giving details of frequency and location of public transport services.	Whole site
All dwellings will be provided with cycle storage.	Whole Site
All dwellings will be provided with access to an EV charging point.	Whole Site
A Travel Plan will be developed which will be used to promote and encourage sustainable forms of transport.	Whole Site

Details are provided in the Transport Assessment, which accompanies the application.

Description of Target	Target/ Scope
Ecology and Landscaping	
Any significant ecological features shall be retained and protected in line with the requirements of BS5837.	Whole site

Description of Target	Target/ Scope
Ecology and Landscaping	
A suitably qualified ecologist has been appointed to provide recommendations for ecological enhancement and these will be included in the landscaping design.	Whole site
A suitably qualified ecologist will be appointed to confirm that applicable legislation is being followed and to prepare a long-term management plan for the site.	Whole site
The overall level of biodiversity within the boundaries of the project shall be greater after the project is completed than was assessed by the ecologist before the project commenced.	Whole site

Details are provided in the Ecology Assessment, which accompanies the application.

Description of Target	Target/ Scope
Resources	
All materials in new buildings will be A+, A or B rated according to The Green Guide to Specification, unless deemed impractical or otherwise prescribed.	Whole Site
All timber for basic elements will be obtained from appropriately certified legal sources. In addition, 80% of building element timber will be procured from sustainably certified forests.	Whole Site
All kitchens will be fitted with internal recycling bins and dedicated external space (s) will be provided for recyclable storage accessible to all potential users.	Whole Site

Description of Target	Target/ Scope
Buildings	
Carbon dioxide emissions will be reduced by at least 45% through energy efficiency, low-carbon and renewable technologies.	Whole Site
All heating will be provided by renewable technologies and there will be no NO_x or CO_2 emissions from the site.	Whole Site
Photovoltaic panels will be considered to selected units, which will not detrimentally impact on the aesthetics of the proposed development. This will be determined at the detailed drawing stage.	Selected dwellings
EU Labelling Information for white goods will be provided to all dwellings and where white goods are to be provided, they will be energy efficient.	All dwellings
100% of domestic fixed internal lighting is to be energy efficient.	All dwellings
The completed building fabric is to achieve air leakage rates of no greater than 4.0 $m^3/hr/m^2$ for the homes.	4.0 $m^3/hr/m^2$ for all dwellings
Sanitary fittings will be selected that minimise the consumption of mains water and all dwellings will achieve a water efficiency target of 110 l/p/d.	All dwellings to use less than 110 l/p/d

Description of Target	Target/ Scope
Construction Process and Site Management	
The scheme is to be registered with the Considerate Constructors Scheme and formal certification achieved. A score of 24 or more points (minimum of at least 5 in each section) will be achieved in the CCS independent site monitor's audit.	CCS score of 24 (Min) across whole site
Waste arising from site will be monitored and segregated into at least five waste streams for recycling throughout the construction period.	Construction Site
All temporary timber (site hoardings, formwork, and scaffold boards) will be from FSC, CSA, SFI or PEFC sources, or re-used timber.	Construction Site

4.0 Proposal

The planning application seeks outline consent and detailed design has not been completed for the unit types.

However, for the purposes for this Statement it has been assumed that the dwellings will be comprised of 1 and 2-bedroom apartments and maisonettes and 2, 3, 4 and 5-bedroom terrace, semi-detached and detached houses.

The energy strategy has been based upon the following indicative mix of accommodation:

Unit Type	Number	Area	Area
		m^2	m^2
Residential Accommodation			
1-Bedroom Apartments	16	53.4	854.4
1-Bedroom Maisonette Apartments	26	53.8	1,398.8
2-Bedroom Apartments	48	62.2	2,985.6
2-Bedroom Terrace and Semi-detached houses	10	76.5	765.0
3-Bedroom Terrace and Semi-detached houses	46	83.2	3,827.2
3-Bedroom Terrace and Semi-detached houses	36	88.3	3,178.8
3-Bedroom Detached houses	30	99.9	2,997.0
4-Bedroom Children's Home	1	106.0	106.0
4-Bedroom Detached house	1	106.0	106.0
4-Bedroom Detached houses	22	112.5	2,475.0
4-Bedroom Detached houses	15	144.3	2,164.5
5-Bedroom Detached houses	6	188.6	1,131.6
Sub-total	257		21,989.9
Non-Residential Accommodation			
Housing with Care	1	5,976.0	5,976.0
Sub-total			5,976.0
Total			**27,965.9**

5.0 Energy Efficiency

5.1 Demand Reduction (Be Lean and Be Clean)

Design

The energy performance of a building is affected by its design, construction and use and whilst occupant behaviour is beyond the remit of this statement, better design and construction methods can significantly reduce the life cycle emissions of a building and assist the occupant to reduce consumption.

Sustainable design is not just about incorporating renewable technologies; buildings should be designed at the outset to provide suitable environmental conditions for the occupants whilst also consuming as little energy as practical.

Passive Design Measures

The passive design measures proposed include;

(i) Passive Solar Gain

Passive measures include allowing for natural ventilation and exposed thermal mass coupled with high levels of insulation, air tightness and the control of solar gain.

The application is for outline consent and the arrangement of the dwellings and the housing with care building has not yet been determined.

However, the Illustrative Masterplan seeks to set out the majority of homes with either a southeast/northwest or northeast/southwest orientation. The design will seek to minimise the number of homes with a solely northerly aspect and maximise the homes with an orientation from southwest through to southeast.

(ii) Natural Daylighting

Whilst the building specifications have yet to be agreed the design of the site will seek to maximise the standard of natural daylighting to all units. This will create a high-quality internal environment, which will reduce the need for artificial lighting.

(iii) Efficient Building Fabric

a. Building Envelope

U-values of the building envelope must meet Building Regulations Part L (2021) standards and further improvements to U-values will reduce the building's heating requirements.

The construction type is currently unknown but the development is equally suited to a traditional load bearing brick and block construction or a timber-framed or other system build technique.

For the purposes of this Statement the following U-values have been assumed for the building elements as the maximum;

Element	Part L Limiting U-values	Proposed U-values	Proposed Improvement
	W/m²K	W/m²K	
Ground Floors	**0.18**	**0.13**	**28%**
External Walls	**0.26**	**0.18**	**31%**
Roofs (cold)	**0.16**	**0.10**	**38%**
Flat Roofs, Sloping Roofs & Dormers	**0.16**	**0.15**	**6%**
Windows, Glazed Doors and Roof Windows	**1.60**	**1.40**	**13%**
External Doors	**1.60**	**1.20**	**25%**

'g' Value for Glazing	**0.55**

b. Air Leakage

Large amounts of heat are lost in winter through air leakage from a building (also referred to as infiltration or air permeability) often through poor sealing of joints and openings in the building.

The Building Regulations set a minimum standard for air permeability of 8 m^3 of air per hour per m^2 of envelope area, at 50Pa. The SAP modelling has been based on achieving a 63% improvement over Building Regulations and will target a permeability of 4.0 $m^3/hr/m^2$ for the homes. The BRUKL calculation has been based on an air permeability of 5.0 $m^3/hr/m^2$ for the housing with care building.

c. Thermal Bridging

The significance of Thermal Bridging, as a potentially major source of fabric heat losses, is increasingly understood. Improving the U-values for the main building fabric without accurately addressing the Thermal Bridging is no longer an option and will not achieve the fabric energy efficiency and energy and CO_2 reduction targets set out in this strategy.

