# 150 Holborn

London EC1

Energy Statement

August 2011

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# Executive Summary

This statement presents the energy strategy developed for the proposed works at 150 Holborn, London. The development consists of refurbishment and extensions of the existing office space including the conversion of a section of the existing building into residential units.

As part of the design development a number of measures have been incorporated into the proposals to maximise the energy efficiency of the development and minimise the associated carbon emissions. A hierarchy of measures have been followed which broadly equates to the following:

1. Passive Design Prioritisation
2. Active Systems Optimisation
3. Use of Combined Cooling Heat And Power
4. Renewable Energy Measures
5. Additional Carbon Reduction Measures

The following sections outline the key proposals under each of the levels of the hierarchy noted above.

## 1. Passive Design Prioritisation

A number of passive energy savings 'lean' are proposed for the new build elements of the building. These include the use of:

- High levels of insulation to achieve low U-values to limit the effects of heat loss from the building
- Balancing the areas of opaque and transparent within the façade to balance daylight against excessive solar gains
- Detailing the building envelope and penetrations to minimise the risk of uncontrolled infiltration
- Use of extensive solar shading to further limit excessive solar gains. The shading levels will be optimised through detail design stage against annual solar exposure studies of the facades to ensure that the façade design responds to the solar radiation exposure.
- Deep window reveals are proposed, in addition to external shading, to the east, west and south facing facades. The deep window reveals will help to shade the windows and reduce solar glare while at the same time assist in controlling privacy and light spillage to neighbouring properties.

### Thermal Performance Improvement To The Existing Facade

In line with Camden Planning Guidance 3 (CPG 3) Section 4 and Approved Document L2B (ADL2B) of the building regulation it is proposed to spend at least 10% of the budget for the new works to improve the façade of the existing building that is being renovated to the standards of the new extensions.

The improvements will take the form of replacing the glazing and applying an insulated rain screen on top of the existing brickwork, thus providing the best benefits of increasing thermal standards while at the same time re-using the existing wall materials.

This is expected to result in significant energy and carbon savings within the overall building.

## 2. Active Systems Optimisation

A number of measures are proposed to minimise the energy consumption and consequential carbon emissions of the new areas being constructed as part of the works. For the new accommodation these measures include the following:

- Use of energy efficient lighting within both the office and residential accommodation throughout.
- The lighting is to be fully zonally controlled within the office areas to allow flexibility of usage and minimise consumption.
- Daylight dimming will be installed in the perimeter areas to maximise the ability of the occupants to use daylight when it is available.
- Occupancy sensing will be used in appropriate areas, for instance WC's, within the office accommodation to ensure that lights are turned off when these spaces are not occupied.
- Variable Air Volume multi-service chilled Beams are proposed for the office accommodation. These provide significant energy savings as compared to conventional fan coil units.
- Central power factor correction for the development.
- Within the residential units high efficiency condensing combination boilers are proposed.

## 3. Use of Combined Cooling Heat And Power and District Energy Systems

Investigations are underway to fully evaluate the feasibility of connection to the University College District Heating system. At present, as the site is at a significant distance from the University College District Heating Network (approximately 1km) it is not felt that a connection would be viable to the development.

It is proposed to install CHP equipment combined with absorption chillers (CCHP) to provide both heating and cooling to the office accommodation within the development. The system is expected to result in significant carbon savings to the development.

The CHP system will incorporate flanged connections to enable a future connection to a district energy system if one should be brought into the area at a later date.

## 4. Renewables Energy Measures

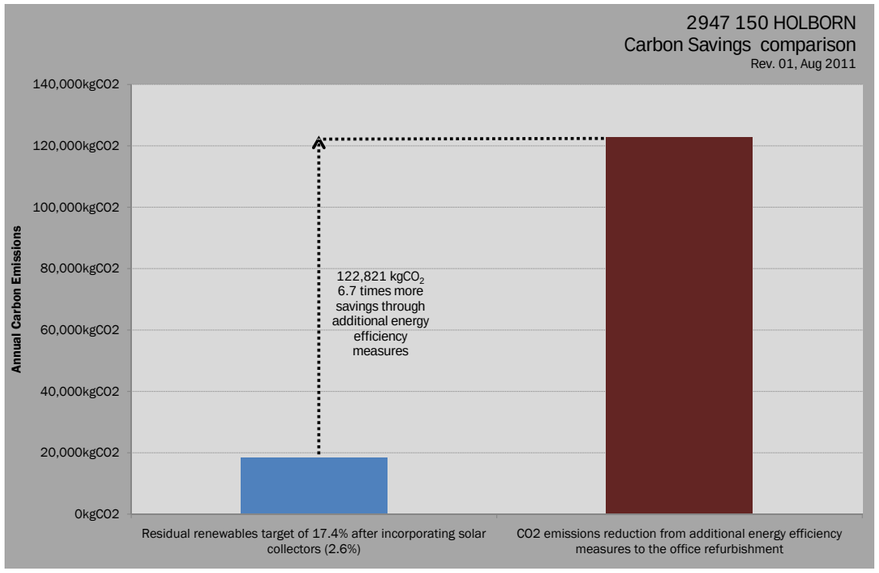
A study of renewable energy technologies has been undertaken. Considering the nature of the site, including its sensitive setting, the building and the refurbishment proposals, only photovoltaic (PV) installation and solar hot water collectors are considered technically feasible for this development.

