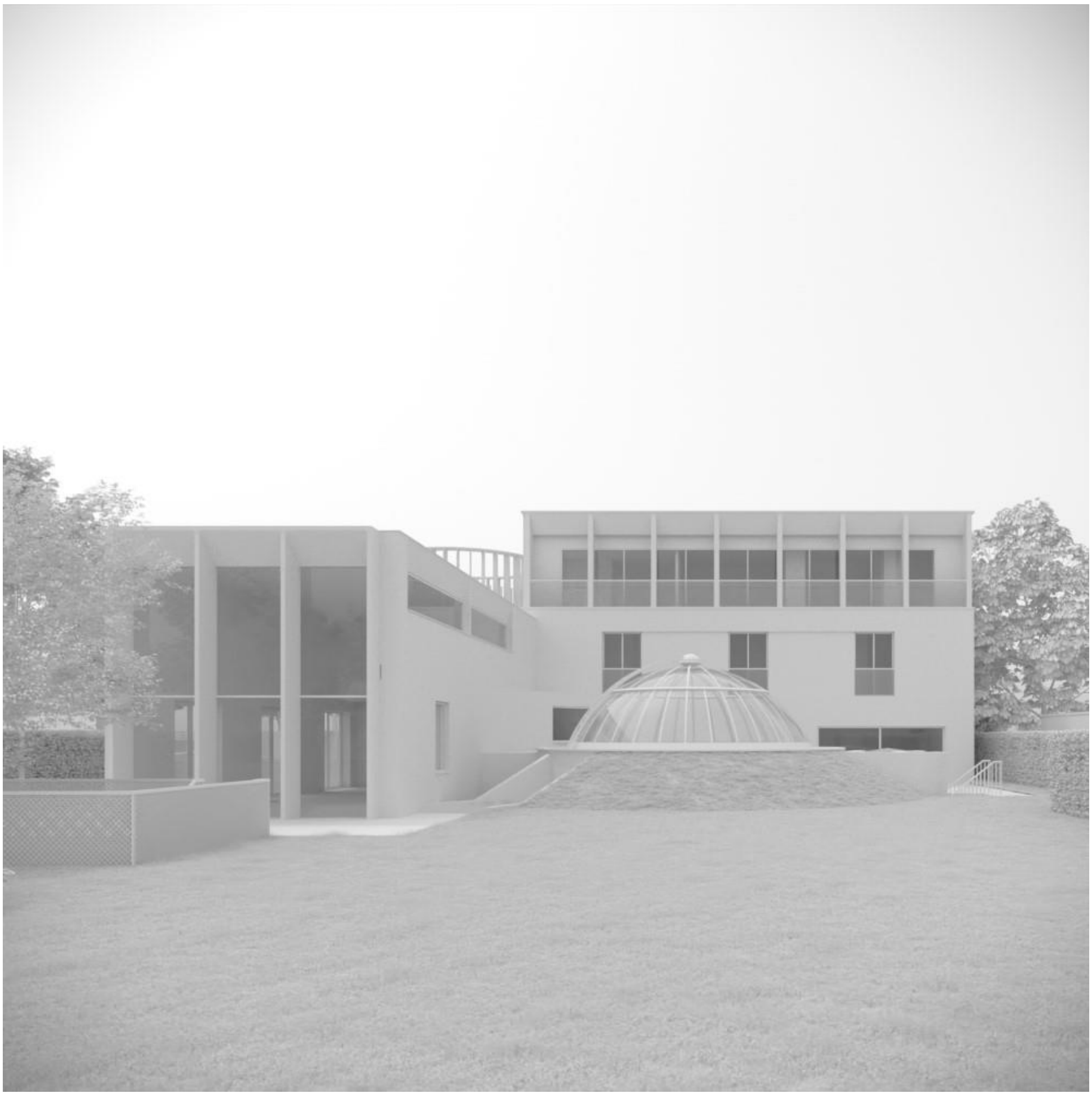
35 Templewood Avenue

Energy and Sustainability Statement



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Peter Deer and Associates Ltd
Solar House, 282 Chase Road, Southgate, London N14 6HA
T: 020 3232 0080 • **E:** Post@pd-a.co.uk
Registered in England No. 3022343

Document Control

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Written by:	Checked by:
Adrian Holmes	John Pengilly

Contact Author

Adrian Holmes

Solar House, 282 Chase Road, Southgate, London N14 6HA

T: 020 3232 0080 • E: sustainability@pd-a.co.uk

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Executive Summary

This energy assessment is written to accompany the planning application for the redevelopment of 35 Templewood Avenue and West Heath Road. A full description of the development proposal is to be found in the Architect's Design and Access statement and summary in the introduction to this site in section 1 of this document. It is noted that the site is located in a residential area, adjacent to Hampstead Heath. The local air quality is affected by vehicles moving along West Heath Road, a major link between Hampstead and Childs Hill, Finchley Road inter change. The local air meets EU standards air quality but slightly exceeds World Health Organisation (WHO) standards. The Local air quality is expected to improve as London Transport switches over to electric buses.

The London Borough of Camden and the Greater London Authority (GLA) energy related emission reduction target is as follows:

On the basis that this is a major residential proposal with more than 1,000m² of new floorspace proposed, the general requirements to be achieved are:

- *'Zero Carbon' with a minimum of a 35% reduction of carbon emissions achieved on-site (the remainder takes the form of a payment); and*
- *Within the above, a minimum of 20% of the reduction in carbon emissions coming via on-site renewables.*

The London Borough of Camden has policys in areas of poor air quality; *"there is an expectation of zero emission buildings"*. Developers should look to prioritise the installation of renewable energy technologies with no polluting emissions. These can be air, ground, or water heat pumps and potentially efficient direct electric 'point of use' heaters to supply a hot water load.

The energy proposal is being developed with the aim of minimising local building emission by resulting in improved local air quality.

The designer has researched the availability of using ground source and water source heat pumps and found that Bagshot Sands are not suitable of the economic use of a ground loop heat pumps system. The proposal is based on the use of air source heat pumps (ASHP) and secondary a back-up boiler to support the swimming pool heating system.

The 2013 Building Regulation adjusted the Target Emissions Rate (TER) for electric heat pumps to above the TER for Gas Boilers. This complicates the GLA tables below which require that BASE energy and Be Lean energy model is calculated using Gas Boilers. The Be Clean and Be Green energy models use the proposed ASHP and PV.

	Carbon Dioxide Emissions for domestic buildings (Tonnes CO_2 per annum)	
	Regulated	Unregulated
Baseline: Part L 2013 of the Building Regulations Compliant Development (ASHP)	21.10	
Baseline: Part L 2013 of the Building Regulations Compliant Development (Gas Boiler)	12.85	6
Be Lean (Gas Boiler)	13.31	23
Be Clean (ASHP)	19.4	22
Be Green (ASHP + PV)	12.69	22

Table 1 Carbon Dioxide Emissions after each stage of the Energy Hierarchy for domestic buildings

The Be Lean energy is predicted to be slightly higher than the base energy option as the notional building has a greater area of south facing windows and is artificially improved by fixed Linear thermal transmittance value. The proposed design cannot maximise the use of south facing windows as this would overlook the neighbours. The thermal improvements listed in section 4 Be Lean - Use less Energy and are an improvement on the recommended values with building regulatiosn.

There are no local proposals for a district heating system, and no secondary alternative options of using waste heat from near neighbours. Therefore, it proposed to make an £8,600 financial contribution to the LBC district heating fund.

Combined Heat and Power is not proposed as the gas engines have higher NOx emissions than equivalent gas boilers.

	Regulated domestic carbon dioxide savings	
	(Tonnes CO_2 per annum)	(%)
Savings from energy demand reduction	0	0%
Savings from heat network / CHP (No CHP)	0	0%
Savings from renewable energy (PV)	8	40%
Cumulative on-site savings	8	40%
Annual savings from off-set payment	13	-
	(Tonnes CO_2)	
Cumulative savings for off-set payment	381	-
Cash in-lieu contribution (£)	£22,851	

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

Zero Emission Air Source Heat Pumps are proposed as the primary heat source for space heating and hot water. An allowance must be made for a gas boiler to back up the swimming pool heating and ventilation plant. An allowance for the possible gas boiler (60kW) has to be made at planning, as the final selection cannot be made until the swimming design parameters have been agreed by the occupiers.

The proposal is to locate the heat pumps and evaporator/ condenser unit in a pit along the West Heath Road away from neighbours. This keeps the plant out of sight and reduces noise emissions.

In the case of the zero-carbon target for homes, a minimum of 40% carbon savings are expected to be delivered on site (16kW PV array). The remaining savings to reach zero carbon are via a cash in lieu contribution of £22,851

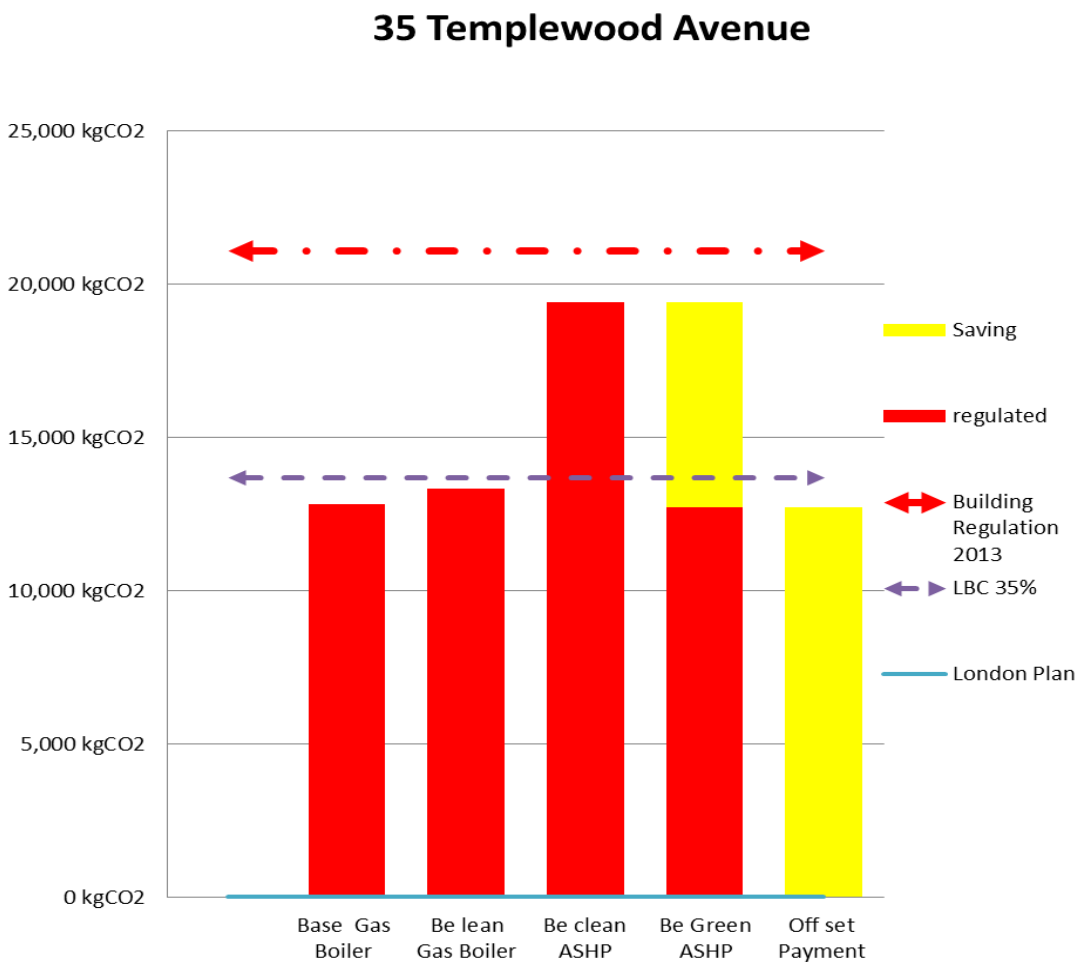


Figure 1Domestic Energy Hierarchy Targets

1 Introduction.

Site

1.1 The site is located at the corner of West Heath Road and Templewood Avenue, facing the western part of Hampstead Heath which sits directly to the north. The site is located within the Redington and Frognal Conservation Area within sub-area 4 (Redington Road and Templewood Avenue).

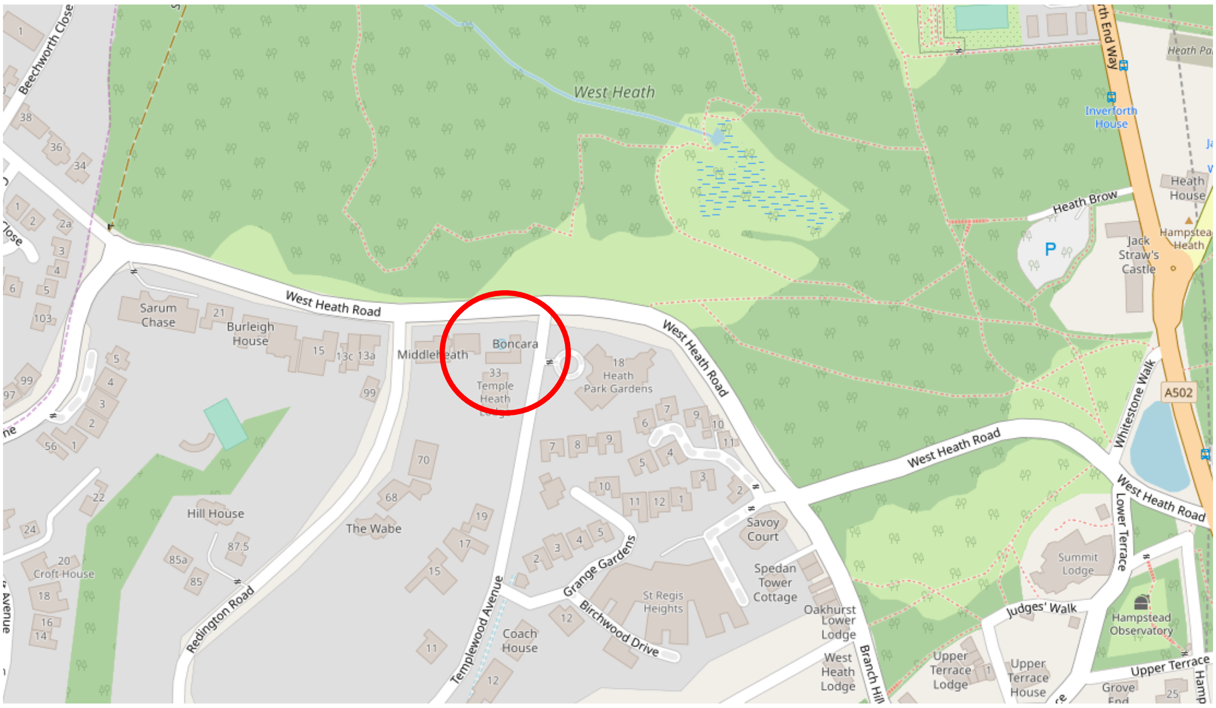


Figure 2 Boncara 35 Templewood Avenue, London. NW3 7UY. (OpenStreetMap)

1.2 The existing house (Boncara) on the site (no.35 Templewood Avenue) is a 3-storey house with a basement, of modern design in red brick with stone banding, which was built in the 1990's.

1.3 This modern house was constructed in the eastern part of the former garden of the Grade II listed Schreiber House (no.9 West Heath Road), which was built in 1962-4 to designs by the architect James Gowan for the furniture designer Chaim Schreiber. In 1968 an external sunken and domed swimming pool, also designed by Gowan, was constructed to the east of the house on land that now comes under the ownership of no.35 Templewood Avenue which forms part of the statutory listing of the Schreiber House. The large modern three-bedroom red brick house at no.35 Templewood Avenue surrounds the listed swimming pool on the south and east sides.

1.4 There have been previous planning applications in 2004 to modify the three-bedroom house and a second application in 2017 for the excavation of a new basement level and the erection of a two-storey extension to the south-eastern corner of the site. This proposal was granted planning permission in 2018. It included a new lift, stairwell, and extension to the third-floor level as well as refurbishment of the listed swimming pool and associated landscaping.

1.5 The current proposed development is to demolish the existing non-listed red brick three-bedroom house and rebuild a new five-bedroom property largely following the footprint and volume of the previously consented scheme. The new family house will sit comfortably within the 0.1 ha site and incorporates the pool building into the geometry of the proposed house. The new house will make architectural sense for the retention and reuse of the listed pool building as a formal and function/event room in its current location. The proposed building is designed with the aim of adding an aesthetic contribution towards the Conservation Area.

Site Geology

1.6 Initial consultation of the British Geological survey interactive maps shows the site is located on heath ground which is slightly higher than the surrounding area. The bedrock is Bagshot Sands, a soft porous sandstone rock with poor thermal conductivity. The site is not suitable for the economic development of a ground source heat pump.

