



ABBHEYCONSULTANTS

Energy Demand Statement - Refurbishment
Project

Manor Court, High Street, Harmondsworth

Heathrow 1 Ltd

11 OCT 2017

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1. ASSESSMENT INFORMATION

Nature of Assessment:	Energy Demand Statement - Refurbishment Project
Project Name:	Manor Court, High Street, Harmondsworth
Project Address:	Manor Court, High Street, Harmondsworth
Client:	Heathrow 1 Ltd
Developer:	Heathrow 1 Ltd
Architect:	Wakelin Associates Architects
Architect's Address:	The Old School House, Bridge Road, Hunton Bridge, Kings Langley, Herts. WD4 8RG

Author:	Matt Fitzpatrick	
Title:	Sustainability Consultant	

Issue Number	Date	Reason	Author
01	21/08/2017	First Issue	MF

Project Description	Conversion of offices to residential. Conversion of nursing home to residential. New Build lodge and associated landscaping and parking- total units 15.
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Figure 1: Proposed Site Plan



2. EXECUTIVE SUMMARY

In keeping with requirements of planning, this statement comprises:

- A Building Regulation baseline energy assessment for the proposed development.
- Energy conservation measures to be undertaken in the design of the development.
- A calculation of CO₂ savings that are to be achieved as a result of energy efficient measures.

Heathrow 1 Ltd has placed considerable emphasis on utilising passive design measures and targeting fabric efficiency in order to mitigate energy use.

The overall fabric energy efficiency specification significantly improves on the requirements of Part L1B 2013, and shows that the development will reduce CO₂ requirements and supply energy efficiently. The proposal demonstrates that all units will achieve a reduction in Dwelling Emission Rates **20.47 %** better than a Part L1B 2013 baseline.

It has been decided that the policy can be met by adopting fabric only approach. The improved fabric and energy efficient measures have reduced the CO₂ emissions. The total reduction is summarised in the table below.

Table 1: Key Figures

Energy and CO ₂ Savings			
	Description	Amount	Unit
Regs & Improvements (TER's)	Total development CO ₂ demand Part L1B 2013 (TER)	41,629	KGCO ₂ /Year
	Total development energy demand Part L1B 2013 (TER)	181,513	kWh/Year
	Actual development CO ₂ demand (DER) Part L1B 2013	33,108	KGCO ₂ /Year
	Actual development CO ₂ demand (DER) Part L1B 2013	143,993	kWh/Year
	Percentage CO ₂ improvement through fabric/control	20.47	%
	Percentage energy improvement through fabric/control	20.67	%
Site Summary	Reduction in energy through renewables	12,110	kWh/Year
	Reduction in CO ₂ through renewables	6,285	KGCO ₂ /Year
	Energy abatement through renewables	8.41	%
	CO₂ abatement through renewables	18.98	%
	Total CO₂ Improvement over baseline	35.57	%

Fabric Energy Efficiency measures reduce CO₂ emissions by **20.47 %** saving over a 2013 baseline unit.

The Introduction of renewables reduces the CO₂ emissions by a further **6,285 KGCO₂/Year**.

The Introduction of renewables reduces the energy demand by a further **12,110 kWh/Year**.

The total CO₂ reduction through renewables is **18.98 %** with a total reduction of **35.57 %** when fabric energy efficiency measures are included.

The reduction in energy through renewables meets the policy requirements of the London Plan and London Borough of Hillingdon.

3. POLICY

3.1 NATIONAL POLICY

3.2 NATIONAL PLANNING POLICY FRAMEWORK (NPPF) MARCH 2012

The NPPF sets out the Government's planning policies for England and how these are expected to be applied. It sets out the Government's requirements for the planning system only to the extent that it is relevant, proportionate and necessary to do so. It provides a framework within which local people and their accountable councils can produce their own distinctive local and neighbourhood plans, which reflect the needs and priorities of their communities.

Chapter 10 Meeting the challenge of climate change, flooding and coastal change

The following paragraphs set out the Government's position in response to reducing carbon emissions:

Paragraph 95: To support the move to a low carbon future, local planning authorities should:

- plan for new development in locations and ways which reduce greenhouse gas emissions;
- actively support energy efficiency improvements to existing buildings; and
- when setting any local requirement for a building's sustainability, do so in a way consistent with the Government's zero carbon buildings policy and adopt nationally described standards.

Paragraph 96: In determining planning applications, local planning authorities should expect new development to:

- comply with adopted Local Plan policies on local requirements for decentralised energy supply unless it can be demonstrated by the applicant, having regard to the type of development involved and its design, that this is not feasible or viable; and
- take account of landform, layout, building orientation, massing and landscaping to minimise energy consumption.

Paragraph 97: To help increase the use and supply of renewable and low carbon energy, local planning authorities should recognise the responsibility on all communities to contribute to energy generation from renewable or low carbon sources. They should:

- have a positive strategy to promote energy from renewable and low carbon sources;
- design their policies to maximise renewable and low carbon energy development while ensuring that adverse impacts are addressed satisfactorily, including cumulative landscape and visual impacts;
- consider identifying suitable areas for renewable and low carbon energy sources, and supporting infrastructure, where this would help secure the development of such sources
- support community-led initiatives for renewable and low carbon energy, including developments outside such areas being taken forward through neighbourhood planning; and
- identify opportunities where development can draw its energy supply from decentralised, renewable or low carbon energy supply systems and for co-locating potential heat customers and suppliers.

3.3 LOCAL POLICY

Policy 5.1

Climate Change Mitigation

Strategic

A. The Mayor seeks to achieve an overall reduction in London's carbon dioxide emissions of 60 per cent (below 1990 levels) by 2025. It is expected that the GLA Group, London boroughs and other organisations will contribute to meeting this strategic reduction target, and the GLA will monitor progress towards its achievement annually.

LDF preparation

B. Within LDFs boroughs should develop detailed policies and proposals that promote and are consistent with the achievement of the Mayor's strategic carbon dioxide emissions reduction target for London.

Policy 5.2

Minimising Carbon Dioxide Emissions

Planning decisions

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

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

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

Residential buildings:

Year Improvement on 2010 Building Regulations

2010 – 2013	25 per cent Code for Sustainable Homes level 4
2013 – 2016	40 per cent
2016 – 2031	Zero carbon

Non-domestic buildings:

Year Improvement on 2010 Building Regulations

2010 – 2013	25 per cent
2013 – 2016	40 per cent
2016 – 2019	As per building regulations requirements
2019 – 2031	Zero carbon

- C. Major development proposals should include a detailed energy assessment to demonstrate how the targets for carbon dioxide emissions reduction outlined above are to be met within the framework of the energy hierarchy.
- D. As a minimum, energy assessments should include the following details:
- a. calculation of the energy demand and carbon dioxide emissions covered by the Building Regulations and, separately, the energy demand and carbon dioxide emissions from any other part of the development, including plant or equipment, that are not covered by the Building Regulations (see paragraph 5.22) at each stage of the energy hierarchy
 - b. proposals to reduce carbon dioxide emissions through the energy efficient design of the site, buildings and services
 - c. proposals to further reduce carbon dioxide emissions through the use of decentralised energy where feasible, such as district heating and cooling and combined heat and power (CHP)
 - d. proposals to further reduce carbon dioxide emissions through the use of on-site renewable energy technologies.