The thermal details for the buildings will be modelled at the detailed working drawing stage but for the purposes of this assessment the thermal details formulated by the Recognised Construction Details have been used. Any details not available on the RCD website will be modelled. These will enable the buildings to achieve the higher energy efficiency requirements of the Building Regulations.

The following table provides the values currently used within the modelled SAP calculations.

Reference	Location	PSI Value
		W/mK
E2	Other Lintels (including other steel lintels)	0.028
E3	Sill	0.024
E4	Jamb	0.019
E5	Ground Floor (Normal)	0.046
E6	Intermediate Floor	0.000
E7	Party Floor	0.036
E10	Eaves (Ceiling)	0.051
E12	Gable (Ceiling)	0.029
E16	Corner (normal)	0.037
E17	Corner (inverted)	-0.079
E18	Party Wall	0.041

d. Ventilation

As a result of increasing thermal efficiency and air tightness, Building Regulations Approved Document F was also revised in 2021 to address the possibility of overheating and poor air quality. The ventilation to the En-Suites and Bathrooms will be comprised of continuous extract ventilation as per System 3 criteria. This will reduce the number of external penetrations required to the building envelope.

Active Design Measures will include;

(i) **Efficient Lighting and Controls**

Throughout the scheme natural lighting will be optimised.

Part L of the Building Regulations requires all light fitting to have lamps with a minimum luminous efficacy of 80 light source lumens per circuit-watt. It is assumed this standard will be achieved.

(ii) **Space Heating and Hot Water**

The SAP modelling has been based upon the installation of exhaust air heat pumps to the apartments (including the maisonette apartments) and air source heat pumps to the houses and the housing with care building.

5.2 Low-Carbon and Renewable Technologies (Be Clean and Be Green)

The carbon dioxide emissions established above have been used to test the viability of various renewable and low-carbon technologies as follows.

The Government's Renewable Obligation defines renewable energy in the UK. The identified technologies are;

- Small hydro-electric
- Landfill and sewage gas
- Onshore and offshore wind
- Biomass
- Tidal and wave power
- Geothermal power
- Solar

The use of landfill or sewage gas, offshore wind or any form of hydroelectric power is not suitable for the site due to its location. The remaining technologies are considered below;

Wind

Wind turbines are available in various sizes from large rotors able to supply whole communities to small roof or wall-mounted units for individual dwellings.

The Government wind speed database predicts local wind speeds at Carpenders Park Farm to be 5.0 m/s at 10m above ground level and 5.7 m/s at 25m above ground level. This is below the level generally required for commercial investment in large wind turbines. In addition the land take, potential for noise and signal interference make a large wind turbine unsuitable for this development.

Roof mounted turbines could be used at the development to generate small but valuable amounts of renewable electricity but the small output and contribution to total emissions means any investment would be small and purely tokenism. The use of wind turbines will also have a detrimental aesthetic impact on the appearance of the development.

The use of wind turbines is not proposed.

Combined Heat and Power and Community Heating

Combined heat and power (CHP) also called co-generation is a de-centralised method of producing electricity from a fuel and 'capturing' the heat generated for use in buildings. The plant is essentially a small-scale electrical power station. The production and transportation of electricity via the National Grid is very inefficient with over 65% of the energy produced at the power station being lost to the atmosphere and through transportation.

CHP units are generally gas fuelled and generate electricity with heat being a by-product. The heat is usually used to meet the hot water load, which is fairly consistent throughout the year.

Historically CO_2 savings have been achieved because gas has been used to generate electricity and gas has had a lower emissions factor than electricity, However, with the de-carbonisation of the electricity grid the benefit of CHP is negated.

CHP is not proposed.

Ground Source Heat Pumps

Sub soil temperatures are reasonably constant and predictable in the UK, providing a store of the sun's energy throughout the year. Below London the groundwater in the lower London aquifer is at a fairly constant temperature of 12° C. Ground source heat pumps (GSHP) extract this low-grade heat and convert it to usable heat for space heating.

GSHP operates on a similar principle to refrigerators, transferring heat from a cool place to a warmer place. They operate most efficiently when providing space heating at a low temperature, typically via under floor heating or with low temperature radiators.

The houses and housing for care building are unlikely to have insufficient ground area to sustain a horizontal collection system and the installations would require a bore hole to each house. This would be cost prohibitive and therefore the use of ground source heat pumps is not proposed. The installation of GSHP to apartment applications is not appropriate.

Solar

(i) Solar Water Heating

Solar hot water panels use the suns energy to directly heat water circulating through panels or pipes. The technology is simple and easily understood by purchasers.

Solar hot water heating panels are based generally around two types, which are available being 'flat plate collectors' and 'evacuated tubes'. Flat plate collectors can achieve an output of up to 1,124 kWh/annum (Schuco) and evacuated tubes can achieve outputs up to 1,365 kWh/annum (Riomay).

Panels are traditionally roof mounted and for highest efficiencies should be mounted plus or minus 30 degrees of due south. Evacuated tubes can be laid horizontally on flat roofs but flat plate collectors are recommended for installation at an incline of 30 degrees.

The installation of exhaust air heat pumps and air source heat pumps reduces the emissions significantly and the installation of solar hot water heating panels would only increase the emissions reduction by a further 5-7%. Solar hot water panels could be used to reduce emissions but the incremental increase in reductions does not represent good value when compared with other technologies.

Solar hot water heating panels are not proposed.

(ii) Photovoltaics

Photovoltaic panels (PV) provide clean silent electricity. They generate electricity during most daylight conditions although they are most efficient when exposed to direct sunlight or are orientated to face plus or minus 30 degrees of due south.

PV panels can be integrated into many different aspects of a development including roofs, walls, shading devices or architectural panels. The panels typically have an electrical warranty of 20-25 years and an expected system lifespan of 25-40 years.

The architecture of the homes is currently unknown but photovoltaic panels are technically considered an appropriate technology and will be considered further at the detailed stage when the scale and orientation of the roofscape of the site is known.

Air Source Heat Pumps (ASHP)

Air sourced heat pumps operate using the same reverse refrigeration cycle as ground source heat pumps; however, the initial heat energy is extracted from the external air rather than the ground.

The system works by transferring heat absorbed from the outside air to an indoor space using a wet central heating system to heat radiators or underfloor heating and provide domestic hot water. Heat pumps work similarly to a refrigerator in that they absorb heat and transfer it to another medium.

ASHPs use electricity and through a condenser/ evaporator system put out somewhere between 3.0 and 3.3 times as much energy as they require to run. ASHPs work well with low temperature systems.

The SAP modelling has been based on the installation of exhaust air heat pumps into the apartments (including the maisonette apartments) and air source heat pumps to the houses and the housing for care building.

5.3 Establishing Carbon Dioxide Emissions

Residential Accommodation

The following is based on the assumed accommodation schedule set out in 4.0 above.

