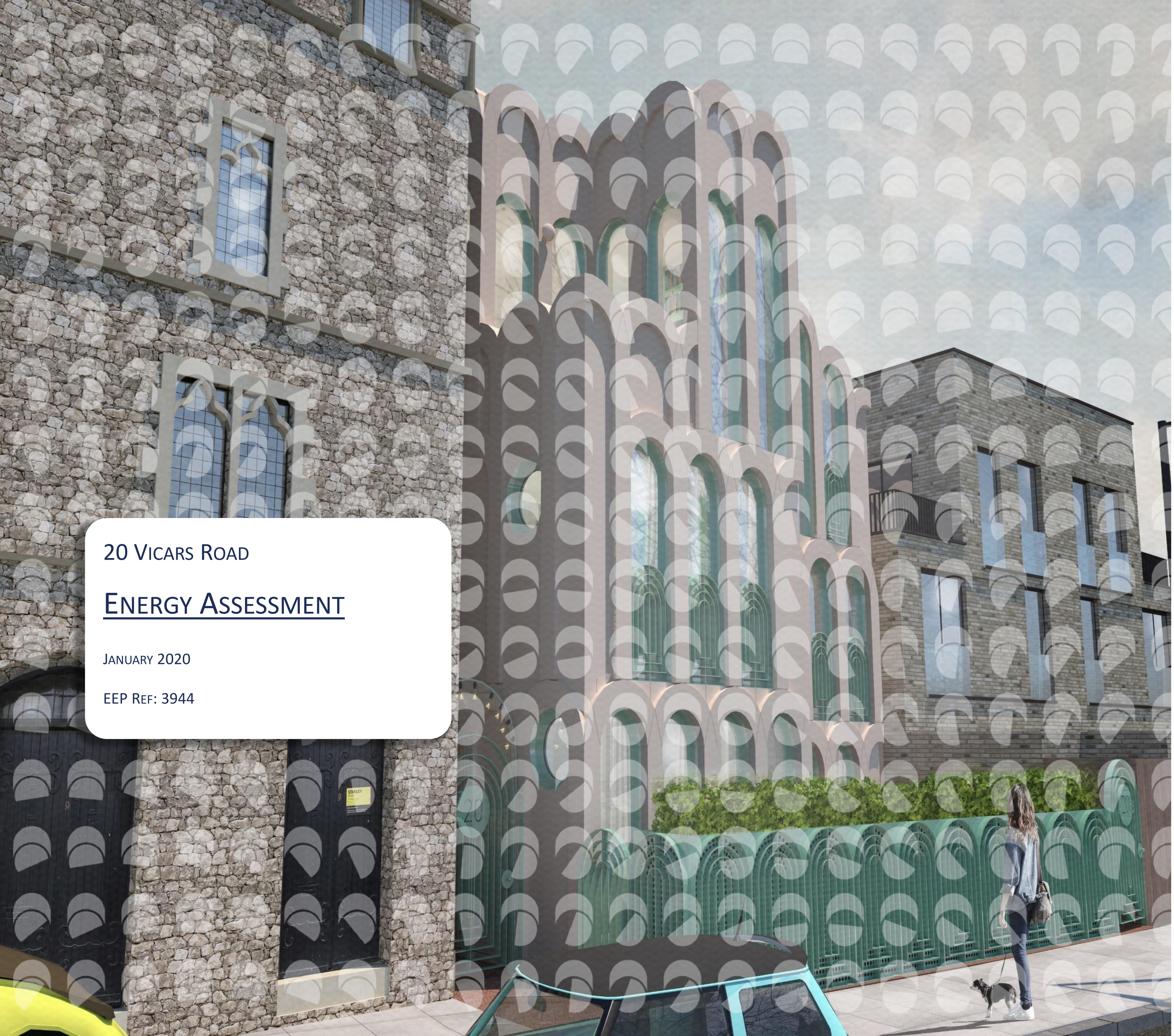

20 Vicars Road

# Energy Assessment

January 2020

EEP Ref: 3944

ENVIRONMENTAL ENGINEERING PARTNERSHIP

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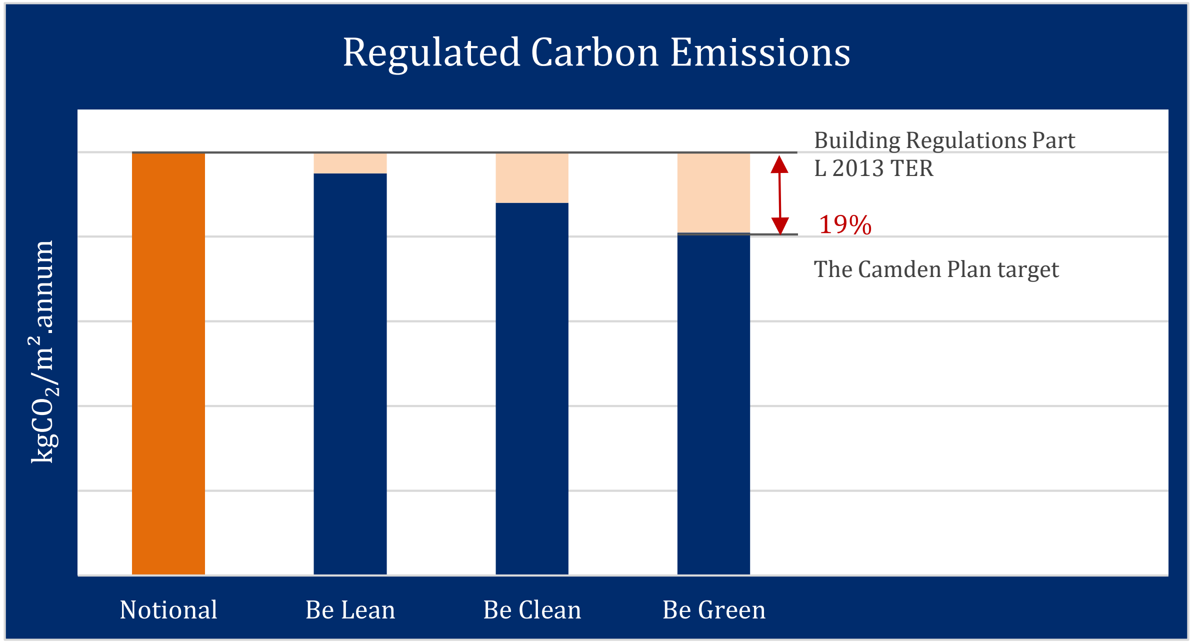
# Contents

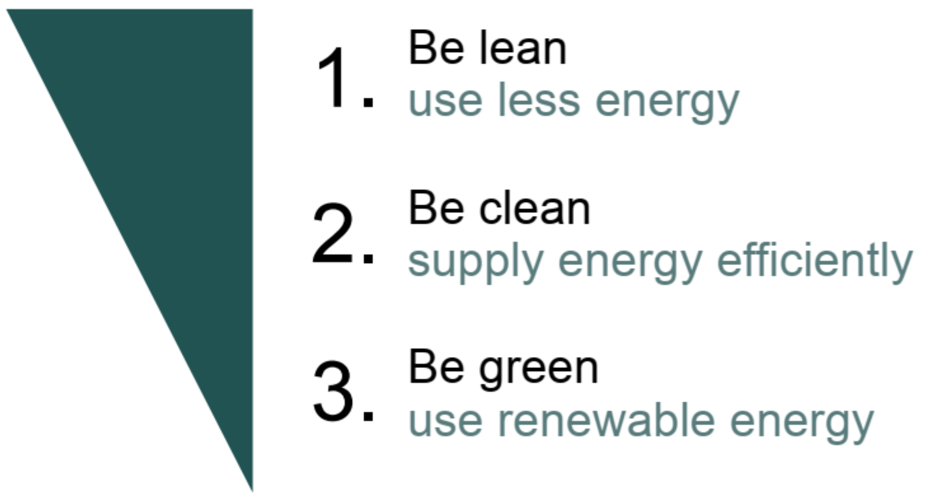




Regulated Carbon Emissions
Building Regulations Part L 2013 TER
19%
The Camden Plan target
kgCO2/m2.annum
Notional
Be Lean
Be Clean
Be Green

# Introduction

The Mayor is committed to making London a zero carbon city and with almost 80% of the city's emissions coming from buildings, therefore, there is a big drive to tackle emissions starting with new build and major refurbishment projects.



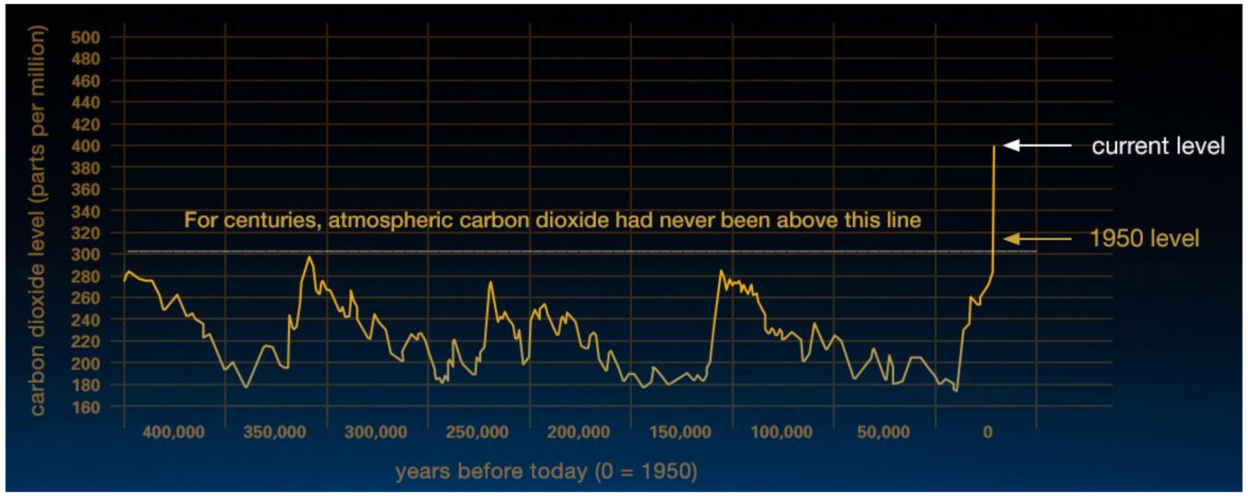

The Camden Local Plan sets out the local council's planning policies which set out the various energy and sustainability targets for project's requiring planning consent. The Camden Local Plan is the name given to a group of policies that together form the development plan for Camden.