1.7 The site is not located over a geological hot spot from which heat can be extracted.

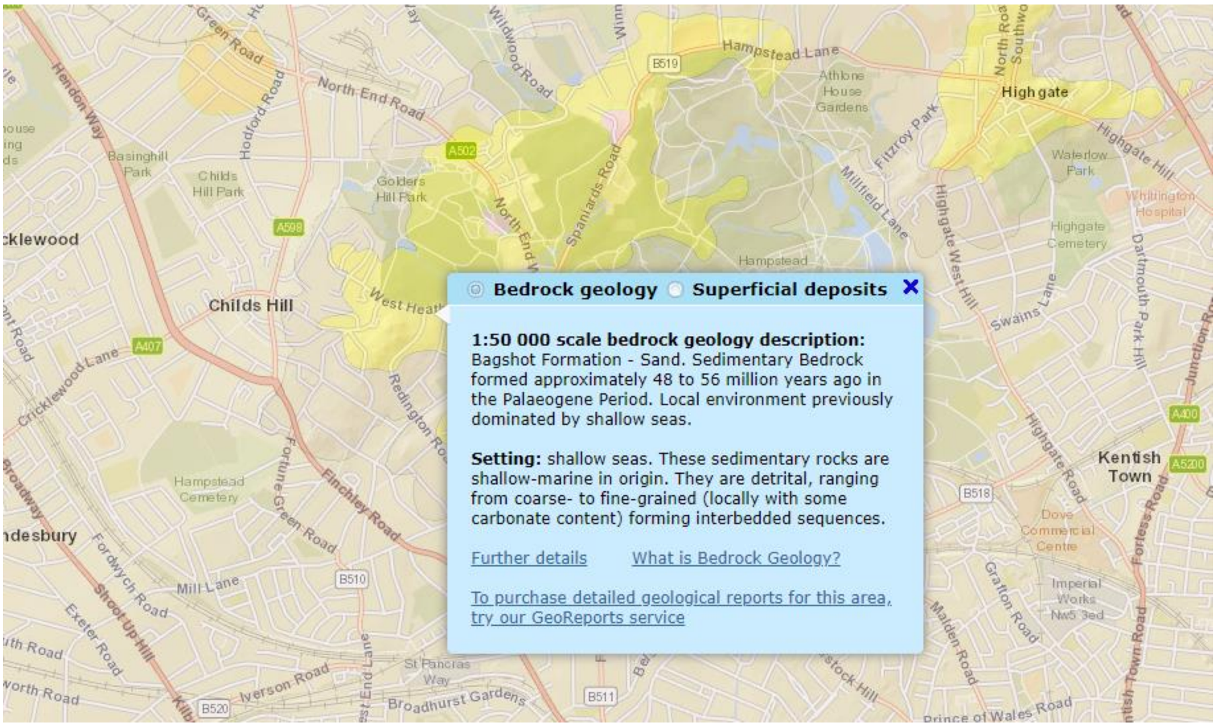
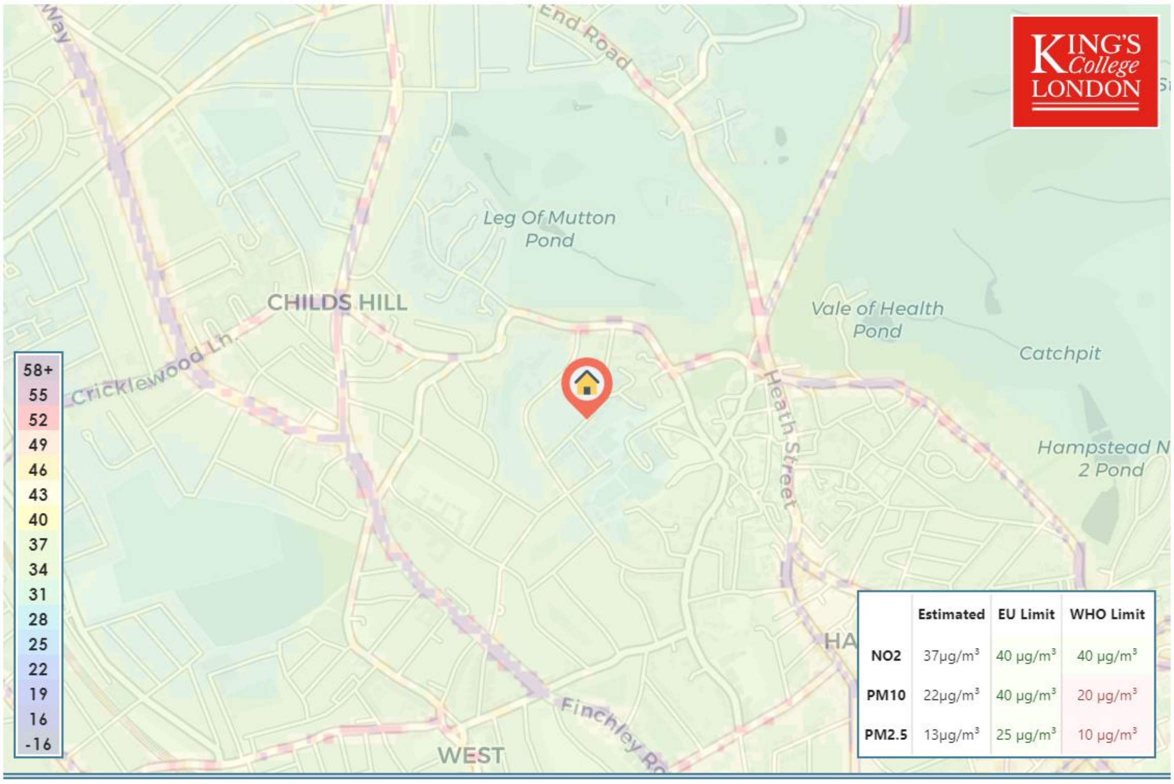


Figure 3 Bedrock 35 Templewood Avenue, (British Geological Survey map).

Local Air Quality

1.8 The whole of Camden is an Air Quality Management Area (AQMA) as it does not meet national air quality objectives for nitrogen dioxide (NO2) and because it is widely accepted that there is no safe level for particulates (PM10 and smaller). Air quality is particularly severe along major roads through the borough, and in the south of the borough which is characterised by high levels of traffic. Major roads are those either in the Transport for London Road Network or designated as a Major Road by Camden.



Nitrogen Dioxide (µg/m³) - Camden, NW3 7UY

1.9 This map was used with permission from The Greater London Authority and Transport for London, who fund, develop and maintain the London Atmospheric Emissions Inventory. For more information please visit data.london.gov.uk

EU Annual Mean Limit Values

NO_2 is 37 µg/m³ passing the EU limit of 40 µg/m³

PM10 is 22 µg/m³ passing the EU limit of 40 µg/m³

PM2.5 is 13 µg/m³ passing the EU limit of 25 µg/m³

World Health Organisation (WHO) Annual Mean Limit Values

NO_2 is 37 µg/m³ passing the WHO limit of 40 µg/m³

PM10 is 22 µg/m³ exceeding the WHO limit of 20 µg/m³

PM2.5 is 13 µg/m³ exceeding the WHO limit of 10 µg/m³

1.10 The site is passing annual mean Nitrogen Dioxide targets but exceeds the WHO airborne particles targets. The airborne particles are mainly caused by the site location close to a road containing a bus route.

1.11 The construction site air quality plan outlines how dust emission from demolition and construction is to be controlled and delivery vehicle movements reduced.

1.12 The site' Nitrogen Dioxide emissions are within the annual target limits. Therefore, retaining the use of low NOx emission boiler is acceptable as secondary heat source.

Flood Risk

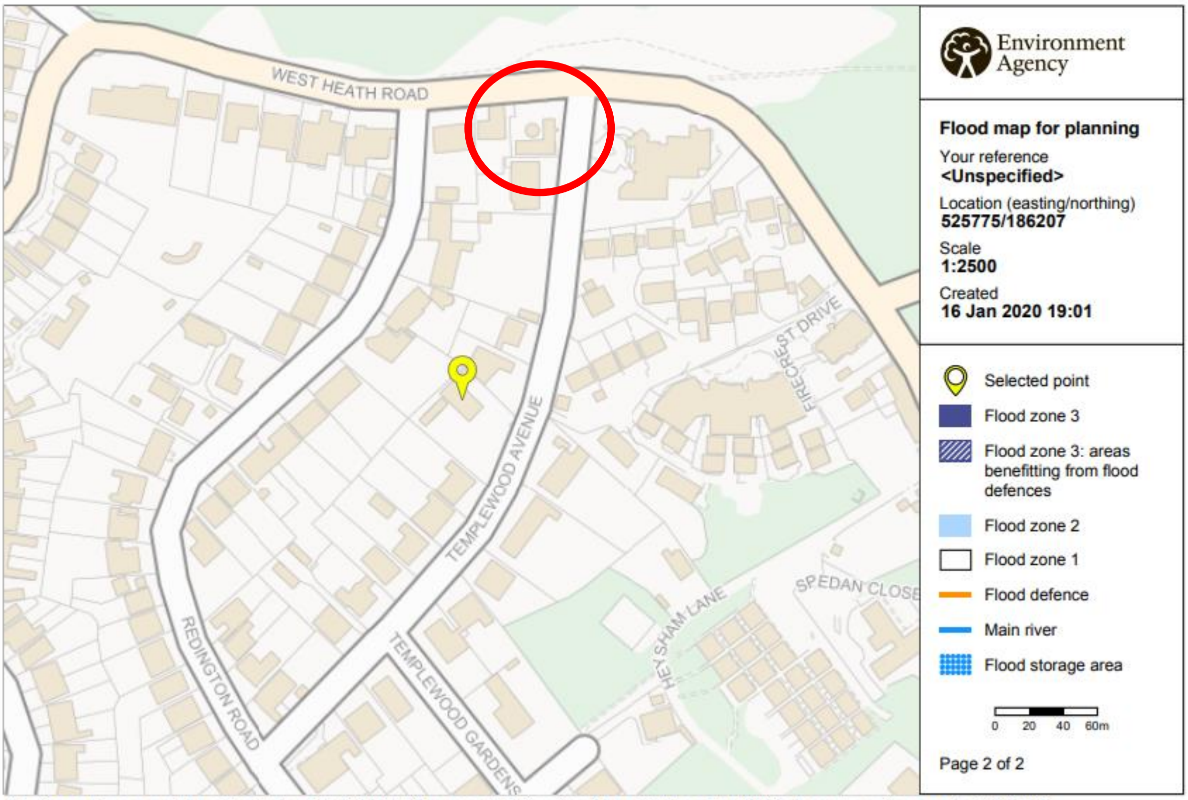


Figure 4 Environment Agency Flood Risk Map.

1.13 The site is not located in a flood risk zone. However, the pool designers will be required to reduce the flow rate from discharge pool water into the sewer network.

2 Planning Polices

2.1 It is expected that new developments will be constructed to the highest standards of sustainable design and construction as proposed by the GLA London Plan (2016) and the London Borough of Camden, Local Plan (2017). These policies are designed to promote the inclusion of on-site renewable energy production, and the use of decentralised energy systems. This approach will help reduce the dependency on conventional fuels for electricity and heating needs and will contribute towards achieving regional and national CO_2 reduction targets, hence mitigating climate change. These policies relate to major projects with over ten Domestic units and / or Non-Domestic projects over 1,000m^2 in area.

Intend to Publish New London Plan 2019 (February 2020).

2.2 The Examination in Public (EiP) on the London Plan was held between 15th January and 22nd May 2019. The Panel of Inspectors appointed by the Secretary of State issued their report and recommendations to the Mayor on 8th October 2019.

2.3 The Mayor has considered the Inspectors' recommendations and, on the 9th December 2019, issued to the Secretary of State his intention to publish the London Plan along with a clean and tracked version of the Intend to Publish London Plan, a statement of reasons for any of the Inspectors' recommendations that the Mayor does not wish to accept and a note that sets out a range of interventions that will help achieve the housing delivery set out in the Plan.

The Current GLA London Plan 2016 updated January 2017:

- Policy 5.1 Climate Change
- Policy 5.2 Minimising Carbon Dioxide emissions
- Policy 5.3 Sustainable Design and Construction
- Policy 5.6 Decentralised Energy in Development Proposals, Planning
- Policy 5.7 Renewable Energy Strategy
- Policy 5.9 Overheating and Cooling
- Policy 5.15 Water Use and Supplies

2.4 The energy assessment must fully comply with Policies 5.2 to 5.9 inclusive and, recognising the integrated nature of the London Plan policies, take account the relevant design i.e. spatial, air quality, transport and climate change adaptation policies in the Plan.

London Borough of Camden - Sustainability and Climate Change Polices.

Policy CC1 Climate Change Mitigation – Energy efficiency and carbon emission reduction, Carbon neutral developments and connection to district heat networks.

Policy CC2 Adapting to climate change – summertime over heating Risk

Policy CC3 Water and flooding – SUD options

Policy CC4 Air quality - Reduction of polluting emission sources and provision of cleaner ventilation systems

Policy CC5 Waste – Reduction of waste in construction, use and demolition.

Policy A4 Noise and vibration - External Noise Report - Use of acoustic glass, ventilation and building fabric.

2.5 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.

2.6 Climate change and minimising the use of resources – there are links between poor health and wellbeing and the ability to heat a home cost effectively and ensuring that the home does not overheat in hot weather. Policies CC1 Climate change mitigation and CC2 Adapting to Climate Change will seek to ensure that buildings are designed to be more energy efficient and to deal effectively with changes to our climate such as wetter winters and hotter summers.

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 the 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.*

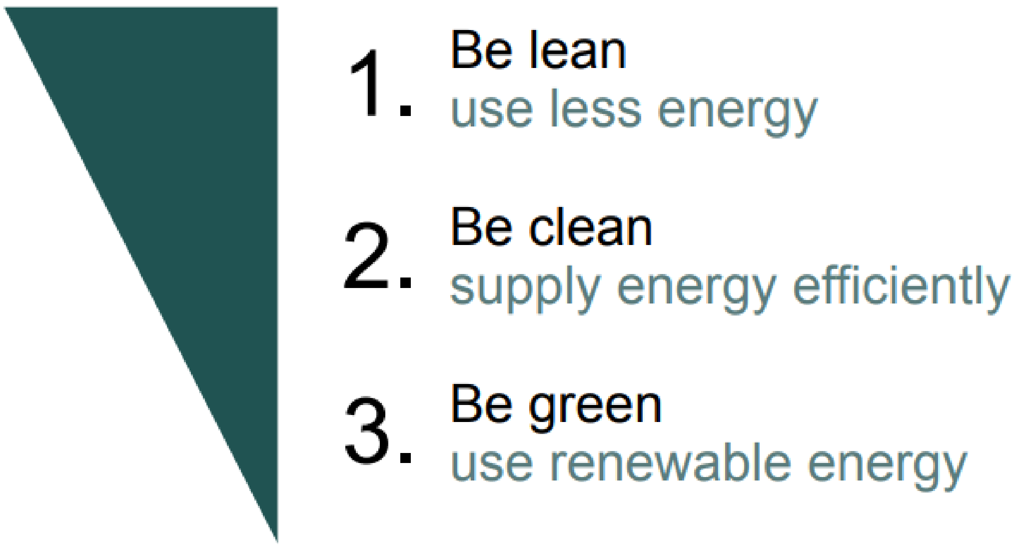
For decentralised energy networks, we will promote decentralised energy by:

- *(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.

2.7 The Council's Sustainability Plan 'Green Action for Change' commits the Council to seek low and where possible zero carbon buildings. New developments in Camden will be expected to be designed to minimise energy use and CO_2 emissions in operation through the application of the energy hierarchy. It is understood that some sustainable design measures may be challenging for listed buildings and some conservation areas.

2.8 The energy hierarchy is a sequence of steps that minimise the energy consumption of a building. Buildings designed in line with the energy hierarchy prioritise 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 a supplementary planning document 'Camden Planning Guidance' on sustainability.



2.9 All developments involving five or more dwellings and/or more than 500 sqm of (gross internal) floor space 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 developments will also be required to demonstrate a 35% CO_2 reduction below Part L 2013 Building Regulations (in addition to any requirements for renewable energy). This can be demonstrated through an energy statement or sustainability statement.

2.10 All developments should consider the feasibility of on-site renewable energy generation. Renewable energy generation should only be considered once the earlier stages of the energy hierarchy have been followed and energy demand has been reduced as far as possible.

Be lean

2.11 Proposals should demonstrate how passive design measures including the development orientation, form, mass, window sizes and positions have been taken into consideration to reduce energy demand. Therefore, demonstrating that the minimum energy efficiency requirements required under building regulations will be met and where possible exceeded. This is in line with stage one of the energy hierarchy 'Be clean'.

Be clean

2.12 The second stage of the energy hierarchy ‘Be clean’ should demonstrate how the development will supply energy efficiently through decentralised energy. Please refer to the section below on decentralised energy generation.

2.13 In areas of poor air quality, there is an expectation of zero emission buildings. Developers should look to prioritise the installation of renewable energy technologies with no polluting emissions. These can be air, ground, or water heat pumps and potentially efficient direct electric ‘point of use’ heaters to supply a hot water load, unless found to be unfeasible.

Be green

2.14 The Council will expect developments of five or more dwellings and/or more than 500 sqm of any gross internal floor space to achieve a 20% reduction in carbon dioxide emissions from on-site renewable energy generation (which can include sources of site related decentralised renewable energy), unless it can be demonstrated that such provision is not feasible. This is in line with stage three of the energy hierarchy ‘Be green’. The 20% reduction should be calculated from the regulated CO_2 emissions of the development after all proposed energy efficiency measures and any CO_2 reduction from non-renewable decentralised energy (e.g. CHP) have been incorporated.

2.15 All major developments will also be expected to demonstrate how relevant London Plan targets for CO_2 reduction, including targets for renewable energy, have been met. Where it is demonstrated that the required London Plan reductions in carbon dioxide emissions cannot be met on site. The Council will require a financial contribution to an agreed, borough wide programme, to provide for local low carbon projects. The borough wide programme will be connected to key projects identified in the Council’s Green Action for Change.

2.16 In cases where standards change or are superseded, the Council will use the equivalent replacement standards.

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:

(j) *the protection of existing green spaces and promoting new appropriate green infrastructure;*
(k) *not increasing, and wherever possible reducing, surface water runoff through increasing permeable surfaces and use of Sustainable*

Drainage Systems;

(l) *Incorporating bio-diverse roofs, combination green and blue roofs and green walls where appropriate; and measures to reduce the impact of urban and dwelling overheating, including application of the cooling hierarchy.*
(m) *Any development involving 5 or more residential units or 500m² or more of any additional floor space 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:

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

(o) Encourage new build residential development to use the Home Quality Mark.

Mark and Passivhaus design standards;

(p) encouraging conversions and extensions of 500m² of residential floor space or above or five or more dwellings to achieve "excellent" in BREEAM domestic refurbishment; and

(q) expecting non-domestic developments of 500 sqm of floor space or above to achieve "excellent" in BREEAM assessments and encouraging zero carbon in new development from 2019

Climate change adaptation measures

(r) *To minimise the risks connected with climate change we will expect the design of developments to consider anticipated changes to the climate.*

2.17 Climate change adaptation involves changing the way we do things to prepare for the potential effects of climate change. We need to ensure that buildings and people can adapt to changes already evident within the climatic system.

2.18 Adapting to a changing climate is identified in Camden's environmental sustainability plan, Green Action for Change (2011-2020). The three key risks which require adaptation measures are flooding, drought and overheating. Specific design measures and 'green infrastructure' such as green roofs, green walls and open spaces can help mitigate some of these risks.

2.19 Changes to our climate could also lead to:

- subsidence, due to increased shrinking and expanding of Camden's clay base;
- poorer air quality;
- a hotter microclimate; • increased summer electricity uses due to increased demand for cooling;
- Threats to the quantity and quality of our water supply.

2.20 Such risks impact upon the health and wellbeing of Camden residents, have financial implications and can have impacts upon whether plant and animal species thrive or decline. Ensuring new developments are designed to adapt to these risks should be a key consideration when assessing applications for development in the borough.

Water supply and quality

2.21 London has a lower rainfall than the national average while having a very high population density. This combination of limited water resources and high demand has resulted in London being declared an area of serious water stress and this trend is likely to be exacerbated by climate change. The Council will protect the borough's existing water infrastructure to ensure there are adequate supply, storage and foul water capabilities.

Policy CC3 Water and flooding

The Council will seek to ensure that development does not increase flood risk and reduces the risk of flooding where possible.

We will require development to:

(s) *incorporate water efficiency measures;*
(t) *avoid harm to the water environment and improve water quality;*
(u) *consider the impact of development in areas at risk of flooding (including drainage);*
(v) *incorporate flood resilient measures in areas prone to flooding;*
(w) *utilise Sustainable Drainage Systems (SuDS) in line with the drainage hierarchy to achieve a greenfield run-off rate where feasible; and*
(x) *Not locate vulnerable development in flood-prone areas.*
(y) *Where an assessment of flood risk is required, developments should consider surface water flooding in detail and groundwater flooding where applicable. The Council will protect the borough's existing drinking water and foul water infrastructure, including the reservoirs at Barrow Hill, Hampstead Heath, Highgate and Kidderpore.*

Air Quality Action Plan.

2.22 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.

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

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.

The Council's Air Quality Action Plan identifies actions and mitigating measures to be implemented by the Council and their partners is to reduce NO2 and PM10 from the four main emission sources of the borough: road transport; gas boilers; new developments; and small industrial processes. The Air Quality Action Plan takes account of the measures contained within the Mayor's Air Quality Strategy 'Clearing the Air'.

In order to help reduce air pollution and adhere to London planning policy, developments must demonstrate that they comply with Policy 7.14 of the London Plan (to be at least air quality neutral).

2.24 In areas of poor air quality, there is an expectation of zero emission buildings. Developers should look to prioritise the installation of renewable energy technologies with no polluting emissions. These can be air, ground, or water heat pumps and potentially efficient direct electric 'point of use' heaters to supply a hot water load, unless found to be unfeasible.

Waste

2.25 The Council is committed to reducing the amount of waste produced throughout the Borough, encouraging recycling and managing collected waste in a sustainable way. It fully supports the objectives of sustainable waste management to control the management of waste in line with the 'waste hierarchy' of prevention, preparing for reuse, recycling, other recovery, and to only consider disposal as a last resort.

Policy CC5 Waste

The Council will seek to make Camden a low waste borough.