- Solar hot water collectors will be installed on the roof of the residential development and will meet 2.6% of Camden's 20% renewable energy requirement.
- PV's have been viewed as a potential technology to make up the remaining 17.4% of the renewables target. However, having regard to viability and limited availability of roof space and the actual carbon reduction PV's can deliver, the applicant is proposing an alternative carbon abatement strategy that will significantly reduce carbon emissions of the building beyond which would be achieved by exclusively meeting the renewables requirement.

## 5. Additional Carbon Reduction measures

The alternative carbon abatement strategy to the installation of PV's on the site will achieve greater reduction in carbon emissions by improving the performance of the existing accommodation, that is to be renovated as part of the proposals, beyond building regulation requirements. The building was originally designed in the early 1980's with poor quality fan coil units and lighting installation. It is proposed to adopt the same highly energy efficient design measures incorporated to the new accommodation within the existing accommodation. This would include the use of VAV Chilled Beams, low energy lighting and controls and the use of CCHP. Significant further carbon savings will be achieved by the incorporation of these measures that are over and above the savings that are to be achieved from the improvements to the façade.

It is predicted that the savings from these measures will reduce $CO_2$ emissions from the site by 122,821 $kgCO_2$ per annum below that of the existing accommodation, once the façade improvement measures have been taken into account. This is approximately 6.7 times the carbon savings that would be delivered if PV's were installed to meet the residual 17.6% $CO_2$ reductions using renewable technology, or to put it in another way, these carbon emissions reductions is approximately equivalent to the carbon emissions of the new-build development to the site resulting in a net reduction in carbon emissions from the site.




Savings in annual carbon emissions using additional carbon reduction measures beyond planning policy requierments.

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# Introduction

This statement outlines the energy strategy for the development and relates it to planning policy. This document is intended to be a statement of energy proposals, in support of the full planning application of the development proposals.

The 150 Holborn proposals consist of the refurbishment and extension of the existing office space and includes the conversion of a section of the existing building into 5 new-build and 1 refurbished residential unit. The existing building has a floor area of approximately 12,798m$^2$ GEA, the majority of which will be refurbished, apart from approximately 2,245m$^2$ of retail space on the ground and basement floors. An extension to the roof and additional accommodation on the Brook Street element of the building will provide new office and additional residential space. In addition, a service yard is being covered over for new amenity space.

This statement highlights the measures by which 150 Holborn will address Camden's planning policies and in what ways the energy sustainable objectives stated in these policies will be achieved.

# Planning Policies Context

## Summary Of Planning Policies

### Current

**Planning Policy Statement 1: Delivering Sustainable Development, (2005)**
**Planning Policy Statement 22: Renewable Energy, (2004)**
**The London Plan (July 2011)**
**Camden Core Strategy (2010-2025)**
**Camden Development Strategy (2010-2025)**
**Camden Planning Guide 3: Sustainability, (2011)**

### Future

**Green Action for Change (2011-2020)**

The following planning policies have been listed here that are applicable to the site.

## National Planning Policies

- Planning Policy Statement 1: Delivering Sustainable Development (PPS 1), both the statement itself and the 2007 supplement. PPS1 sets out the Government's overarching planning policies on the delivery of sustainable development.
- Planning Policy Statement 22: Renewable Energy (PPS 22) Planning Policy Statement 22 (PPS22) sets out the Government's policies for renewable energy, which planning authorities should have regard to when preparing local development documents and when taking planning decisions.

These documents do not contain any specific energy targets.

## London Planning Policies

The London Plan (July 2011) describes the regional objectives of the Greater London Authority (GLA) in delivering energy efficient development within London. Policies relevant to the proposed development at 150 Holborn are:

- Policy 5.1 - Climate change mitigation
- Policy 5.2 - Minimising carbon dioxide emissions
- Policy 5.5 - Decentralised energy networks
- Policy 5.6 - Decentralised energy in development proposals
- Policy 5.7 - Renewable energy

## Camden Planning Policies

Camden have published their own Core Strategy (2010) with accompanying Development Policies (2010) that reflect both the wider national and regional sustainable design objectives alongside Camden's own goals for sustainable construction within the borough. The key issues regarding energy efficiency that these documents raise are contained within the following policies:

- Core Strategy CS13 – Tackling climate change through promoting higher environmental standards
- Development Policy DP22 – Promoting sustainable design and construction

Camden have also developed a companion document to their sustainability policy framework called "Camden Planning Guide 3: Sustainability" (CPG 3), published in 2011. CPG 3 gives further guidance on how proposals are expected to meet the high level policy objectives for a development. CPG 3 gives some limited additional guidance for refurbishment projects.