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

Policy 5.3

Sustainable Design and Construction

Strategic

- A. The highest standards of sustainable design and construction should be achieved in London to improve the environmental performance of new developments and to adapt to the effects of climate change over their lifetime.
- B. Development proposals should demonstrate that sustainable design standards are integral to the proposal, including its construction and operation, and ensure that they are considered at the beginning of the design process.
- C. Major development proposals should meet the minimum standards outlined in the Mayor's supplementary planning guidance and this should be clearly demonstrated within a design and access statement. The standards include measures to achieve other policies in this Plan and the following sustainable design principles:
- a. minimising carbon dioxide emissions across the site, including the building and services (such as heating and cooling systems)
 - b. avoiding internal overheating and contributing to the urban heat island effect
 - c. efficient use of natural resources (including water), including making the most of natural systems both within and around buildings
 - d. minimising pollution (including noise, air and urban runoff)
 - e. minimising the generation of waste and maximising reuse or recycling
 - f. avoiding impacts from natural hazards (including flooding)
 - g. ensuring developments are comfortable and secure for users,
 - h. including avoiding the creation of adverse local climatic condition securing sustainable procurement of materials, using local supplies where feasible, and
 - i. promoting and protecting biodiversity and green infrastructure.

Policy 5.7

Renewable Energy

Strategic

- A. The Mayor seeks to increase the proportion of energy generated from renewable sources, and expects that the projections for installed renewable energy capacity outlined in the Climate Change Mitigation and Energy Strategy and in supplementary planning guidance will be achieved in London.

Planning decisions

- B. Within the framework of the energy hierarchy (see Policy 5.2), major development proposals should provide a reduction in expected carbon dioxide emissions through the use of on-site renewable energy generation, where feasible.

LDF preparation

- C. Within LDFs boroughs should, and other agencies may wish to, develop more detailed policies and proposals to support the development of renewable energy in London – in particular, to identify broad areas where specific renewable energy technologies, including large scale systems and the large scale deployment of small scale systems, are appropriate. The identification of areas should be consistent with any guidelines and criteria outlined by the Mayor.
- D. All renewable energy systems should be located and designed to minimise any potential adverse impacts on biodiversity, the natural environment and historical assets, and to avoid any adverse impacts on air quality.

A Vision for 2026
Local Plan Part 1
Strategic Policies
(Adopted November 2012)

Policy EM1: Climate Change Adaptation and Mitigation

The Council will ensure that climate change mitigation is addressed at every stage of the development process by:

1. Prioritising higher density development in urban and town centres that are well served by sustainable forms of transport.
2. Promoting a modal shift away from private car use and requiring new development to include innovative initiatives to reduce car dependency.
3. Ensuring development meets the highest possible design standards whilst still retaining competitiveness within the market.
4. Working with developers of major schemes to identify the opportunities to help provide efficiency initiatives that can benefit the existing building stock.
5. Promoting the use of decentralised energy within large scale development whilst improving local air quality levels.
6. Targeting areas with high carbon emissions for additional reductions through low carbon strategies. These strategies will also have an objective to minimise other pollutants that impact on local air quality. Targeting areas of poor air quality for additional emissions reductions.
7. Encouraging sustainable techniques to land remediation to reduce the need to transport waste to landfill. In particular developers should consider bioremediation(39) as part of their proposals.
8. Encouraging the installation of renewable energy for all new development in meeting the carbon reduction targets savings set out in the London Plan. Identify opportunities for new sources of electricity generation including anaerobic digestion, hydroelectricity and a greater use of waste as a resource.
9. Promoting new development to contribute to the upgrading of existing housing stock where appropriate.

The Borough will ensure that climate change adaptation is addressed at every stage of the development process by:

10. Locating and designing development to minimise the probability and impacts of flooding.
11. Requiring major development proposals to consider the whole water cycle impact which includes flood risk management, foul and surface water drainage and water consumption.
12. Giving preference to development of previously developed land to avoid the loss of further green areas.
13. Promoting the use of living walls and roofs, alongside sustainable forms of drainage to manage surface water run-off and increase the amount of carbon sinks(40).
14. Promoting the inclusion of passive design(41) measures to reduce the impacts of urban heat effects.

Policy BE1: Built Environment

The Council will require all new development to improve and maintain the quality of the built environment in order to create successful and sustainable neighbourhoods, where people enjoy living and working and that serve the long-term needs of all residents. All new developments should:

1. Achieve a high quality of design in all new buildings, alterations, extensions and the public realm which enhances the local distinctiveness of the area, contributes to community cohesion and a sense of place;
2. Be designed to be appropriate to the identity and context of Hillingdon's buildings, townscapes, landscapes and views, and make a positive contribution to the local area in terms of layout, form, scale and materials and seek to protect the amenity of surrounding land and buildings, particularly residential properties;
3. Be designed to include "Lifetime Homes" principles so that they can be readily adapted to meet the needs of those with disabilities and the elderly, 10% of these

should be wheelchair accessible or easily adaptable to wheelchair accessibility encouraging places of work and leisure, streets, neighbourhoods, parks and open spaces to be designed to meet the needs of the community at all stages of people's lives;

4. In the case of 10 dwellings or over, achieve a satisfactory assessment rating in terms of the latest Building for Life standards (as amended or replaced from time to time);

5. Improve areas of poorer environmental quality, including within the areas of relative disadvantage of Hayes, Yiewsley and West Drayton. All regeneration schemes should ensure that they are appropriate to their historic context, make use of heritage assets and reinforce their significance;

6. Incorporate a clear network of routes that are easy to understand, inclusive, safe, secure and connect positively with interchanges, public transport, community facilities and services;

7. Improve the quality of the public realm and provide for public and private spaces that are attractive, safe, functional, diverse, sustainable, accessible to all, respect the local character and landscape, integrate with the development, enhance and protect biodiversity through the inclusion of living walls, roofs and areas for wildlife, encourage physical activity and where appropriate introduce public art;

8. Create safe and secure environments that reduce crime and fear of crime, anti-social behaviour and risks from fire and arson having regard to Secure by Design standards and address resilience to terrorism in major development proposals;