We will:

- *(a) aim to reduce the amount of waste produced in the borough and increase recycling and the reuse of materials to meet the London Plan targets of 50% of household waste recycled/composted by 2020 and aspiring to achieve 60% by 2031;*
- *(b) deal with North London's waste by working with our partner boroughs in North London to produce a Waste Plan, which will ensure that sufficient land is allocated to manage the amount of waste apportioned to the area in the London Plan;*
- *(c) safeguard Camden's existing waste site at Regis Road unless a suitable compensatory waste site is provided that replaces the maximum throughput achievable at the existing site; and*
- (d) *Make sure that developments include facilities for the storage and collection of waste and recycling.*

Assessing the impact of noise and vibration

2.26 Where uses sensitive to noise and vibration are proposed close to an existing source of noise or when development is likely to generate noise is proposed, the Council will require an acoustic report to accompany the application.

2.27 Noise sensitive development includes housing, schools and hospitals as well as offices, workshops and open spaces. The impacts on external amenity spaces such as gardens and balconies will also be considered. Camden Council's supplementary planning document provides further information on how to minimise the impact of noise of development, including ways to mitigate noise emitted from developments and further detail on how the Council will assess the impact of noise and vibration.

Policy A4 Noise and vibration

The Council will seek to ensure that noise and vibration is controlled and managed.

Development should have regard to Camden's Noise and Vibration Thresholds (Appendix 3). This stipulates - We will not grant planning permission for:

- *(a) development likely to generate unacceptable noise and vibration impacts; or*
- *(b) Development sensitive to noise in locations which experience high levels of noise, unless appropriate attenuation measures can be provided and will not harm the continued operation of existing uses.*

We will only grant permission for noise generating development, including any plant and machinery, if it can be operated without causing harm to the amenities. We will also seek to minimise the impact on local amenities from deliveries and from the demolition and construction phases of development.

3 Establishing Site Carbon Dioxide Emissions

Energy modelling software

3.1 The energy model used to estimate the energy consumption of the domestic areas is in accordance with BRE SAP 2012 energy assessment model for domestic dwellings. Additional energy from equipment and occupational use has been estimated using the BRE Domestic Energy Model Formula 12.

3.2 The National Calculation Methods SBEM energy model is used to estimate the energy consumption for the non-domestic and communal areas. The SBEM energy modelling software was developed to demonstrate the energy and emission savings for compliance with the Building Regulations. The resulting output data is accepted as suitable for early design energy comparison. The SBEM energy model also predicts the unregulated energy usage using national agreed energy benchmarks for the proposed uses of the building.

3.3 The commercial unit has been modelled using SBEM V5.2d.2 with the Bentley Hevacomp Design Database interface.

2013 Building Regulations

3.4 New domestic buildings constructed under the 2013 Building Regulations are considered to be the equivalent standard of buildings constructed to Code for Sustainable Homes Level 4 under the 2010 Building Regulations. The inclusion of the new fabric energy efficiency standard, in addition to the carbon emission reduction target, results in the building requiring higher thermal standards for the fabric. The 2013 Building Regulation carbon emission standard is considered to be a 5% improvement on the 2010 Building Regulations.

3.5 The new buildings are designed with the lowest practical U values including accredited thermal bridging details to meet the new fabric energy efficiency target.

3.6 To meet the carbon emissions reduction target requires the addition of onsite renewable energy from PV. At this point the building passes the Building Regulation without PVs.

Accommodation Schedule

Level	Zone Name	Zone	Area
B1	Pool Plant	Non heated Zone	110.9 m²
GF	Condenser Room	Non heated Zone	15.8 m²
GF	Garage	Non heated Zone	199.0 m²
GF	Lower Ground Floor	Heat Zone	301.7 m²
CL	Listed Swimming Pool	Heat Zone	74.7 m²
UGF	Upper Ground Floor	Heat Zone	278.1 m²
F	First Floor	Heat Zone	155.3 m²
2F	Second Floor	Heat Zone	106.7 m²
Total			**1,242.2 m²**
		Non heated Zone	**325.7 m²**
		Heat Zone	**916.5 m²**

Table 3 Accommodation Schedule

Calculation method

The energy assessment must first establish the regulated CO_2 emissions assuming the development complied with Part L 2013 of the Building Regulations using Building Regulations approved compliance software.

Calculation of the 2013 building regulation Target Emissions Rate (TER).

The CO_2 Emission is first calculated for a notional building of same size and shape as the proposed building which is modified to comply with reference values set out in appendix R of SAP 2012 and listed in table 4 of approved document Part L1A 2013.

The notional building emission rate is modified using the following formulae

$$TER_{2013} = C_H \times FF + C_{PF} + C_L$$

C_H Carbon Dioxide Emission from heating the proposed development

FF Fuel factor – equal to 1 for gas and 1.55 for heat pumps.

C_{PF} Carbon Dioxide Emission from pumps and fans the proposed development

C_L Carbon Dioxide Emission from lighting the proposed development

The building regulation 2013 target emission for dwellings heated with gas boilers is the same as baseline emission rate.

The building regulation 2013 target emission for dwellings heated with electric heat pumps, the target emission rate will rise to almost 50% greater than the baseline emission rate.

Baseline

When determining this baseline, it should be assumed that the heating would be provided by gas boilers and that any active cooling would be provided by electrically powered equipment.

Be Lean

The ‘be lean’ case should assume that the heating is provided by gas boilers and that any active cooling would be provided by electrically powered equipment.

Domestic developments should achieve at least a 10 per cent improvement on Building Regulations from energy efficiency

Be Clean

The ‘be clean’ case use air to water heat pumps as the mains heating system suppling the underfloor heating and hot water cylinders. A secondary air to air heat pumps provides heating and cooling into the living areas.

Benp Green

The ‘be green’ adds the energy and emission saving from providing PV.

Terminology

Regulated Energy use

3.7 Regulated energy is the energy used for the SAP calculation to demonstrate Building Control Compliance, and calculated in the DER SAP model for:

- Heating
- Hot water
- Fans and Pumps
- Lighting

Unregulated Energy

3.8 Unregulated energy is the energy used by the occupants for cooking appliances and entertainment including the energy consumed by the swimming pool and cinema heating cooling and ventilation plant. This energy is not regulated (included / calculated for the DER), as it depends on the occupants and their lifestyles and is modelled using BRE Domestic Energy Model Formula 12.

Base Building or Target Emission Rate (TER)

3.9 This building has been designed to comply with the minimum standards of the 2013 Building Regulations using standard domestic gas boilers.

Proposed Building or Dwelling Emission Rate (DER).

3.10 This proposed building is designed to better the Building Regulations and LB of Camden and GLA planning policies for new domestic buildings. This will be achieved through thermal improvements in the building fabric, and the use of a communal gas boiler with a roof mounted PV array.

Proposed Regulated Energy Systems

	Zone	Heating	Lighting	Ventilation
Basement				
	Underground garage	No heating	LED Lighting, with occupancy sensing controls	Natural ventilated space, permanent opening to the outside with free areas greater than 1/20th of the floor area.
	Cinema	Fan-coil units providing heating and cooling	LED lighting manual lighting controls	Demand controlled ventilation (humidity and CO_2 sensing). At 4 air changes per hour
	Gym		LED lighting with automated lighting control	
	Swimming pool	Special swimming pool ventilation	LED lighting manual lighting controls	Swimming pool heat recovery system
Ground Floor				
	Family room and kitchen	Primary under floor heating with supplementary fan-coil units for improved circulation and optional summer cooling	LED lighting manual lighting controls	Constant supply and extract ventilation at 12l/s person.
	Formal living room			
First Floor				
	Bedroom / Bathrooms	Primary under floor heating with supplementary fan-coil units for improved circulation and optional summer cooling	LED lighting manual lighting controls	Supply air from basement plantroom / local extract ventilation from bathrooms, with boost control
Second Floor				
	Mater Bedroom suite	Primary under floor heating with supplementary fan-coil units for improved circulation and optional summer cooling	LED lighting manual lighting controls	Supply air from basement plantroom / local extract ventilation from bathrooms, with boost control

Table 4 regulated energy systems

Proposed unregulated energy

3.11 Unregulated energy is the energy used by the buildings occupants to live and includes the energy for cooking and for entertainment.

3.12 Large private houses are not occupied as intensively as smaller family homes and therefore the energy consumed for cooking and appliances are relatively low when compared with the size of the property.

3.13 The energy used for heating the cinema, gym and swimming pool is also unregulated energy use.

Sustainable design principles of swimming pools.

3.14 There is a considerable engineering challenge to achieve a sustainable and energy efficient functional private swimming pool. Sustainable indoor pool design will consider the size and volume of the pool hall (Ventilation), volume of the pool water and filtration system.

3.15 The pool hall thermal environment is the main energy consumption of the swimming pool. The pool hall environment dictates the heat losses from the pool water surface and evaporation rates which impacts on the levels of fresh air required to maintain the suitable temperature and humidity levels in the pool hall. It is important that the ventilation plants respond quickly to the use of the pool.

3.16 The pool ventilation design will include a thermal blanket pool cover, which insulates the pool water and allows a lower indoor pool hall temperature when the pool hall is not occupied. The ventilation plant is designed to operate in boost function, heating the pool hall to a few degrees above the pool water temperature. This saves heating energy when the pool is not in use and reduces heat and vapour losses when the cover is removed and pool is used. Energy efficient pool hall ventilation systems must be able to respond quickly and efficiently to the change of thermal environment between an unoccupied and occupied swimming pool. This is more important with private pools that are only generally occupied for less than one hour per day.

3.17 The swimming pool water needs to be kept warm and continually treated to deal with the pollution from bathers. Heat energy and water is lost through the requirements to clean via back washing swimming pool filters. This results in a loss up to a third of the pool water. Energy can be saved through the selection of alternative filter technologies, which are designed to reduce the amount of water required to clean the filters through backwashing.

3.18 Modern swimming pool ancillary equipment is required to meet industry energy efficiency standards. This has resulted in the use of variable speed, energy efficient, motors which are used to power pumps and fans. Modern ancillary pool plant equipment has a higher energy efficiency than systems that are only ten years old.

3.19 LED Lighting has improved in the last five years and generally has a 50% improvement over fluorescent lighting systems.

3.20 The building regulations require the insulation of swimming pool walls and floors and the use of heat recovery ventilation systems.

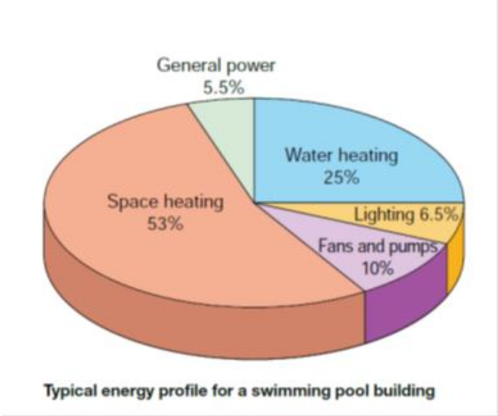


Figure 5 Typical Energy profile for a swimming pool.

Summary of the Energy and Emission Calculation.

Energy	Base	Be lean	Be clean	Be Green
System	Gas Boiler	Gas Boiler	ASHP	ASHP
Area	917 m²	917 m²	917 m²	917 m²
Main Heating (Gas)	50,046 kWh	56,402 kWh		
Hot water (Gas)	5,328 kWh	726 kWh		
Main Heating (Electricity)			30,923 kWh	30,923 kWh
Hot water (Electricity)			4,589 kWh	4,589 kWh
Electricity Pumps Fans	150 kWh	364 kWh	364 kWh	364 kWh
Electricity Lighting	1,504 kWh	1,511 kWh	1,511 kWh	1,511 kWh
Cooling			1 kWh	1 kWh
% of Site Energy Reduction from PV				-12,928 kWh
Local Zero Carbon Generation				35%
Cooking (Unregulated)	110 kWh	110 kWh	110 kWh	110 kWh
Equipment (Unregulated)	11,324 kWh	11,324 kWh	11,324 kWh	11,324 kWh
Swimming pool (Gas)		52,534 kWh		
Swimming Pool (Electricity)		10,383 kWh	30,429 kWh	30,429 kWh
regulated	57,027 kWh	59,004 kWh	37,388 kWh	37,388 kWh
Unregulated	11,434 kWh	74,351 kWh	41,862 kWh	41,862 kWh

Table 5 Summary Site Energy Use

Emission Tables	Base	Be lean	Be clean	Be Green
System	Gas Boiler	Gas Boiler	ASHP	ASHP
Area	917 m²	917 m²	917 m²	917 m²
Main Heating (Gas)	10,810 $kgCO_2$	12,183 $kgCO_2$		
Hot water (Gas)	1,151 $kgCO_2$	157 $kgCO_2$		
Main Heating (Electricity)			16,049 $kgCO_2$	16,049 $kgCO_2$
Hot water (Electricity)			2,382 $kgCO_2$	2,382 $kgCO_2$
Electricity Pumps Fans	78 $kgCO_2$	189 $kgCO_2$	189 $kgCO_2$	189 $kgCO_2$
Electricity Lighting	780 $kgCO_2$	784 $kgCO_2$	784 $kgCO_2$	784 $kgCO_2$
Cooling			0 $kgCO_2$	0 $kgCO_2$
% of Site Energy Reduction from PV				-6,710 $kgCO_2$
% of site Emission reduction from PV				35%
Cooking (Unregulated)	57 $kgCO_2$	57 $kgCO_2$	57 $kgCO_2$	57 $kgCO_2$
Equipment (Unregulated)	5,877 $kgCO_2$	5,877 $kgCO_2$	5,877 $kgCO_2$	5,877 $kgCO_2$
Swimming pool (Gas)		11,347 $kgCO_2$	0 $kgCO_2$	0 $kgCO_2$
Swimming Pool (Electricity)		5,389 $kgCO_2$	15,792 $kgCO_2$	15,792 $kgCO_2$
regulated	12,819 $kgCO_2$	13,313 $kgCO_2$	19,405 $kgCO_2$	12,695 $kgCO_2$
Unregulated	5,934 $kgCO_2$	22,670 $kgCO_2$	21,727 $kgCO_2$	21,727 $kgCO_2$
Building regulation TER	23.02 $kgCO_2$/m²			
Regulated /m²	13.99 $kgCO_2$/m²	14.53 $kgCO_2$/m²	21.17 $kgCO_2$/m²	13.85 $kgCO_2$/m²
Emission saving from BR2013	39%	37%	8%	40%

Table 6 Summary Site Energy Related Emissions

Fuel	Emission Factor	Cost
Gas	0.216 $kgCO_2$/kWh	£0.04
Electricity	0.519 $kgCO_2$/kWh	£0.17

Table 7 Emission factor from Table 12 SAP 2012

3.21 It should be noted that Carbon Dioxide factors used in the current 2013 building regulation no longer reflect the actual level of carbon dioxide emission from electricity due to improved grid efficiency .via the removal of coal fired power station and introduction of offshore wind farms.

3.22 Baseline the 2012 building regulation target is adjusted for electric heat pumps by factor of 34%. The base energy and emission calculation are based on compliant notional building energy values using a gas boiler.

3.23 Be Lean Option use the improve thermal values shown in Table 8 Building Fabric construction and thermal U Values, Table 9 Exposed Thermal Element U values and Table 10; Linear Thermal Bridging Elements. Due to size of the proposed development and number of north facing windows include dynamic thermal insulated panels on second floor Owners suit, it has not been possible to improve the thermal performance of the base case. The 2013 building regulation in ADL1a Appendix C Reporting Evidence Compliance warns against using extreme thermal values and recommends that building control should investigate were windows have U values of less than 1.2W/m^{2}K and walls U Values of less than 0.15W/m^{2}K. Taking the advice from Building Regulation approved document the design is proposing technical achievable thermal values.

3.24 Be clean energy model use air Source heat pumps to provide space heating and hot water and cooling in summer or living areas.

3.25 Be Green same model as the Be Clean with energy and emission reduction from the roof mounted PV Array.

4 Be Lean - Use less Energy

4.1 The proposed development will meet the 2013 Building Regulations, which have been designed to be the equivalent of Code for Sustainable Homes Level 4. The 2013 Building Regulations sets two target values:

Carbon emission reduction

4.2 Passive design techniques are the appropriate selection of glazing facing, window orientation directions with levels of shading, ventilation, insulation, and thermal mass.

Fabric Energy Efficiency

4.3 The Mayor's energy hierarchy is designed to encourage the designers to consider energy saving through specifying and constructing a long-lasting energy efficient building fabric. Recent changes to the building regulations encourage a 'fabric first' approach by including the fabric energy efficiency target.

4.4 Improving the building fabric to reduce heat loss in winter can also result in negatively trapping solar gains in the summer months. To quickly release the heat build-up within the dwellings the windows are designed with large openings to allow purge ventilation and have secure smaller openings for night-time ventilation. This will reduce the risk of summertime overheating and provide effective natural ventilation.

Thermal Elements

External Walls

4.5 The proposed U Values for the thermal elements are the expected standard U values shown in Appendix C of ADL1a for buildings below. These values from a buildability aspect can be achieved with standard building materials.

Element	Proposed U Value (W/m^2K)	Building Regulation Notional dwelling (W/m^2K)
External wall (including Concrete columns) Assumed Medium weight concrete infill blocks and brick outer	0.15	0.18
External party wall with neighbouring building Medium weight concrete Block	0.15	
External wall to lift shaft or stair well (including concrete sheer wall)	0.17	0.18
External wall onto unheated communal corridor -Solid Block with full filled cavity	0.17	0.18
Party wall with neighbouring dwelling - Solid Block with full filled cavity	0.0	0.0
All windows including frames Window frame Factor 0.75.g value 0.57 (Secure by design PAS 24). Unrestricted window openings	1.3	1.4
All roofs concrete reinforced frame insulated eternally	0.15	0.13
Door (Secure by design PAS 24)	1.0	1.0
Air permeability rate	$4m^3/m^2.h$@50pa	
Linear thermal transmittance (thermal bridging)	0.07 (average)	0.05

Table 8 Building Fabric construction and thermal U Values

Proposed construction of the thermal elements

Exposed Element	Construction	Cm kJ/m2K
Ground (supported) Floor	Slab on ground, screed over insulation 110	110
Wall	Cavity wall: dense plaster, AAC block, filled cavity, any outside structure	70
Roof	Plasterboard, insulated flat roof 9	9
Door	Solid Wood Door (PAS 24 Locks)	
Window	Solar shading glass (g value 0.65), High performance acoustic glazing comprising 10/16/8.8 or equivalent having an Rw+Ctr of 38dB.	
Wall to Corridor	Cavity wall: dense plaster, aerated concrete block, filled cavity, any outside structure	70
Wall to Riser	Cavity wall: dense plaster, AAC block, filled cavity, concrete sheer wall or lift shaft	70

Table 9 Exposed Thermal Element U values

4.6 Party wall elements are also included in the current Building Regulations as these walls contribute towards the thermal mass of the dwelling used to attenuate internal temperatures.

Thermal Bridging and Accredited construction details (PSI Values)

4.7 Thermal bridges occur at junctions between building elements. Heat loss associated with a thermal bridge is its linear thermal transmittance, (PSI, Ψ). This is a property of a thermal bridge and is the rate of heat flow per degree per unit length of the bridging that is not accounted for in the U-values of the plain building elements containing the thermal bridge.

4.8 Accredited construction details for thermal bridging elements can be found on the BRE website http://webarchive.nationalarchives.gov.uk/20151113141044/http://www.planningportal.gov.uk/buildingregulations/approveddocuments/partl/bcassociateddocuments9/acd#MasonryCavityWallInsulationDetails

4.9 The certified thermal details and products scheme and database allows users to search a wide range of accurate and independently assessed thermal junction details, products and elements, ensuring accuracy, consistency, credibility and quality throughout the design and specification process.