SAP calculations have been prepared for units of a similar scale, design and specification in order to provide an accurate estimate the total site emissions.

There are 16, 1-bedroom apartments and 26, 1-bedroom maisonettes with floor areas of 53.4 m^2 and 53.8 m^2 respectively and for the purposes of this assessment the emissions are assumed to be similar. SAP calculations have been used for a 1-bedroom ground-floor apartment at 50.0 m^2, which are proposed as representative of all 1-bedroom apartments and maisonette apartments.

There are 48, 2-bedroom apartments with floor areas of 62.2 m^2 and for the purposes of this assessment the emissions are assumed to be similar. SAP calculations have been used for a 2-bedroom top-floor apartment at 62.0 m^2, which are proposed as representative of all 2-bedroom apartments.

There are 10, 2-bedroom terrace/semi-detached houses with a floor area of 76.5 m^2, 46, 3-bedroom terrace/semi-detached houses with a floor area of 83.2 m^2 and 36, 3-bedoom terrace/semi-detached houses with a floor area of 88.3 m^2. Therefore, SAP calculations have been used for an end-terrace house at 84.0 m^2, which are proposed as representative of all terrace and semi-detached houses.

There are 30, 3-bedroom detached houses with a floor area of 99.9 m^2 , two, 4-bedroom detached houses at 106.0 m^2 and 22, 4-bedroom detached houses at 112.5 m^2. SAP calculations have been used for a detached unit at 102.0 m^2, which are proposed as representative of all the houses in this floor area range.

There are 15, 4-bedroom detached houses with a floor area of 144.3 m^2 and six, 5-bedroom detached houses with a floor area of 188.6 m^2. SAP calculations have been used for a detached unit at 159.0 m^2, which are proposed as representative of all the houses in this floor area range.

The Summary SAP Reports for the modelling units are attached as Appendix 1 but the TER and DER emissions can be summarised as follows;

	CO_2 TER	CO_2 DER
	kg CO_2 /m^2/yr	kg CO_2 /m^2/yr
1-Bedroom Ground-floor apartment @ 50.0 m^2	10.15	3.63
2-Bedroom Top-floor apartment @ 62.0 m^2	10.65	3.30
3-Bedroom End-terrace house @ 84.0 m^2	11.45	5.35
4-Bedroom Detached house @ 102.0 m^2	11.94	5.24
4-Bedroom Detached house @ 159.0 m^2	8.93	3.81

Non-Residential Accommodation

A BRUKL calculation, which has been prepared for similar accommodation to the housing for care building has been used to estimate the emissions from this accommodation.

The energy demand and emissions can be summarised as follows:

Housing with Care – 2,060.0 m^2	Notional Energy Demand	Actual Energy Demand
	kWh/m^2	kWh/m^2
Heating	14.54	12.44
Cooling	0.00	0.00
Auxiliary	9.69	8.61
Lighting	10.72	12.59
Hot Water	33.73	32.51
Totals	**68.67**	**66.16**
Emissions (kg/m^2)	**9.52**	**9.17**

Summary

Using the above results, the emissions can be aggregated across similar unit types to arrive at the total site emissions as follows;

	Area	CO_2 TER	CO_2 DER
	m^2	kg/yr	kg/yr
Residential Accommodation			
1-Bed Apartments and Maisonettes (53.4–53.8 m^2)	2,253.2	22,870	8,179
2-Bedroom Apartments (62.2 m^2)	2,985.6	31,797	9,852
2 & 3-Bed End-terr/Semi-det houses (76.5–88.3 m^2)	7,771.0	88,978	41,575
3 & 4-Bedroom Detached houses (99.9–112.5 m^2)	5,684	67,867	29,784
4 & 5-Bed Detached houses (144.3–188.6 m^2)	3,296.1	29,434	12,558
Sub-total	21,883.9	240,946	101,948
Non-residential Accommodation			
Housing with Care	5,976.0	56,892	54,800
Sub-total	5,976.0	56,892	54,800
Totals	**27,859.9**	**297,838**	**156,748**

The total emissions allowable through the Building Regulations (TER) are calculated as:

- **297,838 kg CO_2 per year**

With total actual site emissions (DER) assessed as:

- **156,748 kg CO_2 per year**

The site carbon dioxide emissions are reduced by 141,090 kg CO_2 per year as a result of the energy efficiency measures and renewable technologies, which equates to a reduction of 47.37% of the TER emissions.

5.4 Summary of Calculations and Proposals for Low-carbon and Renewable Technologies

The application seeks outline consent for the construction of up to 257 dwellings (including a Children's Home) and a Housing for Care building. The design and orientation of the units does not form part of the application and therefore the following analysis has to be considered in this context. SAP calculations, which have been prepared for other apartments and houses of a similar scale and design and built to a similar specification to those proposed have been used to provide an accurate assessment of the emissions from the homes. A BRUKL calculation prepared for a similar unit to that proposed has been used to estimate the emissions from the housing with care

The results from the calculations have been aggregated across similar unit types to provide an assessment of the total site emissions.

Various technologies have been considered and whilst wind turbines, combined heat and power, ground source heat pumps and solar hot water heating panels are not considered appropriate the use of photovoltaic panels and air source heat pumps are considered feasible, although the installation of photovoltaic panels are not considered at this stage because the area and orientation of the roofscape is not known.

Be Lean

The construction standards for the fabric of the buildings proposes U-values, which demonstrate good practice and improve upon those required by the Building Regulations. Air tightness standards are targeted at a 63% improvement upon the minimum required by the Building Regulations. In addition, it is proposed to install energy efficiency mechanical and electrical services.

Be Clean and Be Green

As a result of the energy efficiency measures incorporated into the fabric specification of the homes and the housing with care building, the installation of exhaust air heat pumps to the apartments and maisonette apartments and air source heat pumps to the houses and the housing with care building the total emissions from the site based upon the maximum permissible by the Building Regulations (TER) are calculated as **297,838 kg CO_2 per year**, with actual (DER/BER) emissions after energy efficiency measures and the installation of renewable technologies of **156,748 kg CO_2 per year**.

The emissions are reduced by a total of **141,090 kg CO_2 per year**, which equates to a reduction of **47.37%.**

All space heating and hot water will be provided to the buildings from renewable technologies.

There will be no mains gas connection to the site and therefore there will be no on-site NOx or CO_2 emissions.

The proposal meets the requirements of the adopted planning policy.

6.0 Climate change adaption and Water resources

Sustainable Drainage Systems (SUDS)

The site lies within Flood Zone 1 and has a low risk of flooding. SuDS techniques will be employed to dispose of surface water and full details are provided in the Flood Risk Assessment and Surface Water Disposal Strategy, which accompanies the application.

Surface Water Management

Consideration has been given to the use of grey water recycling. However, customer's resistance to the appearance of the recycled water and the cost of the systems does not currently make them a viable option. They have therefore not been included in the proposals.

Water efficiency measures

In excess of 20% of the UK's water is used domestically with over 50% of this used for flushing WCs and washing (source: Environment Agency). The majority of this comes from drinking quality standard or potable water.

The water efficiency measures included will ensure that the water use target of 110 litres per person per day is achieved for the homes.