9. Not result in the inappropriate development of gardens and green spaces that erode the character and biodiversity of suburban areas and increase the risk of flooding through the loss of permeable areas;

10. Maximise the opportunities for all new homes to contribute to tackling and adapting to climate change and reducing emissions of local air quality pollutants. The Council will require all new development to achieve reductions in carbon dioxide emission in line with the London Plan targets through energy efficient design and effective use of low and zero carbon technologies. Where the required reduction from on-site renewable energy is not feasible within major developments, contributions off-site will be sought. The Council will seek to merge a suite of sustainable design goals, such as the use of SUDS, water efficiency, lifetime homes, and energy efficiency into a requirement measured against the Code for Sustainable Homes and BREEAM. These will be set out within the Hillingdon Local Plan: Part 2- Development Management Policies Local Development Document (LDD). All developments should be designed to make the most efficient use of natural resources whilst safeguarding historic assets, their settings and local amenity and include sustainable design and construction techniques to increase the re-use and recycling of construction, demolition and excavation waste and reduce the amount disposed to landfill;

11. In the case of tall buildings, not adversely affect their surroundings including the local character, cause harm to the significance of heritage assets or impact on important views. Appropriate locations for tall buildings will be defined on a Character Study and may include parts of Uxbridge and Hayes subject to considering the Obstacle Limitation Surfaces for Heathrow Airport. Outside of Uxbridge and Hayes town centres, tall buildings will not be supported. The height of all buildings should be based upon an understanding of the local character and be appropriate to the positive qualities of the surrounding townscape.

Support will be given for proposals that are consistent with local strategies, guidelines, supplementary planning documents and Hillingdon Local Plan: Part 2- Development Management Policies.

4. BASELINE ENERGY CALCULATIONS

A baseline total energy demand has been established for the proposed development. Reductions in demand due to energy conservation measures are considered and form the basis of the renewable energy strategy which follows.

Floor plans for the development have been used in conjunction with an outline accommodation schedule and building specifications to prepare initial preliminary SAP Calculations on the proposed conversion scheme.

2 Sets of SAP calculations have carried out to Approved Document Part L1B 2013. The first set with the proposed building specification which will set the proposed DER and a second set with U Values set at maximum allowable U Values as per Part L1B 2013. This second SAP Calculations form the TER and baseline from which the improvements are measured.

The relevant energy loads have been collated from the full SAP calculation sheets and entered into a spread sheet that can be found in the appendices, which calculates the total energy and CO₂ demand.

Regulated Energy Demand is calculated from the energy associated with space heating, hot water and fixed electrical demands (for lights, fans and pumps).

Unregulated energy is the annual electrical energy demand from appliances and would be calculated using the methodology as suggested by SAP2012. SAP calculations are extended to allow for CO₂ emissions associated with appliances and cooking, and to allow for site-wide electricity generation technologies.

Total Energy Demand for the development is calculated from the regulated energy demand figures given above and an additional energy demand associated with unregulated energy.

CO₂ emissions from appliances use equation L14

$$L14 = E_A \times E_{\text{Electricity}} / TFA$$

Where $E_{\text{Electricity}}$ is the emission factor for electricity (SAP 2012 Table 12)

CO₂ emissions from cooking uses equation L16

$$L16 = (119 + 24N) / TFA$$

$$\text{Where } N = 1 + 1.76 \times \{1 - \exp(-0.000349 \times (TFA - 13.9)^2) + 0.0013 \times (TFA - 13.9)\}$$

Total Energy Demand is used in the final analysis to determine the contribution which renewable energy technology makes to total energy requirements for the development once energy conservation measures have been considered.

Energy savings are measured in terms of a reduction in CO₂ emissions and kWh, which are calculated from their association with a particular fuel source. CO₂ Conversion Factors have been taken from Table 2, Building Regulations Part L1B 2013:

Table 2: Fuel Conversion factors

Fuel Source	CO ₂ Conversion Factor (Kg/kWh)
Electricity	0.519 (Displaced 0.519)
Gas	0.216

4.1 CALCULATION OF BASELINE ENERGY AND CO₂ EMISSIONS

Thermal insulation levels and air tightness standards for the baseline case are assumed to just meet the requirements Part L1B 2013 of Building Regulations. The unit is assumed to have conventional gas boilers with the following minimum efficiency standards:

Gas Boiler	Condensing Gas Boiler 88% SEDBUK 2009
Boiler Interlock	Yes
Zoning	Dwellings with a total area >150m ² to have at least two zones
Control of hot water	Independent time control Cylinder stat
Intermittent extract	SFP 0.5 (W/(l-s))
Internal Lighting	75% LEL (45 lamp lumens per circuit watt)

Table 3: Predicted Carbon Emissions: Part L1B 2013 Compliant Unit (TER) including Non domestic

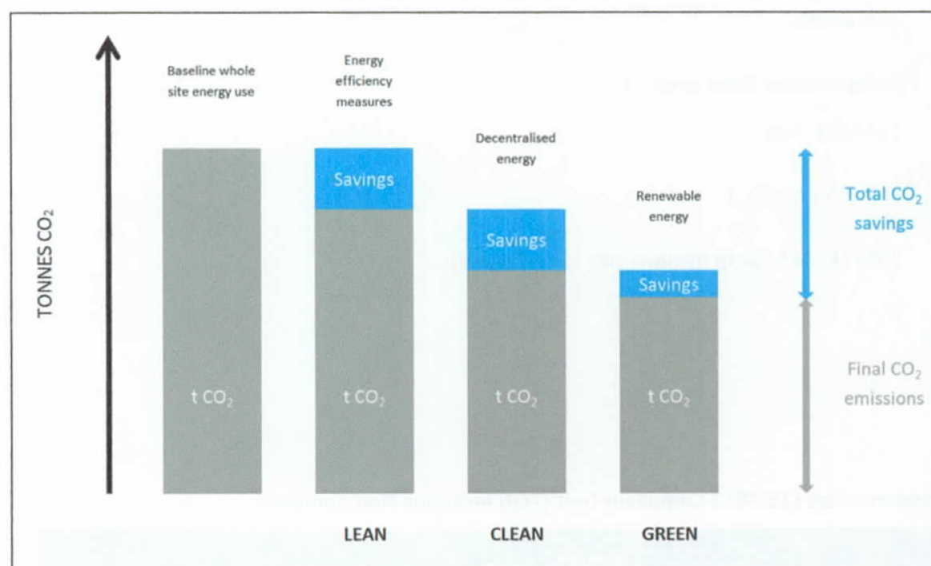
	Space Heating Demand (kWh/a)	Secondary Heating Demand (kWh/a)	Hot Water demand (kWh/a)	Energy from pumps and fans (kWh/a)	Energy from Lighting (kWh/a)	Energy from Appliances (kWh/a)	Totals
Part L1B 2013 Compliant Units	129,369	0	44,152	1,125	6,867	0	181,513
CO ₂ Associated with total Energy Demand (kg/a)	27,944	0	9,537	584	3,564	0	41,629

5. ENERGY HIERARCHY

The accepted standard approach to reducing carbon dioxide emissions in the built environment is as follows;

1. Reduce energy demand (be lean)
2. Supply energy efficiently (be clean)
3. Use renewable energy (be green)

Figure 2: Energy Hierarchy



5.1 BE LEAN – USE LESS ENERGY

Energy demand reduction provides the greatest opportunity for minimising a building's potential CO₂ emissions. Design strategies typically include building form and fabric measures (passive design) and energy efficient building services (active design). Focusing on form and fabric, in particular at an early stage in the building process, is often the most cost effective way to reduce energy and consequently CO₂ emissions.

