# Energy Strategy

## Sixth-floor Apartments at 254 Kilburn High Road

Revision C

Date: 26th April 2021

WALKER MOWER

## REVISION HISTORY

| Revision | Issue Date | Description | Issued By | Checked By |
|---|---|---|---|---|
| A | 25/03/2021 | First Issue | DS/GL | LW |
| B | 22/04/2021 | Revised Issue | DS/ED | DS |
| C | 26/04/2021 | Re-Revised Issue | DS/ED | DS |
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Calculations contained within this report have been produced based on information supplied by the Client and the design team. Any alterations to the technical specification on which this report is based will invalidate its findings.

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# 1. EXECUTIVE SUMMARY

This Energy Strategy has been produced by Walker Mower/Energist UK on behalf of 254 Kilburn HR LLP ('the Applicant').

It will set out the design measures that have been implemented by the Applicant to achieve the required $CO_2$ reductions at the development site: Sixth floor apartments at 254 Kilburn High Road, ('the Development').

The Strategy is written in support of the full planning application submitted to London Borough of Camden.

The Strategy will demonstrate measures taken by the Applicant to comply with:

i) National Planning Policy Framework.

ii) The London Plan (Greater London Authority, 2016) planning policies 5.2 to 5.7 and 5.15 on climate change mitigation measures to:

- Achieve a minimum 35% on-site reduction in $CO_2$ emissions over Approved Document Part L (AD L) 2013 for all major, domestic, and non-domestic development.
- Evaluate the viability of decentralised energy in accordance with the following hierarchy: 1) connection to existing heating or cooling networks, 2) site-wide CHP network and 3) communal heating and cooling.
- Design domestic development so that mains-water consumption meets a target of 105 litres or less per person per day (excluding an allowance of 5 litres or less per person per day for external water consumption).
- In relation to the six new apartments on the sixth floor The local planning policy requirements for London Borough Of Camden to meet:
    - *Condition 5 of 2018/4916/P*

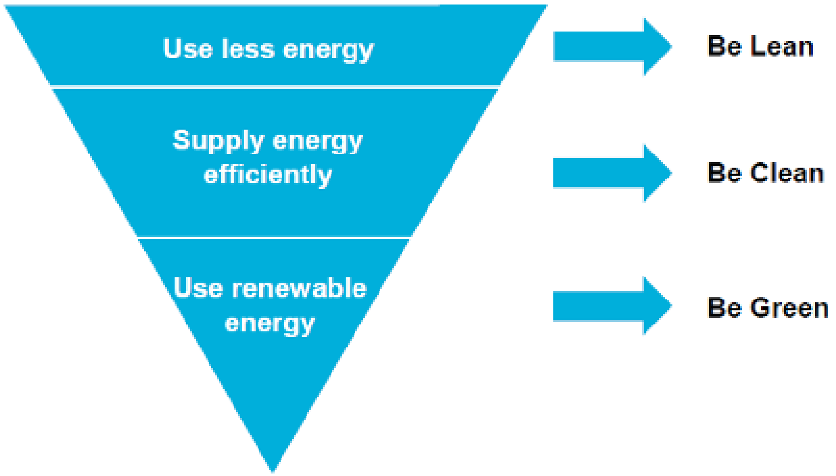
        *(a) Energy efficient measures to demonstrate a 19% $CO^2$ reduction below Part L 2013 Building Regulations.*

        *(B) the feasibility for appropriate renewable or low carbon sustainable energy sources with the aim of reducing the development's carbon emission by at least 20%.*

The Energy Strategy describes demand-reduction measures, energy-efficiency measures, and low-carbon in relation to how the Applicant meets the objectives of the energy hierarchy: Be Lean, Be Clean, Be Green. Refer to Figure 1.

This energy strategy document should be read in conjunction with the Kilburn High Road Integraton UK overheating analysis report dated 4th September 2018 Ref 525.

Figure 1. The Energy Hierarchy.



The Strategy concludes that the following combination of measures, summarised here in Table 1, are included in the design of the Development:

Table 1. Measures incorporated to deliver the energy standard.

| | |
|---|---|
| Be Lean | ▪ Energy-efficient building fabric and insulation to all heat loss floors, walls and roofs.<br>▪ High-efficiency double-glazed windows throughout.<br>▪ Quality of build will be confirmed by achieving good air-tightness results throughout.<br>▪ Efficient-building services including high-efficiency heating systems.<br>▪ Low-energy lighting throughout the building. |
| Be Clean | ▪ A CHP system the Bosch CE19-2NA provides 79% of the heating demand. The system has an efficiency of 86.7% and a Heat to Power Ratio of 1.68. The remaining 21% of the demand will be meet by 90.4% efficient Mains gas boilers. |
| Be Green | ▪ 3.5 kWp of PV South West facing with little or no over shading on a 30° pitch will serve Sixth floor apartments at 254 Kilburn High Road. Which is approximately 25m² – 28m² of panels. |

The impact of these design measures and low-carbon and renewable energy solutions, in terms of how the Applicant delivers their commitment to the energy hierarchy, is illustrated in Figure 2 and Table 2.

Figure 2. How the Sixth-floor apartments at 254 Kilburn High Road deliver the energy hierarchy.

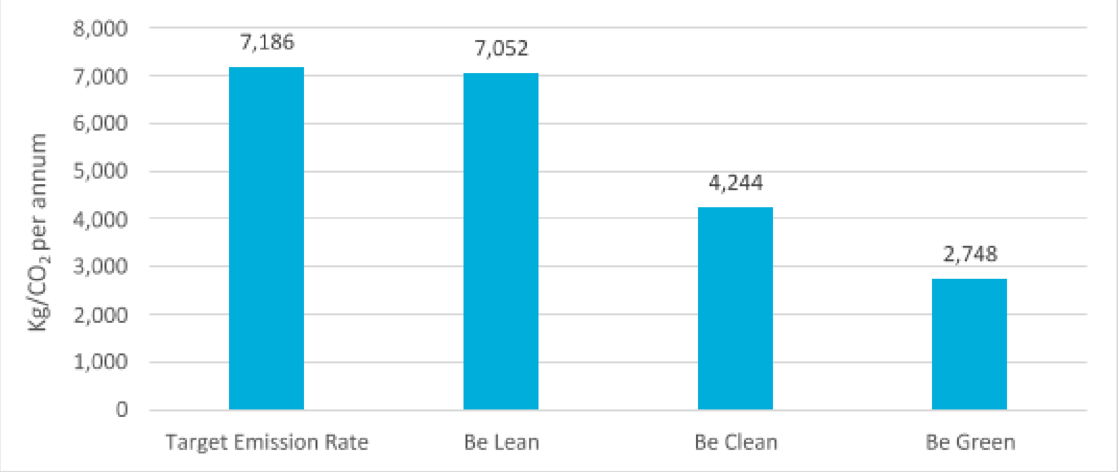


Table 2. $CO_2$ emissions and savings after each stage of the energy hierarchy for the Sixth floor apartments at 254 Kilburn High Road

| | $CO_2$ emissions | |
|---|---|---|
| | Kg/$CO_2$ per annum | % reduction |
| Target Emission Rate:<br>Compliant with AD L 2013 | 7,186 | - |
| Be Lean:<br>After demand-reduction measures | 7,052 | 1.85% |
| Be Clean: | 4,244 | 39.09% |
| Be Green:<br>Low-carbon and renewable energy | 2,748 | 20.82% |
| **Total savings** | **4,438** | **61.76%** |

# 2. INTRODUCTION

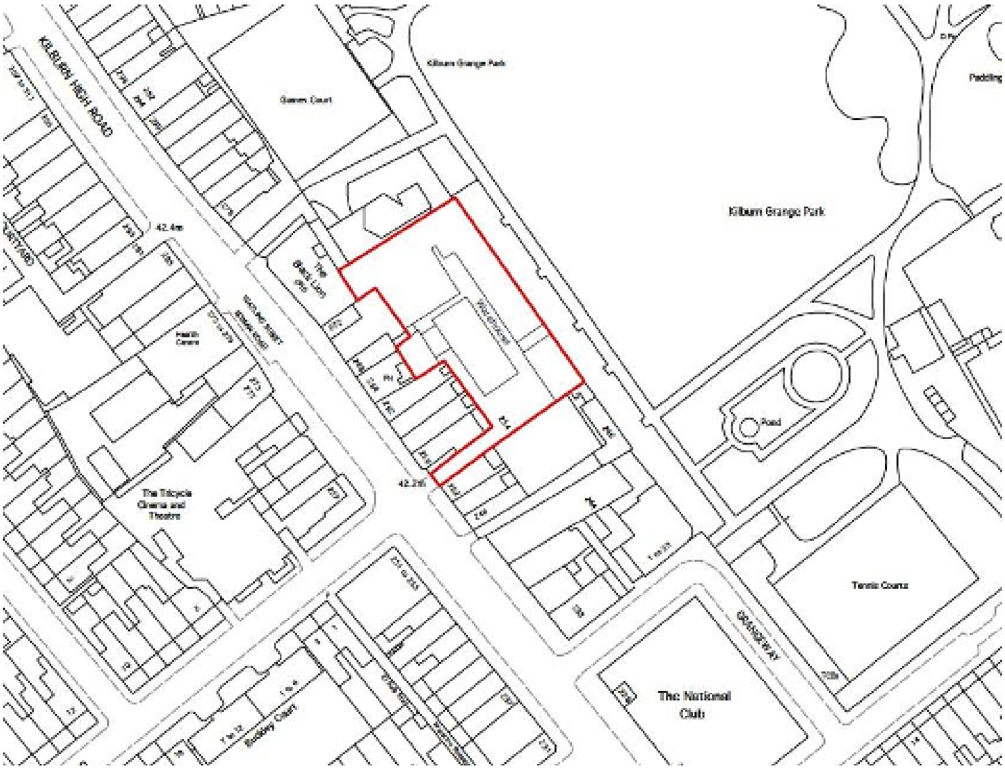
## 2.1 Site Description

This Energy Strategy has been prepared for the Sixth-floor apartments at 254 Kilburn High Road. This falls under the jurisdiction of London Borough of Camden.

The wider Development consists of sixty-six apartments over six floors. This report is assessing the top floor apartments on the sixth floor only.

The site lies on the busy residential and commercial A5, Kilburn High Road.

Map 1. Site location for 254 Kilburn High Road.



Source: Claridge Architects, 30.07.15, Rev A.

## 2.2 Purpose of the Energy Strategy

The Strategy will demonstrate measures taken by the Applicant to comply with:

i) National Planning Policy Framework.

ii) The London Plan (Greater London Authority, 2016) planning policies 5.2 to 5.7 and 5.15 on climate change mitigation measures to:

- Achieve a minimum 35% on-site reduction in $CO_2$ emissions over Approved Document Part L (AD L) 2013 for all major, domestic and non-domestic development.
- Evaluate the viability of decentralised energy in accordance with the following hierarchy: 1) connection to existing heating or cooling networks, 2) site-wide CHP network and 3) communal heating and cooling.
- Design domestic development so that mains-water consumption meets a target of 105 litres or less per person per day (excluding an allowance of 5 litres or less per person per day for external water consumption).
- In relation to the six new apartments on the sixth floor The local planning policy requirements for London Borough Of Camden to meet:
    - *Condition 5 of 2018/4916/P*

      *(a) Energy efficient measures to demonstrate a 19% $CO^2$ reduction below Part L 2013 Building Regulations.*

      *(B) the feasibility for appropriate renewable or low carbon sustainable energy sources with the aim of reducing the development's carbon emission by at least 20%.*

For a detailed summary of the planning policy requirements and design guidance specific to this development, refer to Appendix 2.