Linear	Description	Detail	Value
E2	Other lintels (including other steel lintels)	Accredited	0.3
E3	Sill	Accredited	0.04
E4	Jamb	Accredited	0.05
E7	Party floor between dwellings (in blocks of flats) a)	Accredited	0.07
P3	Intermediate floor between dwellings (in blocks of flats)	Accredited	0
E16	Corner (normal)	Accredited	0.09
E17	Corner (inverted – internal area greater than extern	Accredited	-0.09
E18	Party wall between dwellings	Accredited	0.06

Table 10; Linear Thermal Bridging Elements.

Air tightness

4.10 Building air tightness is a major saving of heating energy, which now has higher importance than external wall U values. Most new domestic dwellings typically achieve permeability rates of less than $4m^3/m^2h$@50Pa.

4.11 The buildings are designed to achieve an air tightness of less than $4m^3/m^2h$@50Pa. This is considered to be a challenging but achievable target as the design team have specified sealing and jointing fabric openings at external element junctions. Leakage is usually caused either by a lack of awareness of the importance of airtightness or by a lack of contractual responsibility for this requirement.

4.12 Airtightness needs to be a priority throughout the construction process – before, during and after. The contractor must apply suitable construction quality assurance methods and it is recommended to undertake early air tests to identify air leakage paths.

Thermal Mass

4.13 Thermal mass is the ability of a material to absorb and store heat energy. Significant heat energy is required to change the temperature of high-density materials like concrete, bricks and tiles. They are therefore said to have a high thermal mass. Lightweight materials such as timber have a low thermal mass. Appropriate use of thermal mass throughout the home can make a big difference to thermal comfort.

4.14 Thermal mass can store solar energy during the day and radiate it at night and, when correctly used, contributes towards moderating internal temperatures by averaging out diurnal (day−night) extremes. This increases comfort and reduces energy costs.

4.15 The design of the dwelling is to use thermal mass by including dense concrete blocks for the internal walls. The dense block is protected from the summer heat and winter cooling by the cavity wall insulation layer. The concrete beam, block floor and the roof construction also add to the thermal mass to the dwellings. This results in the dwellings being considered to have a medium level of thermal mass as shown in the SAP Building Regulation compliance model.

Water

4.16 The UK has less water per person than most other European countries. London is drier than Istanbul, and the South East of England has less water available per person than Sudan and Syria.

4.17 As our population grows, more and more people are sharing this limited resource. Also, the more water consumed the less there is available for the environment. Therefore, it is important that we use water wisely and do not waste it.

4.18 Approved Document Part G of the Building Regulations in April 2010 sets a whole building standard of 125 litres per person per day for domestic buildings. This comprises of internal water use of 120 litres per person per day and an allowance of 5 litres per person per day for outdoor water use. This is specified using the methodology set out in the 'Water Efficiency Calculator for New Dwellings' also used for the Code for Sustainable Homes.

4.19 The internal water use has to be limited to less than 105 litres per person per day (LBH Policy DM29).

Installation	Description	Water Use
WC	Dual Flush Cistern	5 Litres and 3 litres
Wash Hand Basin	Low Flow Regulators or Aerating Taps	3.0 Litres/Min
Bath	Standard	160 litres
Shower	Low Flow Rate Between	8 litres / minute
Kitchen Sink	Standard Monoblack At 2/3 Maximum Flow rate	3.25 Litres/Min
Washing Machine	Not supplied	8.17 Litres Per Kg
Dish Washer	Not supplied	1.25 Litres Per Place Setting
Internal	Complies with CSH Levels 3/4	98.8 Litres / Person / Day
External	Default value	5 Litres / Person / Day
Total Water Consumption	Complies with Part K of Part G water efficiency building regulation.	103.5 Litres / Person / Day

Table 11: Water fitting flow rates to achieve 105 litres per person per day

Low Energy Lighting

4.20 The dwellings are designed using 100% low energy lighting using integrated LED light fittings.

4.21 Recent advances in LED lighting technology with the development of multichip LED Lamps mean it is now possible to install high quality, low energy lights with short warm up periods and low fading loss over the life of the lamps. The lighting industry is continually developing new stylish compact LED luminaries suitable to replace the less efficient halogen luminaries.

4.22 The lighting designers will consult with the designing out crime officer to ensure the energy efficiency lighting measures which do not compromise the occupant's health, safety, and security both internally and externally. As the primary requirement, the communal areas are provided with suitable daylight from windows and artificial lighting to maintain a safe and secure space.

4.23 The designers have taken the following measures to reduce consumption:

- Automatic presence-controlled lighting
- Use long life energy saving LED lamps.
- Natural daylight where appropriate
- Time control and day light sensors for external luminaires
- Reduce external lighting from midnight to 06:00
- All security lighting to have dual lamp luminaries

Mechanical Ventilation with Heat Recovery

4.24 The whole house mechanical ventilation units (MVHR) are generally designed to meet the minimum requirements of the part of the Building Regulations which only require air flow rates designed to replace trickle vents located in the windows.

4.25 It is also important that the potential impact on future occupants of the thermal comfort/cooling strategy is appropriately considered, especially if open windows are relied upon to provide relief from overheating.

Approved Document Part F requires that:

'There shall be adequate means of ventilation provided for people in the building'

4.26 It is proposed to provide MVHR ventilation which is capable of providing a minimum 2 air changes per hour within the dwellings to reduce the occurrence when the occupants are required to leave the windows open to maintain internal comfort levels.

4.27 The designer will also consider additional ventilation options from acoustic trickle vents and external roller shutters designed to reduce sound levels while maintaining adequate ventilation.

4.28 It should be noted that failure of the MVHR fans does not result in the total loss of ventilation, since the units are designed with very low frictional losses and will operate in a passive mode of ventilation..

4.29 Recently major manufacturers have developed an additional external carbon filter unit, designed to meet requirements for dwellings located in urban areas, with poor background air quality containing high levels of air borne pollutants. Using these filters with larger MVHR units (with increased airflow rates above the minimum Building Regulation values) significantly improves the indoor air quality.

Figure 2 Nuaire Q-Aire Carbon Filter

4.30

Most of the manufacturers also provide a commissioning service with on-going annual maintenance contracts. This option is recommended to the occupants/building operators. Regular servicing of the whole house ventilation units ensures regular replacement of the filters and reliable operation.

4.31 To reduce sound and break out nuisance, the boiler and MVHR units are to be located within a suitably designed plant space separate to the living spaces.

Kitchen extract

4.32 A separate cooker hood extractor unit is specified to extract air from above the cooker and vent to the outside through dedicated ductwork. This is required to avoid contaminating the ventilation heat exchanger unit with grease from cooking.

4.33 An alternative to whole house mechanical ventilation units is fitting large trickle vent grills built into the windows or walls with mechanical extract. These manually operated grilles often cause cold draughts in winter and the grilles are often left closed off by the occupants. Once closed, the grills are rarely reopened, resulting in the loss of background ventilation to the dwellings. Trickle vents are not suitable for developments located in an urban environment with poor air background air quality.

Daylight Factor

Natural Daylight

4.34 Daylight enhances resident's enjoyment of an interior and reduces the energy needed to provide artificial light for everyday activities, while controlled sunlight can help to meet part of the winter heating requirement. Sunlight is particularly desirable in living areas and kitchen/dining spaces. The risk of overheating should be taken into account when designing for sunlight alongside the need to ensure appropriate levels of privacy. In addition to the above, BRE good practice guidelines are applied to assess the levels of internal daylight and sunlight.

4.35 Average daylight factors for residential rooms is evaluated by considering light entering from each window from the sky, externally reflected and internally reflected components. The sky component is computed using multiples of the standard case defined by Hopkinson (Daylighting, R G Hopkinson, Heinemann), using a C.I.E. standard overcast sky. Any unobstructed sky below the working plane is ignored for sky component calculations.

4.36 The main occupied rooms, living room and bedrooms have large windows with good average day light factors. To meet the BRE Home Quality Mark the average 'daylight factors criteria' requires the living room and bedroom to exceed 2.0% average daylight factor and for maximum credits the living room should exceed 5.0%.

4.37 All occupied rooms should exceed the higher daylight factors standard set by the BRE Home Quality Mark.

5 Be Clean- Supply Energy Efficiently

GLA

Policy 5.2 Minimising carbon dioxide emissions

Policy 5.6 Decentralised energy in development proposals

5.1 Reduce building carbon emissions through efficient generation of heat and power.

5.2 The GLA Policy 5.6 Decentralised Energy in Development Proposals requires that developments consider the following options:

- Connection to a district heating scheme
- Communal heating scheme with CHP
- Communal heating scheme
- Individual Gas Boilers

5.3 The 'Be Clean' stage of the energy hierarchy aims to ensure that developments have an efficient supply of heat and power. It is the local supply of heat and energy which optimises supply to demand, so is much more efficient. Until now, this step has typically been achieved through the installation of combined heat and power units (CHP) or connection to a Decentralised Energy Network (DEN) often powered by CHP and gas boilers.

Combined Heat and Power

5.4 Combined Heat and Power is a technology for generating usable heat and power efficiently, and is supplied to buildings or a network. In practice it is often combined with a DEN, as it works best with a constant, large demand for heat.

5.5 The carbon benefit of CHP derives from the lower carbon intensity of the generated electricity when compared to that supplied through the national electricity grid. Government projections for grid decarbonisation suggest that the carbon benefit of gas fired CHP will cease by 2032. Given this trajectory and a typical CHP design life of 15-20 years, the latest Government analysis concludes that only CHP deployed before 2023 will deliver carbon savings during its lifetime.

Decentralised Energy Networks

5.6 A Decentralised Energy Network (DEN) is a way of distributing the heat (and more rarely, power) generated from a given energy source(s) across multiple buildings or, as Camden prefers, multiple sites. A DEN is heat-technology-neutral, meaning the heat may come from boilers, heat pumps, and CHP or waste heat sources.

5.7 Camden considers that there are benefits in establishing and supporting existing decentralised energy networks in defined parts of the borough, which connect multiple buildings to one or more energy sources and have the potential to transition to lower carbon and renewable energy sources over time.

Camden's Borough Wide Heat Demand and Heat Source Mapping study (2015)[1] defines decentralised energy growth areas. There are a number of existing decentralised energy networks in the borough, including:

- Bloomsbury Heat and Power
- Gower Street Heat and Power
- King's Cross Central
- Gospel Oak
- Somers Town Energy

London Heat Map Research

5.8 The site is located in a mainly residential area which is not identified in a Camden heat source mapping study as a location with the potential for the development of a future district heating network.

5.9 The site has no suitable alternative energy sources, such as the heat extraction from ground water lakes or river. There are no waste heat opportunities from factories warehouse or industrial activities.

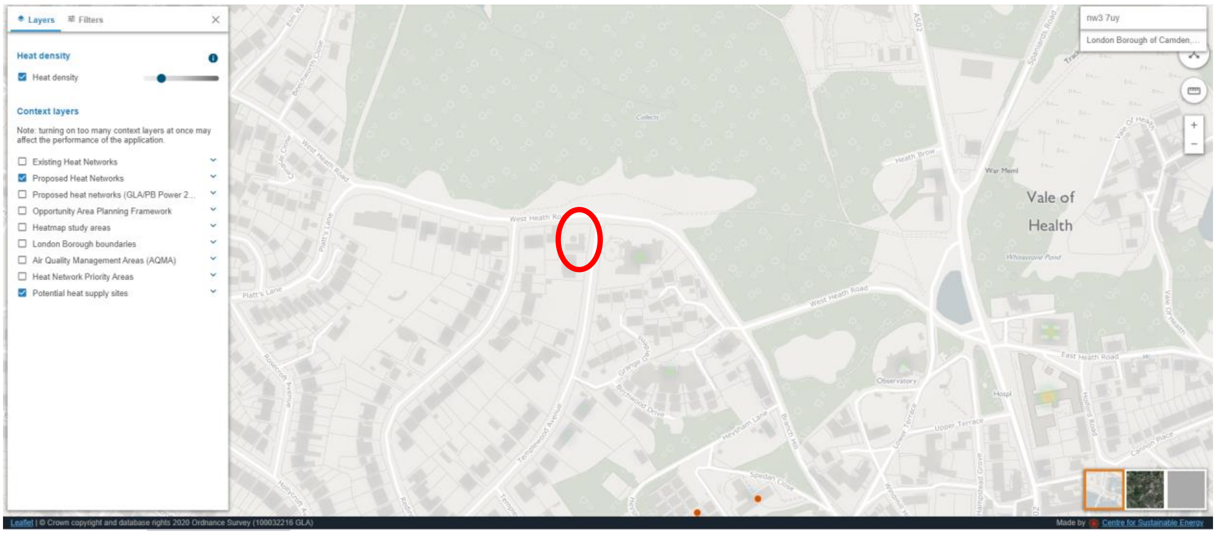


Figure 6 GLA Heat Map (centre of Sustainable Energy)

5.10 As site it is energy poor and there are no proposals for a local district heat network, therefore the London Borough of Camden requires a financial contribution of £8,600. This financial contribution will be used towards the development of a district heat network elsewhere within Borough.

[1] Borough Wide Heat Demand and Heat Source Mapping. London Borough of Camden.

Size of development (storeys)	Residential (per dwelling) or Per 300sqm of non-residential floor space
Over 20	£2,800
8-20	£2,500
5-7	£2,800
3-4	£4,100
2-3	£5,300
Single dwelling houses or single storey commercial developments	£8,600

Table 12 Camden financial contribution for district heating schedule.

Air source heat pumps (ASHP)

5.11 There are two main types of heat pumps which extracts heat from the outside air to heat the interior of a building or to heat hot water. It can also extract the heat from inside a building to provide cooling in summer. The development will use both types of heat pump.

- Air to water heat pumps operate on a similar principle to an ordinary refrigerator. Heat from the atmosphere is extracted by an outdoor unit and is absorbed by a refrigerant solution which is then compressed to a high temperature. The heat generated is used by the indoor unit to create hot water for a traditional heating and hot water system.
- Air to air heat pumps work in a similar way, but instead of generating hot water, the heat from the compressed refrigerant solution is converted into hot air by an indoor unit which is used to heat the building.

5.12 Heat pumps are better suited for use with low temperature underfloor heating systems and are less efficient when used to provide domestic hot water. Heat pumps are ideal for buildings which need heating in winter and cooling in summer.

5.13 Heat pumps use electricity and if incorrectly selected and operated can result in increased heating costs and reduced carbon savings.

5.14 A major disadvantage of air source heat pumps is that the systems efficiency reduces when the outside air temperatures fall below zero Celsius. Heat pumps are not suitable for social properties where there is risk of fuel poverty.

Recommendation

5.15 Heat pumps are proposed as the primary heating source connected to the under-floor heating system.

5.16 The proposed system will include meters to the electricity and heat meters showing the heating energy delivered to the building.

5.17 Camden heat pump calculation considers how much electricity is used for heat or cooling. We will expect carbon calculations to show that the energy required to work the pump versus the energy savings of providing heating is more efficient than gas. Otherwise they will not be acceptable. The calculations will be based on the co-efficient of performance (COP) and the carbon content of electricity and gas. ASHPs need to have a COP of more than 4 to be more efficient than a conventional heating system.

6 Be Green – Use Renewables

Policies

6.1 The Government has adopted a UK wide target for 15% of total energy to be generated by renewable sources by 2020, and these projections represent London's contribution to its 2020 target and beyond.

GLA Policy 5.7 Renewable Energy

6.2 There is a presumption by the GLA that all major development proposals will seek to reduce carbon dioxide emissions by at least 20% by 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. The Mayor encourages the use of a full range of renewable energy technologies, which should be incorporated wherever site conditions make them feasible and where they contribute to the highest overall and most cost-effective carbon dioxide emissions savings for a development proposal.

Solar thermal hot water panels

6.3 A system made of flat plate collectors or evacuated tubes which allow water to flow through and be heated by the sun's rays.

6.4 Uses the sun's heat to warm water - up to 85°C.

Where might this technology be appropriate?

- Suitable for developments with all year hot water demands.
- South facing at 30-40 degrees is ideal, but as the panels do not rely on direct sunlight, they can still be efficient at other angles.
- Can be fitted to existing buildings, but need to consider additional weight of the panels and compatibility of heating/hot water system.

6.5 Residential buildings require domestic hot water for bathing and washing. The usage is intermittent, mainly morning and evenings. Solar thermal systems replenished hot water during day time. To maximise the use of solar thermal hot water requires the occupants to manage their use of hot water to optimise the available solar heated hot water. Modern domestic appliances (washing machines and dishwashers) no longer require hot water, as it is more energy efficient for the machines to heat the small quantities of hot water as required.

6.6 Solar thermal panels are not recommended as a heat source for indoor swimming pools, as there is risk of the solar panels over heating the pool water, resulting in greater requirement to use energy to ventilate the pool hall to remove the increased water vapour. There is limited requirement to use heat in indoor swimming pool during the summer months.

6.7 In the past various companies have experimented with solar thermal storage and heat pump system combinations to reduce heating energy consumption. These systems are still in development and are generally not considered a practical or reliable solution. Space heating is mainly required in winter months when solar thermal energy is low, reducing the carbon potential of this technology. The systems developed so far have reliability and control issues.

Recommendation

6.8 Solar thermal heating is not proposed for this development as the domestic hot water requirement is small and use of solar thermal for space heating is not a practical option.

Photovoltaics

6.9 Photovoltaic cells are panels you can attach to your roof or walls. Each cell is made from one or two layers of semiconducting material, usually silicon. There are a number of different types available e.g. panels, tile cladding and other bespoke finishes.

6.10 When light shines on the PV cell it creates an electric field across the layers. The stronger the sunshine, the more electricity is produced.

- PV works best in full sunlight.
- The best commercial efficiency is 22%.
- In general, 3m^2 of conducting material such as a crystalline array will provide an average output of 90-110 kWh per year.
- Can be used with a green or brown roof as the cooler temperature created locally by the vegetation improves the efficiency of the solar panel.

Recommendation

6.11 The proposal for the development is to install PV Panels on the two flat roofs using low level and low ballast racking systems. This type of racking system reduces weight on the building structure and reduces the risk of damage to the PV array in high wind condition.