As required by the energy hierarchy, the overall energy demand for the development will be reduced by implementing energy efficiency measures as far as practically and economically possible.

5.2 REGULATED ENERGY

To reduce demand for space heating, emphasis has been placed on providing a very high standard of fabric and reducing heat loss through the building envelope. Approved Document Part L1B 2013 sets out the limiting fabric parameters for each of the building elements. Each stated value represents the area-weighted average U-value. Table 1 details the proposed U-values for the development along with anticipated percentage improvements over the maximum allowable average weighted U-values in Part L1B 2013. A strong emphasis has been placed on improving the building fabric with the minimum improvement over the average weighted U value being at least 25% to ensure the development's heating and cooling demands are reduced.

All dwellings will be specified to have 100% of their lighting outlets classed as low energy, thus reducing the future homeowner's electricity bill. Orientation and layout have also been given consideration to help limit heat loss in winter and maximise the potential for free cooling in summer, to limit the risk of overheating.

Overall the proposed passive design measures for this development will provide households with a resource to reduce their energy demand and heat their homes to a satisfactory standard at an affordable cost.

The proposed specification will provide a robust long term solution, future proofing the dwelling for years to come.

5.3 FABRIC SPECIFICATION

The indicative U Values for the scheme are shown in the table below along with the anticipated percentage improvement over the maximum allowable average area weighted U Value in Part L1B 2013.

Table 4: Proposed U Values – 2 Storey House

Element	Average Weighted U Value as Part L1B 2013	Proposed U Value/other	Improvement
External Walls	0.30	0.30	0.00%
Party Wall	0.20	0	100.00%
Floor	0.25	0.25	0.00%
Cold Roof	0.20	0.16	20.00%
Warm/Flat Roof	0.20	0	100.00%
Windows	1.60	1.40	12.50%

5.4 SUPPLY ENERGY EFFICIENTLY - BE GREEN – DECENTRALISED ENERGY

The London Plan requires developments to assess the provision of energy in the following hierarchy;

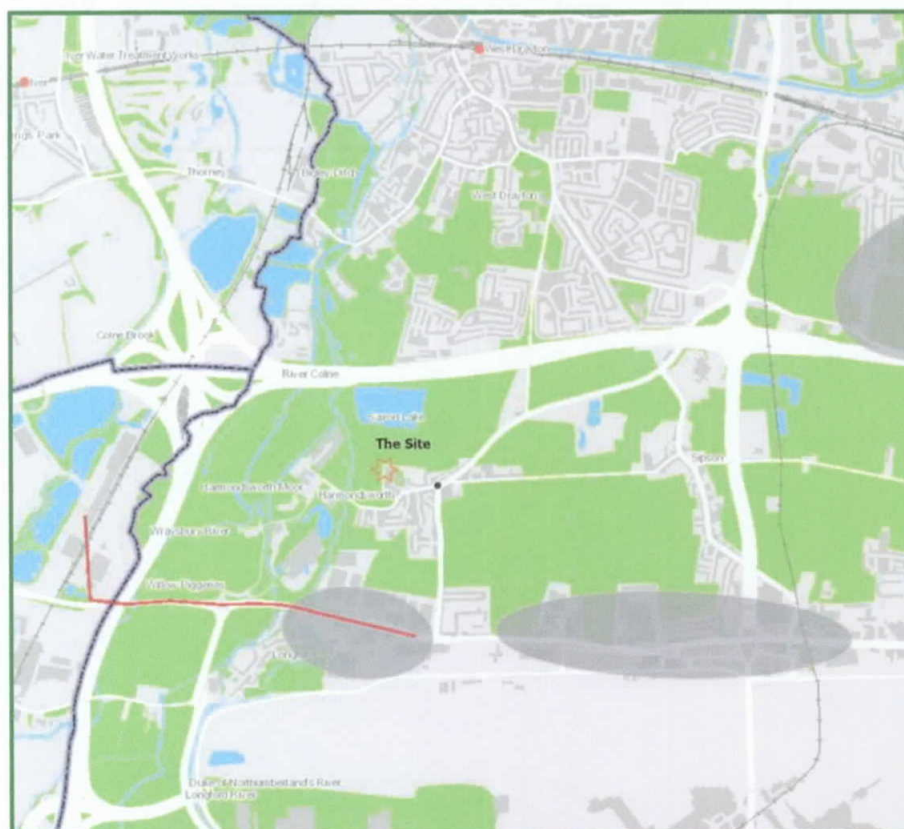
- Connection to existing district heating networks
- Future proofing the development to connect into a planned or potential district heating network
- Provision of onsite community heating including combined heat and power
- On site gas fired community heating

Existing District Heating Networks

The London Heat Map has been consulted to establish if the development lies within proximity to an existing district heating network.

The following extract confirms that the site does not lie in proximity to an existing district heating network and therefore connection is not possible.

Figure 3: Extract of London Heat Map



Key:

Red Lines indicate potential networks

Purple patches indicate Opportunities for future networks

Options for heat supply have been considered below:

Combined Heat and Power

There are many benefits of decentralised heat generation and Combined Heat and Power (CHP) in terms of cost and CO₂ emissions savings. However, technology such as this is more significant for larger developments, ideally complimented with some non-residential use of heat and electricity. The proposed development size of 15 dwellings is at the low end of what the industry tends to view as viable for such systems. The development is for residential dwellings only and this will result in 'peaky' thermal demands with little anchor load to enable efficient operation of gas fired CHP. This option also risks the potential to increase costs to residents.

The site is neither sufficiently dense nor large enough to warrant investment from 3rd party managing agents or Energy Supply Companies (ESCOs). The proposed development would need to be run by an independent agent/company and there would be very little if any interest among existing ESCOs in servicing such a small-scale system. Even if it was possible, the cost of managing fuel procurement, customer billing, operation and maintenance would lead to disproportionately and unnecessary high service charges to residents compared to the provision of heat from individual gas boilers.