The way in which the Applicant meets the energy standard and $CO_2$ reduction target at 254 Kilburn High Road will be explained in this Strategy as follows:

- **The Baseline:** The Development's baseline energy demand, the Target Emission Rate (TER): This will be calculated to establish the minimum on-site standard for compliance with AD L 2013. The baseline is calculated using a mains gas heating system.
- **Be Lean:** The Development's Dwelling Emission Rate (DER) will be calculated to explain how the Applicant's design specification has led to a reduced energy demand and an improved fabric-energy efficiency. The better the design of the building fabric in terms of, for example, insulation, air tightness and orientation to maximise solar gain, the less energy required to heat the dwelling and so the better the fabric energy efficiency.
- **Be Clean:** The potential to provide energy to the development in an efficient way, by either connecting to a District Heat Network (DHN) or installing on-site Combined Heat and Power (CHP), will be assessed and viability concluded.
- **Be Green:** Low-carbon and renewable energy technologies will be assessed for their suitability and viability in relation to the Development. Solutions will be put forward for the development and the resulting $CO_2$ emission savings presented.

## 2.3 Methods

Energist has used SAP 2012 methodology to calculate the energy demand for the six dwellings on the sixth floor.

# 3. BASELINE ENERGY DEMAND

## 3.1 Introduction

In order to measure the effectiveness of demand-reduction measures, it is first necessary to calculate the baseline energy demand, and this has been done using SAP 2012 methodology. This can also be referred to as the Target Emission Rate (TER.) The baseline is calculated using a mains gas heating system.

The resulting AD L 2013 TER for the sixth-floor apartments at 254 Kilburn High Road. has been calculated using Part L model designs which have been applied to the Applicant's Development details. The TER, or baseline energy demand, represents the maximum $CO_2$ emissions that are permitted for the Development in order to comply with AD L 2013.

## 3.2 The Development Baseline

The resulting TER, representing the total maximum $CO_2$ emissions permitted for the Sixth-floor apartments at 254 Kilburn High Road has been calculated as 7,186 kg/$CO_2$ per annum. To ensure compliance with AD L 2013, $CO_2$ emissions should not exceed this figure.

# 4. BE LEAN – REDUCED ENERGY DEMAND

## 4.1 Introduction

The residential development for the sixth-floor apartments at 254 Kilburn High Road achieves a high quality, sustainable design by integrating the following design measures to reduce energy demand:

- Energy-efficient building fabric and insulation to all heat loss floors, walls and roofs.
- High-efficiency double-glazed windows throughout.
- Quality of build will be confirmed by achieving good air-tightness results throughout.
- Efficient-building services including high-efficiency heating systems.
- Low-energy lighting throughout the building.

## 4.2 The Development - Reduced Energy Demand

The Applicant's design specification and intended demand-reduction measures for the Development have been modelled using the same SAP 2012 methodology as before. This allows us to assess the effectiveness of Be Lean measures as a percentage reduction in $CO_2$ emissions over the Baseline.

The total calculated $CO_2$ emissions for the Sixth-floor apartments at 254 Kilburn High Road is 7,052 Kg/$CO_2$ per annum, which is a reduction of 1.85% or 134 Kg/$CO_2$ per annum over the Baseline. Refer to Appendix 3 for SAP Results and Table 3 for the Be Lean design specification.

Table 3. Be Lean design specification for the Sixth-floor apartments at 254 Kilburn High Road.

| Element | Be Lean Design Specification |
|---|---|
| Ground Floor U-Value (W/m².K) | 0.11 & 0.19 Over Commercial |
| External Wall U-Value (W/m².K) | 0.14 |
| Common area Wall | Heated |
| Wall Adj Commercial | 0.36 |
| Party Wall U-Value (W/m².K) | 0 (fully filled and sealed) |
| Roof Lower levels – Flat U-Value (W/m².K) | 0.18 & 0.19 |
| Roof Main – Flat U-Value (W/m².K) | 0.10 |
| Glazing U-Value – including Frame (W/m².K) | 1.3 |
| Glazing g-Value | 0.63 |
| Door U-Value (W/m².K) | 1.3 |
| Design Air Permeability | 4 |
| Space Heating | Mains Gas Boilers |
| Heating Controls | Heating System Controls |
| Domestic Hot Water | Mains Gas Heating System |
| Ventilation | Vent Axia Sentinel Kinetic Plus B |
| Low Energy Lighting | 100% |
| Thermal Bridging | 0.15 Y value |

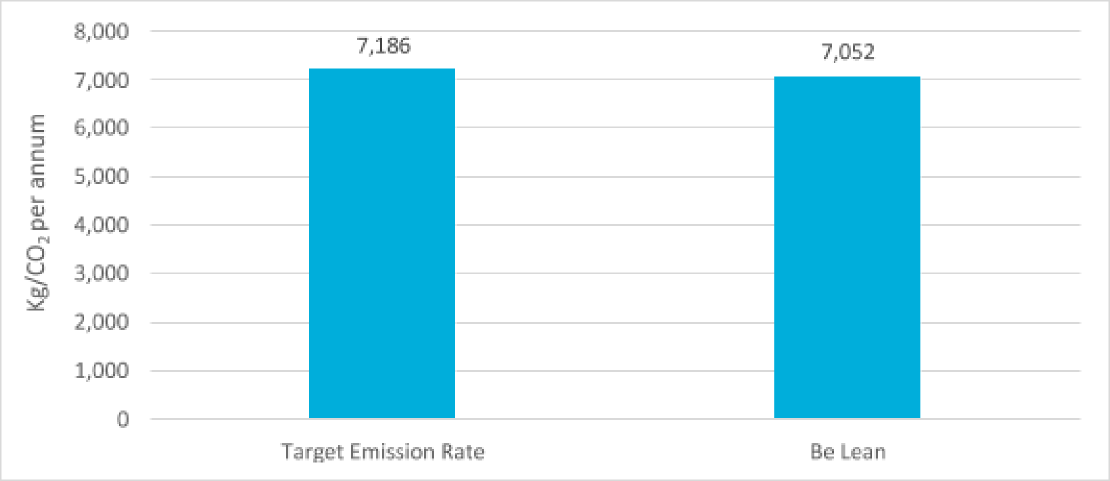
## 4.3 Conclusion

By incorporating sustainable design and energy-reduction design measures for the Sixth-floor apartments at 254 Kilburn High Road, the Applicant will reduce $CO_2$ emissions by 1.85 % over the TER AD L 2013 This is illustrated in Table 4 and Figure 3 below.

Table 4. $CO_2$ emissions and Be Lean demand-reduction measures.

| | $CO_2$ emissions | |
|---|---|---|
| | Kg/$CO_2$ per annum | % reduction |
| Target Emission Rate:<br>Compliant with AD L 2013 | 7,186 | - |
| Be Lean:<br>After demand-reduction measures | 7,052 | 1.85% |

Figure 3. TER and Be Lean $CO_2$-emissions summary.



# 5. BE CLEAN – SUPPLY ENERGY EFFICIENTLY

Steps have been taken by the Applicant to reduce the energy demand of the Development as far as is feasible.

The next step in the energy hierarchy is to consider how the remaining energy demand can be met and whether there is the potential for this to be done through the mechanism of establishing and/or linking up with existing or planned decentralised energy systems.

To ensure compliance with the Greater London Authority's energy hierarchy, the potential to supply energy efficiently to the Development at 254 Kilburn High Road, and further reduce regulated $CO_2$ emissions through Be Clean measures, is evaluated.

## 5.1 Policy Drivers

The London Plan (2016) sets out The Mayor's expectations:

*…For 25% of the heat and power used in London to be generated through the use of localised decentralised energy systems by 2025…*

***A*** *Development proposals should evaluate the feasibility of Combined Heat and Power (CHP) systems, and where the new CHP system is appropriate also examine opportunities to extend the system beyond the site boundary to adjacent sites.*

***B*** *Major Development proposals should select energy systems in accordance with the following hierarchy:*

- *Connection to existing heating or cooling networks*
- *Site wide CHP network*
- *Communal heating and cooling*

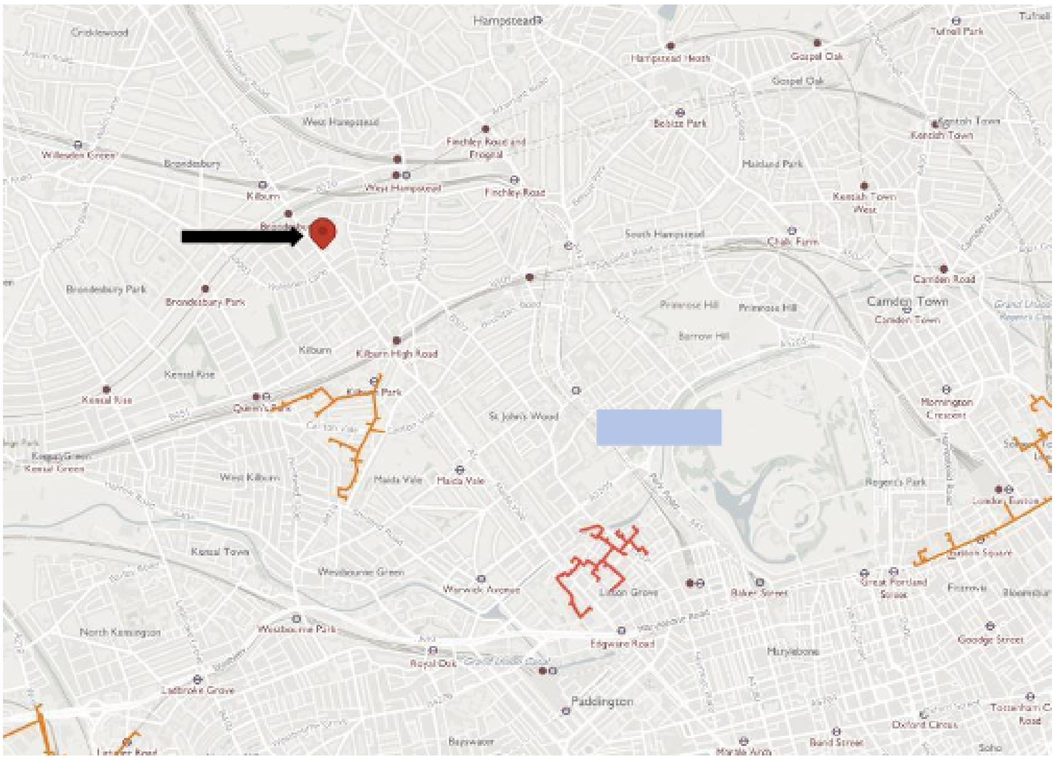
***C*** *Potential opportunities to meet the first priority in this hierarchy are outlined in the London Heat Map tool. Where future network opportunities are identified, proposals should be designed to connect to these networks.*

## 5.2 District Heat Network Viability

District Heat Networks (DHN), also referred to as either district energy systems or district heating schemes, produce steam, hot water or chilled water at a central energy centre. The steam or water is distributed in pre-insulated pipework, to individual buildings for space heating, domestic hot water and air conditioning. As a result, individual buildings served by a DHN do not require their own boilers or chillers (source: UK District Energy Association.)

The London Heat Map has been consulted to establish whether the Development lies within proximity of an existing DHN.

Map 2. 254 Kilburn High Road within the context of the London Heat Map.



Key:

Heat Mapping Decentralised Energy Potential
— Proposed DHN
— Existing DHN
➡ Development Location

## 5.2.1 Application viability

The Development lies within approximately 0.96 kilometres of an existing DHN , Church Street Network, to the South East. The Applicant has incorporated measures to future-proof the building.

## 5.3 Combined Heat and Power

Combined Heat and Power (CHP) is a relatively simple technology comprising of an engine (usually gas fired, but can be oil or biomass fired) which fires a generator producing on-site electricity. This process also generates heat as a by-product which can then be used to provide space heating and hot water. CHP systems can be small scale, used in single buildings, or large scale and used in a community or district heating network. As electricity is produced on site, distribution losses in comparison to the national grid are minimal and the heat by-product is captured instead of being wasted. As a result, CHP provides an efficient, low carbon electricity and heat generation solution to this site.