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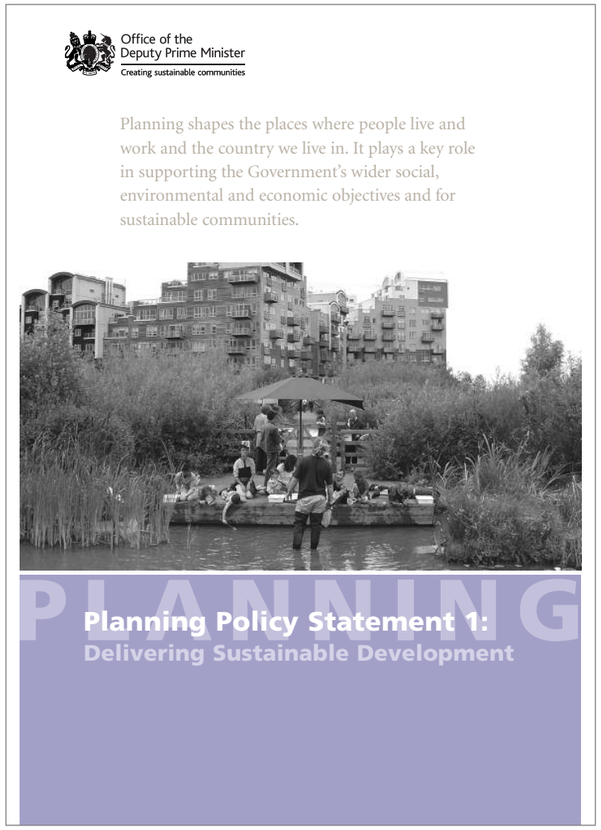
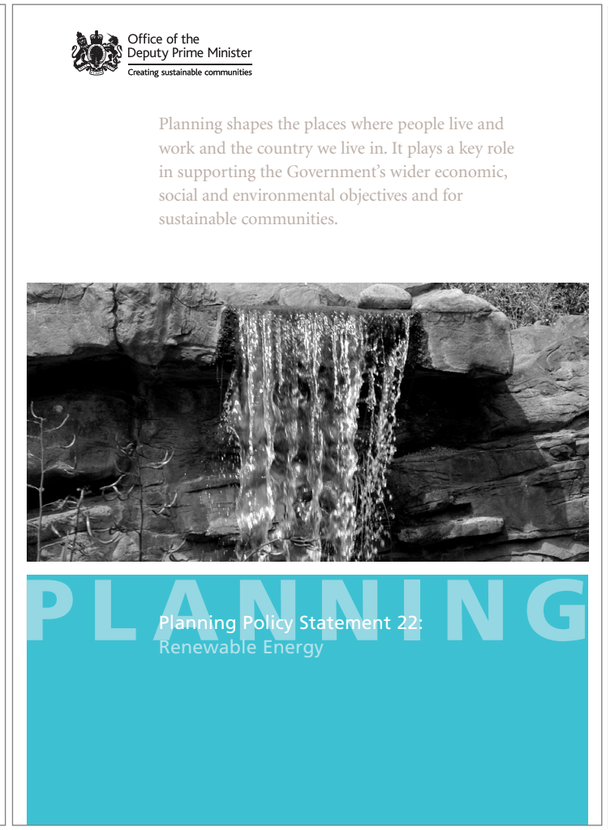
CS13 and DP22 are written framed around 'development'. Our reading of this is the development of additional accommodation within the borough, through either the construction of additional floor space or the creation of different accommodation usage, through conversion or change of use. We have referred to such elements in the proposal as "new or "new build" within this document. While this reading does not change the proposals for the site it helps to define the enumeration of them in a constant and clear manner.



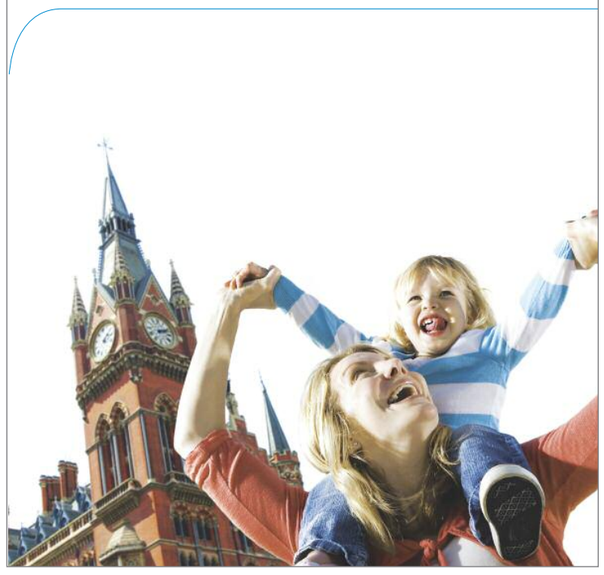

## Camden Planning Policies - Headline targets

- Developments are to target a 20% reduction in carbon dioxide emissions from on-site renewable energy technologies.
- Developments to consider local energy generation and distribution system served by combined heat and power (CHP).