This energy assessment will look at the relevant policies within the Plan and shall demonstrate how this development plans to apply the principles of each policy in both the architectural and building services design.

The relevant sections in The Camden Local Plan are:

Policy CC1: Climate change Mitigation

1. The Energy Hierarchy
2. Sustainable Patterns of Development
3. Resource efficiency, demolition and retrofitting existing buildings
4. Decentralised Energy Generation



# Policy and Context

**Building Regulations Approved Document L1A 2013 – Conservation of fuel and power in new dwellings**

The Regulations place a legal requirement for the Building $CO_2$ Emission Rate (calculated using an approved software package) to be less than the Target Emission Rate for which there is prescribed method for calculating.

The intention of the Government is to reduce the regulated carbon emissions from buildings and in each amendment to the Regulations the requirement for $CO_2$ reductions increases. The latest update came in 2013 and requires a c.a. 9% improvement from the previous Regulations set in 2010.

**The London Plan**

The Mayor's London Plan sets targets and provides guidance to the 32 London boroughs and the Corporation of the City of London for the spatial development of London to 2036. The current version was published in March 2015. First published in 2004 with revisions being made in line with the revised energy performance targets set out in the updated Building Regulations.

**Camden Planning Guidance - Energy Efficiency and Adaptation**

Camden Council has prepared the Camden Planning Guidance on Energy and Resources to support the policies in the Camden Local Plan 2017. This forms a Supplementary Planning Document which provides additional material consideration in planning decisions. The guidance provides information on key energy and resource issues within the borough and support Local Plan Policies CC1 Climate Change Mitigation and CC2 Adapting to Climate Change.

# Policy and Context

**The Camden Local Plan, Policy CC1: Climate Change Mitigation**

- The Council aims to tackle the causes of climate change in the borough by ensuring developments use less energy and assess the feasibility of decentralised energy and renewable energy technologies

- Green Action for Change: Camden's environmental sustainability plan (2011-2020) commits Camden to a 27% borough wide Carbon Dioxide ($CO_2$) reduction by 2017 and a 40% borough wide $CO_2$ reduction by 2020 (London carbon reduction target). Over 90% of Camden's carbon dioxide emissions are produced by the operation of buildings.

- Camden Council commissioned two borough wide carbon reduction studies to ensure that local planning policy appropriately responds to the carbon emissions reduction challenge. The first study, 'Delivering a low carbon Camden', considered carbon reduction scenarios to 2050 to align with the long-term national 80% carbon dioxide reduction target within the Climate Change Act 2008. The 2010 study focused specifically on the challenges of achieving a carbon dioxide reduction target of 40% by 2020.

Both studies concluded that meeting borough carbon dioxide reduction targets depends on the growth of Combined Heat and Power (CHP) led decentralised energy networks; the extensive thermal improvement of existing housing stock; behavior change; the significant deployment of appropriate renewable technologies; and the steady decarbonisation of the national electricity grid.

### 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.

For decentralised energy networks, we will promote decentralised energy by:

g. working with local organisations and developers to implement decentralised energy networks in the parts of Camden most likely to support them;
h. protecting existing decentralised energy networks (e.g. at Gower Street, Bloomsbury, King's Cross, Gospel Oak and Somers Town) and safeguarding potential network routes; and
i. requiring all major developments to assess the feasibility of connecting to an existing decentralised energy network, or where this is not possible establishing a new network.

To ensure that the Council can monitor the effectiveness of renewable and low carbon technologies, major developments will be required to install appropriate monitoring equipment.

# POLICY AND CONTEXT

**The Camden Local Plan, Policy CC1: The Energy Hierarchy**

The energy hierarchy is a sequence of steps that minimise the energy consumption of a building. Buildings designed in line with the energy hierarchy priorities lower cost passive design measures, such as improved fabric performance over higher cost active systems such as renewable energy technologies. The following diagram shows a simplified schematic of the energy hierarchy, which is explained further in supplementary planning document Camden Planning Guidance on sustainability.

**Section 8.8** requires all developments involving five or more dwellings and/or more than 500 sqm of (gross internal) any floorspace will be required to submit an energy statement demonstrating how the energy hierarchy has been applied to make the fullest contribution to $CO_2$ reduction. All new residential development will also be required to demonstrate a 19% $CO_2$ reduction below Part L 2013 Building Regulations (in addition to any requirements for renewable energy).

Note: The London plan references a 35% $CO_2$ reduction below Part L 2013 Building regulations, Camden Local Authority require a 19% carbon reduction target, but for the purposes of this report a 19% reduction has been targeted.

**Be Lean**

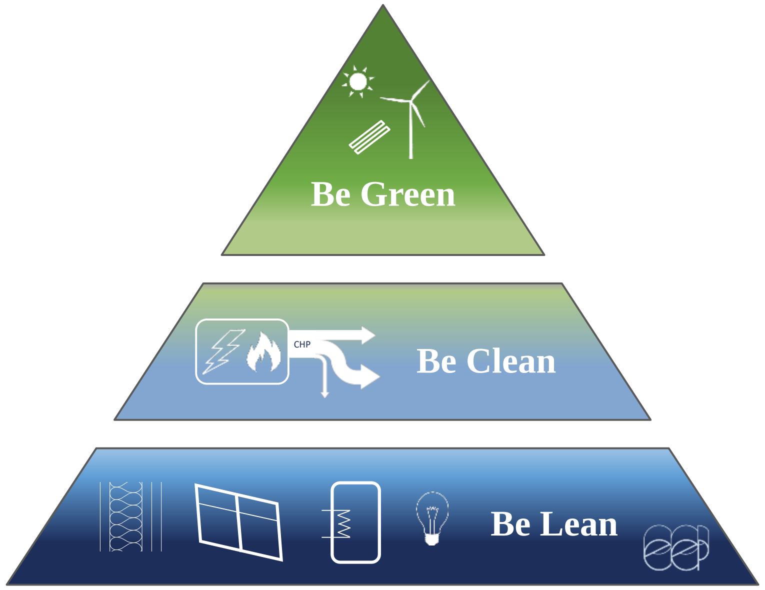
Proposals should demonstrate how passive design measures including the development orientation, form, mass, and window sizes and positions have been taken into consideration to reduce energy demand, demonstrating that the minimum energy efficiency requirements required under building regulations will be met and where possible exceeded.

**Be Clean**

The second stage of the energy hierarchy 'Be Clean' should demonstrate how the development will supply energy efficiently through clean energy systems such as CHP or decentralised energy.

**Be Green**

The "Be Green" stage of the energy hierarchy requires that developments make use of renewable technologies to achieve the sites overall carbon dioxide emissions target.



# Policy and Context

**The Camden Local Plan, Policy CC1: The Energy Hierarchy**

Section 8.41 requires all new developments to submit a statement describing how the project has applied The London Plan's cooling hierarchy and shall demonstrate how the risk of overheating has been mitigated.

The cooling hierarchy includes:

1. Minimise internal heat gains
2. Reduce external heat gains through consideration of; orientation, shading, fenestration, insulation etc.
3. Manage internal heat through exposed thermal mass and high ceilings
4. Passive ventilation
5. Mechanical ventilation
6. Active cooling

**The Camden Local Plan, Cooling Hierarchy**

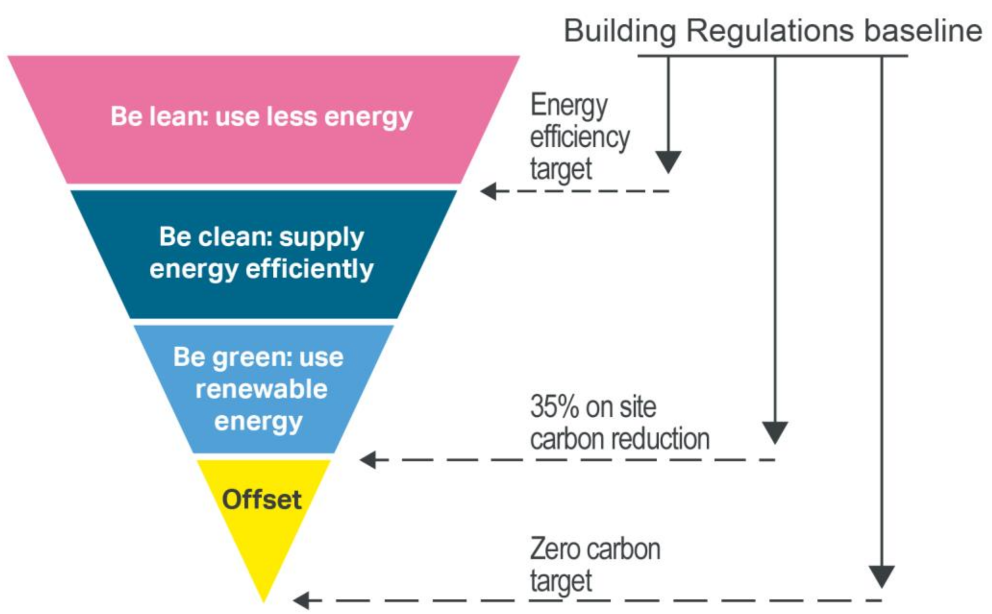
The Camden Local Plan states that active cooling will only be permitted where dynamic thermal modelling demonstrates that there is a clear need for it and the preferred measures detailed in the cooling hierarchy above have been considered.

The provision for cooling has not been included within the development, to mitigate the risk of overheating solar gains have been limited through the use of glazing with ultra low g values to all south facing windows.

The architectural design will follow the principles of Passivhaus by targeting ambitious air infiltration (air tightness) rates and U-values below the limits specified in building regulations.