The following extracts from the GLA guidance on preparing energy assessments (March 2016) detail situations where CHP is unlikely to be a viable solution:

***Small-medium residential development (e.g. containing fewer than 500 apartments).***

*At this scale it is generally not economic to install CHP in residential led, mixed use developments (CHP is installed. However, tends to have lower electrical efficiencies). Due to the small landlord electrical demand, CHP installed to meet the base hear load would require the export of electricity to the grid. However, the administrative burden of managing CHP electricity sales at this small scale where energy service companies (ESCOs) are generally not active, and the low unit price available for small volumes of exported CHP electricity, means it is generally uneconomic for developers to pursue. This can lead to CHP installed but not operated.*

***Non-domestic developments with a simultaneous demand for heat and power for less than 5,000 homes per annum.***

*Examples of such developments may include offices and schools.*

### 5.3.1 Installation considerations

- The sizing of a CHP system is critical to its efficiency and operation. An oversized system will require a large buffer tank to absorb excess heat and will often have to turn off. This is not good for long term operation.
- Systems should therefore be undersized and meet base heating demand (usually hot water demand) to ensure continuous operation.
- Large scale CHP systems will require sufficient plant room to accommodate the engine and buffer vessel.
- Large systems suitable for developments of 500 or more units, although can be viable on smaller schemes.
- Systems perform well where there is a consistent demand for heat.
- Export of electricity can sometimes require an upgrade to a local substation.
- Flue design important.
- Design needs to be bespoke to the needs of the development.

### 5.3.2 Approximate upfront costs (TBC by supplier)

- Costs vary dependant on the size of the system. Small 24 kWt/1 kWe systems may start at £10,000 with larger systems costing substantially more.

### 5.3.3 Advantages

- There are significant $CO_2$ reductions for large-scale development (multiple apartment blocks) where there is a consistent requirement for heat.

### 5.3.4 Disadvantages

- Not financially viable on smaller developments.
- Plant room space required.
- Will not perform well where there is inconsistent demand for heat.
- Up-front and ongoing costs are higher than commercial gas boilers.

## 5.4 Conclusion

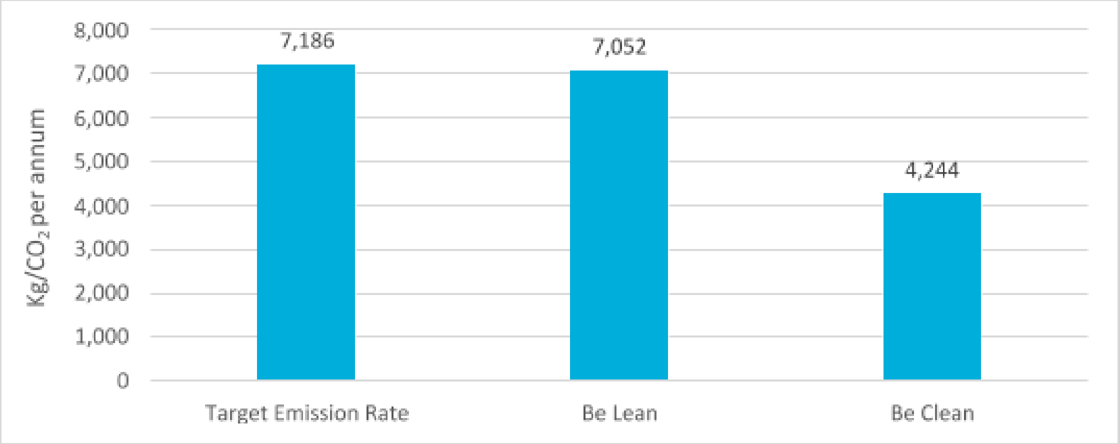
As there is an existing DHNs near the vicinity of 254 Kilburn High Road, the Applicant adopts a strategic and sustainable, site-wide heating solution in the form of a decentralised energy network. The design and engineering of an energy centre - led by gas-fired CHP - will provide heat and power to all domestic units.

By supplying energy efficiently, through a decentralised energy network, the Applicant will reduce $CO_2$ emissions by 39.09% over the TER AD L 2013 for the Sixth-floor apartments at 254 Kilburn High Road. This is illustrated in Table 5 and Figure 4 below.

Table 5. $CO_2$ emissions and Be Clean demand-reduction measures.

| | $CO_2$ emissions | |
|---|---|---|
| | Kg/$CO_2$ per annum | % reduction |
| Target Emission Rate:<br>Compliant with AD L 2013 | 7,186 | - |
| Be Lean:<br>After demand-reduction measures | 7,052 | 1.85% |
| Be Clean: | 4,244 | 39.09% |

Figure 4. TER and Be Clean $CO_2$-emissions summary for Sixth floor apartments at 254 Kilburn High Road



# 6. BE GREEN – LOW-CARBON AND RENEWABLE ENERGY

## 6.1 Introduction

The Applicant adopts a fabric-first approach as the priority solution for this Development and steps have been taken to reduce energy demand through high-quality sustainable design. The planned integration of efficient building fabric and building services has been modelled and is predicted to lead to an enhancement over Part L of the Building Regulations 2013.

The next step in the energy hierarchy is referred to as Be Green. To ensure compliance with the Greater London Authority's energy hierarchy, opportunities to supply energy through low-carbon and renewable energy technologies will be assessed for their feasibility and solutions presented for the development at 254 Kilburn High Road.

The selected solution will be put forward together with the resulting $CO_2$ emission savings.

Viability of the following low-carbon and renewable energy technologies have been considered:

- Wind
- Solar
- Aerothermal
- Geothermal
- Biomass

## 6.2 Policy Drivers

The London Plan (2016) sets out The Mayor's expectations in Policy 5.7 Renewable Energy:

***B** Within the framework of the energy hierarchy, major development proposals should provide a reduction in expected carbon dioxide emissions through the use of on-site renewable energy generation, where feasible…*

***…** There is a presumption that all major development proposals will seek to reduce carbon dioxide emissions by at least 20 per cent through the use of on-site renewable energy generation wherever feasible. Development proposals should seek to utilise renewable energy technologies such as: biomass heating; cooling and electricity; renewable energy from waste; photovoltaics; solar water heating; wind and heat pumps…*

## 6.3 Wind

*The ability to generate electricity via a turbine or similar device which harnesses natural wind energy. This could be considered as an onsite solution to reducing carbon emissions (turbines included within the development), or offsite (investing financially into a nearby wind farm).*

**Installation considerations**

- Wind turbines come in a variety of sizes and shapes. Turbines of 1 Kw can be installed to single house and large-scale turbines of 1-2 MW can be installed on a development to generate electricity to multiple dwellings and other buildings. In both instances the electricity generated can be used on site or exported to the grid. Vertical- or horizontal-axis turbines are available.
- A roof-mounted 1 kW micro wind system costs up to £3,000. A 2.5 kW pole-mounted system costs between £9,900 and £19,000. A 6-kW pole-mounted system costs between £21,000 and £30,000 (taken from the Energy Saving Trust, TBC by supplier)
- Local average wind speed is a determining factor. A minimum average wind speed of 6 m/s is required.
- Noise considerations can be an issue dependent on density and build-up of the surrounding area.
- Buildings in the immediate area can disrupt wind speed and reduce performance of the system.
- Planning permission will be required along with suitable space to site the turbine, whether ground installed, or roof mounted.

**Advantages**

- Generation of clean electricity which can be exported to the grid or used onsite.
- Can benefit from the Feed in Tariff, reducing payback costs.

**Disadvantages**

- Planning restrictions and local climate often limit installation opportunities.
- Annual maintenance required.
- High initial capital cost. It is usual for an investor to consider a series of turbines to make the investment financially sound.

**Development feasibility**

- Installing a large turbine in an area such as this is not considered to be appropriate due to its appearance and physical impact on the built-up environment. Residents' and neighbours' concerns may include the look of the turbine, the hum of the generator and the possibility of stroboscopic shadowing from the blades on homes.
- Wind speed has been checked for the development scheme using the NOABL wind map: http://www.rensmart.com/Weather/BERR. The wind speed at ten metres for the development scheme is 4.8 metres per second (m/s) which is below the minimum of 5 m/s and threshold for technical viability.
- Typical payback times for a single turbine are expected to be greater than 15 years which means that the cost of installing and maintaining a single wind turbine is not considered a commercially-viable option.

## 6.4 Solar PV and Solar Thermal

*The ability to generate energy (either electricity, hot water or a combination of the two) through harnessing natural solar energy. This could include the use of solar thermal panels, photovoltaic (PV) panels, or a combined solution. PV panels, similarly to turbines, can be considered both on and offsite.*

Solar Photovoltaics convert solar radiation into electricity which can be used on site or exported to the national grid.

Solar Thermal generates domestic hot water from the sun's radiation. Glycol circulates within either flat plate or evacuated tube panels, absorbing heat from the sun, and transferring this energy to a water cylinder. A well designed solar thermal system will account for 50-60% of a dwelling's annual hot water demand. Sizing the system to meet a higher demand will lead to excess heat generation in the summer months, and overheating of the system.

| | |
|---|---|
| **Installation considerations** | ▪ Operate most efficiently on a south-facing sloping roof (between 30 and 45-degree pitch.)<br>▪ Shading must be minimal (one shaded panel can impact the output of the rest of the array.)<br>▪ Panels must not be laid horizontally on a flat roof as they will not self-clean. Panels will therefore need to be installed at an angle and with appropriate space between them, to avoid over-shading.<br>▪ Large arrays may require upgrades to substations if exporting electricity to the grid.<br>▪ Local planning requirements may restrict installation of panels on certain elevations.<br>▪ Installation must take into account pitch and fall of the roof, along with any additional plant on the roof to ensure there is sufficient room.<br>▪ The average domestic solar PV system is 4kWp and costs £5,000 - £8,000 (including VAT at 5 per cent) - (taken from the Energy Saving Trust, TBC by supplier.) |
| **Advantages** | ▪ Relatively straightforward installation, connection to landlord's supply and metering.<br>▪ Linear improvement in performance as more panels are installed.<br>▪ Maintenance free.<br>▪ Installation costs are continually reducing.<br>▪ Can benefit from the Feed in Tariff to improve financial payback. |
| **Disadvantages** | ▪ Not appropriate for high-rise developments, due to lack of roof space in relation to total floor area.<br>▪ With Solar Thermal, performance is limited by the hot water demand of the building – system oversizing will lead to overheating. |
| **Development feasibility** | ▪ The suitability of Solar panels has been considered for this Development and are concluded as a technically-viable option.<br>▪ There are potential areas of roof space suitable for the positioning of unshaded Solar PV arrays. |

- The Development is not on land which is protected or listed, so it is considered that Solar panels would not have a negative impact on the local historical environment or the aesthetics of the area.
- The installation of PV panels would mean the occupants would see a reduction in their electricity bills. While if solar thermal panels were to be used, the occupants would see a reduction in hot water bills.

## 6.5 Aerothermal

*The transfer of latent heat in the atmosphere to a compressed refrigerant gas to warm the water in a heating system. This includes air to water heat pumps and air conditioning systems.*

Air Source Heat Pumps (ASHPs) extract heat from the external air and condense this energy to heat a smaller space within a dwelling or non-domestic building. A pump circulates a refrigerant through a coil to absorb energy from the air. This refrigerant is then compressed to raise its temperature which can then be used for space heating and domestic hot water.

They can feed either low-temperature radiators or underfloor heating and often have electric immersion heater back-up for the winter months.

### Installation Considerations

- ASHPs operate effectively in buildings with a low energy demand, as they emit low levels of energy suitable for maintaining rather than dramatically increasing internal temperatures. It is therefore vital that the dwelling has a low heating demand to ensure the system can provide appropriate space-heating capability.
- Underfloor heating will give the best performance, but oversized radiators can also be used.
- Immersion heater back-up required to ensure appropriate Domestic Hot Water (DHW) temperature in winter months.

| | |
|---|---|
| | ▪ Noise from the external unit can limit areas for installation.<br>▪ £7,000-£11,000 per dwelling (taken from the Energy Saving Trust, TBC by supplier.) |
| **Advantages** | ▪ Air source systems are a good alternative solution to providing heating and hot water to well-insulated, low heat loss dwellings.<br>▪ They require additional space when compared to a gas boiler. Space for an external unit is needed, as is space for the hot water cylinder and internal pump.<br>▪ Heat pumps are generally quiet to run, however if a collection of pumps were used, this could generate a noticeable hum while in operation.<br>▪ Running costs between heat pumps and modern gas boilers are comparable. |
| **Disadvantages** | ▪ Residents need to be made aware of the most efficient way of using a heat pump; as the low flow rates used by such a system means that room temperature cannot be changed as reactively as a conventional gas or oil boiler system.<br>▪ Will not perform well in homes that are left unoccupied and unheated for a long period of time.<br>▪ Back-up immersion heating can drastically increase running costs.<br>▪ Noise and aesthetic considerations limit installation opportunities. |
| **Development feasibility** | ▪ ASHPs are not considered a technically viable option for this development scheme.<br>▪ There may be noise issues if installed on the roof.<br>▪ Unless a community ASHP's system was installed, connection to a future Heat Network would not be feasible. |

## 6.6 Geothermal

*The transfer of latent heat from the ground to a compressed refrigerant gas to warm the water in a heating system. This includes ground source heat pumps. Heat can be collected through the use of either horizontally laid or vertically installed coils.*

Ground Source Heat Pumps (GSHPs) operate on the same principle as an Air Source Heat Pump (ASHP) in that they extract heat from a source (in this instance the ground) and compress this energy to increase temperature for space heating and hot water. Pipework is installed into the ground, either through coils or in bore holes and piles, circulating a mix of water and antifreeze to extract energy from the ground, where the year-round temperature is relatively consistent (approx. 10 °C at 4 metres depth). This leads to a reliable source of heat for the building.