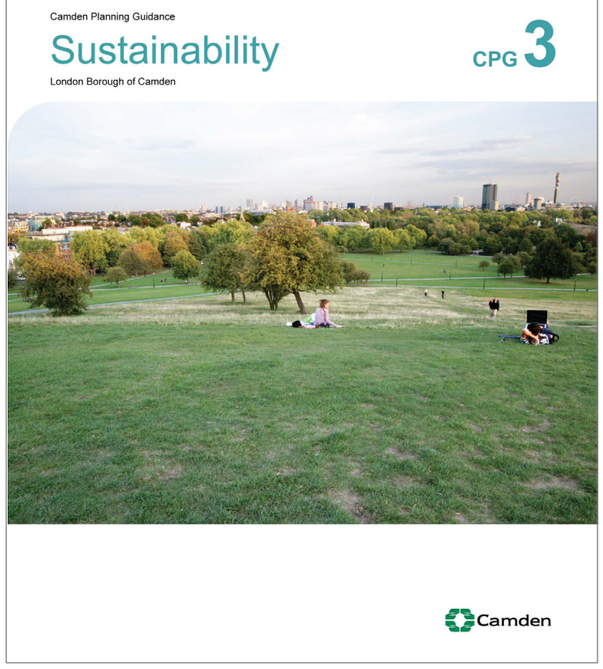
## Future Planning Policies

Green Action for Change 2011-2020 will replace the current sustainability plan, Delivering a Sustainable Camden (2008-2012). It focuses on the key environmental issues on which the Council and additional partners can have the biggest impact

- Reducing Camden's carbon emissions
- Adapting to a changing climate
- Reducing, reusing and recycling waste
- Enhancing biodiversity, improving green spaces and involvement in gardening and food growing.







# Energy Strategy

This statement presents the energy strategy developed for the proposed works at 150 Holborn, London. The development consists of refurbishment and extensions of the existing office space including the conversion of a section of the existing building into residential units.

As part of the design development a number of measures have been incorporated into the proposals to maximise the energy efficiency of the development and minimise the associated carbon emissions. A hierarchy of measures have been followed which broadly equates to the following:

1. Passive Design Prioritisation
2. Active Systems Optimisation
3. Use of Combined Cooling Heat And Power
4. Renewable Energy Measures
5. Additional Carbon Reduction Measures

The following sections outline the key proposals under each of the levels of the hierarchy noted above. Camden Planning Guidance 3 (CPG 3) notes that majority of the policy guidance relates to new buildings, but does provide specific guidance for the renovation of existing buildings within section 4. The rest of the policy measures have been adopted, where appropriate and applicable, for the new build and conversion elements of the development. It is worth noting that due to the size of the extensions the applicable building regulations that apply to it are Approved Document L2B 2010 (ADL2B for non-dwellings and ADL1B for dwellings), which provide guidance for extensions to existing buildings.

## 1. Passive Design Prioritisation

A number of passive energy savings 'lean' are proposed for the new build elements of the building. These include the use of:

- High levels of insulation to achieve low U-values to limit the effects of heat loss from the building
- Balancing the areas of opaque and transparent (glazing) within the façade to balance daylight against excessive solar gains
- Detailing the building envelope and penetrations to minimise the risk of uncontrolled infiltration
- Use of extensive solar shading to further limit excessive solar gains. The shading levels will be optimised through detail design stage against annual solar exposure studies of the facades to ensure that the façade design responds to the solar radiation exposure.
- Deep window reveals are proposed, in addition to external shading, to the east, west and south facing facades. The deep window reveals will help to shade the windows and reduce solar glare while at the same time assist in controlling privacy and light spillage to neighbouring properties.

Alongside the new build works to develop both extensions to the roof and to the Brook Street side of the building and to cover over the service yard there are a number of other works proposed to the existing building.

The existing building has a typical 1980's facade, which is to say it is thermally poor with minimal insulation levels, poor quality glazing that is at the end of its design life (i.e. it would be expected to be leaky) and large thermal bridges. In line with Camden Planning Guidance 3 (CPG 3)Section 4 and Approved Document L2B (ADL2B) of the building regulation it is proposed to spend at least 10% of the budget for the new works to improve the façade of the existing building that is being renovated to the standards of the new extensions.

The improvements will take the form of replacing the glazing and applying an insulated rain screen on top of the existing brickwork, thus providing the best benefits of increasing thermal standards while at the same time re-using the existing wall materials.

This is expected to result in a significant energy and carbon savings within the overall building.

## 2. Active Systems Optimisation

A number of measures are proposed to minimise the energy consumption and consequential carbon emissions of the new build elements being constructed as part of the works. For the new build elements these measures include the following:

- Use of energy efficient lighting within both the office and residential accommodation throughout.
- The lighting is to be fully zonally controlled within the office areas to allow flexibility of usage and minimise consumption.
- Daylight dimming will be installed in the perimeter areas to maximise the ability of the occupants to use daylight when it is available.
- Occupancy sensing will be used in appropriate areas, for instance WC's, within the office and residential accommodation to ensure that lights are turned off when these spaces are not occupied.
- Variable Air Volume Multi Service Chilled Beams are proposed for the office accommodation. These provide significant energy savings as compared to conventional fan coil units.
- Central power factor correction for the development.
- Within the residential units high efficiency condensing combination boilers are proposed.

## 3. Use of Combined Cooling Heat And Power and District Energy Systems

Investigations are underway to fully evaluate the feasibility of connection to the University College District Heating system. At present as the site is at a significant distance from the University College District Heating Network (approximately 1km) it is not felt that a connection would be viable to the development. This option will be considered in more detail in the next design stage.

It is proposed to install CHP equipment combined with absorption chillers to provide both heating and cooling to the new and refurbished office accommodation within the development. CHP plant would be circa 203 kW thermal and 124 kW electricitiy. CHP plant is expected to result in significant carbon savings to the development.