Multiple Connections from the primary heat main to each house would increase the distribution losses on the heat network as well as increase capital costs for the energy infrastructure. The Installation of a communal heating system would also risk the site becoming isolated limiting any potential connection to a larger district network in the near future to deliver low carbon heat more cost effectively.

Overall this option has been discounted because communal gas boilers do not offer any efficiency gains over individual gas condensing boilers once distribution losses are accounted for.

Individual Gas Boilers

Individual gas condensing boilers have many advantages. They can be highly efficient, have much lower NO_x emissions and lower installation costs. Reliability and maintenance requirements are well understood ensuring low costs of installation, operation and maintenance. Homeowners are also very familiar with the concept of gas central heating.

It is proposed that highly efficient mains gas condensing boilers with efficiencies of circa 89.30% SEDBUK2009 are to be installed. The boilers will incorporate optimum start, weather compensation and full zone controls to ensure efficient operation. The cylinders will be highly insulated to ensure that the heat loss per day is kept to a minimum.

5.5 PROPOSED HEATING AND VENTILATION SYSTEMS

The following specification for the heating and ventilation is proposed:

Apartments

Heating:	Ideal Logic Combi ESP 1 Efficiency 89.6% SEDBUK 2009
Secondary Heating:	None
Heating Hot Water Controls:	Time and Temperature Zone Control Delayed Start Stat No Weather Compensation
Flue Gas Heat Recovery:	No
Cylinder:	NA
Heat Loss:	NA
Ventilation:	System 3 fans Decentralised MEV Titon Solitude
Waste Water Heat Recovery:	None

Houses

Heating:	Ideal Logic Heat 15 Efficiency 89.6% SEDBUK 2009
Secondary Heating:	None
Heating Hot Water Controls:	Time and Temperature Zone Control Delayed Start Stat No Weather Compensation
Flue Gas Heat Recovery:	No
Cylinder:	NA
Heat Loss:	NA
Ventilation:	System 3 fans Decentralised MEV Titon Solitude
Waste Water Heat Recovery:	None

Unregulated energy

Unregulated energy will be reduced across the site by ensuring:

- All white goods, where supplied by Heathrow 1 Ltd will conform to EU energy labelling scheme.
- All external lighting will be low energy and will have daylight and/or PIR sensors to avoid wastage.

5.6 PROPOSED HEATING AND VENTILATION SYSTEMS

Using the energy efficiency improvement measures as indicated, a revised predicted energy demand can be calculated to show:

Table 5: Predicted Total Energy Demand: Improved building fabric, controls, and gas boilers

	Space Heating Demand (kWh/a)	Secondary Heating Demand (kWh/a)	Hot Water demand (kWh/a)	Energy from pumps and fans (kWh/a)	Energy from Lighting (kWh/a)	Energy from Appliances (kWh/a)	Totals
Energy Part L1B 2013 Compliant Units (TER)	129,369	0	44,152	1,125	6,867	0	181,513
CO ₂ Associated with total Energy Demand (kg/a)	27,944	0	9,537	584	3,564	0	41,629
Part L1B 2013 Actual Unit (DER)	108,545	-	28,829	1,125	5,494	0	143,993
CO ₂ Associated with total Energy Demand (kg/a)	23,446	-	6,227	584	2,851	0	33,108

When compared against Part L1B 2013 Building Regulations not including unregulated energy:

- Total CO₂ demand for the residential units is calculated to be **33,108** kg per annum. This represents a saving of **20.47 %** over the part L1A 2013 compliant figure of **41,629** kg per annum.
- Total Energy demand for the residential units is calculated to be **143,993** kWh per annum. This represents a saving of **20.67 %** over the part L1A 2013 compliant figure of **181,513** kWh per annum.

5.7 BE GREEN – LOW CARBON AND RENEWABLE ENERGY GENERATION OPTIONS

The following options to supply low carbon and renewable energy generation have been explored and discounted based on the following reasons:

Wind Turbines

Wind turbines have been discounted due to concerns over reliable wind resources. The use of wind turbines are likely to present aesthetic as well as nuisance issues.

Biomass Boilers

Unsuitable for this development due to fuel storage issues and increased traffic of heavy vehicles supplying biomass. Individual biomass boilers in the houses are technically feasible, but would be commercially unviable when compared to alternative solutions at the required level of energy abatement.

Air Source Heat Pumps (ASHP)

Air source heat pumps could be utilised but would require outdoor space for the fan-coil units to each dwelling. These outdoor units would be difficult to conceal without affecting the aesthetics of the building facades.

Ground Source Heat Pumps (GSHP)

Discounted on the grounds of costs and available space. Incompatible with individual gas boilers and blocks of apartments.

Solar Thermal

Size of array limited to size of cylinder, and low carbon reduction efficiency compared to photovoltaic systems.

Solar Photovoltaics (PV)

Due to the density and scale of the development, the ability to integrate the technology easily within the scheme Solar PV is to be considered.

5.8 PROPOSED LOW CARBON AND RENEWABLE OPTIONS

The Low and Zero carbon energy solution proposed to meet the planning condition is to utilise solar photovoltaic panels.

It is proposed that **14.39 KWp (44 No)** Fabric Only Approach are installed as detailed in the following section.

Sanyo 327w Panel



- Height 1.58m
- Width 0.86m

Solar PV technology offers advantages over other low carbon and renewable energy technologies for the following reasons:

Density/scale

- Solar technologies are modular and can be sized to available space constraints and would easily be integrated into the roofscape of the proposed development.
- Solar PV technologies typically require 2-3 times more space to generate the equivalent energy or abate similar emissions as solar thermal panels, but they can be sized to the maximum available roof space.

Technology Integration

- Solar technologies can be easily integrated into the built environment using available roof space. Since they are modular and easily fixed to buildings they can access solar irradiation in almost any location. The technologies can be integrated on almost any roof structure or vertical façade without compromising structural or aesthetic requirements.
- Solar PV systems are generally connected to the dwelling or block via an inverter and any excess generation not utilised on-site is exported seamlessly to the local grid.

Cost-effectiveness

- Solar PV costs have reduced dramatically in the last 2-3 years in the UK, due to increasing demand for the technology driven by sustainability requirements and the Government's stimulus package known as the Feed-In Tariffs (FiTs) scheme which rewards renewable electricity generation with premium tariffs.

CO₂ Abatement Capacity

- Solar PV generates electricity and abates ~2.5 - 3 times more CO₂ than an alternative renewable energy technology that displaces use of gas (e.g. solar hot water technology and/or biomass boilers). Solar PV is well proven with good historical data showing that its performance credentials generally match or exceed manufacturers' claims/modelled generation profiles.