To further mitigate the risk of overheating green roofs have been incorporated within the building design, these reduce heat transfer whilst providing additional environmental and ecological benefits.

The Energy Hierarchy in the upcoming London Plan 2019




Source: Greater London Authority

## POLICY AND CONTEXT

**The Camden Local Plan, Policy CC1: Demolition**

Policy CC1 requires that all proposals involving substantial demolition demonstrate that it is not possible to retain and improve the existing building.

Paragraph 8.17 states:
*"All proposals for substantial demolition and reconstruction should be fully justified in terms of the optimisation of resources and energy use, in comparison with the existing building. Where the demolition of a building cannot be avoided, we will expect developments to divert 85% of waste from landfill and comply with the Institute for Civil Engineer's Demolition Protocol and either reuse materials on-site or salvage appropriate materials to enable their reuse off-site. We will also require developments to consider the specification of materials and construction processes with low embodied carbon content*."

During the design process, consideration has been given to the possibility of the existing building being renovated. The existing dwelling is in a poor state of repair, with evidence of damp. The current dwelling was built in the late Nineteenth Century, and would have had wooden floors with a void to allow air to circulate preventing damp. During the building's history this wooden floor has been removed and replaced with a concrete floor, without a dampproof membrane, leading to the current damp issue.

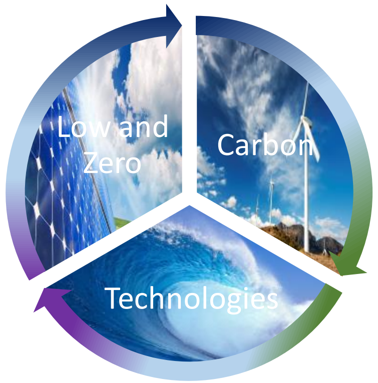
The objective of the proposed scheme is to create a pair of new-build houses. These new houses will each be equipped with an air source heat pump, providing renewable energy, as part of a hybrid air to water heating system; all window are to be double-glazed, with solar glazing used on the South elevation to limit solar gain; and the main perimeter wall of the building will be made from highly-insulated ICF which will lead to near Passivhaus levels of airtightness.

**Re-use of Material**

The bricks from the existing house will be reclaimed and re-used to create paths and paved areas in the front and rear gardens of both new houses, and the alley way between the new building and the school at the rear.

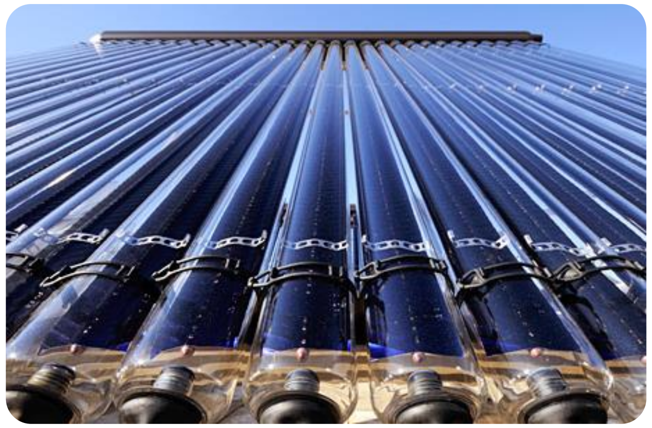
In addition to the re–use of the bricks from the existing dwelling, it is proposed that the demolition is carried out by a company that recycles a very high percentage of its waste. The ambition will be that all materials from the existing house will be recycled or be ground down to become aggregate for construction rather be sent to landfill.

# Low and Zero Carbon Technologies




Before undertaking any energy assessment it is important to review the Low and Zero Carbon (LZC) technologies available and their suitability to the project. There are a number of factors influencing the decision to pursue any LZC installation and these include; location, local environment, political drivers, feasibility (financial and technical), and marketability. In the following sections various available LZC technologies will be reviewed before presenting a decision matrix that will define which technologies will be pursued and tested.

**Solar Thermal Collectors**



Solar water heating (SWH) using solar thermal collectors is a well proven technology and payback periods are relatively short. There are two main types of collector technology – flat plate collectors and evacuated tube collectors. Evacuated tubes are more efficient, around 20% (including better operation on cloudy days), and can produce higher temperature waters up to around 150°C for processes that may be useful for kitchens. Annual outputs of around 450 – 600+ kWh/yr per $m^2$ of collector (flat plate – evacuated) could be possible for a fully optimised installation.

SWH collection panels can achieve net efficiencies around 50%, which is much higher than that of PVs. On the negative side they are slightly more maintenance intensive as PVs benefit from not having any moving parts nor any wet services (i.e. pipework).

**Photovoltaics**

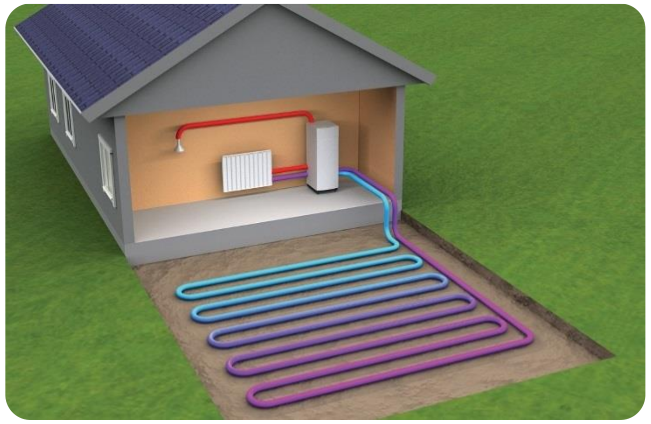
PVs are one of the few true zero carbon energy technologies available on the market. There are no moving parts they require very low maintenance. Systems can be easily integrated into almost any surface at any point in building's life (including fit-out) without major intervention. Systems offer good returns on investment with the Government's "Feed in Tariff" grant.
The annual solar availability in London is around 1000 kWh/$m^2$ cumulative solar radiation incident on an unobstructed (unshaded) horizontal surface. Photovoltaic cells (PV) convert that solar energy (sunlight) into electricity. They are commonly manufactured into glazed collectors which can be ground mounted, roof mounted or building-integrated. The performance of PVs is heavily influenced by over-shadowing. 10% shading could result in 80% loss in electrical performance.

# Low and Zero Carbon Technologies

## Wind Turbines

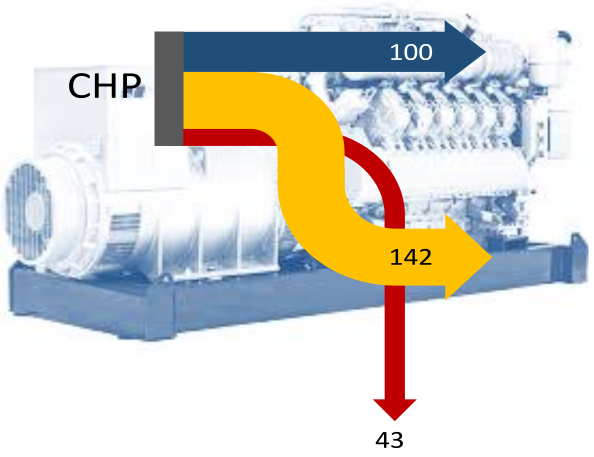
Wind turbines convert the kinetic energy contained in a flowing air/wind mass into electrical energy using an electrical generator.
The following criteria pertaining to this technology have been taken into account for the preliminary viability assessment–visual impacts, noise, intermittent power production, local planning such as height restrictions, impacts on migratory paths of birds, interference with radio and/or TV signals and so on.
The amount of energy which can be extracted is proportional to the square of the turbine diameter and the cube of the wind speed hence the size of the turbine is critical for the viability of an installation. Wind turbines are also known to be quite loud during operation as the mechanically driven generator can be quite loud.

## Heat Pumps



Properly designed and installed heat pumps offer very low carbon space heating and can also provide low carbon cooling. The pumps are powered by electricity although there are variants such as gas-fired absorption units available - albeit with lower efficiencies. Heat pumps take low temperature heat and upgrade it to a higher more useful temperature. The heat source can be from the external ambient air, a nearby water source or the ground. Ambient air and ground as the source of renewable energy have been considered in this assessment.

## Combined Heat and Power




There are various types of co-generation (i.e. CHP/CCHP) prime movers, typically gas turbines, gas engines and fuel cells - or a mix thereof. It is possible that in a modular system some co-generation units could run on biomass (e.g. wood pellets), biofuels, bio-methane from anaerobic digestion of organic wastes, or syngas generated from wastes (e.g. cooking oils, municipal solid waste). Stationary fuel cells are one of the most interesting new technologies and are becoming a more economically viable option for co-generation when compared to aforementioned conventionally used technologies this is due to; better heat-to-power ratios (1:1 vs 1:1.5 for combustion engine CHP), low noise, lower NOx and particulate (PMx) emissions and low-maintenance in operation.

A key requisite for good practice co-generation is that the plant should operate for at least 5,000 hours per annum, i.e. that there is a significant base load for heat all year round - both day and night. Any scheme should as a minimum conform to the CHPQA Good Quality CO-GENERATION Standards (which will also ensure compliance with the EC CO-GENERATION Directive).