The CHP system will incorporate flanged connections to enable a future connection to a district energy system if one should be brought into the area at a later date.

CHP connection to the residential portions of the development was considered but dismissed on technical grounds. In office buildings there is a shut down over the winter period when the building is closed for the Christmas holidays. In addition, outside of office hours during weekdays and weekends, base load from dwellings is small and CHP system designed to meet office energy loads are not capable to be turned down enough to serve reduced office loads and domestic loads. Until district heating systems are brought into the vicinity which would enable heat export, it is not felt that the dwelling alone would provide a sufficient heat load for the CHP systems to remain operational during these periods and as such are better served by standalone systems. Mini or micro CHP systems are currently available in the market. However, the energy loads of the dwelling are too low to have a reliable dedicated standalone CHP system. Therefore CHP technology for the dwellings have been discounted.

## 4. Renewable energy

The site has limited ability to use renewable energy. Using the toolkit to evaluate the differing renewable options has resulted in the following assessment of renewable systems.

### Wind

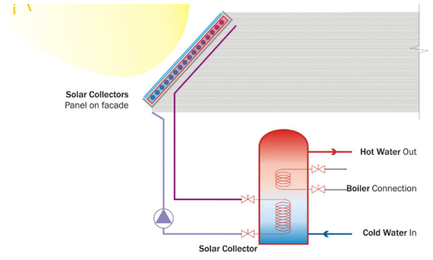
The site is not well suited for wind. Searching the DECC wind speed database the average annual wind speed at 25m above ground level is 5.5m/s. It is often considered that locations with average annual wind speeds of less than 6m/s are not well suited to the use of wind turbines. In order to achieve 6m/s it would likely require a wind turbine that would be greater than 45m above ground level to the centre of the nacelle, which would be unlikely to be acceptable in townscape terms as the site is located adjacent to listed buildings and such an intrusion would harm the heritage setting. In addition the number of adjacent buildings of similar or greater mass to the proposed development would result in uncertain wind conditions and the actual site conditions could be worse than those predicted by the database.

### Ground Source Heat Pumps (GSHP)

In order to maximise use of the existing materials on the site it is proposed to use the existing chillers for the development going forwards. These were installed in 2008 and have run for less than 18 months and are therefore in reasonably good condition. As a GSHP would conventionally act as a significant portion of the chiller equipment for an office building the economic viability of using GSHP is limited. In addition limited works are proposed in the ground external to the building and limited works are proposed to break the existing basement slab of the building and therefore there is limited or no opportunity to install the ground array as part of a GSHP system. With these factors combined the use of GSHP is not considered viable for this development.

### Biomass

Biomass boilers or biomass fuelled CHP is not considered viable for the site. The vicinity has air quality issues which biomass boilers would exacerbate. Furthermore biomass systems require significant spatial requirements for the storage of the associated solid or liquid fuels. Due to space constraints in the basement stemming from working within an existing building it is not felt that this space can be achieved.




### Solar Thermal

Due to the use of CHP within the office accommodation there is limited need for additional heating. It is often during the summer months where CHP systems are struggling for sufficient load to operate that solar thermal systems are generating usable energy. As the residential accommodation is not proposed to be connected to the CHP system it is proposed that flat plate solar thermal collectors 60m$^2$ in area are installed to minimise their energy consumption for the production of domestic hot water. This is predicted to save approximately 2,731 kg$CO_2$ per year and represents a reduction of 2.6% of the new and converted accommodation annual carbon emissions.

### Photovoltaic

Photovoltaics are a technically viable technology for the building. However, the roof already incorporates terraces, ecological roofs and M&E plant and solar thermal technologies. While an element could be installed on the roof it is felt that greater carbon abatement may be achieved through the work on improving the existing building, particularly given the viability issues associated with PV's and the actual carbon reductions that can be achieved.

# 5. Carbon Reduction Calculations

## Part L and Policy Compliant Calculations

The carbon reduction calculations have been carried out to address requirements of Part L of the Building Regulations and the planning policies, highlighted earlier.

As the non-residential development to the site is covered under ADL2B an elemental calculation is required to demonstrate building regulations compliance. Nevertheless a typical floor of the new roof extension and a typical floor of the office accommodation to be refurbished have been modelled with dynamic thermal software tools to understand the associated carbon emissions from these areas. Allowance has been made to convert the associated equipment energy consumption (i.e. non-Part L regulated in new buildings) into a carbon emission from the outputs of the software.

SAP calculations have been undertaken for a typical residential apartment. As SAP does not address equipment loads we have assumed a 13kg$CO_2$/$m^2$ allowance for these items, which will be refined as the design moves forward.

## Renewables Calculations

Based on the calculations in Table 3, the baseline carbon emissions for renewables is 104,928 kg$CO_2$ as this represents the carbon emissions of the new build elements after active and passive design savings have been incorporated. 20% of the baseline would result in a renewable target of 20,986 kg$CO_2$. At present the proposed solar thermal on the residential element delivers 2,731 kg$CO_2$ and would correspond to 2.6% of the baseline carbon emissions. To meet Camden's policy in a simplistic manner this would therefore require a further 18,254 kg$CO_2$ of carbon abatement through the use of renewables. We have estimated that this could be achieved through the use of photovoltaic panels on the roof with an approximate area of 314 $m^2$ and associated cost of approximately £142,000, although roofspace is limited and cannot be accommodated on the roof.