5.9 EFFECTS OF INTRODUCING RENEWABLES/LOW CARBON TECHNOLOGY

SAP12 confirms that the amount of energy produced by solar or PV panels can be calculated based on its orientation, pitch and over shading factor.

The predicted CO₂ and energy savings by the introduction of solar panels are summarised as below:

Table 6: Solar contribution to hot water via SAP12

Solar Contribution to domestic hot water is given by

$$Q_s = S \times Z_{\text{panel}} \times A_{\text{ap}} \times n_0 \times UF \times f(a_1/n_0) \times f(V_{\text{edd}}/V_d)$$

Where:

Q_s	=	solar input kWh/year
S	=	total solar radiation on collector, kWh/m ² /year
Z_{panel}	=	overshading factor
A_{ap}	=	aperture area of collector m ²
n_0	=	zero loss collector efficiency
UF	=	Utilisation factor
a_1	=	linear heat loss
$f(a_1/n_0)$	=	collector performance
V_{edd}	=	effective solar volume litres
V_d	=	daily hot water demand litres
$f(V_{\text{edd}}/V_d)$	=	solar storage volume factor

Table 7: Electricity produced by photovoltaic panels

The electricity produced by the PV module in kWh/year is

$$0.8 \times \text{kWp} \times S \times Z_{\text{pv}}$$

where S is the annual solar radiation from Table H2 (depending on orientation and pitch) and Z_{pv} is the overshading factor from Table H3.

Table 8: Table H2: Annual solar radiation extract from SAP12

Tilt of collector	Orientation of collector				
	South	SE/S	E/W	NE/NW	North
Horizontal	951				
30°	1,080	1,029	908	769	720
45°	1,068	1,004	853	677	597
60°	1,007	939	779	588	393
Vertical	766	719	590	438	364

The predicted CO₂ and energy savings by the introduction of the photovoltaic panels can be summarised as.

The photovoltaic panels to the houses will provide **156.39 kWh/year/m²**. See table below.

This will abate the following:

Table 9: Energy and CO₂ abatement

Item	Amount	Metric
Energy	12,110	kWh/year
CO ₂	6,285	kgCO ₂ /year

Table 10: Energy produced by PV panels to the house

Proposed PV Allocation						
Orientation	No Panels	No of Panels per plot	Pitch	Solar Radiation per m ²	Total Energy abated kWh	Total CO ₂ abated kg CO ₂
South	20	1	30	1080	5648	2931
SE/SW	24	1	30	1029	6462	3354
E/W	0		30	908	0	0
NE/NW	0		30	769	0	0
North	0		30	720	0	0

PV Summary	
WP Cell	0.327
Size m ²	1.43
Total No of PV Cells	44.00
Total M ² (estimated)	62.83
Total KWp Output	14.39
Total CO ₂ Saving Kg CO ₂	6,285
Total Energy Saving Kwh	12,110

The predicted CO₂ and energy savings by the introduction of the photovoltaic panels can be summarised as.

The photovoltaic panels to the houses will provide **156.39 kWh/year/m²**.