# Low and Zero Carbon Technology Decision Matrix

| | Technology | Lifecycle Carbon Saving Potential | Grants | Lifecycle Costs | Space Requirements | Planning Restrictions | Noise | Appropriate for the site | Reason for exclusion |
|---|---|---|---|---|---|---|---|---|---|
| Solar Energy | **Solar Hot Water** | Low | Renewable Heat Incentive | Medium | Low | Suitable | Suitable | Suitable | Discounted due to the roofs being used as roof terraces and green roofs. |
| | **Photovoltaics** | Low-Medium | Feed-In Tariff | High | Low | Suitable | Suitable | Suitable | Discounted due to the roofs being used as roof terraces and green roofs. |
| Wind Energy | **Wind Turbines** | Low-Medium | Feed-In Tariff | Medium | Medium-High | Not acceptable | Noise from gears and generator | Not suitable for urban areas | Noisy and not suitable in urban areas (due to turbulence coming from surrounding buildings). |
| Heat Pumps | **Ground Source Heat Pumps** | Medium | Renewable Heat Incentive | Medium-High | Low | Suitable | Suitable | Not suitable | Limited ground space due to tree root protection zone |
| | **Air Source Heat Pumps** | Low-Medium | Renewable Heat Incentive | Low | Low | Suitable | Fan & compressor noise | Suitable | ASHP tested and found to provide substantial savings. |
| Co-generation and alternative fuels | **Biomass Boilers** | Medium | Renewable Heat Incentive | Medium-Low | Medium | PM10 particulate | Consideration for vehicle noise during regular fuel deliveries to be considered | Not suitable | Discounted due to concerns over emissions, air quality, noise from deliveries and concerns over fuel supplies. |
| | **Biomass CHP** | High | Renewable Heat Incentive | Medium | Medium | PM10 particulate | | Not suitable | |
| | **Gas-fired CHP** | Medium | Feed-In Tariff | Medium-Low | Low | Suitable | Located in acoustically treated plnatrooms | Not suitable | Discounted due to concerns over noise and required demand being too low to be cost effective |
| | **Gas-fired CCHP** | Medium | Feed-In Tariff | Medium-High | Low | Suitable | | Not suitable | |
| | **Fuel Cell CHP/CCHP** | Medium | Feed-In Tariff | High | Low | Suitable | Suitable | Not suitable | |
| | **District Heating/cooling** | Medium-High | Renewable Heat Incentive | Medium | Low | Suitable | Suitable | sn | No networks or future networks planned for the area. |
| Hydro Power | **Small Scale Hydro Power** | Low | Feed-In Tariff | Low | N/A | N/A | N/A | N/A | Not applicable due geographical restrictions. |
| | **Tidal Power** | Low | Feed-In Tariff | Low | N/A | N/A | N/A | N/A | |
| | **Wave Power** | Low | Feed-In Tariff | Low | N/A | N/A | N/A | N/A | |

**Technology to be considered** (green)
**Technology unfeasible or non-applicable** (pink)

# Annual $CO_2$ Emission Calculation – Be Lean

**Modelling Inputs** **Scenario : Be Lean**

| | Value | Unit | Notes |
|---|---|---|---|
| External Wall - U-value | 0.18 | $W/m^2.K$ | |
| Ground Floor - U-value | 0.13 | $W/m^2.K$ | |
| Roof - U-value | 0.13 | $W/m^2.K$ | |
| Window - U-value | 1.2 - 1.4 | $W/m^2.K$ | Double glazed unit - Rooflight |
| Window - g-value | 0.3 - 0.7 | | South Facing and remaining elevations |
| Air permeability | 3.00 | $m^3/hr/m^2$ | |
| Electricity power factor | > 0.95 | | |
| Lighting occupancy controls | Yes | | |
| Lighting daylight controls | No | | |
| Ventilation SFPs | 0.50 | W/l/s | Toilet extract fans |
| Heating Boiler efficiency | 88% | | Condensing boiler, minimum standard for new build home |
| DHW boiler efficiency | 88% | | Condensing boiler, minimum standard for new build home |

The "Be Lean" scenario is used to identify the building's demand reduction measures that are to be incorporated as;

- Fabric insulation and glazing specification

To maximise the passive energy savings that become inherent to the building, following its form and construction, high levels of insulation have been targeted to all exposed surfaces. There is a cost in terms of installation and loss of net internal area (high levels of insulation require larger construction dimensions) but benefit is gained through operational savings and smaller capital cost for heating and reduced overheating risks.

Also, the notional building against which the proposed design is compared features a specified glazing ratio which penalises designs with curtain walled facades or full height glazing. To overcome this windows have been shown to be double glazed with very low U-values and low g-values, this is to ensure that when the external wall is evaluated as a whole the overall insulation level between actual and notional designs will be comparable.

- Lighting efficacy and controls

Through the use of low energy LED light fittings we can provide a 10 fold improvement on the old tungsten and fluorescent fittings meaning significant energy savings can be achieved by optimising the lighting design. Lighting can account for as much as 25% of the building's energy consumption and through design can be reduced by 75%.

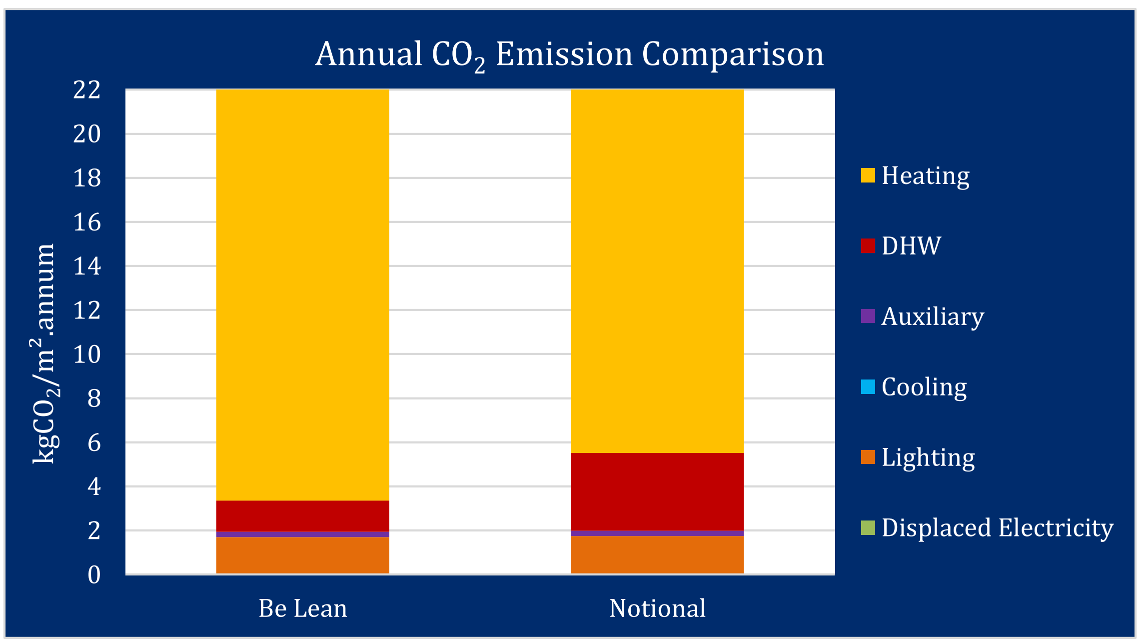
- Efficient mechanical services design strategy

The Building Regulations set a minimum standard for system efficiencies and there are several approaches that can be used and selection will depend on the building environment that include factors such as; size, location, use, local authorities. To meet the building's proposed ventilation requirements the proposed design shall include natural ventilation provided via openable windows.

# Annual $CO_2$ Emission Calculation – Be Lean – 20 Vicars Road

As illustrated in the results, the building sees energy and carbon dioxide emission savings for Domestic Hot Water, this saving gives an overall reduction in the annual carbon dioxide emissions.

The "Be Lean" scenario shows a 0.5% reduction in carbon dioxide emissions compared with the Notional building design.



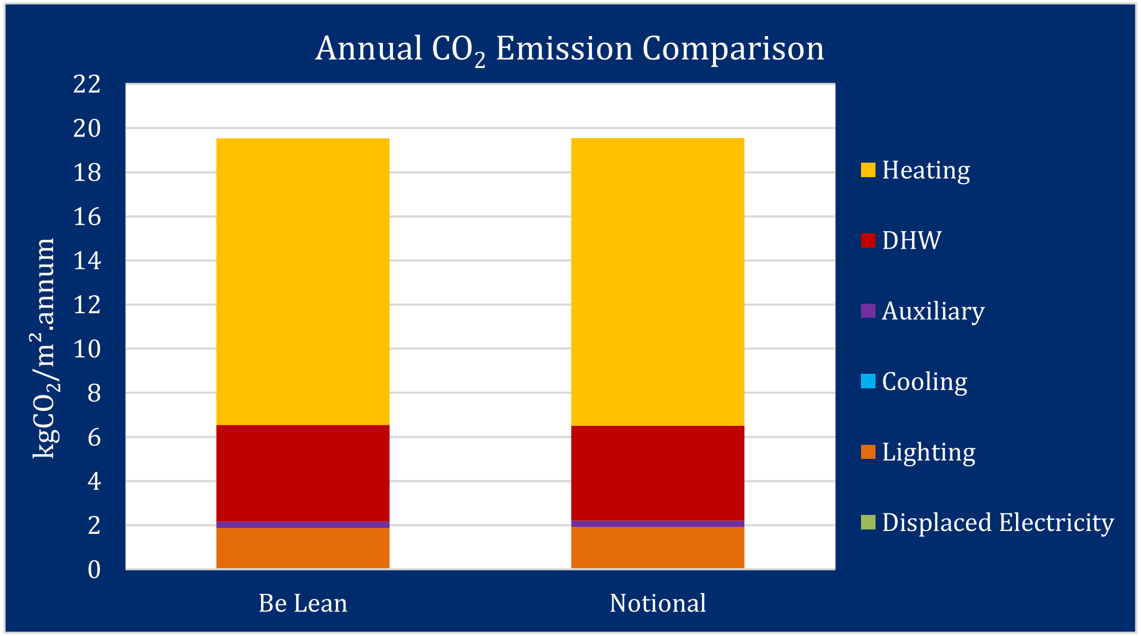

| $CO_2$ Emissions $kgCO_2/m^2$.annum | Be Lean | Notional |
|---|---|---|
| Heating | 18.66 | 16.61 |
| Cooling | 0.00 | 0.00 |
| Auxiliary | 0.24 | 0.24 |
| Lighting | 1.69 | 1.74 |
| DHW | 1.43 | 3.53 |
| Displaced Electricity | 0.00 | 0.00 |
| | 22.02 | 22.12 |
| Total Floor Area ($m^2$) | 160 | 160 |

# ANNUAL $CO_2$ EMISSION CALCULATION – BE LEAN – 20A VICARS ROAD

As illustrated in the results, the building sees favourable energy and carbon dioxide emission savings in all areas apart from "Auxiliary" which accounts from emissions associated with extract fans and pump operations and domestic hot water