Water efficient devices have been evaluated and will be installed. The specification of such devices will be considered at detailed design stage and each will be subject to an evaluation based on technical performance, cost and market appeal, together with compliance with the water use regulations.

The following devices will be incorporated within the apartments, houses and housing with care building:

- water efficient taps;
- water efficient toilets;
- low output showers;
- flow restrictors to manage water pressures to achieve optimum levels and
- water meters.

Below is a typical specification, which would achieve the 110 Litres per person per day target (including five litres per person per day allowance for external water use).

Schedule of Appliance Water Consumption		
Appliance	Flow rate or capacity	Total Litres
WC	6/3 litres dual flush	17.64
Basin	2.0 litres/min.	4.74
Shower	9.0 litres/min	39.33
Bath	175 litres	19.25
Sink	5.0 litres/min	12.56
Washing Machine	6.75 litres/kg	14.18
Dishwasher	1.25 litres/places	4.50
		112.20
	Normalisation Factor	0.91
	Total Internal Water Consumption	102.10
	External Water Use	5.00
	Total Water Consumption	107.10

7.0 Materials and Waste

The BRE Green Guide to Specification is a simple guide for design professionals. The guide provides environmental impact, cost and replacement interval information for a wide range of commonly used building specifications over a notional 60-year building life. The construction specification will prioritise materials within ratings A+, A or B.

Preference will be given to the use of local materials & suppliers where viable to reduce the transport distances and to support the local economy. A full evaluation of these suppliers will be undertaken at the next stage of design.

In addition, timber will be sourced, where practical, certified by PEFC, FSC or an equivalent approved certification body and all site timber used within the construction process will be recycled.

All insulation materials will have a zero-ozone depleting potential

Construction waste

Targets will be set to promote resource efficiency in accordance with guidance from WRAP, Envirowise, BRE and DEFRA.

The overarching principle of waste management is that waste should be treated or disposed of within the region where it is produced.

Construction operations generate waste materials as a result of general handling losses and surpluses. These wastes can be reduced through appropriate selection of the construction method, good site management practices and spotting opportunities to avoid creating unnecessary waste.

The Construction Strategy will explore these issues, some of which are set out below:

- Proper handling and storage of all materials to avoid damage.
- Efficient purchasing arrangements to minimise over ordering.
- Segregation of construction waste to maximise potential for reuse/recycling.
- Suppliers who collect and reuse/recycle packaging materials.

Appendix 1 – Summary SAP Reports for the Modelled Units

Summary for Input Data

elmhurst energy

Property Reference	Carpenders 1BF GND 53	**Issued on Date**	16/03/2025
Assessment Reference	Carpenders 1BF GND 53	**Prop Type Ref**	Carpenders 1BF GND 53
Property	Land at Carpenders Park Farms, Oxhey Lane, Watford, Hertfordshire, WD19 5RJ		

SAP Rating	88 B	**DER**	3.63	**TER**	10.15
Environmental	98 A	**% DER < TER**			64.24
CO_2 Emissions (t/year)	0.17	**DFEE**	17.45	**TFEE**	18.08
Compliance Check	See BREL	**% DFEE < TFEE**			3.48
% DPER < TPER	27.60	**DPER**	38.45	**TPER**	53.10

Assessor Details	Mr. Ivan Ball	**Assessor ID**	DE88-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	Southeast	
Property Tenture	1	
Transaction Type	6	
Terrain Type	Suburban	
1.0 Property Type	Flat, Mid-Terrace	
Position of Flat	Ground-floor flat	
Which Floor	1	
2.0 Number of Storeys	1	
3.0 Date Built	2024	
4.0 Sheltered Sides	2	
5.0 Sunlight/Shade	Average or unknown	
6.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	250.00	kJ/m²K
7.0 Electricity Tariff	Standard	
Smart electricity meter fitted	No	
Smart gas meter fitted	No	

7.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground floor:	6.93 m	50.00 m²	2.40 m

8.0 Living Area 23.23 m²

9.0 External Walls

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area(m²)	Nett Area (m²)	Shelter Res	Shelter	Openings	Area Calculation Type
External Wall	Cavity Wall	Cavity wall : plasterboard on dabs, dense block, filled cavity, any outside structure	0.18		16.63	11.56	0.00	None	5.07	Enter Gross Area

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)	Shelter Res	Shelter
Party Wall	Filled Cavity with Edge Sealing	Plasterboard on dabs mounted on cement render on both sides, AAC blocks, cavity	0.00		51.29		None

10.1 Party Ceilings

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Party Ceiling	Precast concrete plank floor (screed laid on rubber), carpeted	30.00	50.00

11.0 Heat Loss Floors

Description	Type	Storey Index	Construction	U-Value (W/m²K)	Shelter Code	Shelter Factor	Kappa (kJ/m²K)	Area (m²)
Ground Floor	Ground Floor - Solid	Lowest occupied	Suspended concrete floor, carpeted	0.13	None	0.00	75.00	50.00

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Filling Type	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Windows & Glazed Doors	Manufacturer	Window	Double Low-E Soft 0.05			0.55		0.70	1.40

13.0 Openings

Summary for Input Data

elmhurst energy

Name	Opening Type	Location	Orientation	Area (m²)	Pitch
Kitchen/Living/Dining	Windows & Glazed Doors	External Wall	South East	3.15	
Bedroom	Windows & Glazed Doors	External Wall	South East	1.92	

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	

17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Bridge Type	Source Type	Length	Psi	Adjusted Reference:	Imported
E2 Other lintels (including other steel lintels)	Non Gov Approved Schemes	2.70	0.03	0.03	No
E3 Sill	Non Gov Approved Schemes	1.20	0.02	0.02	No
E4 Jamb	Non Gov Approved Schemes	7.40	0.02	0.02	No
E5 Ground floor (normal)	Non Gov Approved Schemes	6.93	0.05	0.05	No
E18 Party wall between dwellings	Non Gov Approved Schemes	4.80	0.04	0.04	No

Y-value	0.01	W/m²K

19.0 Mechanical Ventilation		
Mechanical Ventilation		
Mechanical Ventilation System Present	No	
20.0 Fans, Open Fireplaces, Flues		
Number of open chimneys	0	
Number of open flues	0	
Number of chimneys/flues attached to closed fire	0	
Number of flues attached to solid fuel boiler	0	
Number of flues attached to other heater	0	
Number of blocked chimneys	0	
Number of intermittent extract fans	1	
Number of passive vents	0	
Number of flueless gas fires	0	
21.0 Fixed Cooling System	No	
22.0 Pressure Testing	Yes	
Designed AP_{50}	4.00	m³/(h.m²) @ 50 Pa
Test Method	Blower Door	
22.0 Lighting		
No Fixed Lighting	No	

Name	Efficacy	Power	Capacity	Count
Lighting	80.00	5.00	400.00	24

24.0 Main Heating 1	Database	
Percentage of Heat	100.00	%
Database Ref. No.	100392	
Fuel Type	Electricity	
In Winter	255.16	
In Summer	205.88	
Model Name	Fighter 470	
Manufacturer	NIBE Energy Systems Ltd	
System Type	Heat Pump	
Controls SAP Code	2208	
Is MHS Pumped	Pump in heated space	
Heating Pump Age	2013 or later	
Heat Emitter	Radiators	
Flow Temperature	Enter value	
Flow Temperature Value	45.00	