Financial Inputs		Financial Inputs	
System Size	16 kW	FiT	£0.00
System Cost	-£25,904.8	Exported	£278.21
RPI	2.70%	Saving	£1,051.03
Fuel inflation	0.25%	Total income	£1,329.24
Number of years	20 years	Yield	5.13%
Feed in Tariff	0.00 p/kWh	Payback (years)	19 years
Cost of Electricity	17.00 p/kWh	PV Variables	
Export Price	5.38 p/kWh	Location	Thames
Electricity Exported	40.00%	**Direction**	South
Electricity Used In-House	60.00%	**Panel Angle**	20°
Generated Electricity	12,928 kWh	Shading Factor	None or very little
Export	5,171 kWh	Array Sizes	16 kW
Used	7,757 kWh	Annual electricity	12,928 kWh
Return after 20 year	£2,204.09	Size of array	144 m²

Table 13 PV Financial Appraisal

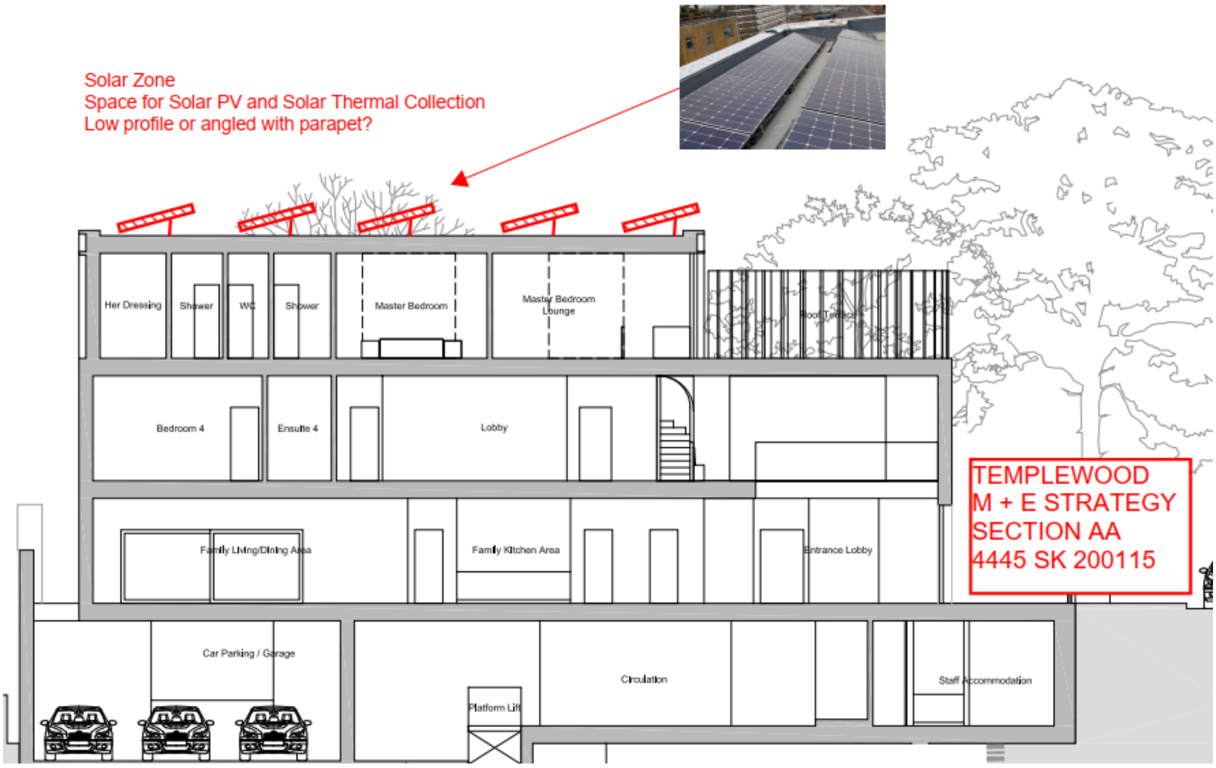


Figure 7 Building Section showing Roof With PV

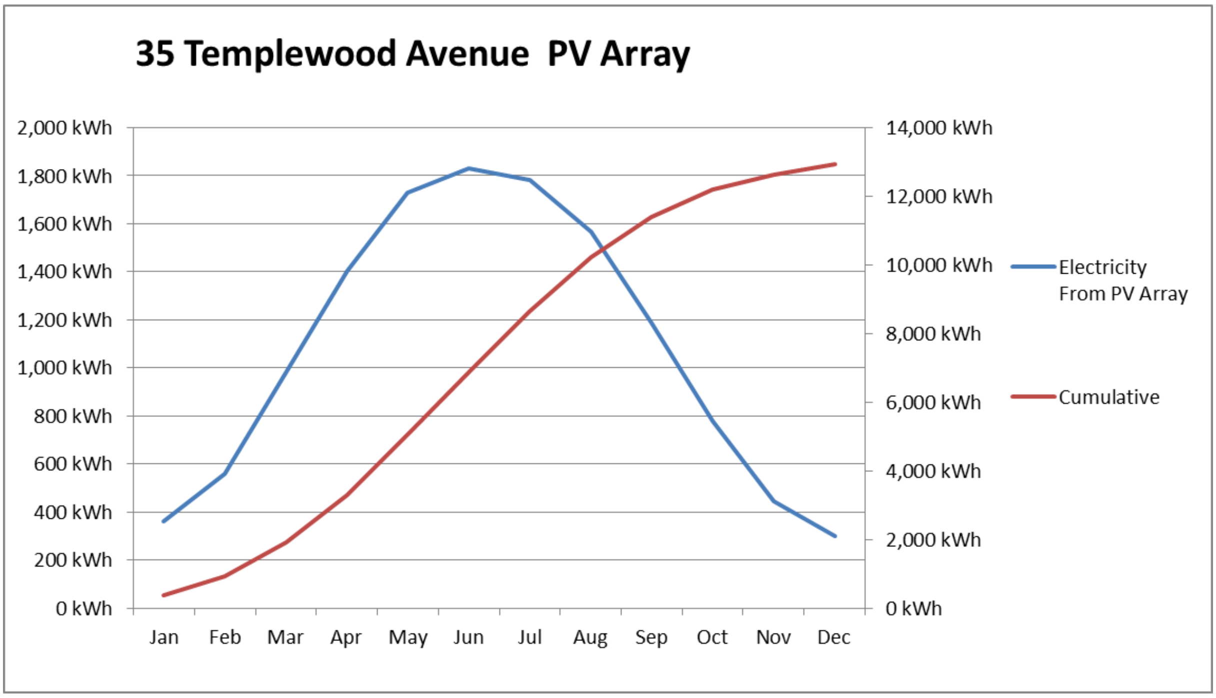


Figure 8 Predicated Annual Energy Generation.

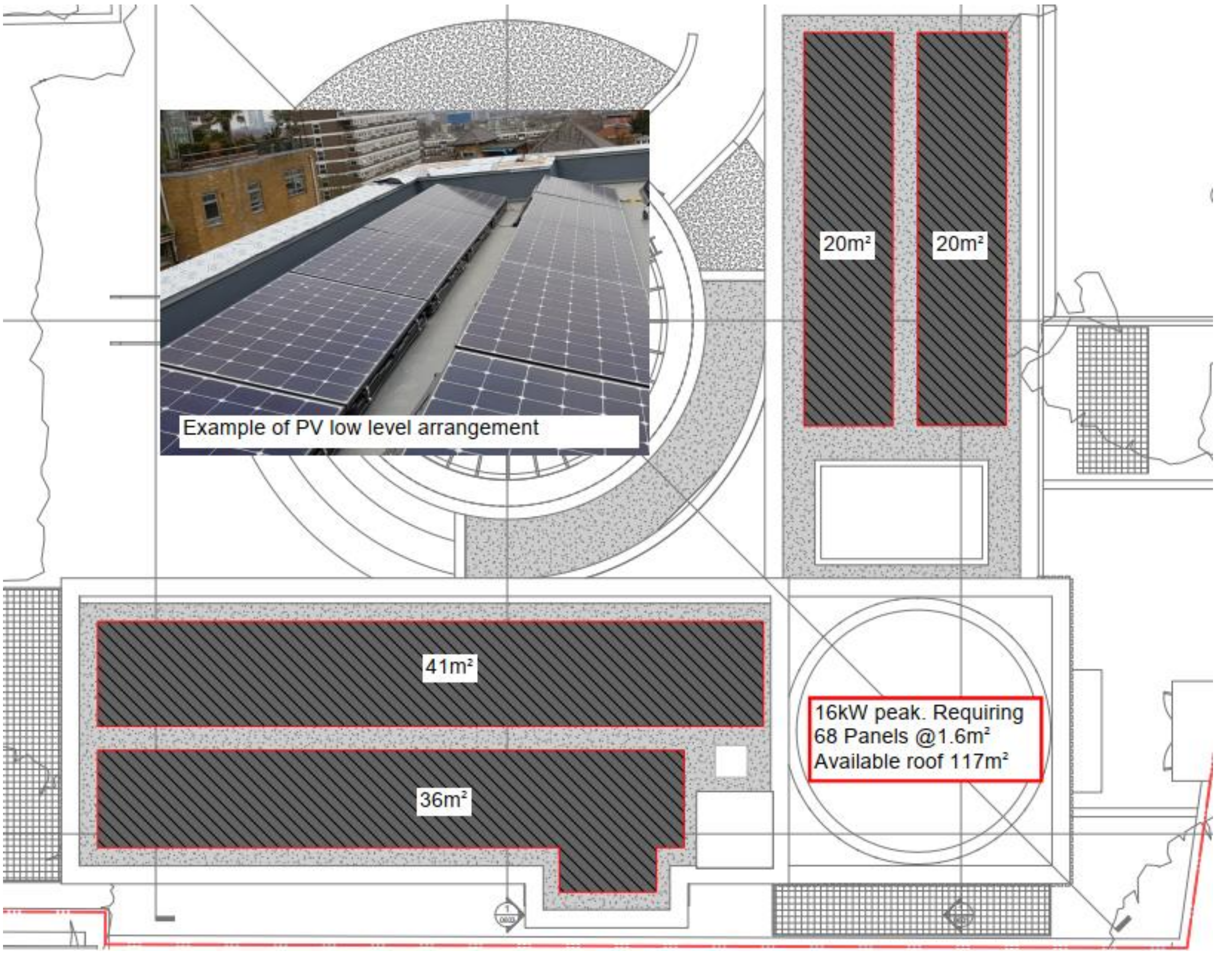


Figure 9Location of Roof Mounted PV

Ground Source Heat Pumps (GSHP) or geothermal

6.12 A network of underground pipes, which circulate a mixture of water and chemicals (to prevent freezing) through a loop and a heat exchanger. The heat from the ground is absorbed by the liquid which is pumped through the buried pipes. A heat exchanger, in the heat pump, extracts the heat from the liquid and transfers it to the building's heating system which can be used for central heating and hot water. In the summer, when the ground is cooler than the air, the system can be reversed to provide cooling.

6.13 Ground source heat pumps require large open ground to accommodate the vertical thermal piles or horizontal slinky heat exchangers. Space is required to avoid ground freezing where the building uses more heating than cooling energy.

6.14 The design and selection of the ground heat exchanger is dictated by soil, ground water levels and available area. Vertical thermal piles are generally the preferred design option in urban locations with space limitations. The type of bedrock and underground water levels influences the design and depth of thermal pile.

6.15 Heat pumps are better suited for use with low temperature underfloor heating systems and are less efficient when used to provide domestic hot water. Heat pumps are ideal for buildings which need heating in winter and cooling in summer.

Recommendation

6.16 The proposed development is not designed to require cooling, and therefore the GSHP system will mainly extract heat from the ground. This means that a large site area is required for the heat exchanger to avoid freezing ground at the end of the heating season. The underlying bedrock is Bagshot Sand which is a poor thermal conductor requiring very deep thermal pipes spaced at least 6m apart.

6.17 GSHP are not recommended for this project as there is an unsuitable domestic heating energy profile and site area limitation and would require a number of evenly spaced very deep vertical thermal piles installed in the garden.

Wind turbines

6.18 Blades or turbines which are rotated by the power of the wind. The wind turns the blades of the turbine to produce electricity. There are two main types of wind turbine:

- Horizontal Axis, most commonly seen wind turbine, requires open spaces with clean air flow (laminar air flow). Generally, a 10kW turbine has 6m diameter blade, on a 12m tall post.
- Vertical axis turbines are available, less commonly seen, works with turbulent air flow found in urbans sites. Typical between 1kW and 6KW. Range in size between 3m and 10m tall.

6.19 Wind turbines must be located in a clear laminar air flow location such as open areas, for example school playing fields and parks.

Recommendation

6.20 Wind turbines are not recommended as the site is located in a conservation area, and surrounded by large buildings and trees.

Biomass Boilers

6.21 Biomass Boilers are similar to standard boilers in that they consume wood fuel to heat water which is circulated around the building.

6.22 Wood is dried and chipped or processed into pellets. The boiler is fed mechanically from a wood chip or pellet store next to the boiler.

6.23 Wood Chip / pellet fuel can be purchased from local suppliers for smaller domestic boilers. Larger commercial boilers require a large wood store with regular fuel deliveries using large vehicles.

Recommendation

6.24 A Biomass Boiler is not suitable for use in an urban location with poor air quality. The use of biomass boilers contributes toward increased NOx and particle emissions forms the boiler and transportation of the fuel. Biomass boilers are not recommended.

7 Sustainable Specification

7.1 Materials will be chosen to lower the environmental impact of the 35 Templewood Avenue development wherever possible. BRE's Green Guide will be consulted when finalising specifications of products and elements of build types. This applies primarily to:

- Roofs
- External walls
- Internal walls (including separating walls)
- Upper and ground floors (including separating floors)
- Windows

7.2 In all cases, it is the applicant's intention to secure Green Guide ratings of between A+ and D.

7.3 All timber used during the development will come from a 'legal source' and will not be on the CITES list, or in the case of Appendix III of the CITES list, it will not have been sourced from a country seeking to protect these species as listed in Appendix III.

7.4 To promote the reduction of emissions of gases with high Global Warming Potential (GWP) associated with the manufacture, installation, use and disposal of foamed thermal and acoustic insulating materials, products will be chosen with a GWP of <5 wherever possible.

7.5 Wherever possible, products will be chosen which comply with additional voluntary industry standards for responsible sourcing, including FSC Chain of Custody and BES 6001:2008 Framework Standard for Responsible Sourcing of Construction Products certifications where applicable.

7.6 Products such as paints and vanishes will be sourced to minimise the use of Volatile Organic Compounds (Formaldehyde, VCM, etc.).

Minimising Site Waste

7.7 A Site Waste Management Plan (SWMP) will be created to include procedures, commitments for waste minimisation and diversion from landfill, as well as setting target benchmarks for resource efficiency in accordance with guidance from:

- DEFRA (Department for Environment, Food and Rural Affairs)
- BRE (Building Research Establishment)
- Envirowise
- WRAP (Waste & Resources Action Programme)
- Environmental performance indicators and/or key performance indicators (KPI) from Envirowise or Constructing Excellence.

7.8 The contractor will be required to establish a 'take back' scheme from suppliers in order to avoid the unnecessary waste of excess materials. Care will also be taken to minimise loss through breakage etc. following guidance from the Waste and Resources Action Programme (WRAP) and others.

Biodiversity

7.9 The presence of any significant ecological features as defined using guidance from BRE will be noted, and the appropriate measures for protection and conservation undertaken before works begin.

7.10 Features to promote biodiversity, such as bird and bat boxes will be incorporated into the design wherever feasible.

Cooling and Overheating

Policies

GLA Policy 5.1 Climate Change

GLA Policy 5.9 Overheating and Cooling

LB Camden Policy CC2 Adapting to climate change – Summertime over heating Risk

Cooling Hierarchy

- Internal Gains – Reduce internal gains from communal heating system pipes by enhanced insulation and lower design flow/return temperatures. Dwelling will have low equipment gains as electronic items tend to be powered only when in use. Low energy LED lighting. Modern, smart, two zone thermal controls.
- External Gains - solar reducing, highly insulated walls reducing heat transfer through the walls and roof.
- Thermal Mass – The inner element of the external walls and party walls use dense concrete block, resulting in a medium thermal mass parameter in the SAP Building Regulation model.
- Passive Ventilation - The windows are designed with secure ventilation panels to provide ventilation in winter and greater summer background ventilation to remove any heat trapped during the day

Overheating

7.11 Overheating is reduced in summer through:

- The windows recessed into the external structure.
- Use of thermal mass within the building structure.
- The heat gains to the external walls being isolated by the fire resistance insulation within the wall cavity.
- The use of large windows with multiple high-and low-level openings.

Natural Ventilation and Summer Time Overheating

7.12 Modern dwellings with low air permeability rates and fabric heat loss often suffer from high internal temperatures on warmer days. A well-designed ventilation strategy is an effective means of reducing the summer overheating risk.

7.13 The proposed development is designed to work with natural ventilation using dual aspect windows

7.14 Mechanical ventilation will contribute towards removing heat under mild weather conditions

7.15 Natural ventilation from side hung sliding windows on hotter days

GLA Overheating Check list

Site location		
	Urban – within central London or in a high-density conurbation	No
	Peri-urban – on the suburban fringes of London	No
Air quality and/or Noise sensitivity – are any of the following in the vicinity of buildings?		
	Busy roads / A roads	Yes
	Railways / Overground / DLR	No
	Airport / Flight path	Yes
	Industrial uses / waste facility	No
Proposed Building Use		
	Will any buildings be occupied by vulnerable people (e.g. elderly, disabled, young children)?	Possibly
	Are residents likely to be at home during the day (e.g. students)?	Possibly
Dwelling Aspect		
	Are there any single aspect units?	No
Glazing ratio		
	Is the glazing ratio (glazing: internal floor area) greater than 25%?	No less than 25%
	If yes, is this to allow acceptable levels of daylighting?	
Security - Are there any security issues that could limit opening of windows for ventilation?		
	Single storey ground floor units	None
	Vulnerable areas identified by the Police Architectural Liaison Officer	To be confirmed
	Other	
	Security grills on ground floor windows	No secure Garden and CCTV
Landscaping		
	Will deciduous trees be provided for summer shading (to windows and pedestrian routes)?	Yes
	Will green roofs be provided?	No, Flat roof used for PV
	Will other green or blue infrastructure be provided around buildings for evaporative cooling?	No, Flat roof used for PV
Materials		
	Have high albedo (light colour) materials been specified?	Architect will specify light coloured roof membrane.
Dwelling aspect		
	% of total units that are single aspect	100%
	% single aspect with N / NE / NW orientation	100%
	% single aspect with E orientation	%
	% single aspect with S / SE / SW orientation	%
	% single aspect with W orientation	%
Glazing ratio - What is the glazing ratio (glazing; internal floor area) on each facade?		

	N / NE / NW	22%
	E	5%
	S / SE / SW	1%
	W	3%
Daylighting		
	What is the average daylight factor range?	3%
Window opening		
	Are windows openable?	YES
	What is the average percentage of openable area for the windows?	60%
Window opening - What is the extent of the opening?		
	Fully openable	Yes
	Limited (e.g. for security, safety, wind loading reasons)	No all window opening 800mm above floor levels
Security		
	Where there are security issues (e.g. ground floor flats) has an alternative night time natural ventilation method been provided (e.g. ventilation grates)?	Secure Garden and CCTV
	Shading	From close proximity of neighbouring buildings
	Is there any external shading?	No
	Is there any internal shading?	Yes, blinds and optional curtains
Glazing Specification		
	Is there any solar control glazing?	Yes, Solar reducing K glass (g=0.6)
Ventilation - What is the ventilation strategy?		
	Natural – background	Trickle vents
	Natural – purge	Windows
	Mechanical – background (e.g. MVHR)	MVHR sized for 3 ACH
	Mechanical – purge	Windows
	What is the average design air change rate	2.0
Heating system		
	Is communal heating present?	NO
	What is the flow/return temperature?	60°C Flow return 30°C
	Have horizontal pipe runs been minimised?	LTHW only operates during heating season
	Do the specifications include insulation levels in line with the London Heat Network Manual	No District Heating.

Table 14: GLA Domestic Overheating Checklist (April 2016)

Building Regulations Overheating Test (SAP 2010) Results

7.16 The calculation is related to the factors that contribute to internal temperature; solar gain (taking account of orientation, shading and glazing transmission); ventilation (taking account of window opening in hot weather), thermal capacity and mean external summer temperature for the location of the dwelling.

8 Carbon Offsetting

Polices

GLA - Policy 5.2 Minimising Carbon Dioxide emissions

Local Policy

Carbon Offsetting Fund

8.1 The council currently implements planning policies requiring high environmental standards in new-build homes. This includes a requirement for a regulated carbon dioxide (CO_2) emissions saving of a minimum of 35% on Part L of the 2013 Building Regulations for all major non domestic developments, in accordance with Policy 5.2 of the London Plan and Energy Hierarchy. The GLA Guidance on Preparing Energy Assessments outlines that only regulated building emissions should be considered.

8.2 London Borough of Camden's Council's carbon offset cost is £60 for every tonne of CO_2 emitted per year over a period of 30 years (or £1,800 per tonne of annual residual CO_2 emissions). Full details are set out in the Section 106 and CIL SPD. This rate is recommended in the Mayor's Sustainable Design and Construction SPG and is in accordance with the DCLG's August 2013 consultation on allowable solutions.