The "Be Lean" scenario shows a 0.1% reduction in carbon dioxide emissions compared with the Notional building design.

| $CO_2$ Emissions $kgCO_2/m^2$.annum | Be Lean | Notional |
|---|---|---|
| **Heating** | 13.00 | 13.05 |
| **Cooling** | 0.00 | 0.00 |
| **Auxiliary** | 0.30 | 0.30 |
| **Lighting** | 1.86 | 1.91 |
| **DHW** | 4.37 | 4.30 |
| **Displaced Electricity** | 0.00 | 0.00 |
| | 19.53 | 19.55 |
| **Total Floor Area ($m^2$)** | 131 | 131 |



# ANNUAL $CO_2$ EMISSION CALCULATION – BE CLEAN

**Modelling Inputs**

**Scenario : Be Clean**

| | Value | Unit | Notes |
|---|---|---|---|
| External Wall - U-value | 0.18 | $W/m^2.K$ | |
| Ground Floor - U-value | 0.13 | $W/m^2.K$ | |
| Roof - U-value | 0.13 | $W/m^2.K$ | |
| Window - U-value | 1.2 - 1.4 | $W/m^2.K$ | Double glazed unit - Rooflight |
| Window - g-value | 0.3 - 0.7 | | South Facing and remaining elevations |
| Air permeability | 3 | $m^3/hr/m^2$ | |
| Electricity power factor | > 0.95 | | |
| Lighting efficacies | 90 - 100 | lm/cW | |
| Lighting occupancy controls | Yes | | |
| Ventilation SFPs | 0.50 | W/l/s | Toilet extract fans |
| Heating Boiler efficiency | 94% | | Specified boiler |
| DHW boiler efficiency | 94% | | Specified boiler |

The "Be Clean" scenario is used to identify further carbon dioxide emission savings to be achieved through the application of low carbon technologies;

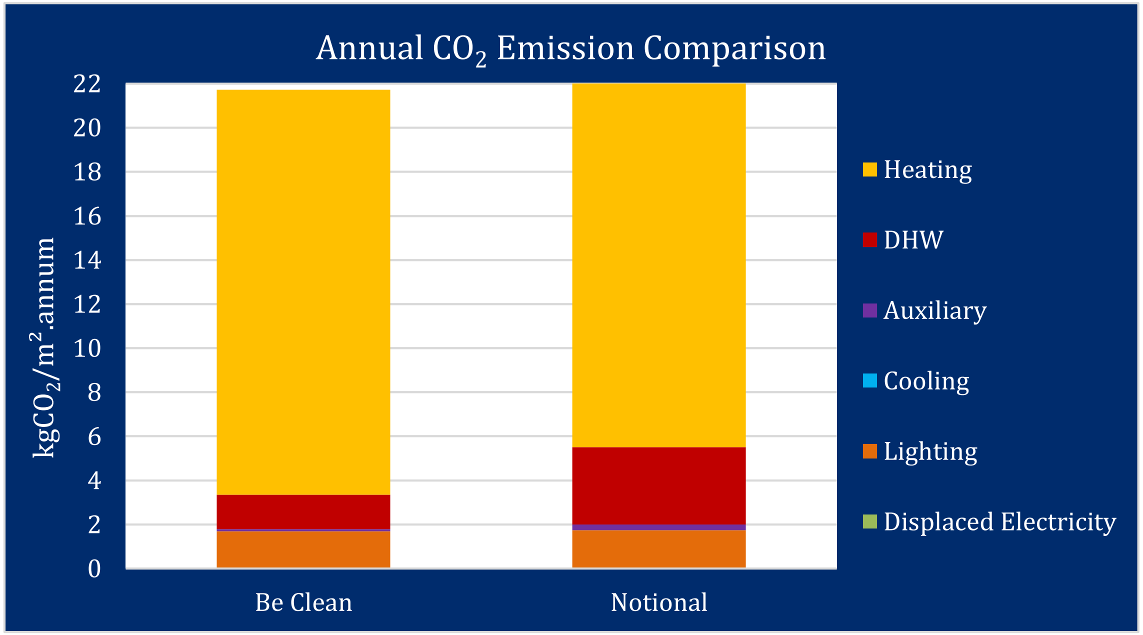
- High Efficiency Boiler

The use of a modern, condensing gas fired boiler with a high efficiency rating allows for an improvement in $CO_2$ emissions for heating and hot water provision. A gas boiler with a high efficiency rating allows for a reduction in fuel use, $No_x$ emissions and $CO_2$ emissions over a gas boiler with a lower efficiency rating.

# Annual $CO_2$ Emission Calculation – Be Clean – 20 Vicars Road

The "Be Clean" scenario shows a 1.7% reduction in carbon dioxide emissions compared with the Notional building design.

The results indicate that emissions savings are achieved in all areas, except for heating. The increase in emissions over the notional building, for heating, can be attributed to the use of a gas fired boiler as the primary heating source. Through the use of low energy LED light fittings, with the use of presence detection and smart controls an overall saving can be achieved.

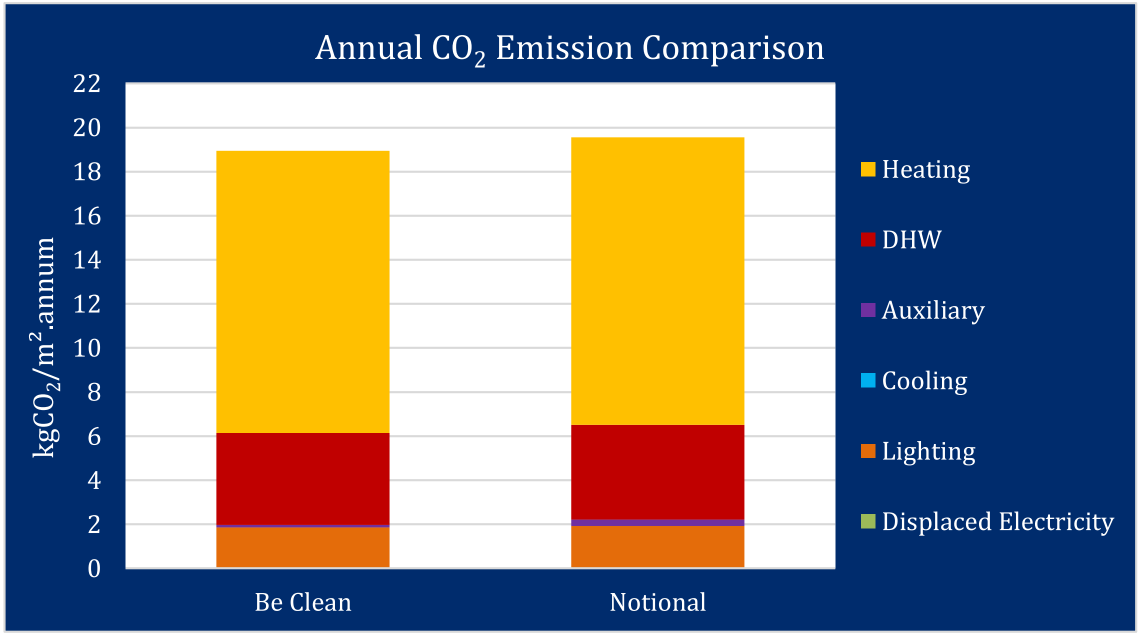



| $CO_2$ Emissions $kgCO_2/m^2$.annum | Be Clean | Notional |
|---|---|---|
| Heating | 18.39 | 16.61 |
| Cooling | 0.00 | 0.00 |
| Auxiliary | 0.09 | 0.24 |
| Lighting | 1.69 | 1.74 |
| DHW | 1.56 | 3.51 |
| Displaced Electricity | 0.00 | 0.00 |
| | 21.73 | 22.11 |
| Total Floor Area ($m^2$) | 160 | 160 |

# ANNUAL $CO_2$ EMISSION CALCULATION – BE CLEAN – 20A VICARS ROAD

The “Be Clean” scenario shows a 3.0% reduction in carbon dioxide emissions compared with the Notional building design.

Through the use of an ultra efficient condensing boiler low energy LED light fittings, the use of presence detection and smart controls an overall saving can be achieved, the results indicate that emissions savings are achieved in all areas.




| $CO_2$ Emissions $kgCO_2/m^2$.annum | Be Clean | Notional |
|---|---|---|
| **Heating** | 12.81 | 13.05 |
| **Cooling** | 0.00 | 0.00 |
| **Auxiliary** | 0.11 | 0.30 |
| **Lighting** | 1.86 | 1.92 |
| **DHW** | 4.16 | 4.30 |
| **Displaced Electricity** | 0.00 | 0.00 |
| | 18.95 | 19.56 |
| **Total Floor Area ($m^2$)** | 131 | 131 |

# Annual $CO_2$ Emission Calculation – Be Green

**Modelling Inputs** — Scenario : Be Green

| | Value | Unit | Notes |
|---|---|---|---|
| External Wall - U-value | 0.18 | W/m².K | |
| Ground Floor - U-value | 0.13 | W/m².K | |
| Roof - U-value | 0.13 | W/m².K | |
| Window - U-value | 1.2 - 1.4 | W/m².K | Double glazed unit - Rooflight |
| Window - g-value | 0.3 - 0.7 | | South Facing and remaining elevations |
| Air permeability | 3 | m³/hr/m² | |
| Electricity power factor | > 0.95 | | |
| Lighting efficacies | 90 - 100 | lm/cW | |
| Lighting occupancy controls | Yes | | |
| Ventilation SFPs | 0.50 | W/l/s | Toilet extract fans |
| Heating efficiency | 3.2 | SCOP | Heat Pump - Mitsubishi PUHZ-SW75VHA |
| Secondary Heating efficiency | 94% | | Specified boiler |
| DHW boiler efficiency | 94% | | Specified boiler |

The "Be Green" stage of the energy hierarchy requires that developments make use of renewable technologies to achieve the sites overall carbon dioxide emissions target.