Summary for Input Data

elmhurst energy

25.0 Main Heating 2	None	
26.0 Heat Networks	None	
27.0 Secondary Heating	None	
28.0 Water Heating		
Water Heating	Main Heating 1	
SAP Code	901	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
Cold Water Source	From mains	
Bath Count	1	
Immersion Only Heating Hot Water	No	
28.3 Waste Water Heat Recovery System		
29.0 Hot Water Cylinder	Internal Store	
Insulation Type	Measured Loss	
Cylinder Volume	170.00	L
Loss	1.56	kWh/day
In Airing Cupboard	No	
34.0 Small-scale Hydro	None	

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
			0	0
			0	0
			0	0

Summary for Input Data

elmhurst energy

Property Reference	Carpenders 2BF TOP 62	**Issued on Date**	16/03/2025
Assessment Reference	Carpenders 2BF TOP 62	**Prop Type Ref**	Carpenders 2BF TOP 62
Property	Land at Carpenders Park Farm, Oxhey Lane, Watford, Hertfordshire, WD19 5RJ		

SAP Rating	87 B	**DER**	3.30	**TER**	10.65
Environmental	98 A	**% DER < TER**			69.01
CO_2 Emissions (t/year)	0.19	**DFEE**	19.50	**TFEE**	21.00
Compliance Check	See BREL	**% DFEE < TFEE**			7.14
% DPER < TPER	34.36	**DPER**	36.88	**TPER**	56.19

Assessor Details	Mr. Ivan Ball	**Assessor ID**	DE88-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	North	
Property Tenture	1	
Transaction Type	1	
Terrain Type	Suburban	
1.0 Property Type	Flat, End-Terrace	
Position of Flat	Top-floor flat	
Which Floor	3	
2.0 Number of Storeys	1	
3.0 Date Built	2024	
4.0 Sheltered Sides	2	
5.0 Sunlight/Shade	Average or unknown	
6.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	250.00	kJ/m²K
7.0 Electricity Tariff	Standard	
Smart electricity meter fitted	Yes	
Smart gas meter fitted	No	

7.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground floor:	17.04 m	61.90 m²	2.40 m

8.0 Living Area	17.37	m²

9.0 External Walls

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area(m²)	Nett Area (m²)	Shelter Res	Shelter	Openings	Area Calculation Type
External Wall	Cavity Wall	Cavity wall : plasterboard on dabs, dense block, filled cavity, any outside structure	0.18		40.90	35.86	0.00	None	5.04	Enter Gross Area

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)	Shelter Res	Shelter
Party Wall	Filled Cavity with Edge Sealing	Plasterboard on dabs mounted on cement render on both sides, AAC blocks, cavity	0.00		39.55		None

10.0 External Roofs

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area(m²)	Nett Area (m²)	Shelter Code	Shelter Factor	Calculation Type	Openings
Roof	External Plane Roof	Plasterboard, insulated at ceiling level	0.10	9.00	61.90	61.90	None	0.00	Enter Gross Area	0.00

11.1 Party Floors

Description	Storey Index	Construction	Kappa (kJ/m²K)	Area (m²)
Party Floor	Lowest occupied	Precast concrete planks floor, screed, carpeted	30.00	61.90

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Filling Type	G-value	Frame Type	Frame Factor	U Value (W/m²K)

Summary for Input Data

Windows & Glazed Doors	Manufacturer	Window	Double Low-E Soft 0.05	0.55	0.70	1.40

13.0 Openings

Name	Opening Type	Location	Orientation	Area (m²)	Pitch
Kitchen/Living/Dining & Bedroom	Windows & Glazed Doors	External Wall	South East	5.04	

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Bridge Type	Source Type	Length	Psi	Adjusted Reference:	Imported
E2 Other lintels (including other steel lintels)	Non Gov Approved Schemes	4.20	0.03	0.03	No
E3 Sill	Non Gov Approved Schemes	4.20	0.02	0.02	No
E4 Jamb	Non Gov Approved Schemes	17.04	0.02	0.02	No
E7 Party floor between dwellings (in blocks of flats)	Non Gov Approved Schemes	17.04	0.04	0.04	No
E18 Party wall between dwellings	Non Gov Approved Schemes	4.80	0.04	0.04	No
E16 Corner (normal)	Non Gov Approved Schemes	2.40	0.04	0.04	No
E10 Eaves (insulation at ceiling level)	Non Gov Approved Schemes	17.04	0.05	0.05	No

Y-value	0.02	W/m²K

19.0 Mechanical Ventilation

Mechanical Ventilation

Mechanical Ventilation System Present	No	

20.0 Fans, Open Fireplaces, Flues

Number of open chimneys	0	
Number of open flues	0	
Number of chimneys/flues attached to closed fire	0	
Number of flues attached to solid fuel boiler	0	
Number of flues attached to other heater	0	
Number of blocked chimneys	0	
Number of intermittent extract fans	1	
Number of passive vents	0	
Number of flueless gas fires	0	
21.0 Fixed Cooling System	No	
22.0 Pressure Testing	Yes	
Designed AP_{50}	4.00	m³/(h.m²) @ 50 Pa
Test Method	Blower Door	

22.0 Lighting

No Fixed Lighting	No				
	Name	**Efficacy**	**Power**	**Capacity**	**Count**
	Lighting	80.00	5.00	400.00	22

24.0 Main Heating 1	Database	
Percentage of Heat	100.00	%
Database Ref. No.	100392	
Fuel Type	Electricity	
In Winter	292.17	
In Summer	170.00	
Model Name	Fighter 470	
Manufacturer	NIBE Energy Systems Ltd	
System Type	Heat Pump	
Controls SAP Code	2208	
Heating Pump Age	2013 or later	
Heat Emitter	Radiators	

Summary for Input Data

elmhurst energy

Flow Temperature	Enter value	
Flow Temperature Value	45.00	
25.0 Main Heating 2	None	
26.0 Heat Networks	None	
27.0 Secondary Heating	None	
28.0 Water Heating		
Water Heating	Independent	
SAP Code	941	
Fuel Type	Electricity	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
Cold Water Source	From mains	
Bath Count	1	
28.3 Waste Water Heat Recovery System		
29.0 Hot Water Cylinder	Hot Water Cylinder	
Cylinder Stat	Yes	
Cylinder In Heated Space	Yes	
Independent Time Control	Yes	
Insulation Type	Measured Loss	
Cylinder Volume	150.00	L
Loss	1.68	kWh/day
Pipes insulation	All accessible pipework insulated	
In Airing Cupboard	No	
31.0 Thermal Store	None	
32.0 Photovoltaic Unit	One Dwelling	
Export Capable Meter?	Yes	
Connected To Dwelling	Yes	
Diverter	No	
Battery Capacity [kWh]	0.00	

PV Cells kWp	Orientation	Elevation	Overshading	FGHRS	MCS Certificate	Overshading Factor	MCS Certificate Reference	Panel Manufacturer
0.65	South	30°	Modest		No	0.80		