As photovoltaics offer relatively low return in terms of carbon abatement for the investment an alternative is proposed whereby additional

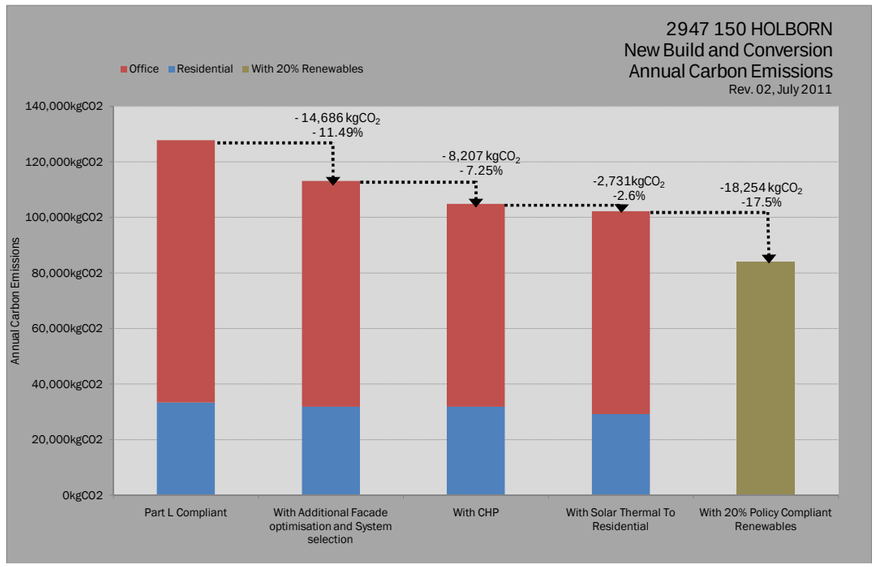



Fig.01 New build and conversion Annual Carbon emissions

The SAP results for the residential calculations give the following carbon intensities for this accommodation:

**Table 1: Residential Carbon Intensities**

| | Part L | | Total | |
|---|---|---|---|---|
| Typical Apartment (SAP TER) | 21.06 | kg$CO_2$/$m^2$ | 34.06 | kg$CO_2$/$m^2$ |
| Optimised Apartment (SAP BER) | 19.57 | kg$CO_2$/$m^2$ | 32.57 | kg$CO_2$/$m^2$ |
| Renewable Apartment (SAP BER) | 16.78 | kg$CO_2$/$m^2$ | 29.78 | kg$CO_2$/$m^2$ |

For the new build offices the carbon intensities that have been extracted from the energy model are as follows:

**Table 2: New Build Office Accommodation Carbon Intensities**

| | **Part L** (kg$CO_2$/$m^2$) | **Equipment** (kg$CO_2$/$m^2$) | **Total** (kg$CO_2$/$m^2$) |
|---|---|---|---|
| Extension Office ADL2B Compliant | 37.56 | 19.08 | 56.64 |
| Extension Office Optimised | 29.63 | 19.08 | 48.71 |
| Extension Office with CHP | 25.55 | 18.24 | 43.79 |

Using the carbon intensities in the previous two tables this produces the following overall carbon consumption for the new development on the site:

**Table 3: New Build Development Annual Carbon Totals**

| | **Part L Compliant** (kg$CO_2$) | **With Active and Passive Design** (kg$CO_2$) | **With CHP** (kg$CO_2$) | **With Solar Thermal to Residential** (kg$CO_2$) | **With 20% Policy Compliant Renewables** (kg$CO_2$) |
|---|---|---|---|---|---|
| Residential | 33,345 | 31,886 | 31,886 | 29,155 | - |
| Office | 94,476 | 81,248 | 73,042 | 73,042 | - |
| Total | 127,820 | 113,134 | 104,928 | 102,196 | 83,942 |

improvements beyond policy are undertaken to the areas of the building being refurbished in addition to the façade replacement. Table 4 outlines the carbon intensities from the calculations undertaken.

Once the carbon intensities in Table 4 are multiplied by the floor area of the portions of the building that are being refurbished it results in the carbon profile in Table 5. This is also summarised in the graph in Fig 02.

## Beyond Policy

As can be demonstrated from the calculations in Table 5 the overall savings of undertaking these works to the existing office areas that are being refurbished results in an additional saving of 122,821 $kgCO_2$. This saving that is beyond both the regulatory and planning requirements for the development. For comparison, the savings are 1.2 times the overall emissions of the new construction on the site or equivalent to over 6.7 times the residual carbon to be abated by renewables if the development was to focus solely on a 20% renewables target.

In effect by carrying out the upgrades to the existing building fabric it is proposed that the building as a whole will have comparable energy consumption. This is a significantly higher degree of carbon abatement than sought by policy. The total carbon profile for both the new development and the refurbished works is summarised in Table 6 and the proceeding table.