Zero Carbon Homes – new policy requirement from 1 October 2016

8.3 The Mayor of London has set out the approach to achieving the London Plan policy aim of "zero carbon homes" for major developments in the Housing Supplementary Planning Guidance (SPG), published in March 2016.

8.4 From 1 October 2016, any new homes forming part of major developments are required to continue to meet the on-site 35% CO_2 reduction target for regulated carbon dioxide emissions. However, they will also be required to offset all remaining regulated CO_2 emissions to 100% or "zero carbon emissions,"

8.5 The funds secured by the Camden council will be ring-fenced to deliver carbon emissions savings at other locations within borough via Section 106 legal agreements.

Domestic Carbon Offset Payment Calculation

8.6 The 35% emission reduction target is mainly met through the installation, without the loss of other amenities such as the green roof.

9 Air Quality Neutral

9.1 Air Quality Neutral (AQN) is a calculation procedure designed to simplify the air quality calculation with respect to the impact of the new development on local air quality. This calculation procedure considers the impact on air quality from both building heating, cooling system and transport emissions.

Building Emission

9.2 An all-electric heating system using is proposed for this development, which is zero polluting and complies with air quality neutral benchmark.

Transport

9.3 The CA Transport Statement February 2020 – this document has not calculated the number of vehicle movements generated by the development.

Trip Generation

Due to the nature and scale of the development, a detailed trip generation assessment is not considered appropriate. The site proposes to accommodate 3 on-site parking spaces with a dewlling partial extension of the development to accommodate a total of 7 bedrooms. Typically, residential dwellings generate a demand for circa 6-9 two-way movements across a standard weekday. Therefore, the proposal is unlikely to generate a significant proportion of trips or any change in person trips when compared with the extant use resulting in no detrimental effect on the surrounding highway network.

Figure 10 Paragraph 5.2 Transport Statement: 31 Templewood Avenue February 2020.

9.4 The CA Transport statement confirms that post construction there is no material change in vehicle movements as result of this development.

9.5 The Air Quality neutral bench mark assumes 407 trips per year (1.6 trip day per dwelling). The current average number of trip for this type of house 6-9 vehicle movement which exceeds the target.

Transport Emission Benchmark		

Floor area	1,242 m²	m²
Number dwellings	2	Number
Number trips per weekday	8	Number
Average distance	3.7	km
Average number per year	407	
NOx	0.37	g/Vehicle-km
PM10	0.0665	g/Vehicle-km
NOx	2,847.52 g	
PM10	511.78 g	
Target NOx	1,116.00 g	
Target PM10	200.00 g	
Test NOX	Fail	
Test PM10	Fail	

Table 15 Transport Benchmark

Appendices

Appendix A Swimming Pool Energy Analysis

Swimming pool ventilation

All newly designed UK projects need to comply with the minimum standards stipulated by Part F of the latest building control regulations (2013). The swimming pool AHU is purpose designed to exceed these strenuous standards and ensure legal compliance.

The Swimming pool AHU regulates pool room humidity levels by introducing controlled amounts of fresh air. In the UK, the moisture content of the outside air is always less than the air within the pool room, enabling highly effective natural dehumidification as the room air is exchanged. This is a major energy saving compared with older indoor swimming pool ventilation plant installed in the Schreiber Pool.

To reduce the heat loss incurred through this ventilation process, a method of heat recovery is employed using a large ‘Cross Flow’ multi-plate recuperator, where heat within the expelled room, air is passively conducted, via a series of adjoining plates, directly to the incoming colder fresh air.

The ability of the ‘Cross Flow’ heat recuperator to provide genuine heat recovery from expelled room air actually increases as the outside fresh air becomes colder, so the system is able to maintain its outstanding heat recovery efficiency, even during cold winter weather.

In older swimming pool ventilation plant the operation of fixed fan motor (pre2010) accounted for the high percentage of the energy consumed by the Swimming pool AHU. The use of modern DC motor coupled to an AC inverter speed control, coupled to more efficient backward curved, centrifugal impellor, dramatically reduces the AHU energy consumption.

Against the consideration that the permanent operation of an air fan motor may represent the largest consumer of energy within an indoor pool, the XF employs a very special type of digital fan to offer the best possible energy efficiency and, so, the lowest operating cost of any such system. The digital fan uses a directly driven, backward curved, centrifugal impellor, which features a DC motor coupled to an AC inverter.

The Swimming pool AH provides a modulated level of fresh air dilution to achieve an enhanced impression of freshness and to prevent any build-up of chemical odours. A slightly negative air pressure is also achieved to help prevent the pool room atmosphere migrating into adjoining areas, or compromising vapour barriers.

Modern swimming pool cleaning chemicals are design not to emit odours, which is often a sign of poor pool maintenance.

As the quantity of air emitted to atmosphere has an increased relevance to the overall energy usage of the application, the expelled air volume is precisely regulated by the combined effect of a motorised air damper and the automated power of the variable speed exhaust air fan.

To ensure that the optimum pool room air and pool water temperatures are always achieved supplementary heat emitters are incorporated within the Swimming pool AHU.

A high capacity pool water heat emitter is used to ensure a swift initial warm-up period for the pool from cold to start up. The high capacities coils reduce the amount of time the AHU operates at full power reduce overall energy consumption across the year.

The use of modern digital controllers linked to the internet allows remote monitoring, software updates by manufactures technicians.

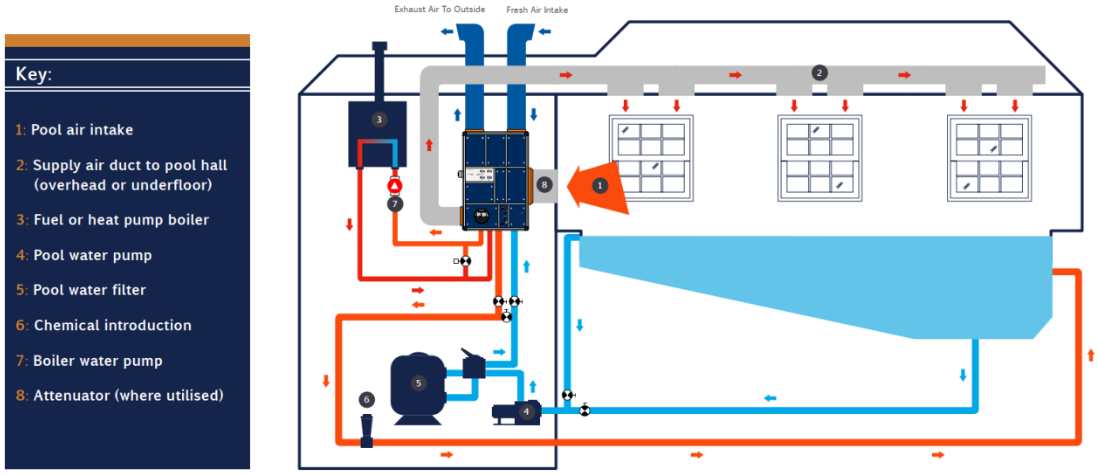


Figure 11 Swimming pool plant

	Fuel	Energy	Emissions	Cost
Support for Pool water heating	GAS	15,662 KWh	3,383 $kgCO_2$	£626.48
space heating	GAS	8,499 KWh	1,836 $kgCO_2$	£339.96
Pool water heating	GAS	28,373 KWh	14,726 $kgCO_2$	£1,134.93
Fans	Electricity	1,809 KWh	939 $kgCO_2$	£307.53
Pumps supplementary pool heating	Electricity	423 KWh	220 $kgCO_2$	£71.91
Filter Pump	Electricity	7,300 KWh	3,789 $kgCO_2$	£1,241.00
Pool water heating Pump	Electricity	851 KWh	442 $kgCO_2$	£144.70
Total		62,918 KWh	25,333 $kgCO_2$	£3,866.52

Table 16 Standard Heat recovery ventilation using GAS boilers as Heat source

	Fuel	Energy	Emissions	Cost
Support for Pool water heating	Electricity	4,549 KWh	2,361 $kgCO_2$	£773.33
space heating	Electricity	2,374 KWh	1,232 $kgCO_2$	£403.58
Pool water heating	Electricity	8,512 KWh	4,418 $kgCO_2$	£1,447.04
Fans	Electricity	2,198 KWh	1,141 $kgCO_2$	£373.66
Pumps supplementary pool heating	Electricity	2,942 KWh	1,527 $kgCO_2$	£500.14
Filter Pump	Electricity	7,300 KWh	3,789 $kgCO_2$	£1,241.00
Pool water heating Pump	Electricity	2,554 KWh	1,325 $kgCO_2$	£434.11
Total		30,429 KWh	15,792 $kgCO_2$	£5,172.86

Table 17 ASHP Ventilation and pool heating Unit.

The Air Source Heat Pumps is capable of producing low temperature heat more efficiently than gas boilers, however this is at a cost of increased hours of operation and financial cost. The heat pump option on paper is more efficient than a gas boiler option, but with slower thermal response.

Saving	Unit	Percentage
Energy	32,489 KWh	52%
Emission	9,541 $kgCO_2$	38%
Cost	-£1,306.34	134%

Table 18 Summary of pool cost and savings

Pool Energy model input variables	Value
Pool Surface Area	52 m^2
Pool Water Volume	100 m^3
Pool hall volume	228 m^3
Number of total pool water refills	4
Water mains	6 °C
pool Water	30 °C
Pump (water heater)	2.0 kW
Annual Pool Water Heating	25,536 KWh
Filter Pump	2.0 kW
Filter Pump Operation	7,300 hrs

Table 19 Pool Energy Model Inputs

Appendix A Summary GLA Energy Tables

Ref	FLA (m²)	No	Space Heating (kW	Fuel type Space Heating	Domestic Hot Wate	Fuel typeDomestic	Lighting (kWh p.a.)	Auxiliary (kWh p.a.)	Cooking	Appliance	PV Kwp	TER Worksheet TER 2012 (kgCO2 / m2)	Target Fabric Energy Efficiency (TFEE) (kWh/m²)
Main House	862	1	47,994 kWh	Gas	3,219 kWh	Gas	1,240 kWh	75 kWh	62 kWh	9,508 kWh	17	22.66	71
Staff Houses	54.5	1	2,051 kWh	Gas	2,108 kWh	Gas	264 kWh	75 kWh	48 kWh	1,816 kWh	0	28.78	50
Total Energy	916.5	2	50,046 kWh		5,328 kWh		1,504 kWh	150 kWh	110 kWh	11,324 kWh			
Total Emissions			25,974 kgCO2		2,765 kgCO2		780 kgCO2	78 kgCO2	57 kgCO2	5,877 kgCO2		23 kgCO2	

Table 20 Baseline Energy Model

Ref	FLA (m²)	No	Space Heating (kWh p.a.)	Fuel type Space Heating	Domestic Hot Water (kWh p.a.)	Fuel type Domestic Hot Water	Lighting (kWh p.a.)	Auxiliary (kWh p.a.)	DER Worksheet DER 2012 (kgCO2 / m2)	Dwelling Fabric Energy Efficiency (DFEE) (kWh/m²)
Main House	862	1	56,402 kWh	Gas	3,462 kWh	Gas	1,240 kWh	75 kWh	17.36	66.6
Staff Houses	54.5	1	726 kWh	Gas	1,128 kWh	Gas	272 kWh	289 kWh	12.69	47.9
Total Energy	917	2	57,128 kWh		4,589 kWh		1,511 kWh	364 kWh	30 kWh	115 kWh
Total Emissions			29,649 kgCO2		2,382 kgCO2		784 kgCO2	189 kgCO2	16 kgCO2	59 kgCO2

Table 21 Be Lean Energy

Ref	FLA (m²)	No	Space Heating (kWh p.a.)	Fuel type Space Heating	Domestic Hot Water (kWh p.a.)	Fuel type Domestic Hot Water	Space and Domestic Hot Water from CHP (kWh p.a.)	Fuel type CHP	Electricity generated by CHP (kWh p.a.)	Lighting (kWh p.a.)	Auxiliary (kWh p.a.)	DER Worksheet DER 2012 (kgCO2 / m2)	Dwelling Fabric Energy Efficiency (DFEE) (kWh/m²)
Main House	862	1	30,193 kWh	Electricity	1,760 kWh	Electricity				1,240 kWh	120 kWh	13.53	67.90
Staff Houses	54.5	1	730 kWh	Electricity	1,087 kWh	Electricity				272 kWh	244 kWh	22.22	47.90
Total Energy	916.5 m²	2	30,923 kWh		2,847 kWh					1,511 kWh	364 kWh		
Total Emissions			16,049 kgCO2		1,477 kgCO2					784 kgCO2	189 kgCO2	14 kgCO2	67 kgCO2

Table 22 Be Clean Energy

	FLA (m²)	No	Space Heating (kWh p.a.)	Fuel type Space Heating	Domestic Hot Water (kWh p.a.)	Fuel type Domestic Hot Water	Space and Domestic Hot Water from CHP (kWh p.a.)	Fuel type CHP	Electricity generated by CHP (kWh p.a.)	Electricity generated by renewable (kWh p.a.) if applicable	Lighting (kWh p.a.)	Auxiliary (kWh p.a.)	Cooling (kWh p.a.)	DER Worksheet DER 2012 (kgCO2 / m2)
Main House	862	1	30,193 kWh	Electricity	1,760 kWh	Electricity				-12,928 kWh	1,240 kWh	120 kWh	1 kWh	13.53
Staff Houses	54.5	1	730 kWh	Electricity	1,087 kWh	Electricity				0 kWh	272 kWh	244 kWh	0	22.22

Table 23 Be Green

Appendix B SAP Be lean

Appendix C SAP Repoart5 Be Green.

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.4.23
Printed on 25 February 2020 at 13:34:09

Project Information:

Assessed By: () **Building Type:** Detached House

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 786.7m²

Site Reference : 35 Tmplewood Avenue **Plot Reference:** Main House (BE GREEN)

Address : Main House (Be GREEN), 35 Templewood Avenue, London, NW3 7UY

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)	22.66 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	13.53 kg/m²	OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	70.8 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	67.9 kWh/m²	
		OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.15 (max. 0.30)	0.15 (max. 0.70)	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	1.40 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main Heating system:	Heat pumps with radiators or underfloor heating - electric Air source heat pump with flow temperature <= 35°C	
Secondary heating system:	None	

5 Cylinder insulation

Hot water Storage:	Measured cylinder loss: 3.92 kWh/day	
	Permitted by DBSCG: 3.92 kWh/day	OK
Primary pipework insulated:	Yes	OK

6 Controls

Space heating controls	TTZC by plumbing and electrical services	OK
Hot water controls:	Cylinderstat	OK
	Independent timer for DHW	OK

Regulations Compliance Report

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 (Thames valley):	Not significant	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: South	5.4m²
Windows facing: East	4.8m²
Windows facing: East	3.84m²
Windows facing: East	7.7m²
Windows facing: West	1.5m²
Windows facing: North	19.47m²
Windows facing: North	26.4m²
Windows facing: South	4.5m²
Windows facing: North	77.88m²
Windows facing: West	14.4m²
Windows facing: North	19.8m²
Windows facing: East	14.19m²
Windows facing: East	5.2m²
Windows facing: North	11.55m²
Windows facing: North	13m²
Windows facing: West	3m²
Ventilation rate:	4.00

10 Key features

Photovoltaic array
Fixed cooling system

Thermal Bridge Report

Property Details: Main House (BE GREEN)

Address:	Main House (Be GREEN), 35 Templewood Avenue, London, NW3 7UY
Located in:	England
Region:	Thames valley

Thermal bridges:

Thermal bridges:

User-defined = UD
Default = D
Approved = A
User-defined (individual PSI-values) Y-Value = 0.0841

External Junctions Details:

Junction Type	PSI-Value	Length	Reference	Type
Other lintels (including other steel lintels)	1	85.871	E2	[D]
Sill	0.08	85.871	E3	[D]
Jamb	0.1	136.4	E4	[D]
Corner (normal)	0.18	73.5	E16	[D]
Corner (inverted internal area greater than external area)	0	17.5	E17	[D]
Flat roof	0.08	93	E14	[D]

SAP Input

Property Details: Main House (BE GREEN)

Address:	Main House (Be GREEN), 35 Templewood Avenue, London, NW3 7UY
Located in:	England
Region:	Thames valley
UPRN:	
Date of assessment:	09 January 2020
Date of certificate:	25 February 2020
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Owner-occupied
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Medium
Water use <= 125 litres/person/day:	True
PCDF Version:	455

Property description:

Dwelling type:	House
Detachment:	Detached
Year Completed:	2023

Floor Location:	Floor area:	Storey height:
Basement floor	247 m²	3 m
Floor 1	278 m²	3.5 m
Floor 2	155 m²	3.5 m
Floor 3	106.7 m²	3.5 m

Living area: 75 m² (fraction 0.099)
Front of dwelling faces: South

Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
A Gd S	SAP 2012	Windows	low-E, En = 0.05, soft coat	Yes	Wood
B Gd E	SAP 2012	Windows	low-E, En = 0.05, soft coat	Yes	Wood
C Gd E	SAP 2012	Windows	low-E, En = 0.05, soft coat	Yes	Wood
D Gd E	SAP 2012	Windows	low-E, En = 0.05, soft coat	Yes	Wood
E Gd W	SAP 2012	Windows	low-E, En = 0.05, soft coat	Yes	Wood
G Gd N	SAP 2012	Windows	low-E, En = 0.05, soft coat	Yes	Wood
H F N	SAP 2012	Windows	low-E, En = 0.05, soft coat	Yes	Wood
I F S	SAP 2012	Windows	low-E, En = 0.05, soft coat	Yes	Wood
J F N	SAP 2012	Windows	low-E, En = 0.05, soft coat	Yes	Wood
K F W	SAP 2012	Windows	low-E, En = 0.05, soft coat	Yes	Wood
L S N	SAP 2012	Windows	low-E, En = 0.05, soft coat	Yes	Wood
M S E	SAP 2012	Windows	low-E, En = 0.05, soft coat	Yes	Wood
O LG E	SAP 2012	Windows	low-E, En = 0.05, soft coat	Yes	Wood
P LG N POOL	SAP 2012	Windows	low-E, En = 0.05, soft coat	Yes	Wood
Q Grd N	SAP 2012	Windows	low-E, En = 0.05, soft coat	Yes	Wood
R Grd W	SAP 2012	Windows	low-E, En = 0.05, soft coat	Yes	Wood

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
A Gd S	12mm	0.7	0.57	1.4	1.8	3
B Gd E	12mm	0.7	0.57	1.4	4.8	1
C Gd E	12mm	0.7	0.57	1.4	3.84	1
D Gd E	12mm	0.7	0.57	1.4	7.7	1
E Gd W	12mm	0.7	0.57	1.4	1.5	1
G Gd N	12mm	0.7	0.57	1.4	19.47	1
H F N	12mm	0.7	0.57	1.4	6.6	4
I F S	12mm	0.7	0.57	1.4	2.25	2

SAP Input

J F N	12mm	0.7	0.57	1.4	19.47	4
K F W	12mm	0.7	0.57	1.4	4.8	3
L S N	12mm	0.7	0.57	1.4	19.8	1
M S E	12mm	0.7	0.57	1.4	14.19	1
O LG E	12mm	0.7	0.57	1.4	2.6	2
P LG N POOL	12mm	0.7	0.57	1.4	11.55	1
Q Grd N	12mm	0.7	0.57	1.4	13	1
R Grd W	12mm	0.7	0.57	1.4	3	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
A Gd S		Grd Wall	South	1.2	1.5
B Gd E		Grd Wall	East	2.4	2
C Gd E		Grd Wall	East	1.919	2
D Gd E		Grd Wall	East	3.852	2
E Gd W		Grd Wall	West	1	1.5
G Gd N		Grd Wall	North	5.9	3.3
H F N		First Flr Wall	North	2	3.3
I F S		First Flr Wall	South	1.5	1.5
J F N		First Flr Wall	North	5.9	3.3
K F W		First Flr Wall	West	1.5	3.2
L S N		Second Fllr Wall	North	6	3.3
M S E		Second Fllr Wall	East	4.3	3.3
O LG E		LG Wall	East	1.3	2
P LG N POOL		LG Wall	North	3.5	3.3
Q Grd N		Grd Wall	North	5.2	2.5
R Grd W		Grd Wall	West	1.5	2