Again, an electrically powered pump circulates the liquid and powers the compressor, however annual efficiencies for GSHPs tend to be higher than those of ASHPs.

**Installation considerations**

- Require appropriate ground conditions to sink piles/bore holes or excavate for coils (which also require a large area of land.)
- Decision between coils or piles can lead to significant extra cost.
- Need to consider whether low temperature output is fed through underfloor heating (most efficient) or oversized radiators.
- Similar to ASHPs, perform best in well-insulated buildings with a low heating demand.
- Electric immersion heater required for winter use.
- £11,000-£15,000 per dwelling dependent on the size of the system (taken from the Energy Saving Trust, TBC by supplier.)

**Advantages**

- Perform well in well-insulated buildings, with limited heating demand.
- More efficient than ASHPs.

| | |
|---|---|
| **Disadvantages** | ▪ The coils can be damaged by natural earthworks and by intensive gardening practices – occupants would need to be aware of the location of the coils for this system, and how to operate the system efficiently. Coils may also be damaged within the dwelling where the circuit is connected to the internal unit.<br>▪ Will not perform well in buildings that are left unoccupied and unheated for a long period of time.<br>▪ Back up immersion heating can drastically increase running costs.<br>▪ Large area of ground needed for coil installation. |
| **Development feasibility** | ▪ GSHPs are considered a technically-viable option for this development scheme as there are no physical constraints in terms of ground conditions and area available for installation.<br>▪ The capital installation cost would, however, be high which leads us to the conclusion that GSHPs would not be a commercially-viable option for this development scheme. |

## 6.7 Biomass

*Providing a heating system fuelled by plant-based materials such as wood, crops, or food waste.*

Biomass boilers generate heat for space heating and domestic hot water through the combustion of biofuels, such as woodchip, wood pellets or potentially biofuel or bio diesel. Biomass is considered to be virtually zero carbon. They can be used on an individual scale or for multiple dwellings as part of a district-heating network. A back-up heat source should be provided as consistent delivery of fuel is necessary for continued operation.

| | |
|---|---|
| **Installation considerations** | ▪ Biomass boilers are larger than conventional gas-fired boilers and also require what can be significant storage space for the fuel source. This needs to be considered at planning stage to ensure an appropriate plant room can be provided. |

| | |
|---|---|
| | ▪ Flue required to expel exhaust gases – design needs to be in line with the requirements of the Building Regulations.<br>▪ Need to consider whether fuel deliveries will be reliable and consistent to the location of the site (especially relevant in rural areas) and whether the plant room can be easily accessed by the delivery vehicle.<br>▪ £9,000-£21,000 per dwelling dependent on size (taken from Energy Saving Trust, TBC by Supplier). |
| **Advantages** | ▪ Considerable reduction in $CO_2$ emissions. |
| **Disadvantages** | ▪ Limited reduction in running costs compared to A-rated gas boilers, but at a substantially higher up-front cost.<br>▪ Plant room space required for boiler and storage.<br>▪ Dependent on consistent delivery of fuel.<br>▪ Ongoing maintenance costs (need to be cleaned regularly to remove ash.) |
| **Development Feasibility** | ▪ Biomass is not considered a technically-viable option for the development scheme. The primary reason for this is down to the Development's location within the context of Inner City London and the negative environmental impact of high levels of NOx gases that are emitted from biomass boilers and the subsequent impact on local air quality. This is contrary to planning policies for air quality in London.<br>▪ There are, however, concerns regarding a sustainable supply of biomass to the site.<br>▪ The capital installation cost would, however, be high which leads us to the conclusion that biomass would not be a commercially-viable option for this development scheme. |

## 6.8 Conclusion

The following low-carbon and renewable energy technologies, summarised here in Table 6, are considered potentially viable options for the Sixth-floor apartments at 254 Kilburn High Road.

Table 6: Summary of Feasibility for the Sixth-floor apartments at 254 Kilburn High Road.

| | |
|---|---|
| | ▪ Solar PV |
| | ▪ Wind<br>▪ Aerothermal<br>▪ Geothermal<br>▪ Biomass |

The Applicant proposes to install 3.5 kWp of PV South West facing with little or no overs shading on a 30° pitch, which will serve the sixth-floor apartments. Which is approximately 25m² – 28m² of panels

# 7. MAINS-WATER CONSUMPTION

## 7.1 Introduction

The water consumption of a dwelling has a significant impact on not only direct operational running costs (i.e. water consumption charges), but also indirectly through additional energy usage and the heating of water for domestic use. This is, in part, reflected in SAP 2012 methodology which assumes reduced energy consumption should a dwelling be compliant with Approved Document Part G 2013.

The standard of 110 litres of water per person per day can be met using the following specification as set out in Table 7 below. A water-efficiency calculation, demonstrating how the Applicant can achieve compliance, can be referred to in Appendix 4.

Table 7. Water calculations for new dwellings at 254 Kilburn High Road.

| Element | Rented | Shared Ownership | Private |
|---|---|---|---|
| Kitchen Taps flow rate | 5 Litres per minute | 5 Litres per minute | 5 Litres per minute |
| Other basin Taps flow rate | 5 Litres per minute | 4 Litres per minute | 5 Litres per minute |
| WCs Flush Volume | 4/2.6 Litres | 6/4 Litres | 6/3 Litres |
| Shower Flow rate | 9 Litres per minute | 9 Litres per minute | 9 Litres per minute |
| Bath Volume | 130 Litres | 195 Litres | 170 Litres |
| Dishwasher water consumption | 1.25 litres per place setting | 0.73 litres per place setting | 0.73 litres per place setting |
| Washing-machine water | 8.17 litres per Kg | 4.6 litres per Kg | 4.6 litres per Kg |

# 8. CONCLUSIONS AND RECOMMENDATIONS

The Applicant demonstrates their commitment to the energy and water-efficiency standards for the Sixth-floor apartments at 254 Kilburn High Road as follows:

- The Development has been designed to achieve a total reduction in $CO_2$ emissions of 61.76% over the TER AD L 2013 through Be Lean, Be Clean and BE Green measures and successfully exceeded the target.
- The domestic elements of the Development will be designed to ensure that mains-water consumption will successfully deliver a target of 110 litres or less per person per day.

Table 8. Measures incorporated to deliver the energy standard.

| | |
|---|---|
| Be Lean | ▪ Energy-efficient building fabric and insulation to all heat loss floors, walls and roofs.<br>▪ High-efficiency double-glazed windows throughout.<br>▪ Quality of build will be confirmed by achieving good air-tightness results throughout.<br>▪ Efficient-building services including high-efficiency heating systems.<br>▪ Low-energy lighting throughout the building. |
| Be Clean | ▪ The CHP system the Bosch CE19-2NA provides 79% of the heating demand. The system has an efficiency of 86.7% and a Heat to Power Ratio of 1.68. The remaining 21% of the demand will meet by 90.4% efficient Mains gas boilers. |
| Be Green | ▪ 3.5 kWp of PV South West facing with little or no overs shading on a 30° pitch will serve Sixth floor apartments at 254 Kilburn High Road. Which is approximately 25m² – 28m² of panels. |

The way in which these design measures deliver the Applicant's commitment to the energy hierarchy is illustrated in Figure 5 and Table 9 overleaf.

Figure 5: How the Development delivers the energy hierarchy.

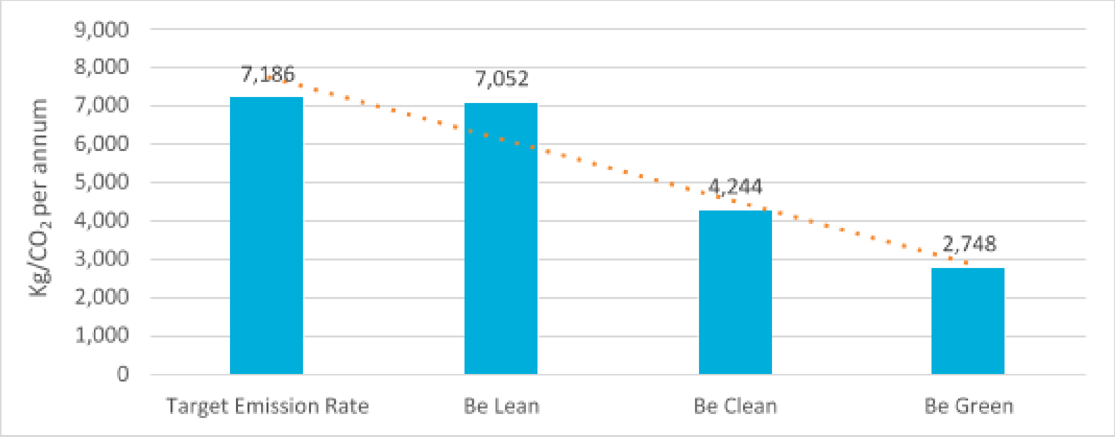


Table 9. $CO_2$ emissions and savings after each stage of the energy hierarchy for the Sixth-floor apartments at 254 Kilburn High Road

| | $CO_2$ emissions | |
|---|---|---|
| | Kg/$CO_2$ per annum | % reduction |
| Target Emission Rate:<br>Compliant with AD L 2013 | 7,186 | - |
| Be Lean:<br>After demand-reduction measures | 7,052 | 1.85% |
| Be Clean: | 4,244 | 39.09% |
| Be Green:<br>Low-carbon and renewable energy | 2,748 | 20.82% |
| **Total savings** | **4,438** | **61.76%** |

# 9. APPENDICES

## APPENDIX 1: LIST OF ABBREVIATIONS

| | |
|---|---|
| AD L 2013 | Approved Document Part L of Buildings Regulations 2013 |
| ASHP | Air Source Heat Pump |
| CHP | Combined Heat & Power |
| DER | Dwelling Emission Rate |
| DHN | District Heat Network |
| DHW | Domestic Hot Water |
| ESCO | Energy Services Company |
| GSHP | Ground Source Heat Pump |
| LPA | Local Planning Authority |
| PV | Photovoltaics |
| SAP | Standard Assessment Procedure |
| TER | Target Emission Rate |

# APPENDIX 2. PLANNING POLICY AND DESIGN GUIDANCE

## The Climate Change Act (2008)

Passed in November 2008, the Climate Change Act mandated that the UK would reduce emissions of six key greenhouse gases, including Carbon Dioxide, by 80% by 2050.

As a consequence, the reduction of carbon dioxide emissions is at the forefront of National, Regional and Local Planning Policy, along with continuing step changes in performance introduced by the Building Regulations Approved Document L (2013).

## Approved Document L (2013)

This development is subject to the requirements of Approved Document L (2013). AD L 2013 represented an approximate reduction of 6% in the Target Emission Rate (Kg/$CO_2$/sqm per annum) over the requirements of Approved Document L (2010) for residential development and an aggregate 9% reduction for non-residential development. AD L (2013) also sees the introduction of a Fabric Energy Efficiency Target, a measure of heating demand (kW hrs/sqm per annum) to ensure new-build dwellings with low-carbon heating systems still meet satisfactory energy-efficiency standards.