34.0 Small-scale Hydro None

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
			0	0
			0	0
			0	0

Summary for Input Data

elmhurst energy

Property Reference	Carpenders 3BH END 85	**Issued on Date**	16/03/2025
Assessment Reference	Carpenders 3BH END 85	**Prop Type Ref**	Carpenders 3BH END 85
Property	Land at Carpenders Park Farm, Oxhey Lane, Watford, Hertfordshire, WD19 5RJ		

SAP Rating	78 C	**DER**	5.35	**TER**	11.45
Environmental	95 A	**% DER < TER**			53.28
CO_2 Emissions (t/year)	0.42	**DFEE**	35.73	**TFEE**	36.61
Compliance Check	See BREL	**% DFEE < TFEE**			2.40
% DPER < TPER	5.76	**DPER**	56.36	**TPER**	59.81

Assessor Details	Mr. Ivan Ball	**Assessor ID**	DE88-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	Southwest	
Property Tenture	1	
Transaction Type	6	
Terrain Type	Suburban	
1.0 Property Type	House, End-Terrace	
2.0 Number of Storeys	2	
3.0 Date Built	2024	
4.0 Sheltered Sides	2	
5.0 Sunlight/Shade	Average or unknown	
6.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	250.00	kJ/m²K
7.0 Electricity Tariff	Standard	
Smart electricity meter fitted	No	
Smart gas meter fitted	No	

7.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground floor:	19.60 m	41.16 m²	2.40 m
1st Storey:	19.60 m	42.76 m²	2.40 m

8.0 Living Area	26.60	m²

9.0 External Walls

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area(m²)	Nett Area (m²)	Shelter Res	Shelter	Openings	Area Calculation Type
External Wall	Cavity Wall	Cavity wall : plasterboard on dabs, dense block, filled cavity, any outside structure	0.18		94.08	76.82	0.00	None	17.26	Enter Gross Area

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)	Shelter Res	Shelter
Party Wall	Filled Cavity with Edge Sealing	Plasterboard on dabs mounted on cement render on both sides, AAC blocks, cavity	0.00		40.56		None

10.0 External Roofs

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area(m²)	Nett Area (m²)	Shelter Code	Shelter Factor	Calculation Type	Openings
External Roof	External Plane Roof	Plasterboard, insulated at ceiling level	0.10	9.00	42.76	42.76	None	0.00	Enter Gross Area	0.00

11.0 Heat Loss Floors

Description	Type	Storey Index	Construction	U-Value (W/m²K)	Shelter Code	Shelter Factor	Kappa (kJ/m²K)	Area (m²)
Ground Floor	Ground Floor - Solid	Lowest occupied	Suspended concrete floor, carpeted	0.13	None	0.00	75.00	41.16
Exposed Floor	Exposed Floor - Timber	+1	Timber exposed floor, insulation between joists	0.13	None	0.00	20.00	1.60

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Filling Type	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Windows & Glazed Doors	Manufacturer	Window	Double Low-E Soft 0.05			0.55		0.70	1.40
External Doors	Manufacturer	Half Glazed Door	Double Low-E Soft 0.05			0.55		0.70	1.40

Summary for Input Data

elmhurst energy

13.0 Openings

Name	Opening Type	Location	Orientation	Area (m²)	Pitch
Kitchen/Breakfast	Windows & Glazed Doors	External Wall	North West	0.81	
Kitchen/Breakfast	Windows & Glazed Doors	External Wall	South West	2.84	
Kitchen/Breakfast	Windows & Glazed Doors	External Wall	South East	0.81	
Hall	External Doors	External Wall	South West	1.89	
WC	Windows & Glazed Doors	External Wall	South West	0.47	
Living	Windows & Glazed Doors	External Wall	North East	1.62	
Living	Windows & Glazed Doors	External Wall	North East	3.78	
Bed 1	External Doors	External Wall	South West	2.16	
Bed 2	Windows & Glazed Doors	External Wall	North East	2.88	

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	

17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Bridge Type	Source Type	Length	Psi	Adjusted Reference:	Imported
E2 Other lintels (including other steel lintels)	Non Gov Approved Schemes	11.85	0.03	0.03	No
E3 Sill	Non Gov Approved Schemes	9.15	0.02	0.02	No
E4 Jamb	Non Gov Approved Schemes	28.50	0.02	0.02	No
E5 Ground floor (normal)	Non Gov Approved Schemes	19.60	0.05	0.05	No
E16 Corner (normal)	Non Gov Approved Schemes	14.40	0.04	0.04	No
E17 Corner (inverted – internal area greater than external area)	Non Gov Approved Schemes	4.80	-0.08	-0.08	No
E6 Intermediate floor within a dwelling	Non Gov Approved Schemes	19.60	0.00	0.00	No
E10 Eaves (insulation at ceiling level)	Non Gov Approved Schemes	6.58	0.05	0.05	No
E12 Gable (insulation at ceiling level)	Non Gov Approved Schemes	13.00	0.03	0.03	No

Y-value	0.02	W/m²K

19.0 Mechanical Ventilation

Mechanical Ventilation

Mechanical Ventilation System Present	No	

20.0 Fans, Open Fireplaces, Flues

Number of open chimneys	0	
Number of open flues	0	
Number of chimneys/flues attached to closed fire	0	
Number of flues attached to solid fuel boiler	0	
Number of flues attached to other heater	0	
Number of blocked chimneys	0	
Number of intermittent extract fans	3	
Number of passive vents	0	
Number of flueless gas fires	0	

21.0 Fixed Cooling System	No	

22.0 Pressure Testing	Yes	
Designed AP_{50}	4.00	m³/(h.m²) @ 50 Pa
Test Method	Blower Door	

22.0 Lighting

No Fixed Lighting	No	

Name	Efficacy	Power	Capacity	Count
Lighting	80.00	5.00	400.00	40

24.0 Main Heating 1	Database	
Percentage of Heat	100.00	%
Database Ref. No.	102607	
Fuel Type	Electricity	
In Winter	264.38	
In Summer	163.62	
Model Name	aroTHERM 5kW	
Manufacturer	Vaillant Group UK Ltd	

Summary for Input Data

System Type	Heat Pump	
Controls SAP Code	2208	
Is MHS Pumped	Pump in heated space	
Heating Pump Age	2013 or later	
Heat Emitter	Radiators	
Flow Temperature	Enter value	
Flow Temperature Value	45.00	
25.0 Main Heating 2	None	
26.0 Heat Networks	None	
27.0 Secondary Heating	None	
28.0 Water Heating		
Water Heating	Main Heating 1	
SAP Code	901	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
Cold Water Source	From mains	
Bath Count	1	
Immersion Only Heating Hot Water	No	
28.3 Waste Water Heat Recovery System		
29.0 Hot Water Cylinder	Hot Water Cylinder	
Cylinder Stat	No	
Cylinder In Heated Space	No	
Independent Time Control	No	
Insulation Type	Measured Loss	
Cylinder Volume	200.00	L
Loss	1.68	kWh/day
Pipes insulation	All accessible pipework insulated	
In Airing Cupboard	No	
31.0 Thermal Store	None	
34.0 Small-scale Hydro	None	