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
LG Basement	152.54	0	152.54	0.15	0	False	N/A
LG Wall	16.8	16.75	0.05	0.15	0	False	N/A
Grd Wall	314	58.71	255.29	0.15	0	False	N/A
First Flr Wall	314.4	123.18	191.22	0.15	0	False	N/A
Second Fllr Wall	164.3	33.99	130.31	0.15	0	False	N/A
Frist Flr roof	172	0	172	0.13	0		N/A
Secod Floor	106	0	106	0.13	0		N/A
basement floor roof	23	0	23	0.13	0		N/A
basement	247			0.13			N/A
Internal Elements							
Party Elements							

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0841

Length	Psi-value		
85.871	1	E2	Other lintels (including other steel lintels)
85.871	0.08	E3	Sill
136.4	0.1	E4	Jamb
73.5	0.18	E16	Corner (normal)
17.5	0	E17	Corner (inverted internal area greater than external area)
93	0.08	E14	Flat roof

Ventilation:

Pressure test: Yes (As designed)
Ventilation: Natural ventilation (extract fans)

SAP Input

Number of chimneys:	0
Number of open flues:	0
Number of fans:	5
Number of passive stacks:	0
Number of sides sheltered:	0
Pressure test:	4

Main heating system:

Main heating system:	Heat pumps with radiators or underfloor heating Electric heat pumps Fuel: Electricity Info Source: SAP Tables SAP Table: 214 Air source heat pump with flow temperature <= 35°C Underfloor heating, pipes in screed above insulation Central heating pump : Unknown Design flow temperature: Design flow temperature >45°C Room-sealed Boiler interlock: Yes

Main heating Control:

Main heating Control:	Time and temperature zone control by suitable arrangement of plumbing and electrical services Control code: 2207

Secondary heating system:

Secondary heating system:	None

Space cooling system:

Space cooling system:	Packaged systems Energy label class: B Compressor control: Systems with variable speed compressors Cooled area: 700 (fraction 0.890)

Water heating:

Water heating:	From main heating system Water code: 901 Fuel :Electricity Hot water cylinder Cylinder volume: 500 litres Cylinder insulation: Measured loss, 3.92kWh/day Primary pipework insulation: True Cylinderstat: True Cylinder in heated space: True Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Yes
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	Photovoltaic 1 Installed Peak power: 17 Tilt of collector: Horizontal Overshading: None or very little Collector Orientation: South
Assess Zero Carbon Home:	No

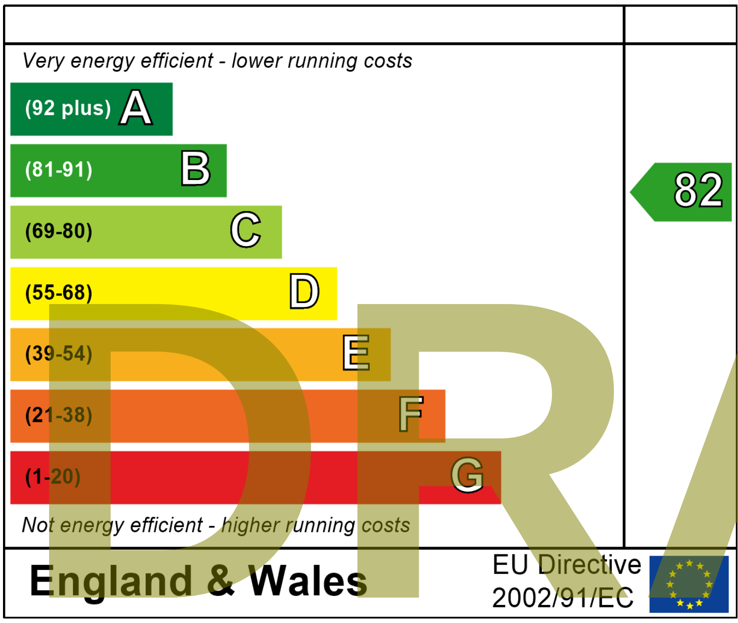
Predicted Energy Assessment

Main House (Be GREEN)		Dwelling type:	Detached House
35 Templewood Avenue		Date of assessment:	09 January 2020
London		Produced by:	Stroma Certification
NW3 7UY		Total floor area:	786.7 m²

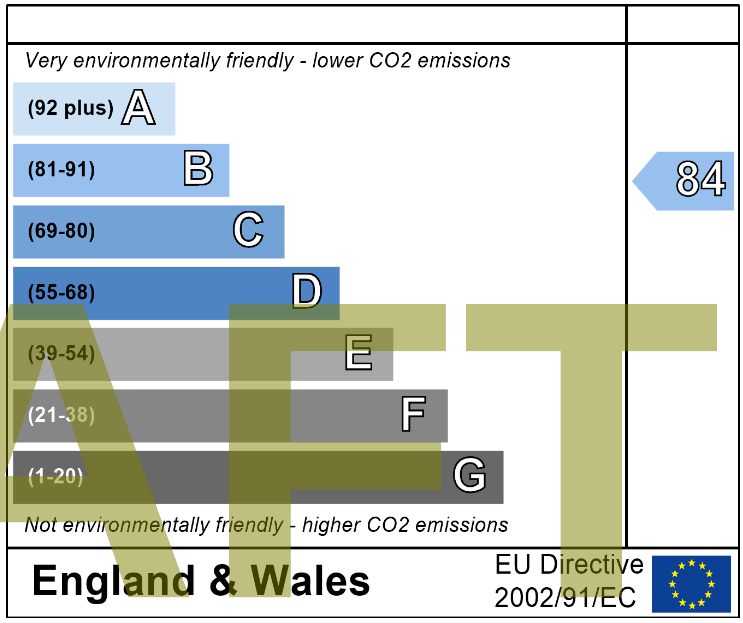
This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about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

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 25 February 2020 at 13:34:05

Project Information:

Assessed By: () **Building Type:** Detached House

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 54.5m²

Site Reference : 35 Tmplewood Avenue **Plot Reference:** Staff Houses (Be Green)

Address : Staff House , 35 Templewood Avenue, London, NW3 7UY

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)	28.78 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	22.22 kg/m²	OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	50.2 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	47.9 kWh/m²	
		OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.15 (max. 0.30)	0.15 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	0.13 (max. 0.20)	0.13 (max. 0.35)	OK
Openings	1.60 (max. 2.00)	1.60 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

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
Air source heat pump with flow temperature <= 35°C

Secondary heating system: None

5 Cylinder insulation

Hot water Storage:	Measured cylinder loss: 1.80 kWh/day	
	Permitted by DBSCG: 1.89 kWh/day	OK
Primary pipework insulated:	Yes	OK

Regulations Compliance Report

6 Controls

Space heating controls	TTZC by plumbing and electrical services		OK
Hot water controls:	Cylinderstat		OK
	Independent timer for DHW		OK

7 Low energy lights

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

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.72	
Maximum	1.5	OK
MVHR efficiency:	92%	
Minimum	70%	OK

9 Summertime temperature

Overheating risk (Thames valley):	Medium	OK

Based on:

Overshading:	Average or unknown
Windows facing: North	6.8m²
Windows facing: South	3.4m²
Ventilation rate:	2.00

10 Key features

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

Thermal Bridge Report

Property Details: Staff Houses (Be Green)

Address:	Staff House , 35 Templewood Avenue, London, NW3 7UY
Located in:	England
Region:	Thames valley

Thermal bridges:

Thermal bridges:

User-defined = UD
Default = D
Approved = A
User-defined (individual PSI-values) Y-Value = 0.0756

External Junctions Details:

Junction Type	PSI-Value	Length	Reference	Type
Sill	0.08	5.1	E3	[D]
Jamb	0.1	12	E4	[D]
Other lintels (including other steel lintels)	1	5.1	E2	[D]

SAP Input

Property Details: Staff Houses (Be Green)

Address:	Staff House , 35 Templewood Avenue, London, NW3 7UY
Located in:	England
Region:	Thames valley
UPRN:	
Date of assessment:	09 January 2020
Date of certificate:	25 February 2020
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Owner-occupied
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Medium
Water use <= 125 litres/person/day:	True
PCDF Version:	455

Property description:

Dwelling type:	House	
Detachment:	Detached	
Year Completed:	2020	
Floor Location:	Floor area:	Storey height:
Basement floor	54.5 m²	3.2 m
Living area:	15.2 m² (fraction 0.279)	
Front of dwelling faces:	North	

Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
N	SAP 2012	Windows	low-E, En = 0.2, hard coat	Yes	Wood
s	SAP 2012	Windows	low-E, En = 0.2, hard coat	Yes	Wood

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
N	12mm	0.7	0.64	1.6	3.4	2
s	12mm	0.7	0.64	1.6	3.4	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
N		Exposed Wall	North	1.7	2
s		Exposed Wall	South	1.7	2

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
Exposed Wall	36.057	10.2	25.86	0.15	0	False	N/A
Burried Wall	22.5	0	22.5	0.15	0	False	N/A
Garden Roof	30.2	0	30.2	0.13	0		N/A
Internal Elements							
Party Elements							
party wall	65.3						N/A
Party roof	24.3						N/A
Party Floor	54.4						N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0756

Length	**Psi-value**		
5.1	0.08	E3	Sill

SAP Input

	12	0.1	E4	Jamb
	5.1	1	E2	Other lintels (including other steel lintels)

Ventilation:

Pressure test:	Yes (As designed)
Ventilation:	Balanced with heat recovery Number of wet rooms: Kitchen + 1 Ductwork: Insulation, rigid Approved Installation Scheme: False
Number of chimneys:	0
Number of open flues:	0
Number of fans:	0
Number of passive stacks:	0
Number of sides sheltered:	2
Pressure test:	3

Main heating system:

Main heating system:	Heat pumps with radiators or underfloor heating Electric heat pumps Fuel: Electricity Info Source: SAP Tables SAP Table: 214 Air source heat pump with flow temperature <= 35°C Underfloor heating, pipes in screed above insulation Central heating pump : 2013 or later Design flow temperature: Design flow temperature<=45°C Room-sealed Boiler interlock: Yes

Main heating Control:

Main heating Control:	Time and temperature zone control by suitable arrangement of plumbing and electrical services Control code: 2207

Secondary heating system:

Secondary heating system:	None

Water heating:

Water heating:	From main heating system Water code: 901 Fuel :Electricity Hot water cylinder Cylinder volume: 150 litres Cylinder insulation: Measured loss, 1.8kWh/day Primary pipework insulation: True Cylinderstat: True Cylinder in heated space: True Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Yes
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

Predicted Energy Assessment

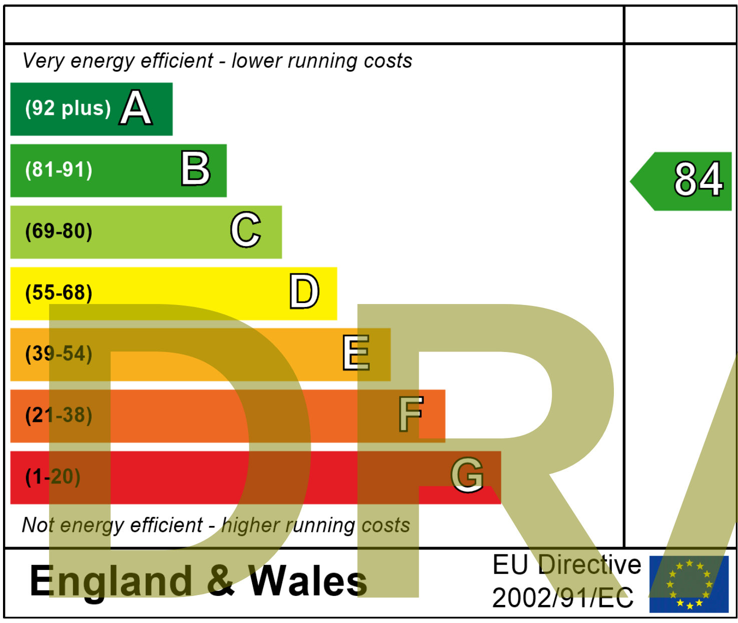
Staff House
35 Templewood Avenue
London
NW3 7UY

Dwelling type:	Detached House
Date of assessment:	09 January 2020
Produced by:	Stroma Certification
Total floor area:	54.5 m²

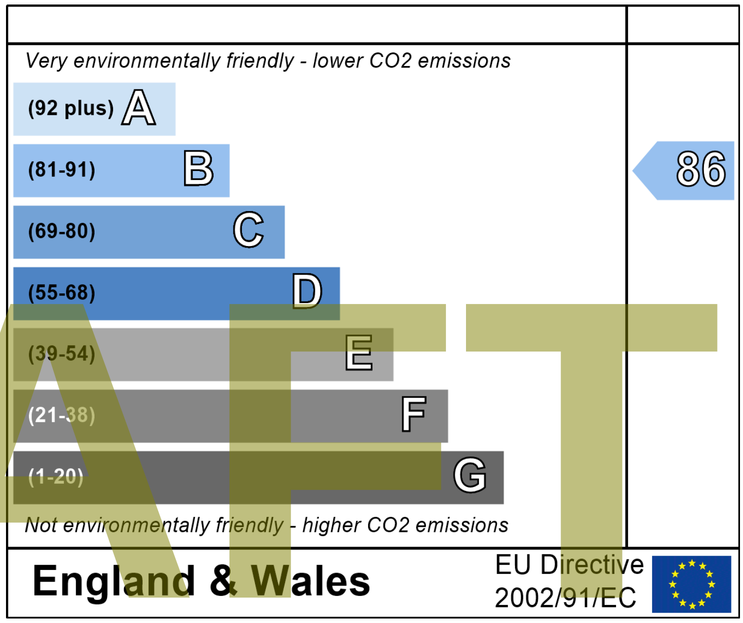
This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about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

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 25 February 2020 at 13:34:00

Project Information:

Assessed By: ()

Building Type: Detached House

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 786.7m²

Site Reference : 35 Tmplewood Avenue

Plot Reference: Main House (Be Lean)

Address : Main House (Be Lean) , 35 Templewood Avenue, London, NW3 7UY

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: Mains gas
Fuel factor: 1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER)	14.93 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	17.36 kg/m²	Fail

Excess emissions = 2.43 kg/m² (16.3 %)

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	70.8 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	66.6 kWh/m²	
		OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.15 (max. 0.30)	0.15 (max. 0.70)	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	1.37 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

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

4 Heating efficiency

Main Heating system: Boiler systems with radiators or underfloor heating - mains gas
Data from manufacturer
Efficiency 89.0 % SEDBUK2009
Minimum 88.0 % **OK**

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 3.90 kWh/day
Permitted by DBSCG: 3.92 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	Yes	**OK**

6 Controls

Space heating controls	TTZC by plumbing and electrical services	**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 (Thames valley):	Not significant	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: South	5.4m²
Windows facing: East	4.8m²
Windows facing: East	3.84m²
Windows facing: East	7.7m²
Windows facing: West	1.5m²
Windows facing: North	19.47m²
Windows facing: North	26.4m²
Windows facing: South	4.5m²
Windows facing: North	77.88m²
Windows facing: West	14.4m²
Windows facing: North	19.8m²
Windows facing: East	14.19m²
Windows facing: East	5.2m²
Windows facing: North	11.55m²
Windows facing: North	13m²
Windows facing: West	3m²
Ventilation rate:	4.00

10 Key features

Air permeablility	3.0 m³/m²h
Windows U-value	1 W/m²K
Fixed cooling system	

Thermal Bridge Report

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Address:	Main House (Be Lean) , 35 Templewood Avenue, London, NW3 7UY
Located in:	England
Region:	Thames valley

Thermal bridges:

Thermal bridges:

User-defined = UD
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User-defined (individual PSI-values) Y-Value = 0.0841

External Junctions Details:

Junction Type	PSI-Value	Length	Reference	Type
Other lintels (including other steel lintels)	1	85.871	E2	[D]
Sill	0.08	85.871	E3	[D]
Jamb	0.1	136.4	E4	[D]
Corner (normal)	0.18	73.5	E16	[D]
Corner (inverted internal area greater than external area)	0	17.5	E17	[D]
Flat roof	0.08	93	E14	[D]

SAP Input

Property Details: Main House (Be Lean)

Address:	Main House (Be Lean) , 35 Templewood Avenue, London, NW3 7UY
Located in:	England
Region:	Thames valley
UPRN:	
Date of assessment:	09 January 2020
Date of certificate:	25 February 2020
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Owner-occupied
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Medium
Water use <= 125 litres/person/day:	True
PCDF Version:	455

Property description:

Dwelling type:	House
Detachment:	Detached
Year Completed:	2020

Floor Location:	Floor area:	Storey height:
Basement floor	247 m^2	3 m
Floor 1	278 m^2	3.5 m
Floor 2	155 m^2	3.5 m
Floor 3	106.7 m^2	3.5 m

Living area:	75 m^2 (fraction 0.099)
Front of dwelling faces:	South

Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
A Gd S	SAP 2012	Windows	low-E, En = 0.05, soft coat	Yes	Wood
B Gd E	SAP 2012	Windows	low-E, En = 0.05, soft coat	Yes	Wood
C Gd E	SAP 2012	Windows	low-E, En = 0.05, soft coat	Yes	Wood
D Gd E	SAP 2012	Windows	low-E, En = 0.05, soft coat	Yes	Wood
E Gd W	SAP 2012	Windows	low-E, En = 0.05, soft coat	Yes	Wood
G Gd N	SAP 2012	Windows	low-E, En = 0.05, soft coat	Yes	Wood
H F N	SAP 2012	Windows	low-E, En = 0.05, soft coat	Yes	Wood
I F S	SAP 2012	Windows	low-E, En = 0.05, soft coat	Yes	Wood
J F N	SAP 2012	Windows	low-E, En = 0.05, soft coat	Yes	Wood
K F W	SAP 2012	Windows	low-E, En = 0.05, soft coat	Yes	Wood
L S N	SAP 2012	Windows	low-E, En = 0.05, soft coat	Yes	Wood
M S E	SAP 2012	Windows	low-E, En = 0.05, soft coat	Yes	Wood
O LG E	SAP 2012	Windows	low-E, En = 0.05, soft coat	Yes	Wood
P LG N POOL	SAP 2012	Windows	low-E, En = 0.05, soft coat	Yes	Wood
Q Grd N	SAP 2012	Windows	low-E, En = 0.05, soft coat	Yes	Wood
R Grd W	SAP 2012	Windows	low-E, En = 0.05, soft coat	Yes	Wood

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
A Gd S	12mm	0.7	0.57	1.4	1.8	3
B Gd E	12mm	0.7	0.57	1.4	4.8	1
C Gd E	12mm	0.7	0.57	1.4	3.84	1
D Gd E	12mm	0.7	0.57	1.4	7.7	1
E Gd W	12mm	0.7	0.57	1.4	1.5	1
G Gd N	12mm	0.7	0.57	1.4	19.47	1
H F N	12mm	0.7	0.57	1.4	6.6	4
I F S	12mm	0.7	0.57	1.4	2.25	2