## National Policy

The National Planning Policy Framework encourages Local Planning Authorities to "Have a positive strategy to promote energy from renewable and low-carbon sources" (NPPF paragraph 97), whilst "Ensuring that the adverse impacts are addressed satisfactorily, including cumulative landscape and visual impacts". This suggests that although LPAs should encourage renewable technology, the merits of such should be assessed on a site-by-site basis.

The NPPF also requires that policy-making and planning obligations do not threaten the viability of a development, by maintaining competitive returns for developers and landowners alike. In this respect flexibility is encouraged by LPAs to ensure sustainability standards can be met without incurring unreasonable development costs.

## The London Plan 2016

The following policies are applicable to this development from the London Plan:

### Policy 5.1 Climate Change Mitigation

*The Major seeks to achieve an overall reduction in London's carbon dioxide emissions of*

*60% (below 1990 levels) by 2025. It is expected that the GLA Group, London boroughs and other organisations will contribute to meeting the strategic reduction target, and the GLA will monitor progress towards its achievement annually.*

### Policy 5.2 Minimising Carbon Dioxide Emissions

***A*** *Development proposals should make the fullest contribution to minimising carbon dioxide emissions in accordance with the following energy hierarchy:*

1. *Be lean: use less energy*
2. *Be clean: supply energy efficiently*
3. *Be green: use renewable energy*

***B*** *The Mayor will work with boroughs and developers to ensure that major developments meet the following targets for carbon dioxide emissions reduction in buildings. These targets are expressed as minimum improvements over the Target Emissions Rate (TER) outlined in the national Building Regulations leading to zero carbon residential buildings from 2016 and zero carbon non-domestic buildings from 2019.*

NB the date the planning application is submitted determines the applicable target

Residential buildings:

| Year | Improvement on Building Regulations |
|---|---|
| 2010 - 30th September 2013 | 25% over AD L 2010 |
| 1st October 2013 – 5th April 2014 | 40% over AD L 2010 |
| 6th April 2013 - 2016 | 35% over AD L 2013 |
| 2016 - 2036 | Zero Carbon |

Non-Domestic buildings:

| Year | Improvement on Building Regulations |
|---|---|
| 2010 - 30th September 2013 | 25% over AD L 2010 |
| 1st October 2013 – 5th April 2014 | 40% over AD L 2010 |
| 6th April 2013 - 2016 | 35% over AD L 2013 |
| 2016 - 2019 | 50% over AD L 2013 |
| 2016 - 2036 | Zero Carbon |

***C*** *Major Development's proposals should include a detailed energy assessment to* *demonstrate how the targets for carbon dioxide emissions reduction outlined above are to be met within the framework of the energy hierarchy.*

***D*** *As a minimum, energy assessments should include the following details:*

- *a) Calculation of the energy demand and carbon dioxide emissions covered by the Building Regulations and, separately, the energy demand and carbon dioxide emissions from any other part of the development, including plant or equipment, that are not covered by the Building Regulations… at each stage of the energy hierarchy*
- *b) Proposals to reduce carbon dioxide emissions through the energy efficient design of the site, buildings and services*
- *c) Proposals to further reduce carbon dioxide emissions through the use of decentralised energy where feasible, such as district heating and cooling and combined heat and power (CHP)*
- *d) Proposals to further reduce carbon dioxide emissions through the use of on-site renewable energy technologies.*

***E*** *The carbon dioxide reduction targets should be met on-site. Where it is clearly demonstrated that the specific targets cannot be fully achieved on-site, any shortfall may be provided off-site or through a cash in lieu contribution to the relevant borough to be ring fenced to secure delivery of carbon dioxide savings elsewhere.'*

### Policy 5.3 Sustainable Design and Construction

*The highest standards of sustainable design and construction should be achieved in London to improve the environmental performance of new developments and to adapt to the effects of climate change over their lifetime.*

### Policy 5.4 Retrofitting

*The environmental impact of existing urban areas should be reduced through policies and programmes that bring existing buildings up to the Mayor's standards on sustainable design and construction. In particular, programmes should reduce carbon dioxide emissions, improve the efficiency of resource use (such as water) and minimise the generation of pollution and waste from existing building stock.*

### Policy 5.5 Decentralised Energy Networks

***A*** *The Mayor expects 25 per cent of the heat and power used in London to be generated through the use of localised decentralised energy systems by 2025. In order to achieve this target, the Mayor prioritises the development of decentralised heating and cooling networks at the development and area wide levels, including larger scale heat transmission networks.*

***B*** *Within LDFs boroughs should develop policies and proposals to identify and establish decentralised energy network opportunities. Boroughs may choose to develop this as a supplementary planning document and work jointly with neighbouring boroughs to realise wider decentralised energy network opportunities. As a minimum boroughs should:*

- *a) identify and safeguard existing heating and cooling networks*
- *b) identify opportunities for expanding existing networks and establishing new*

*networks. Boroughs should use the London Heat Map tool and consider any new developments, planned major infrastructure works and energy supply opportunities which may arise*

*c) develop energy master plans for specific decentralised energy opportunities which identify:*

- *Major heat loads (including anchor heat loads, with particular reference to sites such as universities, hospitals, and social housing)*
- *Major heat supply plant*
- *Possible opportunities to utilise energy from waste*
- *Possible heating and cooling network routes*
- *Implementation options for delivering feasible projects, considering issues of procurement, funding and risk and the role of the public sector*

*d) Require developers to prioritise connection to existing or planned decentralised energy networks where feasible.*

### Policy 5.6 Decentralised Energy in Development Proposals

***A*** *Development proposals should evaluate the feasibility of Combined Heat and Power (CHP) systems, and where the new CHP system is appropriate also examine opportunities to extend the system beyond the site boundary to adjacent sites.*

***B*** *Major Development proposals should select energy systems in accordance with the following hierarchy:*

1. *Connection to existing heating or cooling networks*
2. *Site wide CHP network*
3. *Communal heating and cooling.*

***C*** *Potential opportunities to meet the first priority in this hierarchy are outlined in the London Heat Map tool. Where future network opportunities are identified, proposals should be designed to connect to these networks.*

### Policy 5.7 Renewable Energy

***B*** *Within the framework of the energy hierarchy, major development proposals should provide a reduction in expected carbon dioxide emissions through the use of on-site renewable energy generation, where feasible.*

***D*** *All renewable energy systems should be located and designed to minimise any potential adverse impacts on biodiversity, the natural environment and historical assets.*

### Policy 5.15 Water Use and Supplies

***B*** *Development should minimise the use of mains water by:*

*a) Incorporating water saving measures and equipment*
*b) Designing residential development so that mains water consumption would meet a target of 105 litres or less per head per day (Excluding an allowance of 5 litres or less per head per day for external water consumption).*

## Sustainable Design and Construction SPG (April 2014)

## Camden Local Plan (2017)

### Policy C1 Health and wellbeing

The Council will improve and promote strong, vibrant and healthy communities through ensuring a high quality environment with local services to support health, social and cultural wellbeing and reduce inequalities.

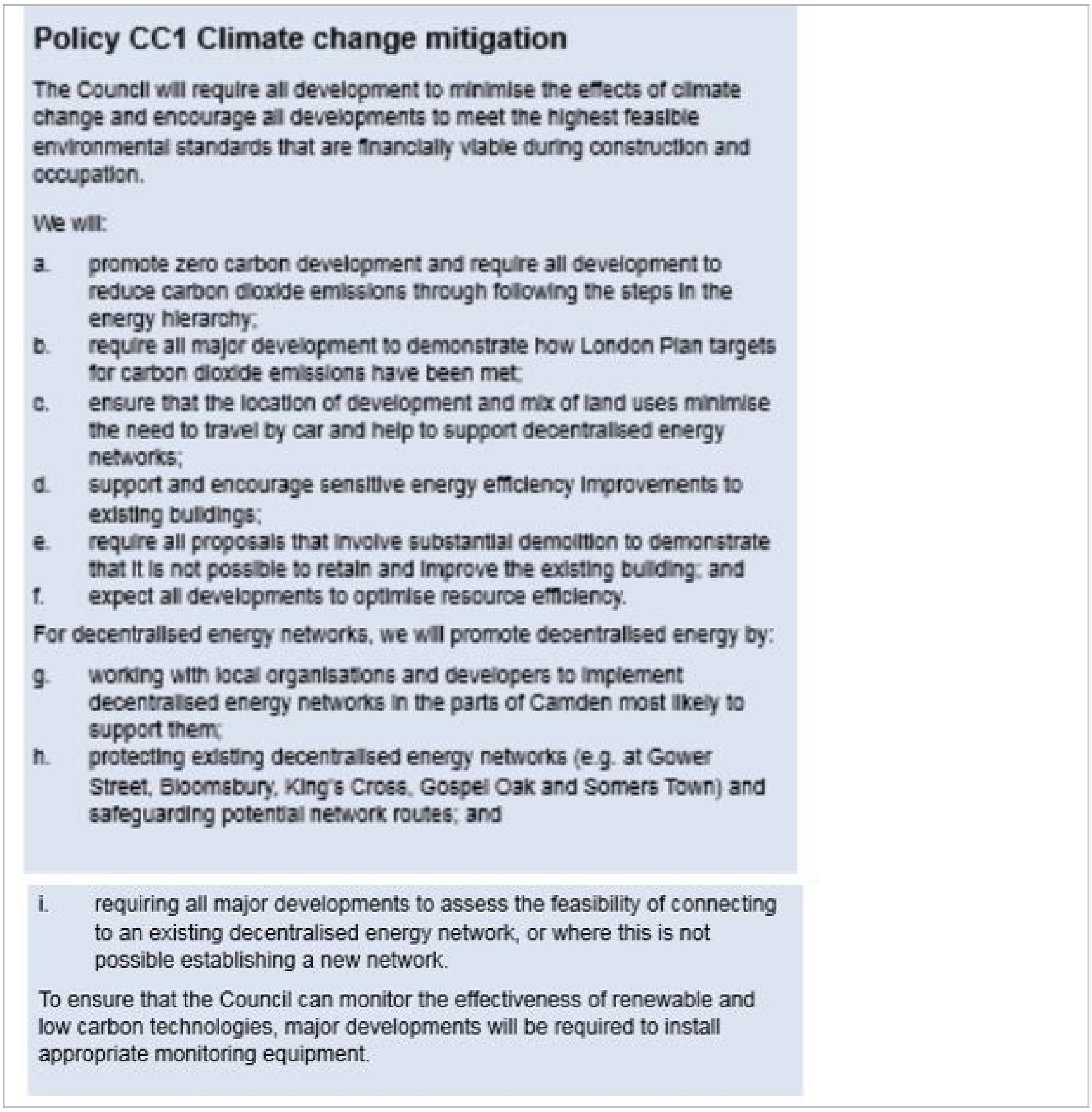
Measures that will help contribute to healthier communities and reduce health inequalities must be incorporated in a development where appropriate.

The Council will require:

a. development to positively contribute to creating high quality, active, safe and accessible places; and
b. proposals for major development schemes to include a Health Impact Assessment (HIA).

We will:

c. contribute towards the health priorities of the Health and Wellbeing Board and partners to help reduce health inequalities across the borough;
d. support the provision of new or improved health facilities, in line with Camden's Clinical Commissioning Group and NHS England requirements; and
e. protect existing health facilities in line with Policy C2 Community facilities.