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

Typical Cost	Typical savings per year	Ratings after improvement	
		SAP rating	Environmental Impact
£4,000 - £6,000	£90	C 80	A 96
£3,500 - £5,500	£233	B 86	A 97
		0	0

Summary for Input Data

elmhurst energy

Property Reference	Carpenders 4BH DET 105	**Issued on Date**	16/03/2025
Assessment Reference	Carpenders 4BH DET 105	**Prop Type Ref**	Carpenders 4BH DET 105
Property	Land at Carpenders Park Farm, Oxhey Lane, Watford, Hertfordshire, WD19 5RJ		

SAP Rating	77 C	**DER**	5.24	**TER**	11.94
Environmental	95 A	**% DER < TER**			56.11
CO_2 Emissions (t/year)	0.5	**DFEE**	41.67	**TFEE**	43.14
Compliance Check	See BREL	**% DFEE < TFEE**			3.40
% DPER < TPER	12.15	**DPER**	54.94	**TPER**	62.53

Assessor Details	Mr. Ivan Ball	**Assessor ID**	DE88-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	North	
Property Tenture	1	
Transaction Type	6	
Terrain Type	Suburban	
1.0 Property Type	House, Detached	
2.0 Number of Storeys	2	
3.0 Date Built	2024	
4.0 Sheltered Sides	2	
5.0 Sunlight/Shade	Average or unknown	
6.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	250.00	kJ/m²K
7.0 Electricity Tariff	Standard	
Smart electricity meter fitted	No	
Smart gas meter fitted	No	

7.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground floor:	24.32 m	51.00 m²	2.40 m
1st Storey:	24.32 m	51.00 m²	2.40 m

8.0 Living Area	26.60	m²

9.0 External Walls

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area(m²)	Nett Area (m²)	Shelter Res	Shelter	Openings	Area Calculation Type
External Wall	Cavity Wall	Cavity wall : plasterboard on dabs, dense block, filled cavity, any outside structure	0.18		160.18	140.70	0.00	None	19.48	Enter Gross Area

10.0 External Roofs

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area(m²)	Nett Area (m²)	Shelter Code	Shelter Factor	Calculation Type	Openings
External Roof	External Plane Roof	Plasterboard, insulated at ceiling level	0.10	9.00	60.25	60.25	None	0.00	Enter Gross Area	0.00

11.0 Heat Loss Floors

Description	Type	Storey Index	Construction	U-Value (W/m²K)	Shelter Code	Shelter Factor	Kappa (kJ/m²K)	Area (m²)
Ground Floor	Ground Floor - Solid	Lowest occupied	Suspended concrete floor, carpeted	0.13	None	0.00	75.00	60.25

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Filling Type	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Windows & Glazed Doors	Manufacturer	Window	Double Low-E Soft 0.05			0.55		0.70	1.40
External Doors	Manufacturer	Half Glazed Door	Double Low-E Soft 0.05			0.55		0.70	1.40

13.0 Openings

Name	Opening Type	Location	Orientation	Area (m²)	Pitch
Living	Windows & Glazed Doors	External Wall	North	2.43	
WC	Windows & Glazed Doors	External Wall	North	1.26	
Bedroom 1	Windows & Glazed Doors	External Wall	North	2.16	
Hall	External Doors	External Wall	North	1.89	
Living	Windows & Glazed Doors	External Wall	East	0.61	

Summary for Input Data

Living	Windows & Glazed Doors	External Wall	West	0.61
Bed 1 & Bath	Windows & Glazed Doors	External Wall	West	1.26
Family	External Doors	External Wall	South	3.15
Kitchen	Windows & Glazed Doors	External Wall	South	2.52
Bed 3	Windows & Glazed Doors	External Wall	South	1.44
Bed 2	Windows & Glazed Doors	External Wall	South	2.16

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	

17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Bridge Type	Source Type	Length	Psi	Adjusted Reference:	Imported
E2 Other lintels (including other steel lintels)	Non Gov Approved Schemes	13.50	0.03	0.03	No
E3 Sill	Non Gov Approved Schemes	11.10	0.02	0.02	No
E4 Jamb	Non Gov Approved Schemes	34.20	0.02	0.02	No
E5 Ground floor (normal)	Non Gov Approved Schemes	31.89	0.05	0.05	No
E16 Corner (normal)	Non Gov Approved Schemes	24.00	0.04	0.04	No
E17 Corner (inverted – internal area greater than external area)	Non Gov Approved Schemes	4.80	-0.08	-0.08	No
E6 Intermediate floor within a dwelling	Non Gov Approved Schemes	30.27	0.00	0.00	No
E10 Eaves (insulation at ceiling level)	Non Gov Approved Schemes	19.30	0.05	0.05	No
E12 Gable (insulation at ceiling level)	Non Gov Approved Schemes	11.00	0.03	0.03	No

Y-value	0.02	W/m²K

19.0 Mechanical Ventilation

Mechanical Ventilation

Mechanical Ventilation System Present	No	

20.0 Fans, Open Fireplaces, Flues

Number of open chimneys	0	
Number of open flues	0	
Number of chimneys/flues attached to closed fire	0	
Number of flues attached to solid fuel boiler	0	
Number of flues attached to other heater	0	
Number of blocked chimneys	0	
Number of intermittent extract fans	3	
Number of passive vents	0	
Number of flueless gas fires	0	

21.0 Fixed Cooling System	No	

22.0 Pressure Testing	Yes	
Designed AP_{50}	4.00	m³/(h.m²) @ 50 Pa
Test Method	Blower Door	

22.0 Lighting

No Fixed Lighting	No	

Name	Efficacy	Power	Capacity	Count
Lighting	80.00	5.00	400.00	52

24.0 Main Heating 1	Database	
Percentage of Heat	100.00	%
Database Ref. No.	102607	
Fuel Type	Electricity	
In Winter	260.12	
In Summer	163.71	
Model Name	aroTHERM 5kW	
Manufacturer	Vaillant Group UK Ltd	
System Type	Heat Pump	
Controls SAP Code	2208	
Is MHS Pumped	Pump in heated space	

Summary for Input Data

Heating Pump Age	2013 or later	
Heat Emitter	Radiators	
Flow Temperature	Enter value	
Flow Temperature Value	45.00	
25.0 Main Heating 2	None	
26.0 Heat Networks	None	
27.0 Secondary Heating	None	
28.0 Water Heating		
Water Heating	Main Heating 1	
SAP Code	901	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
Cold Water Source	From mains	
Bath Count	1	
Immersion Only Heating Hot Water	No	
28.3 Waste Water Heat Recovery System		
29.0 Hot Water Cylinder	Hot Water Cylinder	
Cylinder Stat	No	
Cylinder In Heated Space	No	
Independent Time Control	No	
Insulation Type	Measured Loss	
Cylinder Volume	200.00	L
Loss	1.68	kWh/day
Pipes insulation	All accessible pipework insulated	
In Airing Cupboard	No	
31.0 Thermal Store	None	
34.0 Small-scale Hydro	None	

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
	£4,000 - £6,000	£91	C 79	A 96
	£3,500 - £5,500	£243	B 85	A 97
			0	0