Figure 4: South Elevation of Stables Office block showing 20 PV panels

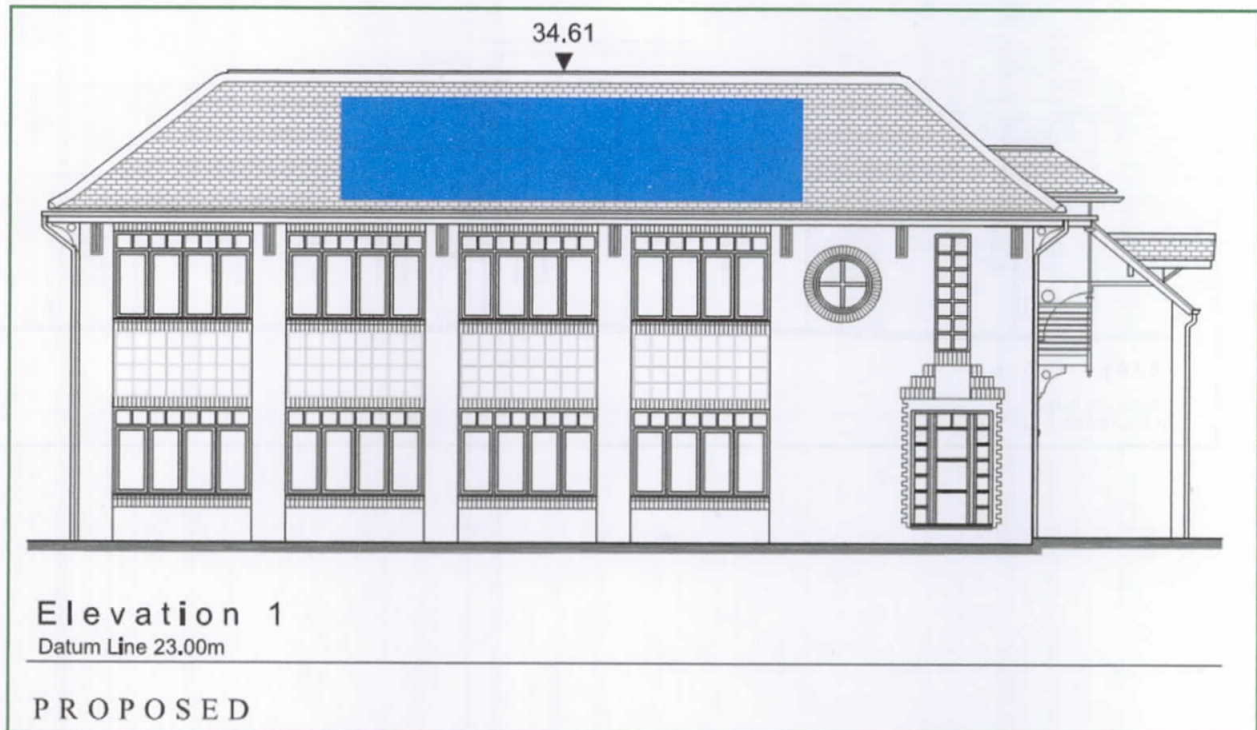


Figure 5 South West Elevation Stables Office Block showing 12 PV Panels

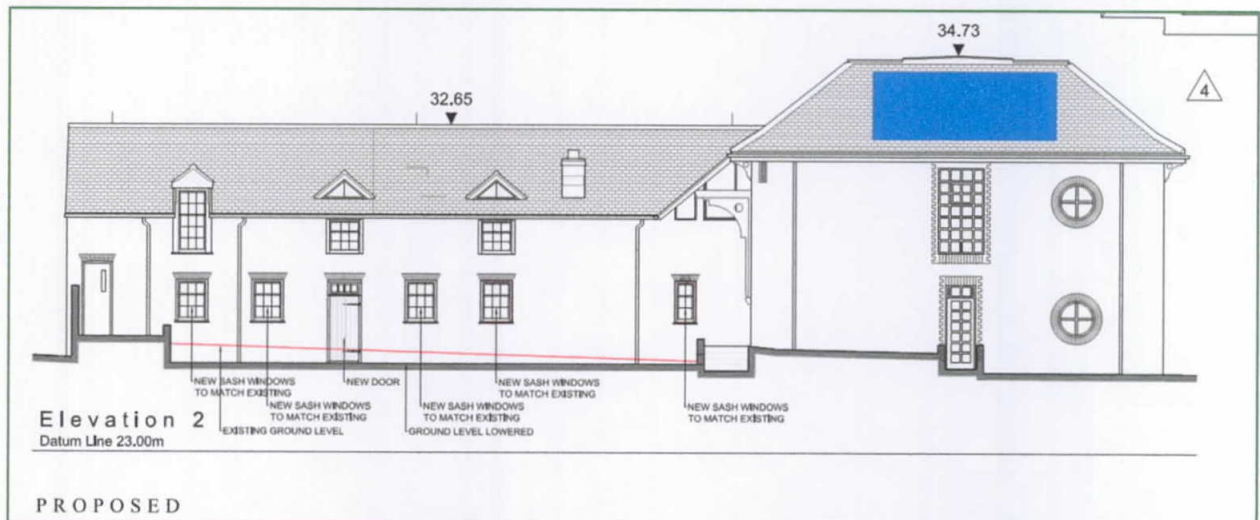


Figure 6 South East Elevation Stables Office Block showing 12 PV Panels



5.10 SUMMER OVERHEATING AND COOLING

With a continual drive for energy efficiency through both the Building Regulations and Local Planning Authority requirements, the risk of overheating to dwellings in the summer months is becoming more prevalent. Overheating can be a mild discomfort or a hazard to health if managed incorrectly, so it is vitally important that overheating risk be mitigated to ensure the dwelling will be both energy efficient and comfortable to live in.

Summer overheating is caused when there is excess build-up of heat within a dwelling. This can occur where there is excessive solar gain and limited means to absorb excess heat into the building fabric or purge this heat through ventilation. Summer overheating can be managed through a variety of measures and the chosen solution will vary from development to development. These measures can include:

Limiting solar gain

- **Glazing g value:** This is a measure of how much solar radiation penetrates the glazing. The lower the g value the less solar gain enters a dwelling. Glazing with low g values may have a darker tint to the glazing, so aesthetic considerations are also a factor. Lower g values (below 0.5) are often required in apartments with single facades. Specifying g values below 0.2 will increase cost substantially and also limit the number of available suppliers for glazing.
- **External shading:** Windows can be shaded with Brise Soleil or balconies of the dwelling above to reduce solar gain in the summer months. If aligned correctly external shading can reduce solar gain in summer and still allow for it in winter when the sun is lower.
- **Internal Shading:** Blinds can be used to limit solar gain in a dwelling. They can either be automatic, triggered by the sun's presence on the window, or operated manually. Manual operation requires the occupant to be present however, so this option isn't a reliable option when trying to mitigate overheating risk.

Purging excess heat build up

- **Thermal Mass:** thermal mass is the measure of a dwelling's ability to absorb energy. A dwelling with a high thermal mass (high proportion of concrete) has the ability to absorb heat during the day, which helps maintain a steady internal temperature. This heat can be released back into the dwelling at night time, when the temperature of the dwelling is lower, helping to maintain a consistent internal temperature.

Ventilation: A dwelling can be ventilated to purge excess heat build-up. This can be done through openable windows, especially where cross ventilation is possible. Where ventilation through windows isn't possible, due to security, noise or pollution issues, Mechanical Ventilation can be used. The ventilation rates required to purge a dwelling can often be quite high, requiring oversized systems.

WATER SAVING MEASURES

The following devices will be incorporated within each home:

- Water efficient taps.
- Water efficient cisterns.
- Low output showers.
- Flow restrictors to manage water pressures to achieve optimum levels.
- Water meters to all premises with guidance on water consumption and savings.

Advice will be provided to the residents from the Sales Team through a comprehensive Home Owners Pack, detailing how to make optimum use of the devices installed around the home. Further, in marketing the scheme sustainable elements such as water reduction will be promoted.

The following flow rates are proposed to ensure that the 105 Litres per person per day is met.

		Job no:		Alec Green Manor Court			
		Date:					
		Assessor name:					
		Registration no:					
		Development name:					
WATER EFFICIENCY CALCULATOR FOR NEW DWELLINGS - (BASIC CALCULATION)							
House Type:		Type 1		Type 2		Type 3	
Description:		House		Apartment			
Installation Type	Unit of measure	Capacity/ flow rate	Litres/ person/ day	Capacity/ flow rate	Litres/ person/ day	Capacity/ flow rate	Litres/ person/ day
Is a dual or single flush WC specified?		Dual		Dual		Select option:	
WC	Full flush volume	4.5	6.57	4.5	6.57		0.00
	Part flush volume	3	8.88	2	5.92		0.00
Taps (excluding kitchen and external taps)	Flow rate (litres / minute)	2.5	5.53	2.5	5.53		0.00
Are both a Bath & Shower Present?		Bath & Shower		Bath & Shower		Select option:	
Bath	Capacity to overflow	170	18.70	170	18.70		0.00
Shower	Flow rate (litres / minute)	9	39.33	9	39.33		0.00
Kitchen sink taps	Flow rate (litres / minute)	10	14.76	10	14.76		0.00
Has a washing machine been specified?		No		No		Select option:	
Washing Machine	Litres / kg		17.16		17.16		0.00
Has a dishwasher been specified?		No		No		Select option:	
Dishwasher	Litres / place setting		4.50		4.50		0.00
Has a waste disposal unit been specified?		No		No		Select option:	
Water Softener	Litres / person / day		0.00		0.00		0.00
Calculated Use		115.4		112.5		0.0	
Normalisation factor		0.91		0.91		0.91	
Code for Sustainable Homes	Total Consumption	105.0		102.3		0.0	
	Mandatory level	Level 1/2		Level 3/4		-	
Building Regulations 17.K	External use	5.0		5.0		5.0	
	Total Consumption 17.K Compliance?	Yes		Yes		-	

6. CONCLUSIONS

The fabric and energy efficiency specification has been enhanced significantly.

An efficient mechanical ventilation system is proposed that will introduce fresh air to the building to ensure the internal comfort of the building is maintained.