## 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.

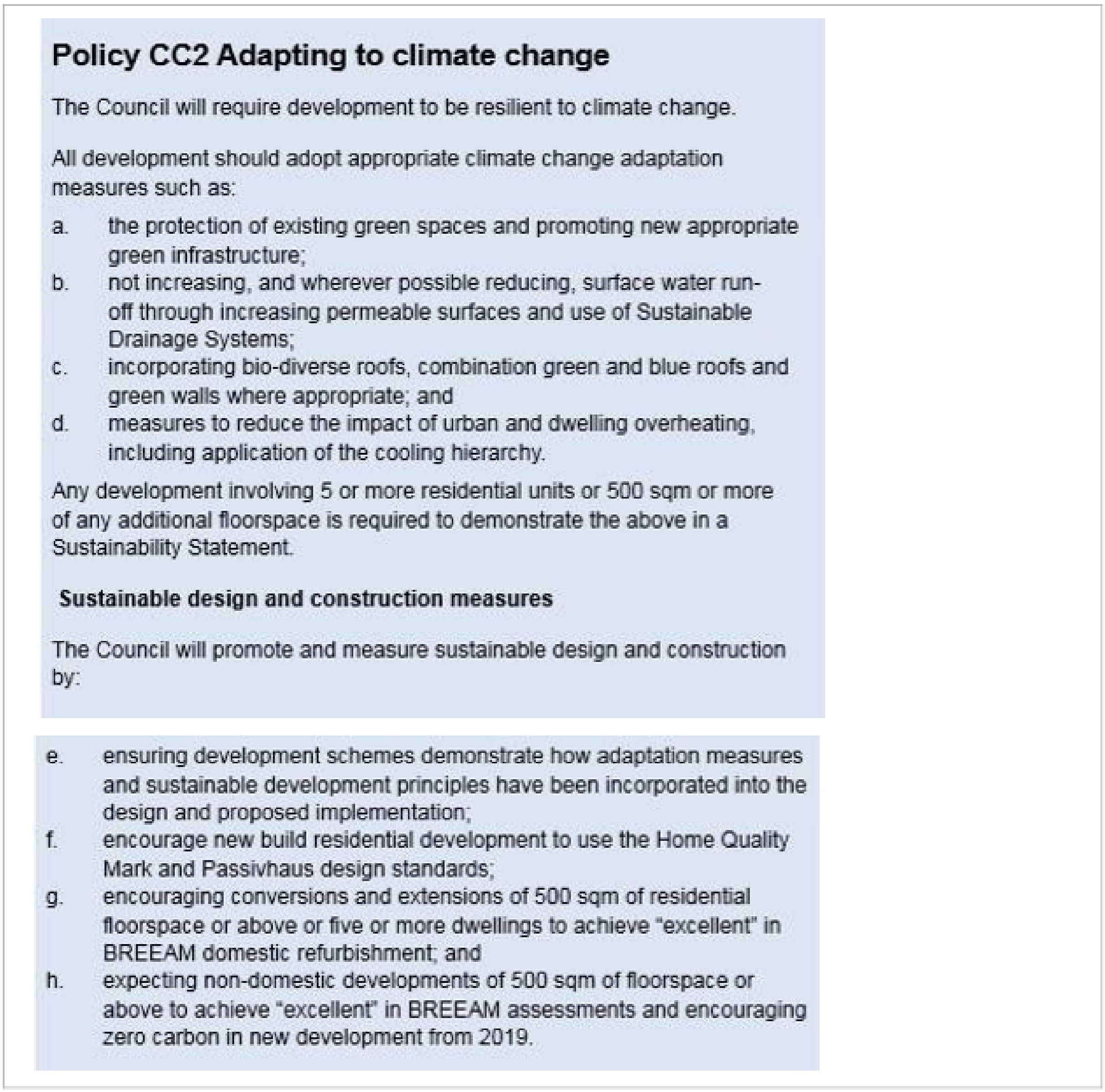
We will:

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 CC2 Adapting to climate change

The Council will require development to be resilient to climate change.

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

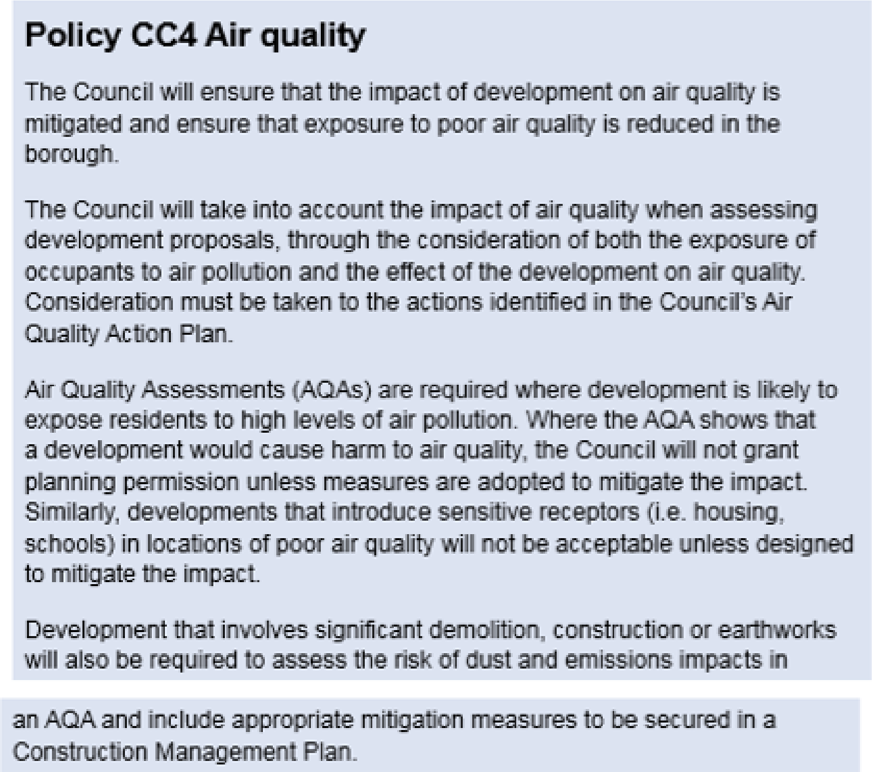
a. the protection of existing green spaces and promoting new appropriate green infrastructure;
b. not increasing, and wherever possible reducing, surface water run-off through increasing permeable surfaces and use of Sustainable Drainage Systems;
c. incorporating bio-diverse roofs, combination green and blue roofs and green walls where appropriate; and
d. measures to reduce the impact of urban and dwelling overheating, including application of the cooling hierarchy.

Any development involving 5 or more residential units or 500 sqm or more of any additional floorspace is required to demonstrate the above in a Sustainability Statement.

**Sustainable design and construction measures**

The Council will promote and measure sustainable design and construction by:

e. ensuring development schemes demonstrate how adaptation measures and sustainable development principles have been incorporated into the design and proposed implementation;
f. encourage new build residential development to use the Home Quality Mark and Passivhaus design standards;
g. encouraging conversions and extensions of 500 sqm of residential floorspace or above or five or more dwellings to achieve "excellent" in BREEAM domestic refurbishment; and
h. expecting non-domestic developments of 500 sqm of floorspace or above to achieve "excellent" in BREEAM assessments and encouraging zero carbon in new development from 2019.



### Policy CC4 Air quality

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

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

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

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

## The Housing Standards Review and implications on Local Planning Policy

On March 25th, 2015, the Government confirmed its policy to limit energy-efficiency targets that can be imposed on a development as a result of the Housing Standards Review. New developments should not be conditioned to achieve a reduction in Carbon Emissions exceeding a 19% improvement over the requirements of Approved Document L (2013) – the equivalent energy performance of a Code for Sustainable Homes Level 4 dwelling.

In addition, the Government confirmed that the Code for Sustainable Homes is no longer an applicable standard for planning permissions granted on or after March 26th, 2015. If a Local Planning Authority has an existing policy requirement for the CSH it may still condition the Ene 1 and Wat 1 requirements for CSH Level 4, but cannot require assessment against the remaining categories and full CSH Certification.

Sites with planning permission granted prior to March 25th, 2015 can still be assessed and certified against the Code for Sustainable Homes, where there is a requirement to do so (known as legacy sites).

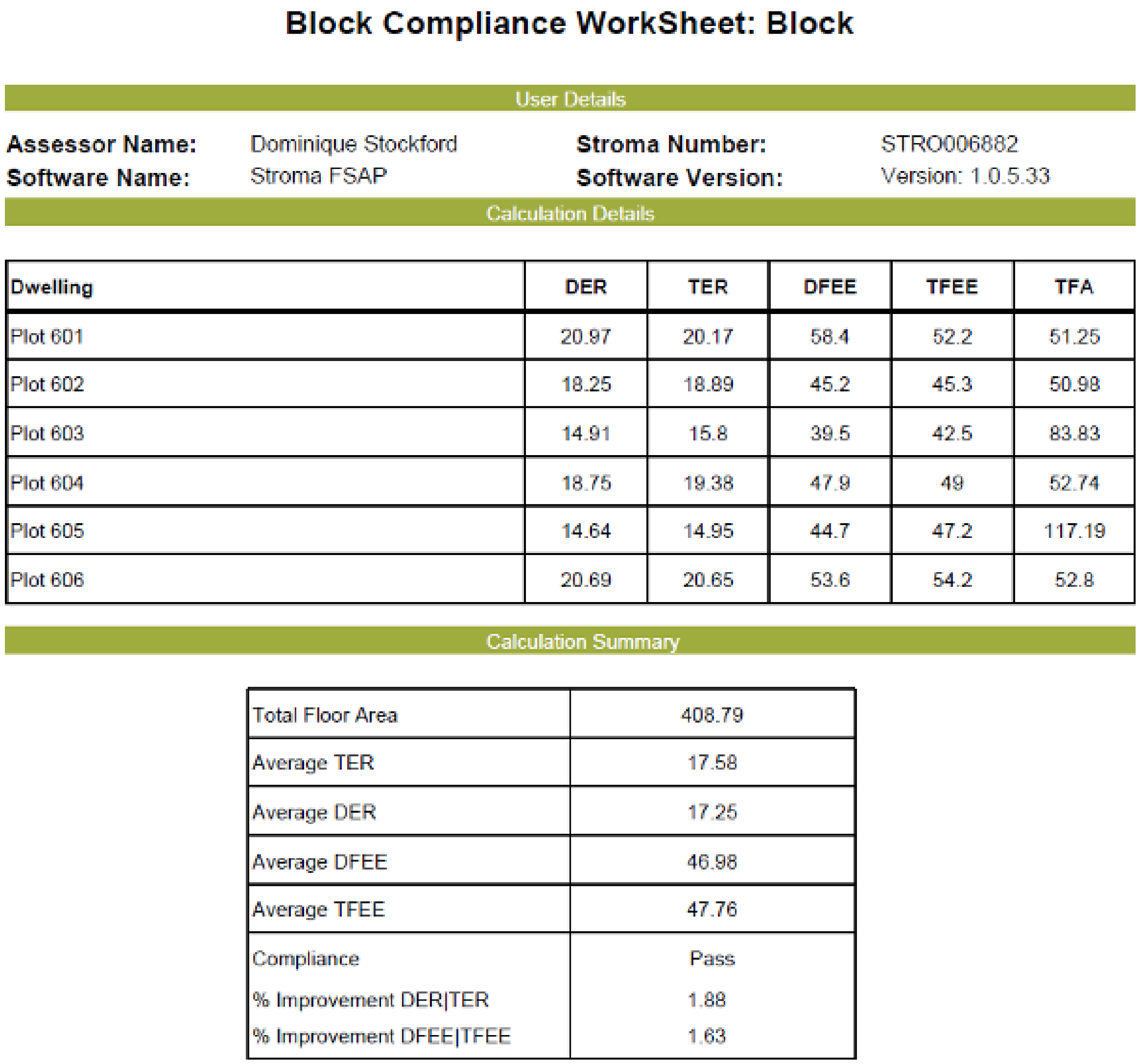
A CSH requirement can also apply where a previously approved Outline Planning Permission has been granted prior to March 25th, 2015.

# APPENDIX 3: SAP RESULTS.

**Emissions - kg $CO_2$/m$^2$/year**

| Dwelling Type | Total Target Emissions | Be Lean | Be Clean | Be Green |
|---|---|---|---|---|
| Plot 601 | 1,034 | 1,075 | 616 | -879 |
| Plot 602 | 963 | 931 | 563 | 563 |
| Plot 603 | 1,325 | 1,250 | 771 | 771 |
| Plot 604 | 1,022 | 989 | 579 | 579 |
| Plot 605 | 1,752 | 1,716 | 1,075 | 1,075 |
| Plot 606 | 1,090 | 1,092 | 640 | 640 |
| **Total Emissions** | **7,186** | **7,052** | **4,244** | **2,748** |

Be Lean FSAP Block Compliance Sheets.