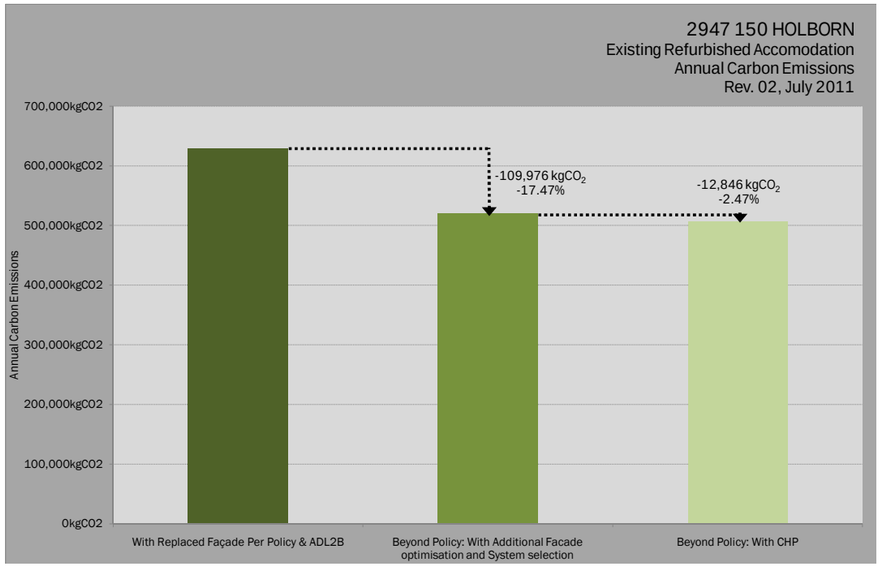



Fig 02 Existing refurbished office annual carbon emissions

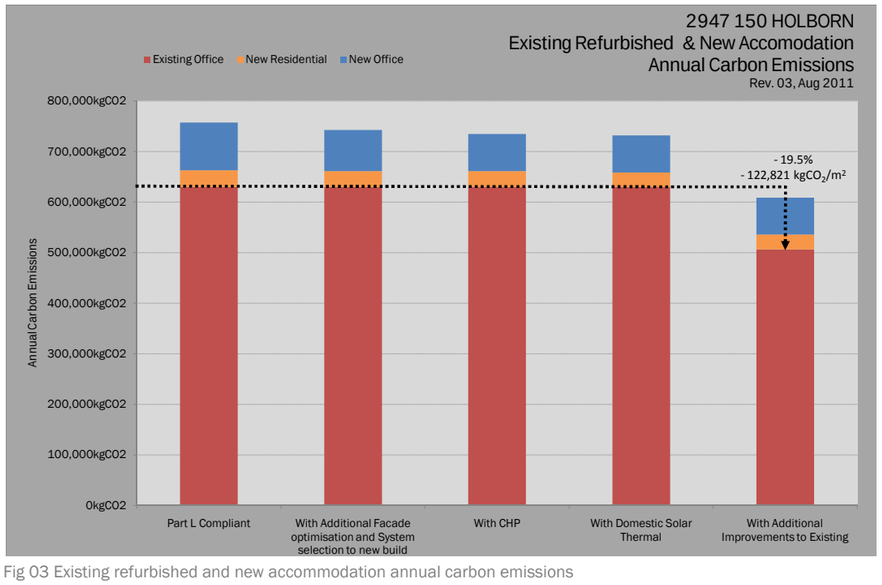



Fig 03 Existing refurbished and new accommodation annual carbon emissions

Table 4 outlines the carbon intensities from the calculations undertaken.

**Table 4: Existing Office Accommodation Carbon Intensities**

| | **Part L** ($kgCO_2/m^2$) | **Equipment** ($kgCO_2/m^2$) | **Total** ($kgCO_2/m^2$) |
|---|---|---|---|
| Existing Refurbished Office with new facade (ADL2B compliant and Planning policy compliant) | 36.8 | 19.06 | 55.86 |
| Existing Office with active and passive measures | 27.04 | 19.06 | 46.10 |
| Existing Office with CHP | 25.9 | 19.06 | 44.96 |

Table 5 outlines the carbon intensities from the combined annual carbon totals

**Table 5: Refurbished Office Annual Carbon Totals**

| | **With Replaced facade per policy & ADL2B** ($kgCO_2$) | **With Active and Passive Measures** ($kgCO_2$) | **With Additional Optimisation Beyond Policy including CHP** ($kgCO_2$) |
|---|---|---|---|
| Total | 629,430 | 519,455 | 506,609 |

**Table 6: Combined Annual carbon totals from new development and refurbishment of existing office accommodation**

| | **Part L & Policy compliant** ($kgCO_2$) | **With active & passive design** ($kgCO_2$) | **With CHP** ($kgCO_2$) | **With domestic solar thermal** ($kgCO_2$) | **With additional improvements to existing** ($kgCO_2$) |
|---|---|---|---|---|---|
| New Residential | 33,345 | 31,886 | 31,886 | 29,155 | 29,155 |
| New Office | 94,476 | 81,248 | 73,042 | 73,042 | 73,042 |
| Existing Office | 629,430 | 519,455 | 519,455 | 519,455 | 506,609 |
| **Total** | **757,251** | **632,589** | **624,383** | **621,651** | **608,806** |

# Conclusion

The proposed development at 150 Holborn will significantly improve the sustainability credentials of the existing building and radically reduce the energy required to operate the development.