In this instance and within the context of the buildings form and location the most suitable renewable technology has been found to be Air Source Heat Pump (according to the LZC decision matrix) producing low carbon heating.

- Air Source Heat Pump

To ensure that an Air Source Heat Pump runs efficiently the system needs to be accurately sized. The size of a heat pump depends on factors, including outdoor design temperature, desired room temperature and the system flow and return temperatures.

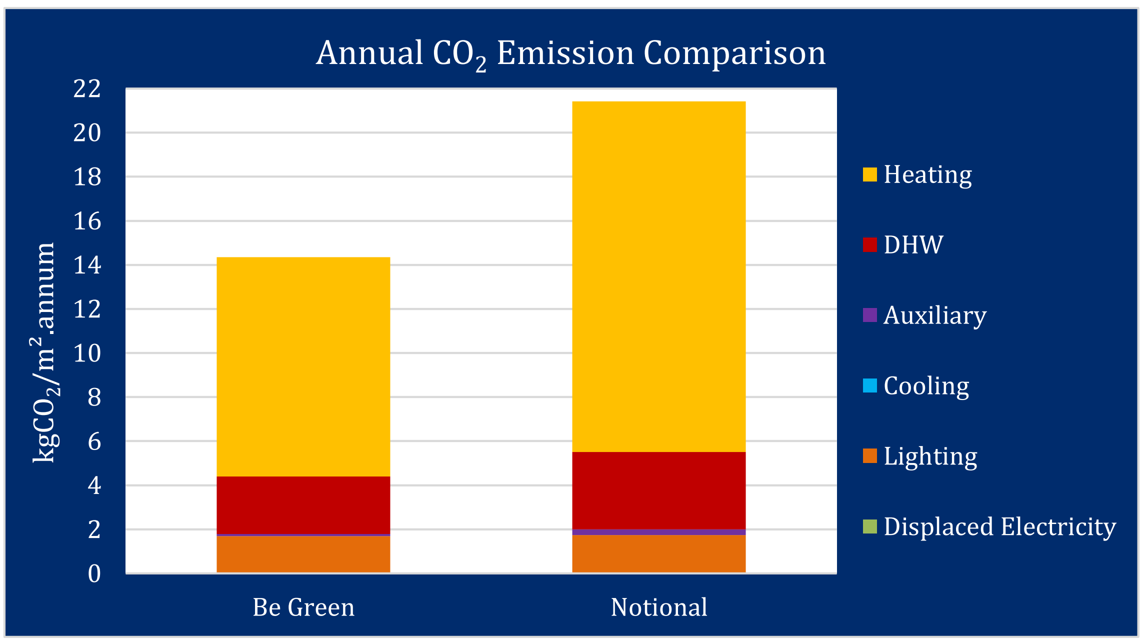
The proposed system shall be an air to water system utlising the R32 refrigerant gas which has a Global Warming Potential 68% lower than the conventional R410a refrigerant (675 vs 2,088). The system will be a monobloc system meaning the refrigerant will not extend beyond the external unit thereby reducing the amount of refrigerant needed as well as eliminating the risk of refrigerant leaks within the building.

The heat pump will be used to supply the heating and hot water, with a secondary boiler used for additional hot water support.

# ANNUAL $CO_2$ EMISSION CALCULATION – BE GREEN – 20 VICARS ROAD

The "Be Clean" scenario shows a 32.9% reduction in carbon dioxide emissions compared with the Notional building design.

The major carbon emission savings can be attributed to the efficiency gains in using the air source heat pump (electrical) in place of a conventional gas-fired boiler. The efficiency of the air source heat pumps is almost 3.5 times greater than the specified boiler (320% vs 94%), but the carbon emission factor for electricity versus gas is 0.519 $kgCO_2$/kWh vs 0.216 $kgCO_2$/kWh (more than two times greater).

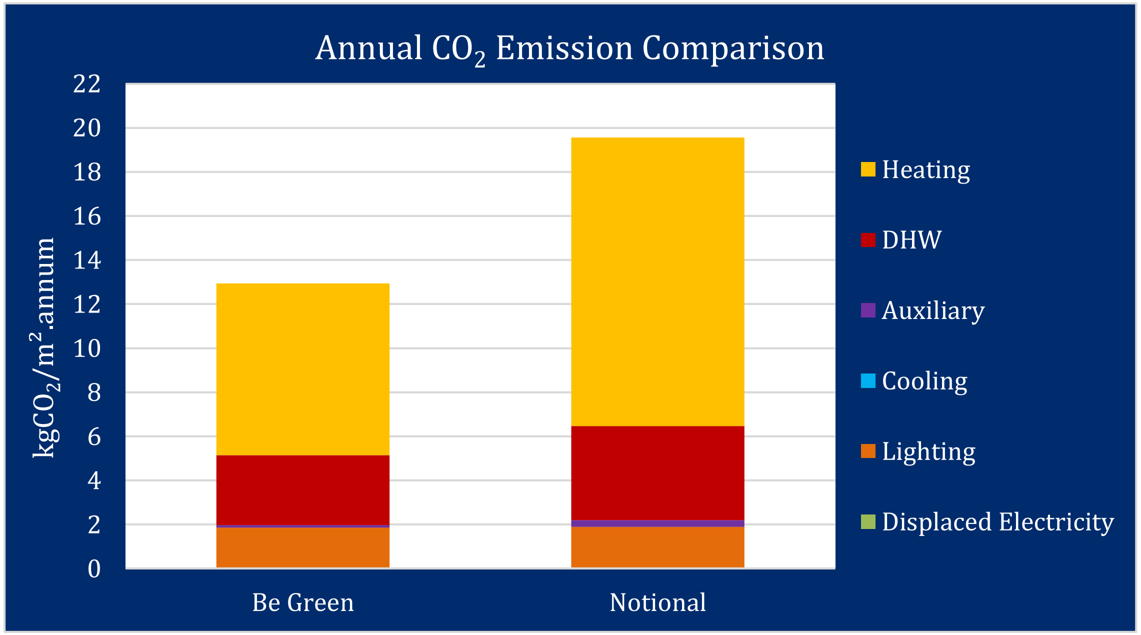



| $CO_2$ Emissions $kgCO_2/m^2$.annum | Be Green | Notional |
|---|---|---|
| Heating | 9.96 | 15.92 |
| Cooling | 0.00 | 0.00 |
| Auxiliary | 0.09 | 0.24 |
| Lighting | 1.69 | 1.74 |
| DHW | 2.61 | 3.51 |
| Displaced Electricity | 0.00 | 0.00 |
| | 14.36 | 21.42 |
| Total Floor Area ($m^2$) | 160 | 160 |

# ANNUAL $CO_2$ EMISSION CALCULATION – BE GREEN – 20A VICARS ROAD

The "Be Clean" scenario shows a 33.8% reduction in carbon dioxide emissions compared with the Notional building design.

The major carbon emission savings can be attributed to the efficiency gains in using the air source heat pump (electrical) in place of a conventional gas-fired boiler. The efficiency of the air source heat pumps almost 3.5 times greater than the specified boiler (320% vs 94%), but the carbon emission factor for electricity versus gas is 0.519 $kgCO_2$/kWh vs 0.216 $kgCO_2$/kWh (more than two times greater).




| $CO_2$ Emissions $kgCO_2/m^2$.annum | Be Green | Notional |
|---|---|---|
| **Heating** | 7.81 | 13.10 |
| **Cooling** | 0.00 | 0.00 |
| **Auxiliary** | 0.11 | 0.30 |
| **Lighting** | 1.86 | 1.89 |
| **DHW** | 3.16 | 4.27 |
| **Displaced Electricity** | 0.00 | 0.00 |
| | 12.95 | 19.56 |
| **Total Floor Area ($m^2$)** | 131 | 131 |

# Sustainability Statement

The client and returning occupiers of 20 Vicars Road have set an ambitious target for sustainability where the design team have been tasked with maximising energy savings through passive and active designs, as well measures looking at water savings and ecology.

In response the following measures can be directly attributed to the sustainability design of the building;

Passive architectural designs:

- High insulation levels exceeding minimum Building Regulation requirements.
- High performance double glazing units with low u-values and g-values.
- Solar control glass on the south facing elevation
- Exposed thermal mass designed to reduce heating demands.

Active services designs:

- Space heating and hot water provided by highly efficient air source heat pumps.
- Specification of low energy LED lighting with occupancy controls and dimming.

Water saving measures:

- Rainwater harvesting to be used for irrigation.
- Dual flush toilets to limit over consumption of water.

Ecological features:

- Green roofs have been included to some terrace areas to be used to promote; species biodiversity, local wildlife, and improve air quality.
- Green roofs will also provide rainwater attenuation to limit the impact to the local sewers.

With all of these measures in place the buildings have shown an impressive annual carbon dioxide emission reduction of **32.9%** and **33.8%** for 20 and 20a Vicars Road respectively when compared with the notional building and exceeds the Camden target of 19%.

## CONCLUSIONS

Every effort has been made to prioritise energy savings and carbon dioxide emission reductions through early engagement with the design team during concept development and extensive energy modelling.

Ambitious levels of thermal performance have been set for the building fabric with double glazing specified for all new windows and the target u-values for all external elements have been set well below the limits set by The Building Regulations.