## Block Compliance WorkSheet: Block

User Details

| | | | |
|---|---|---|---|
| **Assessor Name:** | Dominique Stockford | **Stroma Number:** | STRO006882 |
| **Software Name:** | Stroma FSAP | **Software Version:** | Version: 1.0.5.33 |

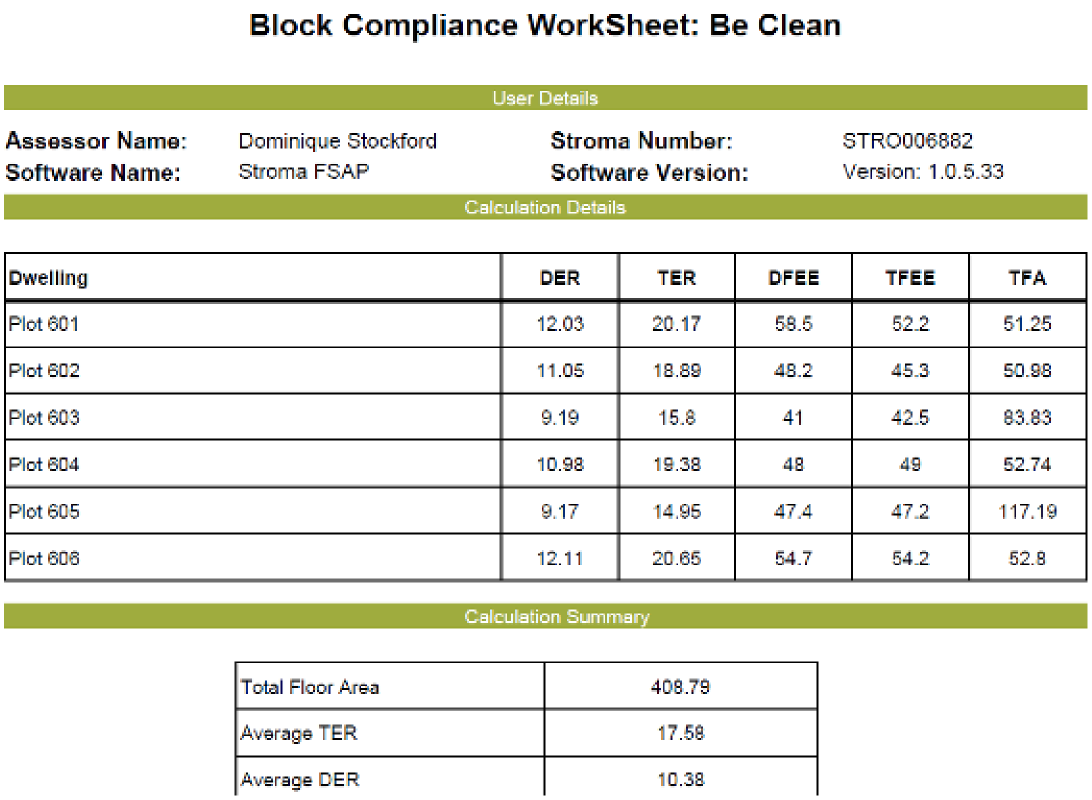
Calculation Details

| **Dwelling** | **DER** | **TER** | **DFEE** | **TFEE** | **TFA** |
|---|---|---|---|---|---|
| Plot 601 | 20.97 | 20.17 | 58.4 | 52.2 | 51.25 |
| Plot 602 | 18.25 | 18.89 | 45.2 | 45.3 | 50.98 |
| Plot 603 | 14.91 | 15.8 | 39.5 | 42.5 | 83.83 |
| Plot 604 | 18.75 | 19.38 | 47.9 | 49 | 52.74 |
| Plot 605 | 14.64 | 14.95 | 44.7 | 47.2 | 117.19 |
| Plot 606 | 20.69 | 20.65 | 53.6 | 54.2 | 52.8 |

Calculation Summary

| | |
|---|---|
| Total Floor Area | 408.79 |
| Average TER | 17.58 |
| Average DER | 17.25 |
| Average DFEE | 46.98 |
| Average TFEE | 47.76 |
| Compliance<br>% Improvement DER\|TER<br>% Improvement DFEE\|TFEE | Pass<br>1.88<br>1.63 |

## Be Clean FSAP Block Compliance Sheets.



### Block Compliance WorkSheet: Be Clean

User Details

**Assessor Name:** Dominique Stockford
**Stroma Number:** STRO006882
**Software Name:** Stroma FSAP
**Software Version:** Version: 1.0.5.33

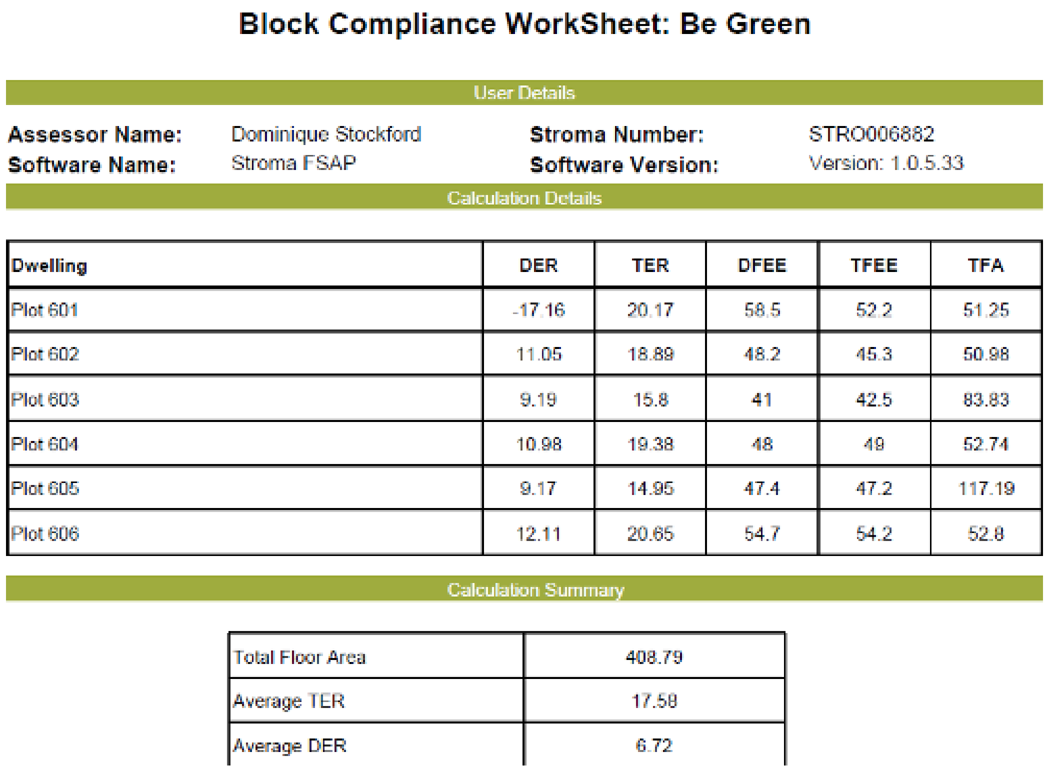
Calculation Details

| Dwelling | DER | TER | DFEE | TFEE | TFA |
|---|---|---|---|---|---|
| Plot 601 | 12.03 | 20.17 | 58.5 | 52.2 | 51.25 |
| Plot 602 | 11.05 | 18.89 | 48.2 | 45.3 | 50.98 |
| Plot 603 | 9.19 | 15.8 | 41 | 42.5 | 83.83 |
| Plot 604 | 10.98 | 19.38 | 48 | 49 | 52.74 |
| Plot 605 | 9.17 | 14.95 | 47.4 | 47.2 | 117.19 |
| Plot 606 | 12.11 | 20.65 | 54.7 | 54.2 | 52.8 |

Calculation Summary

| | |
|---|---|
| Total Floor Area | 408.79 |
| Average TER | 17.58 |
| Average DER | 10.38 |

## Be Green FSAP Block Compliance Sheets.



### Block Compliance WorkSheet: Be Green

User Details

**Assessor Name:** Dominique Stockford
**Stroma Number:** STRO006882
**Software Name:** Stroma FSAP
**Software Version:** Version: 1.0.5.33

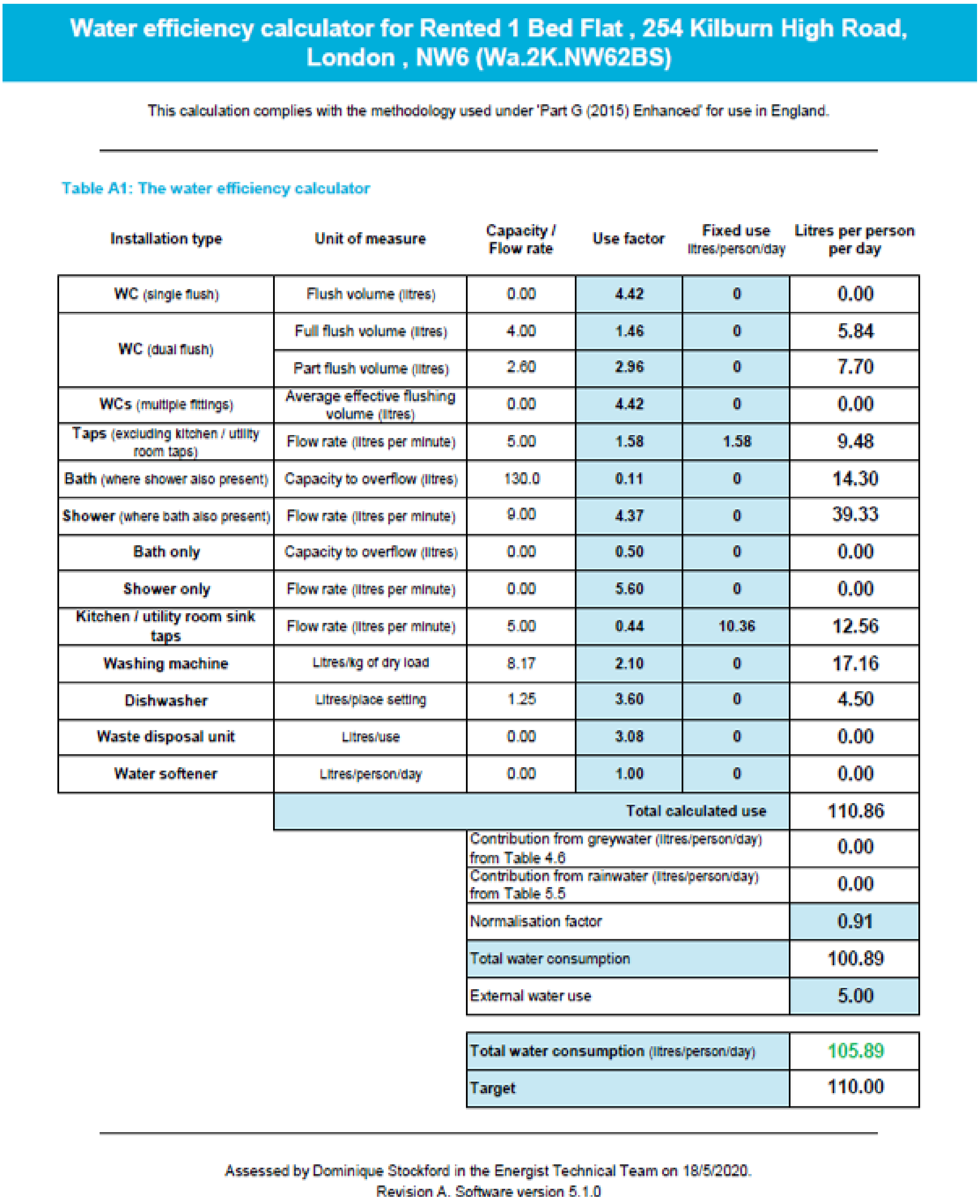
Calculation Details

| Dwelling | DER | TER | DFEE | TFEE | TFA |
|---|---|---|---|---|---|
| Plot 601 | -17.16 | 20.17 | 58.5 | 52.2 | 51.25 |
| Plot 602 | 11.05 | 18.89 | 48.2 | 45.3 | 50.98 |
| Plot 603 | 9.19 | 15.8 | 41 | 42.5 | 83.83 |
| Plot 604 | 10.98 | 19.38 | 48 | 49 | 52.74 |
| Plot 605 | 9.17 | 14.95 | 47.4 | 47.2 | 117.19 |
| Plot 606 | 12.11 | 20.65 | 54.7 | 54.2 | 52.8 |