The available options for delivery of energy have been appraised and highly efficient individual condensing gas boilers are the optimal method of supplying the homeowners with efficient, cost effective space heating and hot water.

The heating design will be enhanced by specifying full zone and optimum start controls to ensure that the homeowners have an effective, easy to control system. A high percentage of internal lights will be low energy which will reduce energy and CO₂ emissions further.

CO₂ has been reduced on the scheme through the use of renewables and low carbon technology.

Total Energy and CO₂ savings across the site - Regulated Energy only, are summarised in the table below as follows:

Table 11: Predicted CO₂ and Energy Savings

Energy and CO ₂ Savings			
	Description	Amount	Unit
Regs & Improvements (TER's)	Total development CO ₂ demand Part L1B 2013 (TER)	41,629	KGCO ₂ /Year
	Total development energy demand Part L1B 2013 (TER)	181,513	kWh/Year
	Actual development CO ₂ demand (DER) Part L1B 2013	33,108	KGCO ₂ /Year
	Actual development CO ₂ demand (DER) Part L1B 2013	143,993	kWh/Year
	Percentage CO ₂ improvement through fabric/control	20.47	%
	Percentage energy improvement through fabric/control	20.67	%
Site Summary	Reduction in energy through renewables	12,110	kWh/Year
	Reduction in CO ₂ through renewables	6,285	KGCO ₂ /Year
	Energy abatement through renewables	8.41	%
	CO ₂ abatement through renewables	18.98	%
	Total CO ₂ Improvement over baseline	35.57	%

Fabric Energy Efficiency measures reduce CO₂ emissions by **20.47 %** saving over a 2013 baseline unit.

The Introduction of renewables reduces the CO₂ emissions by a further **6,285 KGCO₂/Year**.

The Introduction of renewables reduces the energy demand by a further **12,110 kWh/Year**.

The total CO₂ reduction through renewables is **18.98 %** with a total reduction of **35.57 %** when fabric energy efficiency measures are included.

The reduction in energy through renewables meets the policy requirements of the London Plan and London Borough of Hillingdon.

7. APPENDICES

7.1 THE PREDICTED ENERGY AND CO2 DEMAND

Table 12: Predicted Energy Demand

Energy	Include Unregulated Energy			No	Building Regs Version		2013	Predicted Energy Demand				
Type	Dwelling Name	TFA	No of Types	Main Heating Fuel Requirement (DER)	Secondary Main Heating Fuel Requirement (DER)	Secondary Heating Fuel Requirement (DER)	Water Fuel Requirement (DER)	Electricity Pumps Fans Requirement (DER)	Electricity Lighting Requirement (DER)	Unit Total	Unregulated Energy Demand	Development Total
1	Unit 1	285.14	1	20,974	-	-	2,638	75	785	24,471	0	24,471
2	Unit 2	198.04	1	15,792	-	-	2,594	75	629	19,090	0	19,090
3	Unit 3-Stable Block Apart	54.47	1	3,944	-	-	1,554	75	250	5,823	0	5,823
4	Unit 4-Stable Block Apart	51.13	1	3,651	-	-	1,512	75	238	5,476	0	5,476
5	Unit 5-Stable Block Apart	50.68	1	4,148	-	-	1,506	75	235	5,963	0	5,963
6	Unit 6-Stable Block Apart	54.47	1	3,439	-	-	1,555	75	250	5,318	0	5,318
7	Unit 7-Stable Block Apart	51.13	1	3,183	-	-	1,514	75	236	5,009	0	5,009
8	Unit 8-Stable Block Apart	59.56	1	4,746	-	-	1,614	75	271	6,706	0	6,706
9	Unit 9 - Stable Block	115.62	1	9,151	-	-	1,980	75	474	11,680	0	11,680
10	Unit 10 - Stable Block	114.96	1	9,450	-	-	1,978	75	502	12,005	0	12,005
11	Unit 11 as 12	99.06	1	7,115	-	-	2,505	75	401	10,096	0	10,096
12	Unit 12 - Office Block	99.06	1	7,115	-	-	2,505	75	401	10,096	0	10,096
13	Unit 13 as 12	99.06	1	7,115	-	-	2,505	75	401	10,096	0	10,096
14	Unit 14 - Office Block	49.48	1	4,362	-	-	1,491	75	230	6,157	0	6,157
15	Unit 15 - Office Block	40.22	1	4,361	-	-	1,380	75	192	6,008	0	6,008
Totals		1,422	15	108,545	-	-	28,829	1,125	5,494	143,993	-	143,993

Table 13: Predicted CO2 Demand

CO2	Include Unregulated Energy			No	Building Regs Version		2013	Predicted CO2 Demand				
Type	Dwelling Name	TFA	No of Types	Main Heating Fuel Requirement (DER)	Secondary Main Heating Fuel Requirement (DER)	Secondary Heating Fuel Requirement (DER)	Water Fuel Requirement (DER)	Electricity Pumps Fans Requirement (DER)	Electricity Lighting Requirement (DER)	Unit Total	Unregulated Energy Demand	Development Total
1	Unit 1	285.14	1	10,886	-	-	1,369	39	407	12,701	0	12,701
2	Unit 2	198.04	1	8,196	-	-	1,346	39	326	9,908	0	9,908
3	Unit 3-Stable Block Apart	54.47	1	2,047	-	-	806	39	130	3,022	0	3,022
4	Unit 4-Stable Block Apart	51.13	1	1,895	-	-	785	39	123	2,842	0	2,842
5	Unit 5-Stable Block Apart	50.68	1	2,153	-	-	781	39	122	3,095	0	3,095
6	Unit 6-Stable Block Apart	54.47	1	1,785	-	-	807	39	130	2,760	0	2,760
7	Unit 7-Stable Block Apart	51.13	1	688	-	-	327	39	123	1,176	0	1,176
8	Unit 8-Stable Block Apart	59.56	1	1,025	-	-	349	39	140	1,553	0	1,553
9	Unit 9 - Stable Block	115.62	1	1,977	-	-	428	39	246	2,689	0	2,689
10	Unit 10 - Stable Block	114.96	1	2,041	-	-	427	39	260	2,768	0	2,768
11	Unit 11 as 12	99.06	1	1,537	-	-	541	39	208	2,325	0	2,325
12	Unit 12 - Office Block	99.06	1	1,537	-	-	541	39	208	2,325	0	2,325
13	Unit 13 as 12	99.06	1	1,537	-	-	541	39	208	2,325	0	2,325
14	Unit 14 - Office Block	49.48	1	942	-	-	322	39	119	1,422	0	1,422
15	Unit 15 - Office Block	40.22	1	942	-	-	298	39	100	1,379	0	1,379
Totals		1,422	15	39,186	-	-	9,669	584	2,851	52,290	-	52,290