With this strategy the thermal modelling exercise demonstrating the three levels of The Energy Hierarchy show the following progressing reductions in annual carbon dioxide emissions:

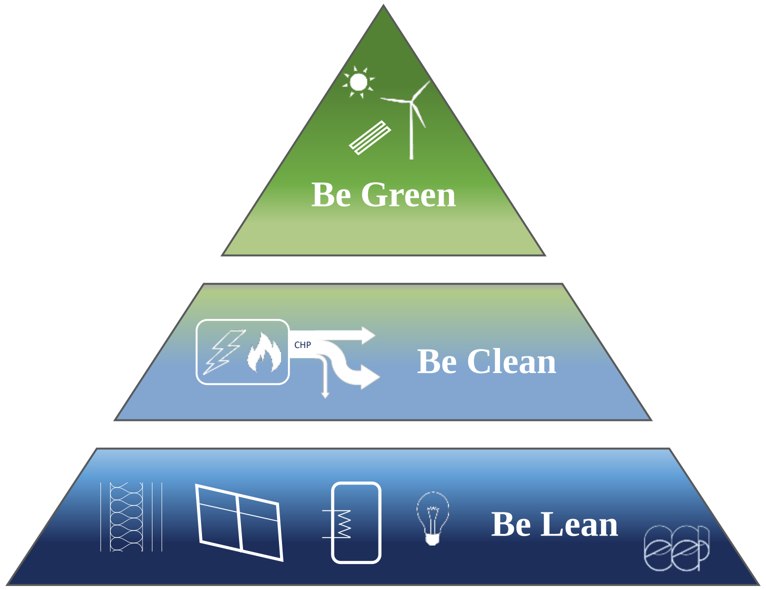
20 Vicars Road

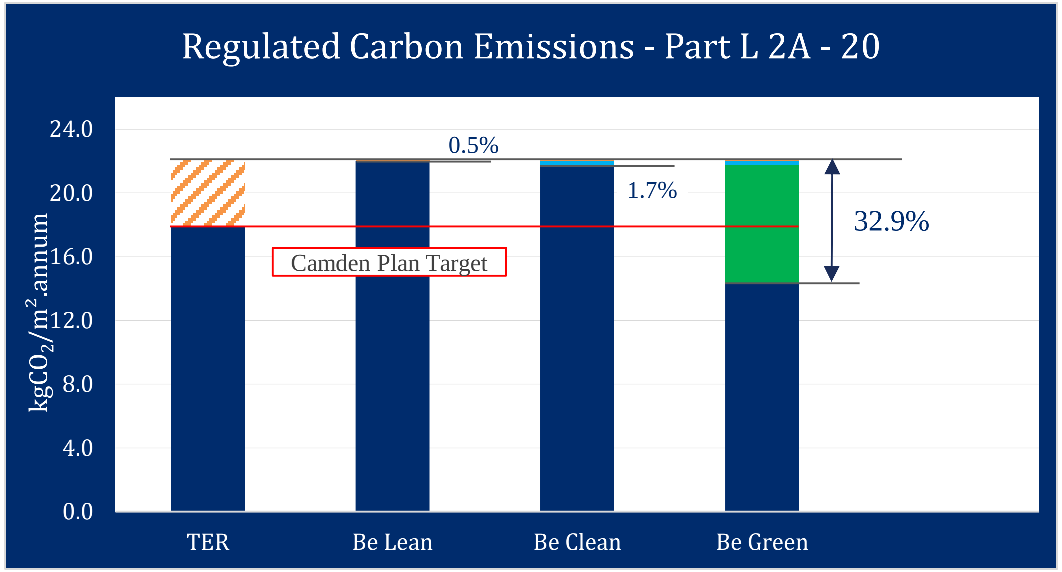
- Be Lean – **0.5%**
- Be Clean – **1.7%**
- Be Green – **32.9%**

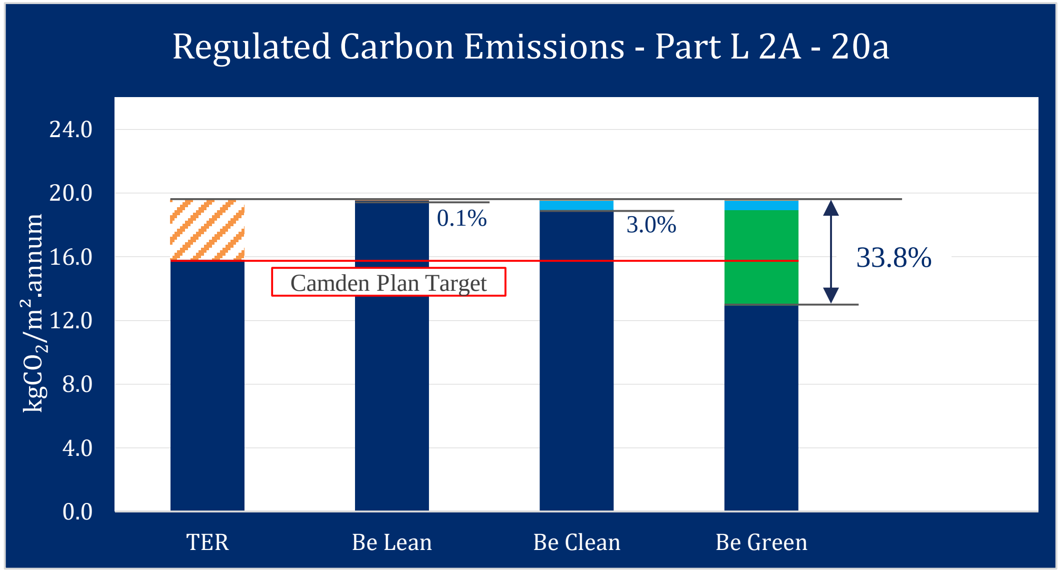
20A Vicars Road

- Be Lean – **0.1%**
- Be Clean – **3.0%**
- Be Green – **33.8%**

This demonstrates that the building will achieve the 19% carbon dioxide reductions targets as set by The Camden Local Plan.



ENVIRONMENTAL ENGINEERING PARTNERSHIP

CONSULTING ENGINEERS

## Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.4.23
*Printed on 28 January 2020 at 14:24:12*

**Project Information:**

**Assessed By:** () **Building Type:** Semi-detached House

**Dwelling Details:**

**NEW DWELLING DESIGN STAGE** Total Floor Area: 160m²
**Site Reference :** 20 Vicars Road **Plot Reference:** 20 - Be Green
**Address :** 20 , Vicars Road, Camden, London , NW5 4NL

**Client Details:**

**Name:**
**Address :**

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

**1a TER and DER**

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

| | | |
|---|---|---|
| Target Carbon Dioxide Emission Rate (TER) | 21.42 kg/m² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 14.37 kg/m² | OK |

**1b TFEE and DFEE**

| | | |
|---|---|---|
| Target Fabric Energy Efficiency (TFEE) | 83.0 kWh/m² | |
| Dwelling Fabric Energy Efficiency (DFEE) | 81.7 kWh/m² | |
| | | OK |

**2 Fabric U-values**

| Element | Average | Highest | |
|---|---|---|---|
| External wall | 0.18 (max. 0.30) | 0.18 (max. 0.70) | OK |
| Party wall | 0.00 (max. 0.20) | - | OK |
| Floor | 0.13 (max. 0.25) | 0.13 (max. 0.70) | OK |
| Roof | 0.13 (max. 0.20) | 0.13 (max. 0.35) | OK |
| Openings | 1.24 (max. 2.00) | 1.50 (max. 3.30) | OK |

**2a Thermal bridging**

Thermal bridging calculated using user-specified y-value of 0.15

**3 Air permeability**

| | | |
|---|---|---|
| Air permeability at 50 pascals | 3.00 (design value) | |
| Maximum | 10.0 | OK |

**4 Heating efficiency**

Main Heating system:
Heat pumps with radiators or underfloor heating - electric
Mitsubishi Ecodan 8.5 kW

Main Heating system 2:
Boiler systems with radiators or underfloor heating - mains gas
Data from manufacturer
Combi boiler
Efficiency 94.0 % SEDBUK2009
Minimum 88.0 % OK

## Regulations Compliance Report

Minimum 88.0 % OK

Secondary heating system: None

**5 Cylinder insulation**

| | | |
|---|---|---|
| Hot water Storage: | Measured cylinder loss: 1.79 kWh/day | |
| | Permitted by DBSCG: 2.24 kWh/day | OK |
| Primary pipework insulated: | Yes | OK |

**6 Controls**

| | | |
|---|---|---|
| Space heating controls | TTZC by plumbing and electrical services | OK |
| Space heating controls 2: | Time and temperature zone control by suitable arrangement of plumbing and electrical | OK |
| Hot water controls: | Cylinderstat | OK |
| | Independent timer for DHW | OK |
| Boiler interlock: | Yes | OK |

**7 Low energy lights**

| | | |
|---|---|---|
| Percentage of fixed lights with low-energy fittings | 100.0% | |
| Minimum | 75.0% | OK |

**8 Mechanical ventilation**

Not applicable

**9 Summertime temperature**

| | | |
|---|---|---|
| Overheating risk (South East England): | Not significant | OK |
| Based on: | | |
| Overshading: | More than average | |
| Windows facing: South | 4.34m² | |
| Windows facing: South | 3.74m² | |
| Windows facing: South | 4.34m² | |
| Windows facing: South | 3.74m² | |
| Windows facing: South | 10.28m² | |
| Windows facing: West | 2.17m² | |
| Windows facing: West | 3.08m² | |
| Windows facing: West | 3.08m² | |
| Windows facing: West | 7.7m² | |
| Windows facing: West | 2.22m² | |
| Windows facing: West | 2.57m² | |
| Windows facing: North | 1.87m² | |
| Windows facing: North | 1.54m² | |
| Windows facing: North | 2.17m² | |
| Windows facing: North | 1.54m² No overhang | |
| Windows facing: North | 3.08m² | |
| Roof windows facing: Horizontal | 7.74m² | |
| Ventilation rate: | 6.00 | |
| Blinds/curtains: | None | |

**10 Key features**

| | |
|---|---|
| Air permeablility | 3.0 m³/m²h |
| Party Walls U-value | 0 W/m²K |