Summary for Input Data

Property Reference	Carpenders 4BH DET 159	**Issued on Date**	16/03/2025
Assessment Reference	Carpenders 4BH DET 159	**Prop Type Ref**	Carpenders 4BH DET 159
Property	Land at Carpenders Park Farm, Oxhey Lane, Watford, Hertfordshire, WD19 5RJ		

SAP Rating	81 B	**DER**	3.81	**TER**	8.93
Environmental	96 A	**% DER < TER**			57.33
CO_2 Emissions (t/year)	0.56	**DFEE**	36.65	**TFEE**	37.80
Compliance Check	See BREL	**% DFEE < TFEE**			3.04
% DPER < TPER	15.07	**DPER**	39.76	**TPER**	46.82

Assessor Details	Mr. Ivan Ball	**Assessor ID**	DE88-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	Northwest	
Property Tenture	1	
Transaction Type	6	
Terrain Type	Suburban	
1.0 Property Type	House, Detached	
2.0 Number of Storeys	2	
3.0 Date Built	2024	
4.0 Sheltered Sides	2	
5.0 Sunlight/Shade	Average or unknown	
6.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	250.00	kJ/m²K
7.0 Electricity Tariff	Standard	
Smart electricity meter fitted	No	
Smart gas meter fitted	No	

7.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground floor:	39.20 m	80.18 m²	2.40 m
1st Storey:	39.20 m	78.86 m²	2.40 m

8.0 Living Area 26.60 m²

9.0 External Walls

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area(m²)	Nett Area (m²)	Shelter Res	Shelter	Openings	Area Calculation Type
External Wall	Cavity Wall	Cavity wall : plasterboard on dabs, dense block, filled cavity, any outside structure	0.18		188.16	163.94	0.00	None	24.22	Enter Gross Area

10.0 External Roofs

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area(m²)	Nett Area (m²)	Shelter Code	Shelter Factor	Calculation Type	Openings
External Roof	External Plane Roof	Plasterboard, insulated at ceiling level	0.10	9.00	80.20	80.20	None	0.00	Enter Gross Area	0.00

11.0 Heat Loss Floors

Description	Type	Storey Index	Construction	U-Value (W/m²K)	Shelter Code	Shelter Factor	Kappa (kJ/m²K)	Area (m²)
Ground Floor	Ground Floor - Solid	Lowest occupied	Suspended concrete floor, carpeted	0.13	None	0.00	75.00	80.20

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Filling Type	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Windows & Glazed Doors	Manufacturer	Window	Double Low-E Soft 0.05			0.55		0.70	1.40
External Doors	Manufacturer	Half Glazed Door	Double Low-E Soft 0.05			0.55		0.70	1.40

13.0 Openings

Name	Opening Type	Location	Orientation	Area (m²)	Pitch
Living Room	Windows & Glazed Doors	External Wall	North West	2.43	
Study	Windows & Glazed Doors	External Wall	North East	0.71	
Study & WC	Windows & Glazed Doors	External Wall	South West	1.43	
Hall	External Doors	External Wall	South West	1.89	
Dining	Windows & Glazed Doors	External Wall	South West	2.16	

Dining	Windows & Glazed Doors	External Wall	South East	2.16
Kitchen	Windows & Glazed Doors	External Wall	South West	1.89
Utility	External Doors	External Wall	South West	2.21
Bed 3	Windows & Glazed Doors	External Wall	North West	2.16
Bed 4	Windows & Glazed Doors	External Wall	South West	1.44
Ensuite	Windows & Glazed Doors	External Wall	South West	0.71
Master	Windows & Glazed Doors	External Wall	South West	2.16
Bed 2	Windows & Glazed Doors	External Wall	South East	2.16
Bath	Windows & Glazed Doors	External Wall	North East	0.71

14.0 Conservatory None

15.0 Draught Proofing 100 %

16.0 Draught Lobby No

17.0 Thermal Bridging Calculate Bridges

17.1 List of Bridges

Bridge Type	Source Type	Length	Psi	Adjusted Reference:	Imported
E2 Other lintels (including other steel lintels)	Non Gov Approved Schemes	20.05	0.03	0.03	No
E3 Sill	Non Gov Approved Schemes	15.45	0.02	0.02	No
E4 Jamb	Non Gov Approved Schemes	39.90	0.02	0.02	No
E5 Ground floor (normal)	Non Gov Approved Schemes	39.20	0.05	0.05	No
E16 Corner (normal)	Non Gov Approved Schemes	28.80	0.04	0.04	No
E17 Corner (inverted – internal area greater than external area)	Non Gov Approved Schemes	9.60	-0.08	-0.08	No
E6 Intermediate floor within a dwelling	Non Gov Approved Schemes	39.20	0.00	0.00	No
E10 Eaves (insulation at ceiling level)	Non Gov Approved Schemes	30.70	0.05	0.05	No
E12 Gable (insulation at ceiling level)	Non Gov Approved Schemes	8.50	0.03	0.03	No

Y-value 0.02 W/m²K

19.0 Mechanical Ventilation

Mechanical Ventilation

Mechanical Ventilation System Present: No

20.0 Fans, Open Fireplaces, Flues

Number of open chimneys	0
Number of open flues	0
Number of chimneys/flues attached to closed fire	0
Number of flues attached to solid fuel boiler	0
Number of flues attached to other heater	0
Number of blocked chimneys	0
Number of intermittent extract fans	3
Number of passive vents	0
Number of flueless gas fires	0

21.0 Fixed Cooling System No

22.0 Pressure Testing Yes

Designed AP_{50} 4.00 m³/(h.m²) @ 50 Pa

Test Method: Blower Door

22.0 Lighting

No Fixed Lighting: No

Name	Efficacy	Power	Capacity	Count
Lighting	80.00	5.00	400.00	64

24.0 Main Heating 1 Database

Percentage of Heat	100.00 %
Database Ref. No.	102615
Fuel Type	Electricity
In Winter	279.85
In Summer	172.92
Model Name	aroTHERM 8kW
Manufacturer	Vaillant Group UK Ltd
System Type	Heat Pump

Summary for Input Data

Controls SAP Code	2208	
Is MHS Pumped	Pump in heated space	
Heating Pump Age	2013 or later	
Heat Emitter	Radiators	
Flow Temperature	Enter value	
Flow Temperature Value	45.00	
25.0 Main Heating 2	None	
26.0 Heat Networks	None	
27.0 Secondary Heating	None	
28.0 Water Heating		
Water Heating	Main Heating 1	
SAP Code	901	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
Cold Water Source	From mains	
Bath Count	1	
Immersion Only Heating Hot Water	No	
28.3 Waste Water Heat Recovery System		
29.0 Hot Water Cylinder	Hot Water Cylinder	
Cylinder Stat	No	
Cylinder In Heated Space	No	
Independent Time Control	No	
Insulation Type	Measured Loss	
Cylinder Volume	300.00	L
Loss	1.68	kWh/day
Pipes insulation	All accessible pipework insulated	
In Airing Cupboard	No	
31.0 Thermal Store	None	
34.0 Small-scale Hydro	None	

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
	£4,000 - £6,000	£86	B 82	A 96
	£3,500 - £5,500	£257	B 87	A 97
			0	0