The renewables target set by Camden requires the development to reduce 21 tonnes of $CO_2$ emissions from the site annually. The design team has suggested additional measures beyond building regulation compliant requirement and is predicted to reduce the carbon emissions by 123 tonnes of $CO_2$. This is approximately 6.7 times more carbon reduced beyond the residual 17.6% $CO_2$ reductions by Council's Camden Planning Guidance 3 - Sustainability (CPG3) policy requirements from on-site renewables. The following are some of the key strategies and targets that are proposed to achieve this carbon reduction and provide facilities of a standard that reflect best practice in sustainable mixed-used design.

1. Passive design has been prioritised. The building envelope will have low u-values and high levels of air tightness to significantly lower energy loads.

2. Extensive solar control strategies have been proposed for the glazed facades. Window sizes have been optimised, and external louvred shading to control solar gains in summer has been integrated into the design. Deep window reveals have been proposed for facades to the east, west and south to further reduce summer-time solar gains.

3. Use of energy efficient lighting with daylight dimming and presence detection sensors has been incorporated in the design of office spaces to reduce energy consumption.

4. Variable air volume (VAV) Multi-service chilled beams has been proposed to maintain thermally comfortable office accomodation.

5. Solar hot water collectors will be installed on the roof to serve the residential element of the development with domestic hot water.

6. A trigeneration plant consisting of Combined Heat and Power (CHP) plant and absorption chillers will provide both heating and cooling to the office accommodation.

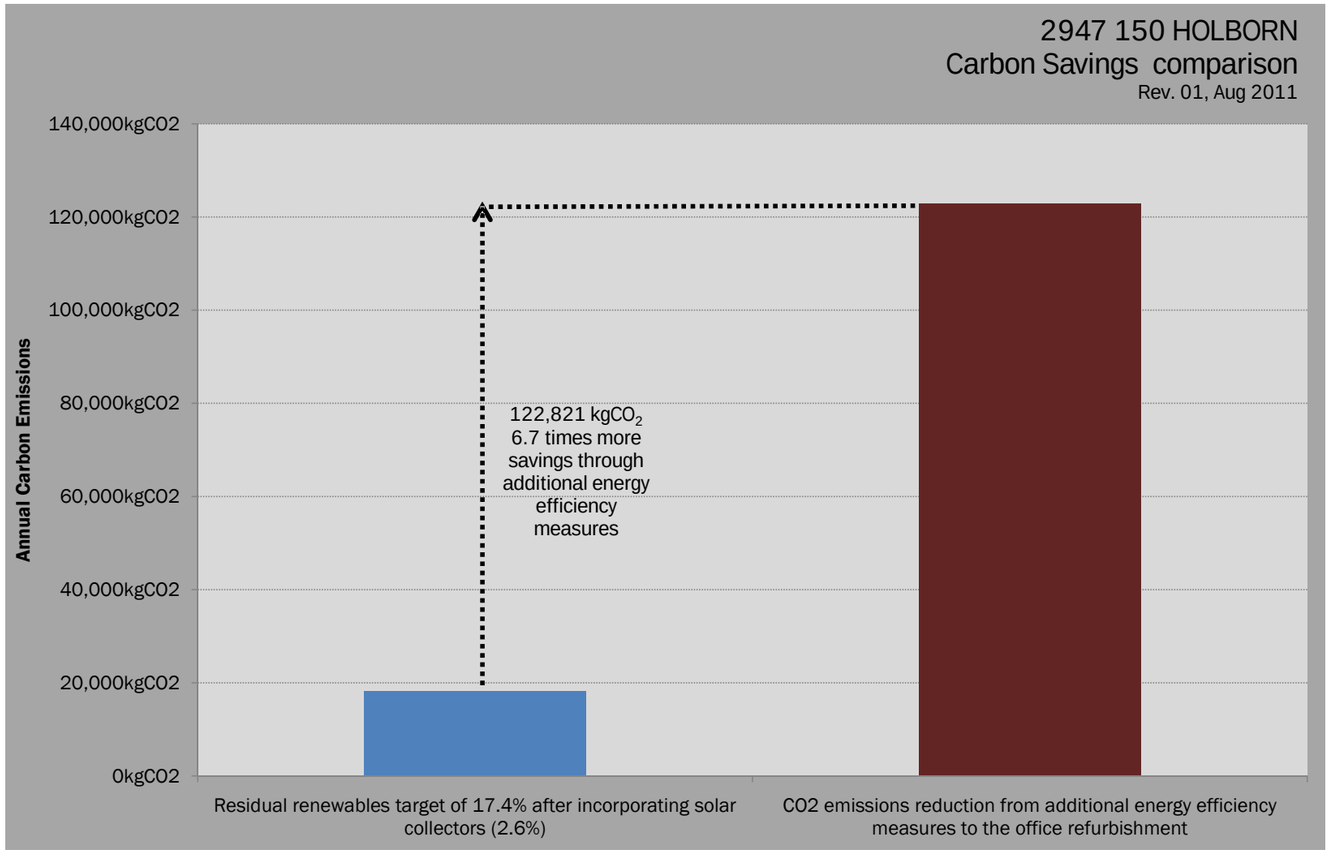



Fig 04 Savings in annual carbon emissions using additional carbon reduction measures compared to what is required by the planning policy