Calculation Summary

| | |
|---|---|
| Total Floor Area | 408.79 |
| Average TER | 17.58 |
| Average DER | 6.72 |

## APPENDIX 4: WATER-EFFICIENCY CALCULATIONS.



### Water efficiency calculator for Rented 1 Bed Flat , 254 Kilburn High Road, London , NW6 (Wa.2K.NW62BS)

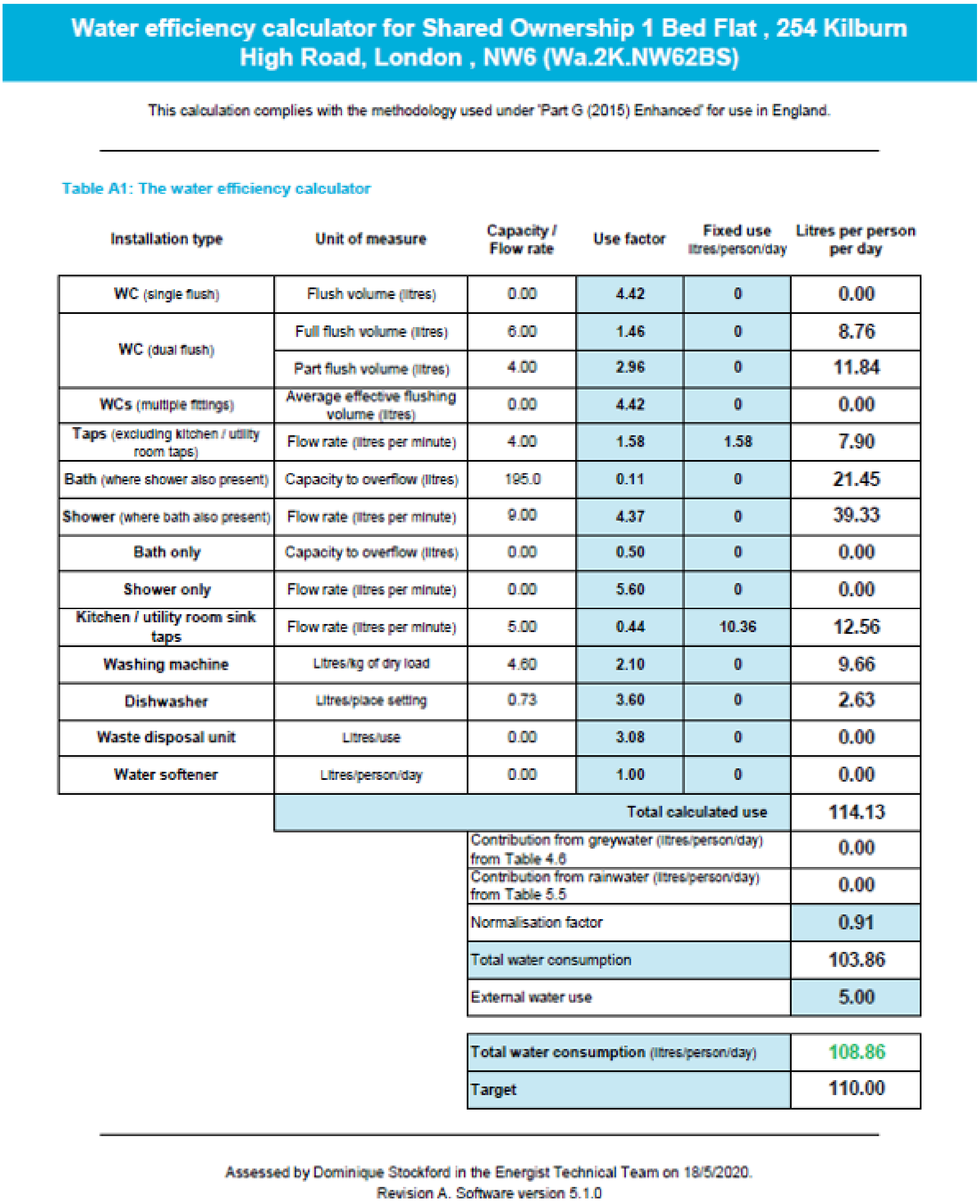
This calculation complies with the methodology used under 'Part G (2015) Enhanced' for use in England.

Table A1: The water efficiency calculator

| Installation type | Unit of measure | Capacity / Flow rate | Use factor | Fixed use litres/person/day | Litres per person per day |
|---|---|---|---|---|---|
| **WC** (single flush) | Flush volume (litres) | 0.00 | 4.42 | 0 | 0.00 |
| **WC** (dual flush) | Full flush volume (litres) | 4.00 | 1.46 | 0 | 5.84 |
| | Part flush volume (litres) | 2.60 | 2.96 | 0 | 7.70 |
| **WCs** (multiple fittings) | Average effective flushing volume (litres) | 0.00 | 4.42 | 0 | 0.00 |
| **Taps** (excluding kitchen / utility room taps) | Flow rate (litres per minute) | 5.00 | 1.58 | 1.58 | 9.48 |
| **Bath** (where shower also present) | Capacity to overflow (litres) | 130.0 | 0.11 | 0 | 14.30 |
| **Shower** (where bath also present) | Flow rate (litres per minute) | 9.00 | 4.37 | 0 | 39.33 |
| **Bath only** | Capacity to overflow (litres) | 0.00 | 0.50 | 0 | 0.00 |
| **Shower only** | Flow rate (litres per minute) | 0.00 | 5.60 | 0 | 0.00 |
| **Kitchen / utility room sink taps** | Flow rate (litres per minute) | 5.00 | 0.44 | 10.36 | 12.56 |
| **Washing machine** | Litres/kg of dry load | 8.17 | 2.10 | 0 | 17.16 |
| **Dishwasher** | Litres/place setting | 1.25 | 3.60 | 0 | 4.50 |
| **Waste disposal unit** | Litres/use | 0.00 | 3.08 | 0 | 0.00 |
| **Water softener** | Litres/person/day | 0.00 | 1.00 | 0 | 0.00 |
| | **Total calculated use** | | | | 110.86 |
| | | Contribution from greywater (litres/person/day) from Table 4.6 | | | 0.00 |
| | | Contribution from rainwater (litres/person/day) from Table 5.5 | | | 0.00 |
| | | Normalisation factor | | | 0.91 |
| | | Total water consumption | | | 100.89 |
| | | External water use | | | 5.00 |

| | |
|---|---|
| **Total water consumption** (litres/person/day) | 105.89 |
| **Target** | 110.00 |

Assessed by Dominique Stockford in the Energist Technical Team on 18/5/2020.
Revision A. Software version 5.1.0



## Water efficiency calculator for Shared Ownership 1 Bed Flat , 254 Kilburn High Road, London , NW6 (Wa.2K.NW62BS)

This calculation complies with the methodology used under 'Part G (2015) Enhanced' for use in England.

Table A1: The water efficiency calculator

| Installation type | Unit of measure | Capacity / Flow rate | Use factor | Fixed use litres/person/day | Litres per person per day |
|---|---|---|---|---|---|
| **WC** (single flush) | Flush volume (litres) | 0.00 | 4.42 | 0 | 0.00 |
| **WC** (dual flush) | Full flush volume (litres) | 6.00 | 1.46 | 0 | 8.76 |
| | Part flush volume (litres) | 4.00 | 2.96 | 0 | 11.84 |
| **WCs** (multiple fittings) | Average effective flushing volume (litres) | 0.00 | 4.42 | 0 | 0.00 |
| **Taps** (excluding kitchen / utility room taps) | Flow rate (litres per minute) | 4.00 | 1.58 | 1.58 | 7.90 |
| **Bath** (where shower also present) | Capacity to overflow (litres) | 195.0 | 0.11 | 0 | 21.45 |
| **Shower** (where bath also present) | Flow rate (litres per minute) | 9.00 | 4.37 | 0 | 39.33 |
| **Bath only** | Capacity to overflow (litres) | 0.00 | 0.50 | 0 | 0.00 |
| **Shower only** | Flow rate (litres per minute) | 0.00 | 5.60 | 0 | 0.00 |
| **Kitchen / utility room sink taps** | Flow rate (litres per minute) | 5.00 | 0.44 | 10.36 | 12.56 |
| **Washing machine** | Litres/kg of dry load | 4.60 | 2.10 | 0 | 9.66 |
| **Dishwasher** | Litres/place setting | 0.73 | 3.60 | 0 | 2.63 |
| **Waste disposal unit** | Litres/use | 0.00 | 3.08 | 0 | 0.00 |
| **Water softener** | Litres/person/day | 0.00 | 1.00 | 0 | 0.00 |
| | | | | **Total calculated use** | 114.13 |
| | | Contribution from greywater (litres/person/day) from Table 4.6 | | | 0.00 |
| | | Contribution from rainwater (litres/person/day) from Table 5.5 | | | 0.00 |
| | | Normalisation factor | | | 0.91 |
| | | Total water consumption | | | 103.86 |
| | | External water use | | | 5.00 |
| | | **Total water consumption** (litres/person/day) | | | 108.86 |
| | | **Target** | | | 110.00 |

Assessed by Dominique Stockford in the Energist Technical Team on 18/5/2020.
Revision A. Software version 5.1.0

# Water efficiency calculator for Private 2 Bed Flat , 254 Kilburn High Road, London , NW6 (Wa.2K.NW62BS)

This calculation complies with the methodology used under 'Part G (2015) Enhanced' for use in England.

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Table A1: The water efficiency calculator

| Installation type | Unit of measure | Capacity / Flow rate | Use factor | Fixed use litres/person/day | Litres per person per day |
|---|---|---|---|---|---|
| **WC** (single flush) | Flush volume (litres) | 0.00 | 4.42 | 0 | 0.00 |
| **WC** (dual flush) | Full flush volume (litres) | 6.00 | 1.46 | 0 | 8.76 |
| | Part flush volume (litres) | 3.00 | 2.96 | 0 | 8.88 |
| **WCs** (multiple fittings) | Average effective flushing volume (litres) | 0.00 | 4.42 | 0 | 0.00 |
| **Taps** (excluding kitchen / utility room taps) | Flow rate (litres per minute) | 5.00 | 1.58 | 1.58 | 9.48 |
| **Bath** (where shower also present) | Capacity to overflow (litres) | 170.0 | 0.11 | 0 | 18.70 |
| **Shower** (where bath also present) | Flow rate (litres per minute) | 9.00 | 4.37 | 0 | 39.33 |
| **Bath only** | Capacity to overflow (litres) | 0.00 | 0.50 | 0 | 0.00 |
| **Shower only** | Flow rate (litres per minute) | 0.00 | 5.60 | 0 | 0.00 |
| **Kitchen / utility room sink taps** | Flow rate (litres per minute) | 5.00 | 0.44 | 10.36 | 12.56 |
| **Washing machine** | Litres/kg of dry load | 4.60 | 2.10 | 0 | 9.66 |
| **Dishwasher** | Litres/place setting | 0.73 | 3.60 | 0 | 2.63 |
| **Waste disposal unit** | Litres/use | 0.00 | 3.08 | 0 | 0.00 |
| **Water softener** | Litres/person/day | 0.00 | 1.00 | 0 | 0.00 |
| | **Total calculated use** | | | | 110.00 |
| | | Contribution from greywater (litres/person/day) from Table 4.6 | | | 0.00 |
| | | Contribution from rainwater (litres/person/day) from Table 5.5 | | | 0.00 |
| | | Normalisation factor | | | 0.91 |
| | | Total water consumption | | | 100.10 |
| | | External water use | | | 5.00 |

| | |
|---|---|
| **Total water consumption** (litres/person/day) | 105.10 |
| **Target** | 110.00 |

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Assessed by Dominique Stockford in the Energist Technical Team on 18/5/2020.
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