SAP Input

J F N	12mm	0.7	0.57	1.4	19.47	4
K F W	12mm	0.7	0.57	1.4	4.8	3
L S N	12mm	0.7	0.57	1	19.8	1
M S E	12mm	0.7	0.57	1.4	14.19	1
O LG E	12mm	0.7	0.57	1.4	2.6	2
P LG N POOL	12mm	0.7	0.57	1.4	11.55	1
Q Grd N	12mm	0.7	0.57	1.4	13	1
R Grd W	12mm	0.7	0.57	1.4	3	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
A Gd S		Grd Wall	South	1.2	1.5
B Gd E		Grd Wall	East	2.4	2
C Gd E		Grd Wall	East	1.919	2
D Gd E		Grd Wall	East	3.852	2
E Gd W		Grd Wall	West	1	1.5
G Gd N		Grd Wall	North	5.9	3.3
H F N		First Flr Wall	North	2	3.3
I F S		First Flr Wall	South	1.5	1.5
J F N		First Flr Wall	North	5.9	3.3
K F W		First Flr Wall	West	1.5	3.2
L S N		Second Fllr Wall	North	6	3.3
M S E		Second Fllr Wall	East	4.3	3.3
O LG E		LG Wall	East	1.3	2
P LG N POOL		LG Wall	North	3.5	3.3
Q Grd N		Grd Wall	North	5.2	2.5
R Grd W		Grd Wall	West	1.5	2

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
LG Basement	152.54	0	152.54	0.15	0	False	N/A
LG Wall	16.8	16.75	0.05	0.15	0	False	N/A
Grd Wall	314	58.71	255.29	0.15	0	False	N/A
First Flr Wall	314.4	123.18	191.22	0.15	0	False	N/A
Second Fllr Wall	164.3	33.99	130.31	0.15	0	False	N/A
Frist Flr roof	172	0	172	0.13	0		N/A
Secod Floor	106	0	106	0.13	0		N/A
basement roof	23	0	23	0.13	0		N/A
basement	247			0.13			N/A
Internal Elements							
Party Elements							

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0841

Length	Psi-value		
85.871	1	E2	Other lintels (including other steel lintels)
85.871	0.08	E3	Sill
136.4	0.1	E4	Jamb
73.5	0.18	E16	Corner (normal)
17.5	0	E17	Corner (inverted internal area greater than external area)
93	0.08	E14	Flat roof

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Natural ventilation (extract fans)

SAP Input

Number of chimneys:	0
Number of open flues:	0
Number of fans:	5
Number of passive stacks:	0
Number of sides sheltered:	0
Pressure test:	3

Main heating system:

Main heating system:

Boiler systems with radiators or underfloor heating
Gas boilers and oil boilers
Fuel: mains gas
Info Source: Manufacturer Declaration
Manufacturer's data
Efficiency: 89.0% (SEDBUK2009)
Regular condensing with automatic ignition
Fuel Burning Type:
Underfloor heating, pipes in screed above insulation
Central heating pump : 2013 or later
Design flow temperature: Design flow temperature<=45°C
Room-sealed
Boiler interlock: Yes

Main heating Control:

Main heating Control:

Time and temperature zone control by suitable arrangement of plumbing and electrical services
Control code: 2110

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system:

Packaged systems
Energy label class: B
Compressor control: Systems with variable speed compressors
Cooled area: 700 (fraction 0.890)

Water heating:

Water heating:

From main heating system
Water code: 901
Fuel :mains gas
Hot water cylinder
Cylinder volume: 500 litres
Cylinder insulation: Measured loss, 3.9kWh/day
Primary pipework insulation: True
Cylinderstat: True
Cylinder in heated space: False
Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Yes
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

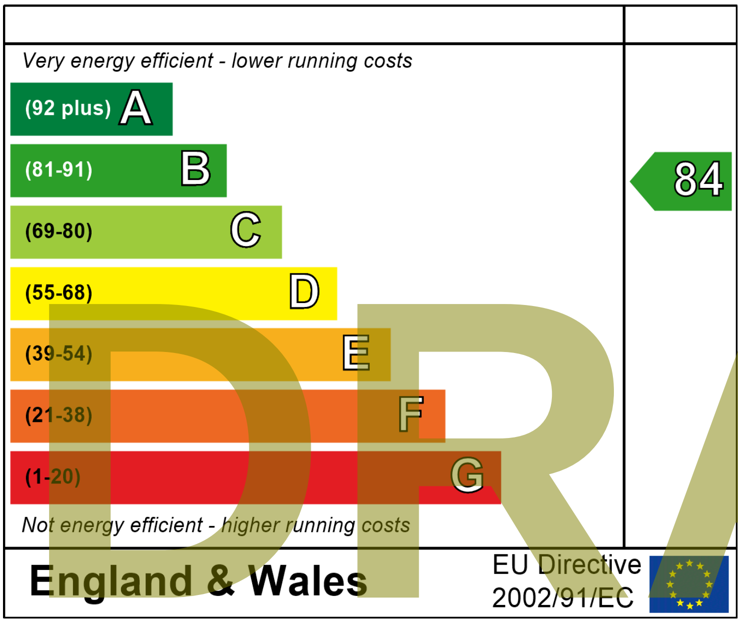
Predicted Energy Assessment

Main House (Be Lean) 35 Templewood Avenue London NW3 7UY	Dwelling type: Date of assessment: Produced by: Total floor area:	Detached House 09 January 2020 Stroma Certification 786.7 m²

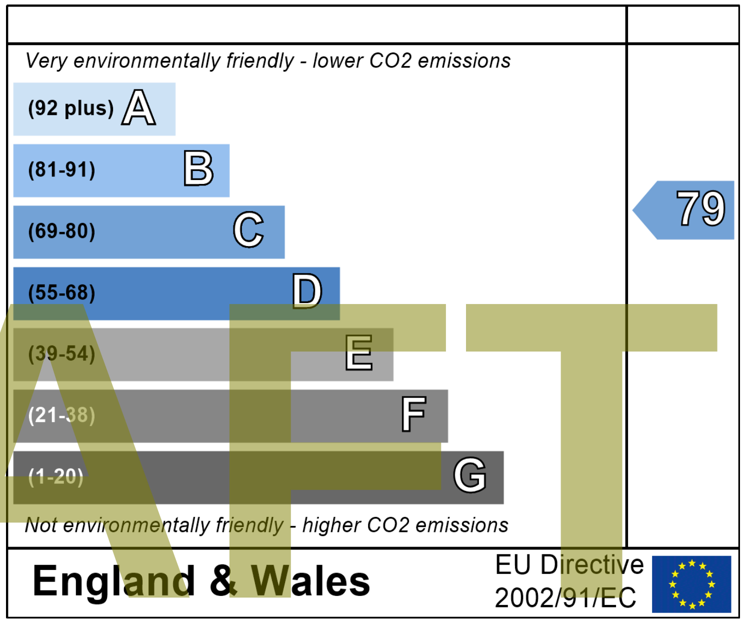
This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about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

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 25 February 2020 at 13:33:56

Project Information:

Assessed By: () **Building Type:** Detached House

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 54.5m²

Site Reference : 35 Tmplewood Avenue **Plot Reference:** Staff House (Be Lean)

Address : Staff House (Be Lean), 35 Templewood Avenue, London, NW3 7UY

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: Mains gas
Fuel factor: 1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER)	19.72 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	12.69 kg/m²	OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	50.2 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	47.9 kWh/m²	
		OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.15 (max. 0.30)	0.15 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	0.13 (max. 0.20)	0.13 (max. 0.35)	OK
Openings	1.60 (max. 2.00)	1.60 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

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

4 Heating efficiency

Main Heating system:	Boiler systems with radiators or underfloor heating - mains gas Data from manufacturer Efficiency 170.0 % SEDBUK2009 Minimum 88.0 %	OK
Secondary heating system:	None	

5 Cylinder insulation

Hot water Storage:	Measured cylinder loss: 1.80 kWh/day Permitted by DBSCG: 1.89 kWh/day	OK

Regulations Compliance Report

Primary pipework insulated:	Yes	OK

6 Controls

Space heating controls	TTZC by plumbing and electrical services	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

Continuous supply and extract system		
Specific fan power:	0.72	
Maximum	1.5	OK
MVHR efficiency:	92%	
Minimum	70%	OK

9 Summertime temperature

Overheating risk (Thames valley):	Medium	OK

Based on:

Overshading:	Average or unknown
Windows facing: North	6.8m²
Windows facing: South	3.4m²
Ventilation rate:	2.00

10 Key features

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

Thermal Bridge Report

Property Details: Staff House (Be Lean)

Address:	Staff House (Be Lean), 35 Templewood Avenue, London, NW3 7UY
Located in:	England
Region:	Thames valley

Thermal bridges:

Thermal bridges:

User-defined = UD
Default = D
Approved = A
User-defined (individual PSI-values) Y-Value = 0.0756

External Junctions Details:

Junction Type	PSI-Value	Length	Reference	Type
Sill	0.08	5.1	E3	[D]
Jamb	0.1	12	E4	[D]
Other lintels (including other steel lintels)	1	5.1	E2	[D]

SAP Input

Property Details: Staff House (Be Lean)

Address:	Staff House (Be Lean), 35 Templewood Avenue, London, NW3 7UY
Located in:	England
Region:	Thames valley
UPRN:	
Date of assessment:	09 January 2020
Date of certificate:	25 February 2020
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Owner-occupied
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Medium
Water use <= 125 litres/person/day:	True
PCDF Version:	455

Property description:

Dwelling type:	House	
Detachment:	Detached	
Year Completed:	2020	
Floor Location:	Floor area:	Storey height:
Basement floor	54.5 m²	3.2 m
Living area:	15.2 m² (fraction 0.279)	
Front of dwelling faces:	North	

Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
N	SAP 2012	Windows	low-E, En = 0.2, hard coat	Yes	Wood
s	SAP 2012	Windows	low-E, En = 0.2, hard coat	Yes	Wood

Name:	Gap:	Frame Factor:	g-value:	U-value:	Area:	No. of Openings:
N	12mm	0.7	0.64	1.6	3.4	2
s	12mm	0.7	0.64	1.6	3.4	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
N		Exposed Wall	North	1.7	2
s		Exposed Wall	South	1.7	2

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
Exposed Wall	36.057	10.2	25.86	0.15	0	False	N/A
Burried Wall	22.5	0	22.5	0.15	0	False	N/A
Garden Roof	30.2	0	30.2	0.13	0		N/A
Internal Elements							
Party Elements							
party wall	65.3						N/A
Party roof	24.3						N/A
Party Floor	54.4						N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0756

Length	Psi-value		
5.1	0.08	E3	Sill

SAP Input

12	0.1	E4	Jamb
5.1	1	E2	Other lintels (including other steel lintels)

Ventilation:

Pressure test:	Yes (As designed)
Ventilation:	Balanced with heat recovery Number of wet rooms: Kitchen + 1 Ductwork: Insulation, rigid Approved Installation Scheme: False
Number of chimneys:	0
Number of open flues:	0
Number of fans:	0
Number of passive stacks:	0
Number of sides sheltered:	2
Pressure test:	3

Main heating system:

Main heating system:	Boiler systems with radiators or underfloor heating Gas boilers and oil boilers Fuel: mains gas Info Source: Manufacturer Declaration Manufacturer's data Efficiency: 170.0% (SEDBUK2009) Regular condensing with automatic ignition Fuel Burning Type: Underfloor heating, pipes in screed above insulation Central heating pump : 2013 or later Design flow temperature: Design flow temperature<=45°C Room-sealed Boiler interlock: Yes

Main heating Control:

Main heating Control:	Time and temperature zone control by suitable arrangement of plumbing and electrical services Control code: 2110

Secondary heating system:

Secondary heating system:	None

Water heating:

Water heating:	From main heating system Water code: 901 Fuel :mains gas Hot water cylinder Cylinder volume: 150 litres Cylinder insulation: Measured loss, 1.8kWh/day Primary pipework insulation: True Cylinderstat: True Cylinder in heated space: True Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Yes
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None

SAP Input

Assess Zero Carbon Home: No

Predicted Energy Assessment

Staff House (Be Lean)	Dwelling type:	Detached House
35 Templewood Avenue	Date of assessment:	09 January 2020
London	Produced by:	Stroma Certification
NW3 7UY	Total floor area:	54.5 m²

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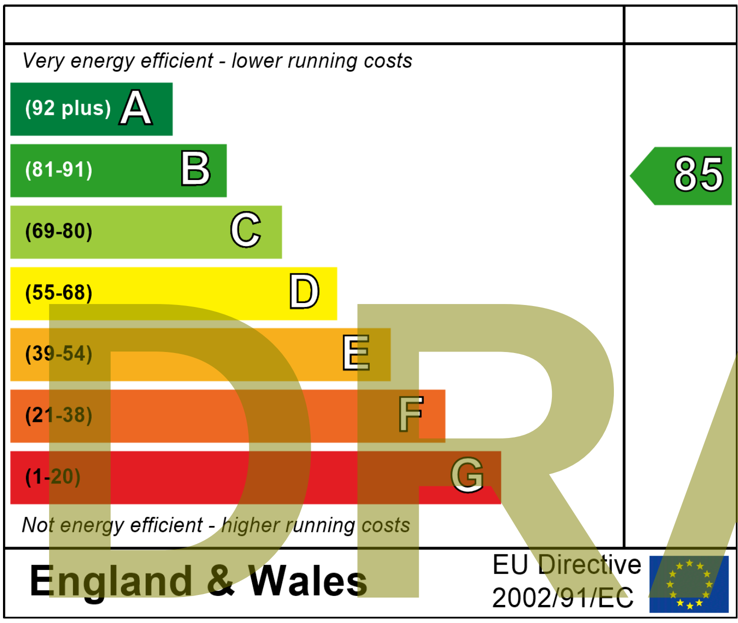
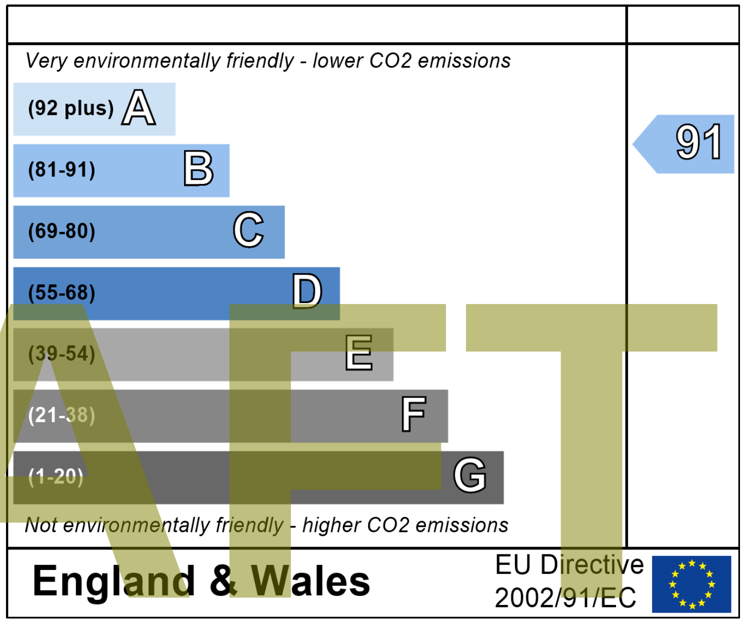


Environmental Impact (CO_2) Rating



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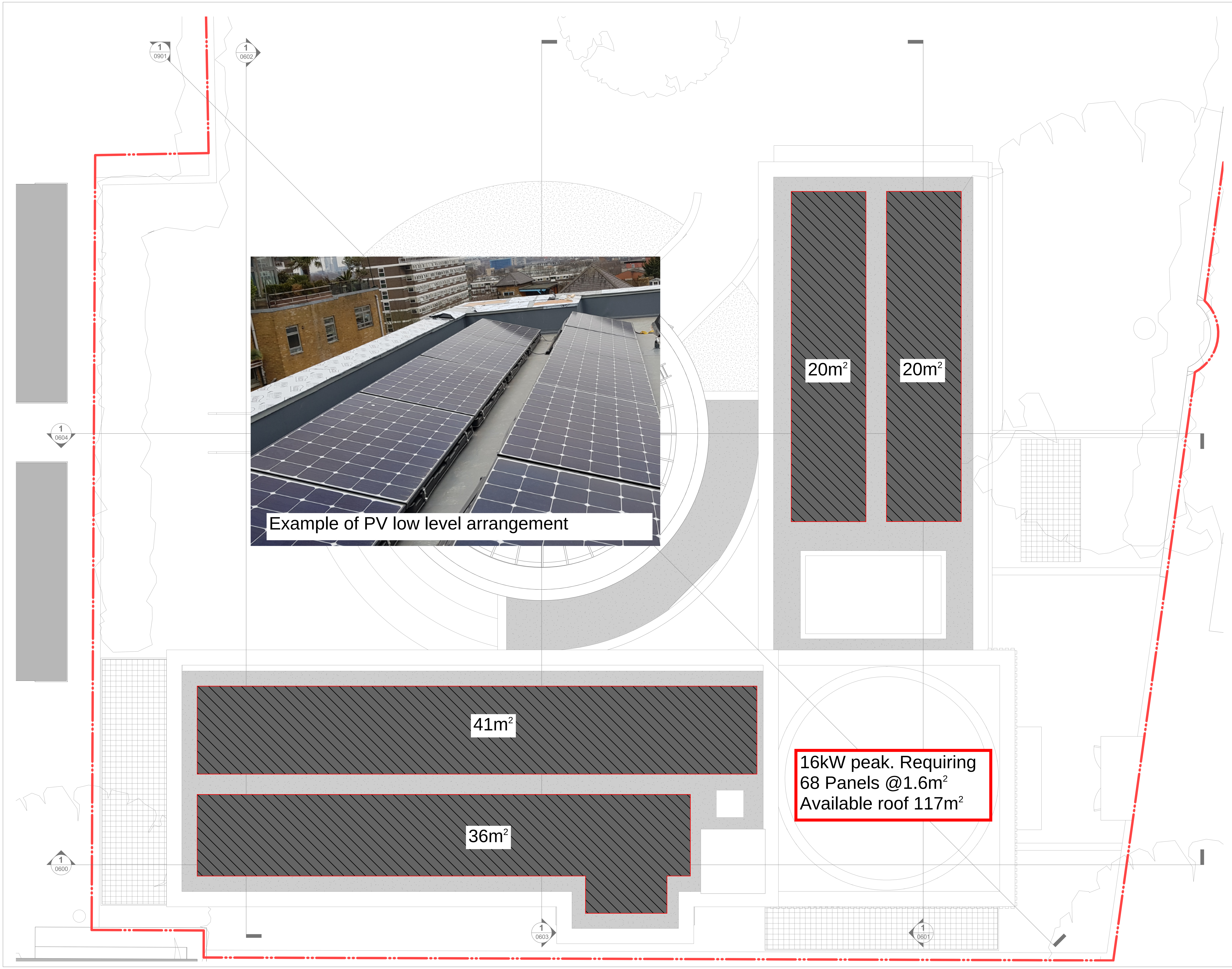

Example of PV low level arrangement

LYNDON GOODE ARCHITECTS

For general enquires: studio@lyndongoode.com

Do not scale from this drawing. Contractor to check and verify all building and site dimensions, levels and sewer invert levels at connection points before work starts.

This drawing is to be read and checked in conjunction with information provided by the engineers and other specialists.

REV.	DATE	DESCRIPTION
P01	xx/xx/xx	First Issue

KEY PLAN

INFORMATION

DRAFT

0 5 10 25 m
Scale (1:50)

PROJECT
35 Templewood Avenue

DRAWING
Proposed Roof GA Plan

SCALE
1 : 50 at A1

REV.
P01

DRAWING NUMBER
TAV- LGA- ZA- 03- DR- A- 0213

DRAWING STATUS
PRELIMINARY