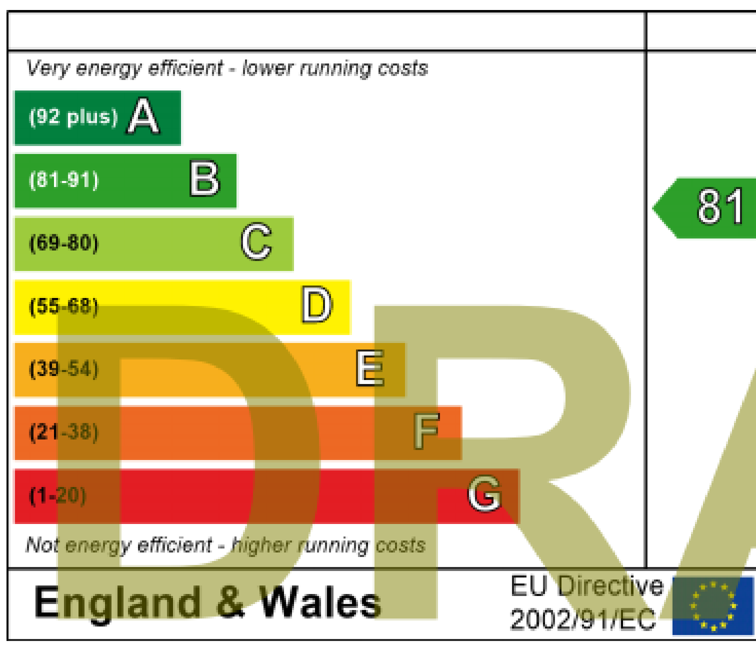
# Predicted Energy Assessment

| | | | |
|---|---|---|---|
| 20 | | Dwelling type: | Semi-detached House |
| Vicars Road | | Date of assessment: | 21 January 2020 |
| Camden | | Produced by: | Stroma Certification |
| London | | Total floor area: | 160 m² |
| NW5 4NL | | | |

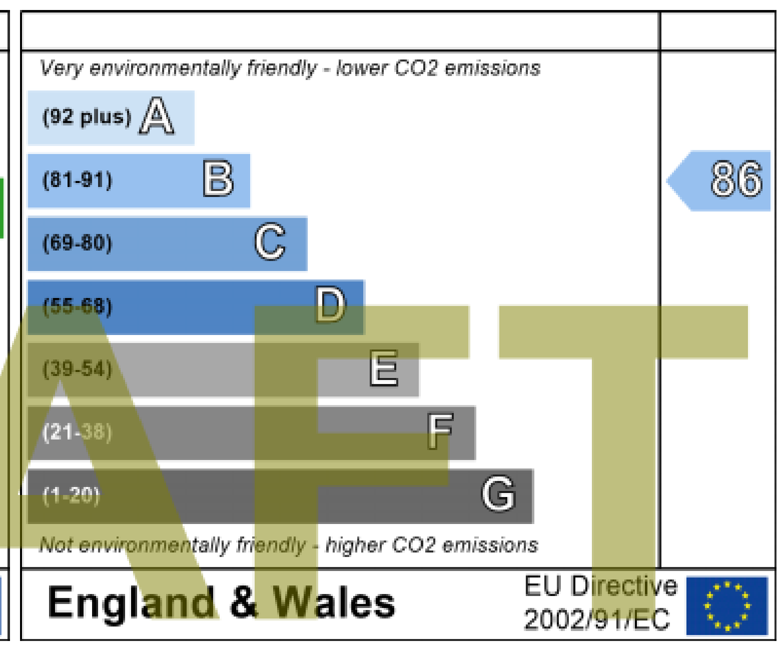
This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

Energy performance has been assessed using the SAP 2012 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO2) emissions.

## Energy Efficiency Rating




## Environmental Impact ($CO_2$) Rating






The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO2) emissions. The higher the rating the less impact it has on the environment.

## Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.4.23
*Printed on 24 January 2020 at 13:59:02*

**Project Information:**

**Assessed By:** () **Building Type:** Semi-detached House

**Dwelling Details:**

**NEW DWELLING DESIGN STAGE** Total Floor Area: 131m²
**Site Reference :** 20 Vicars Road **Plot Reference:** 20a Be Green
**Address :** 20 , Vicars Road, Camden, London , NW5 4NL

**Client Details:**

**Name:**
**Address :**

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

**1a TER and DER**

| | | |
|---|---|---|
| Fuel for main heating system: Electricity | | |
| Fuel factor: 1.55 (electricity) | | |
| Target Carbon Dioxide Emission Rate (TER) | 19.57 kg/m² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 12.96 kg/m² | OK |

**1b TFEE and DFEE**

| | | |
|---|---|---|
| Target Fabric Energy Efficiency (TFEE) | 70.0 kWh/m² | |
| Dwelling Fabric Energy Efficiency (DFEE) | 69.5 kWh/m² | |
| | | OK |

**2 Fabric U-values**

| Element | Average | Highest | |
|---|---|---|---|
| External wall | 0.18 (max. 0.30) | 0.18 (max. 0.70) | OK |
| Party wall | 0.00 (max. 0.20) | - | OK |
| Floor | 0.13 (max. 0.25) | 0.13 (max. 0.70) | OK |
| Roof | 0.13 (max. 0.20) | 0.13 (max. 0.35) | OK |
| Openings | 1.26 (max. 2.00) | 1.50 (max. 3.30) | OK |

**2a Thermal bridging**

Thermal bridging calculated using user-specified y-value of 0.15

**3 Air permeability**

| | | |
|---|---|---|
| Air permeability at 50 pascals | 3.00 (design value) | |
| Maximum | 10.0 | OK |

**4 Heating efficiency**

Main Heating system:
Heat pumps with radiators or underfloor heating - electric
Mitsubishi Ecodan 8.5 kW

Main Heating system 2:
Boiler systems with radiators or underfloor heating - mains gas
Data from manufacturer
Combi boiler
Efficiency 94.0 % SEDBUK2009
Minimum 88.0 % OK



## Regulations Compliance Report

| | | |
|---|---|---|
| Secondary heating system: | None | |

**5 Cylinder insulation**

| | | |
|---|---|---|
| Hot water Storage: | Measured cylinder loss: 1.79 kWh/day | |
| | Permitted by DBSCG: 2.24 kWh/day | OK |
| Primary pipework insulated: | Yes | OK |

**6 Controls**

| | | |
|---|---|---|
| Space heating controls | TTZC by plumbing and electrical services | OK |
| Space heating controls 2: | Time and temperature zone control by suitable arrangement of plumbing and electrical s | OK |
| Hot water controls: | Cylinderstat | OK |
| | Independent timer for DHW | OK |
| Boiler interlock: | Yes | OK |

**7 Low energy lights**

| | | |
|---|---|---|
| Percentage of fixed lights with low-energy fittings | 100.0% | |
| Minimum | 75.0% | OK |

**8 Mechanical ventilation**

Not applicable

**9 Summertime temperature**

| | | |
|---|---|---|
| Overheating risk (South East England): | Slight | OK |
| Based on: | | |
| Overshading: | More than average | |
| Windows facing: North | 2.01m² | |
| Windows facing: North | 3.32m² | |
| Windows facing: North | 1.66m² | |
| Windows facing: North | 3.86m² | |
| Windows facing: North | 1.87m² | |
| Windows facing: North | 2.73m² | |
| Windows facing: North | 3.21m² | |
| Windows facing: East | 4.34m² | |
| Windows facing: East | 3.74m² | |
| Windows facing: South | 1.66m² | |
| Windows facing: South | 1.93m² | |
| Windows facing: South | 1.87m² | |
| Windows facing: South | 2.73m² | |
| Roof windows facing: Horizontal | 7.74m² | |
| Ventilation rate: | 6.00 | |

**10 Key features**

| | |
|---|---|
| Air permeablility | 3.0 m³/m²h |
| Party Walls U-value | 0 W/m²K |

## Predicted Energy Assessment

20
Vicars Road
Camden
London
NW5 4NL

| | |
|---|---|
| Dwelling type: | Semi-detached House |
| Date of assessment: | 21 January 2020 |
| Produced by: | Stroma Certification |
| Total floor area: | 131 m² |

This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

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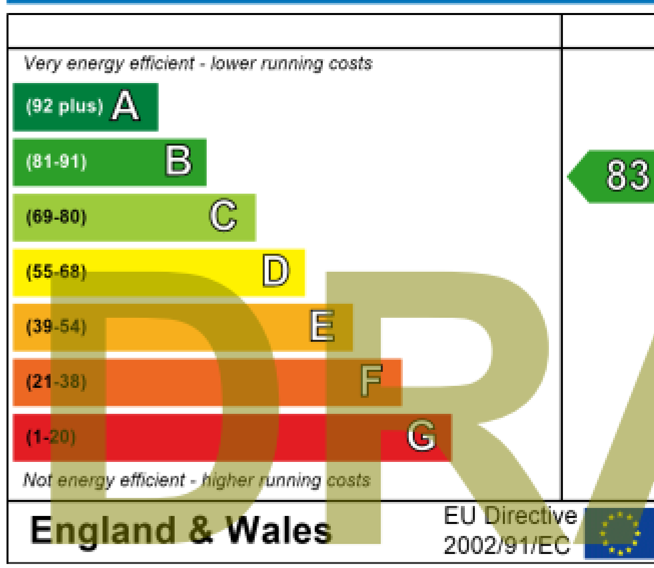
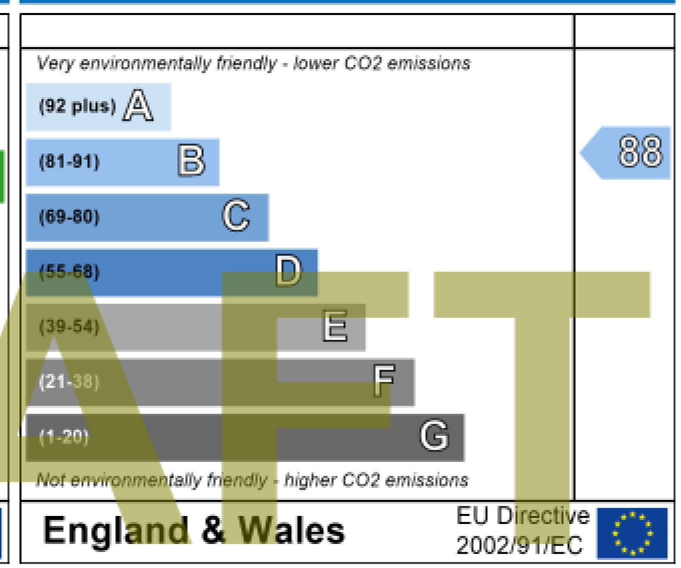
### Energy Efficiency Rating




### Environmental Impact ($CO_2$) Rating




The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO2) emissions. The higher the rating the less impact it has on the environment.