PARRITT LENG

Company no. 4973529

Integrated Services:
Architecture + Urban Design
Construction + Management
Marketing + Communications

THE WHITE LODGE
252 FINCHLEY ROAD
LONDON NW3

ENERGY ASSESSMENT
(to be read in conjunction with the Sustainability Statement in the A3 report)
April 2010
Project 124/ REV B

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The Proposed Development

The proposed development at 252 Finchley Road will comprise of the creation of a new fourteen unit residential apartment with lower ground car parking.

The development have been design to ensure that adequate levels of ventilation and thermal comfort can be achieved through natural ventilation of the internal spaces, wherever possible as well as enhanced levels of insulation to minimise energy loss.

Introduction

The London Renewables Toolkit sets out a methodology for assessing the carbon emissions from a development. Section 4.3 of the Toolkit outlines the benchmark approach as an acceptable method. The prediction methodology of-assessing carbon emissions have been used for the residential section of the development.

Prediction Method

Using the benchmarks shown below, together with the floor area for the residential development, the carbon emissions were calculated for the new proposals. Since the Development falls under the 2006 revision to the Building Regulations - Approved Document Part L, the baseline carbon emissions are calculated on the emissions which result from compliance with 2006 Part L Building Regulations. However, the London Renewables Toolkit benchmark figures are based on 2002 Building Regulations, therefore a reduction in the overall CO_2 emissions must be made to these benchmark figures to ensure compliance with current Building Regulations. These reductions are as follows:

- New domestic buildings (residential):

> 20% reduction against current regulations (For dwellings with gas heating systems)

The following table shows the results:

Carbon Factors		
	kg CO_2/kWh	kg C/kWh
Electricity	0.43	0.117
Gas	0.19	0.052

PRIVATE RESIDENTIAL	TOTAL		
Benchmark:	London Renewables Toolkit Section 4.13.11 Town Centre Residential		
Gross internal Floor Area	1409 m^2		
		CO_2 (tonnes)	C (tonnes)
Carbon benchmark	9.04 kg C/ m^2	46.71	12.74
Reduction to account for now Part L (2006)	20%	CO_2 (tonnes)	C(tonnes)

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TOTAL	37.37	10.19

The carbon emissions used as a basis for the carbon mitigation strategy are shown in the following table, based on the carbon factors shown in the previous table. The total CO_2 emission reduction required for the development is therefore **8** tonnes per annum.

	Private Residential	Total
	37.37	37.37
20% CO_2 (tonnes)	**7.474**	**7.474**
20% CO_2 electricity equivalent (MWh)	17.38	17.38
20% CO_2 gas equivalent (MWh)	39.34	39.34

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Energy Mitigation Approach

A holistic approach to carbon mitigation based on a hierarchy where the most active measures used to reduce carbon emissions are those that cost the least is utilised.

Solar design includes the correct orientation and form of a building in relation to its environment. As it is an existing building with internal refurbishments, changing the building form and orientation is not applicable.

Passive systems include an emphasis on the use of natural ventilation, effective solar shading and daylighting to obviate the need for active systems. Where active systems are required their design should minimise energy consumption while still performing to the required standard. Examples include utilising lighting controls based on occupancy with automated daylighting controls.

Renewable systems should be considered in the context of the building and can be used to further reduced carbon emissions once cost effective options for reducing energy consumption have been implemented.

If renewable systems cannot be used effectively or prove to be too costly, the remaining carbon emissions associated with energy supplied from carbon intensive sources should be mitigated by ensuring the most efficient use is made of these sources. An example of this is providing on-site combined heat and power generation or the distribution of electricity at the highest voltage practical where it must be distributed over longer distances.

Mayor's Energy Hierarchy

The Mayor of London's Energy Strategy - Green Light for Clean Power utilises a hierarchy which is summarised as follows:

Be lean:	Reduce energy consumption
Be green:	Supply energy from on-site renewables
Be clean:	Supply energy from efficient sources

Energy Strategy structure

The sections of the report that follow are structured in a manner suggested by the London Renewables Toolkit and cover the elements of the Mayor's Energy Hierarchy outlined above including an options appraisal for on-site renewable energy sources.

Reducing energy consumption

The thermal performance of the building envelopes is key in the overall design approach for the development. Particular emphasis is given to improvements in the `U' values of the various elements, the utilisation of solar gain in the winter season and the air tightness in the building to reduce heat losses. For refurbishments in particular, all walls will be insulated internally and between floors and walls. The roof will benefit with renewal and new insulation in compliance with the Building Regulations and all existing windows will be treated with seals to reduce heat loss. New windows will be air tight and FENSA compliant. The roof on the side extension will have a green roof for enhanced insulation. This approach addresses passive techniques to reduce energy consumption.

Private residential units

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The provision of a high performance insulation to the existing façade will reduce carbon emissions arising from space heating and to a high standard based on compliance to the revised Part L of the building regulations as a minimum.

Natural ventilation will be used to ensure good fresh air supply with minimum energy consumption wherever possible.

Individual metering will be provided to all individual units. Options for the provision of on-display metering will also be considered where it is felt this might increase awareness of energy efficiency and influence behaviour.

The need for electric lighting will be minimised by ensuring good access to daylight for all living spaces. Low energy light fittings will be used where appropriate.

Supplying energy from renewable sources

The following renewable energy sources were considered for the energy strategy, based on the London Renewables Toolkit:

- Biomass heating
- Biomass CHP
- Small scale wind turbines
- Solar photovoltaics
- Solar thermal collector's

Biomass Heating

Using wood fuel for heating is one of the oldest forms of renewable energy systems. Modern biomass heating uses locally sourced wood chips, or wood pellets, in a specially designed boiler which combusts the woodfuel at high temperature, attaining very high efficiencies to produce hot water for space or water heating with minimal emissions.

The key issues for wood fuel heating are adequate fuel supply, suitable wood fuel handling systems and sufficient space allowance for the increased plant size. In order to minimise the handling of wood fuel by appropriate facilities maintenance staff, a biomass boiler system must handle fuel in a manner which is fully automated. The main criteria for the system are:

- Problem-free fuel feed from bunker to boiler;
- Rapid and simple on-site cycle for delivery vehicles, to minimise fuel costs;
- Use of simple tipper trucks or trailers to minimise fuel delivery costs;
- A maximum delivery frequency of once per week;
- Sufficient plant room allowance and access for flue and LTHW distribution.

There exists little opportunity to integrate a biomass boiler into the development since it is located in a built up area, has issues associated with the exhaust fumes and flue requirements and there is no space within the development for adequate fuel storage. Further, it is highly unlikely that suitable access for wood fuel delivery can be accommodated at the site. Additionally, given the likely delivery frequency the effect on local transport would be detrimental. The availability of a consistently high quality supply of wood fuel in the Central London location is also questionable. In conclusion, biomass heating is not suitable for any part of the development.

Biomass CHP

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For the reasons outlined above biomass CHP is not feasible for any element of the Development. Additionally the unproven nature of this technology, together with the high maintenance requirement means it is not considered further in this report.

Small scale wind turbines

Electrical energy from a small scale wind turbine is one of the most highly visible and recognisable renewable energy systems. Additionally a small scale wind turbine is one of the most effective generators of renewable energy in the UKs climate. However, due to built up nature of the immediate surroundings and the effect this has an urban wind patterns, combined with the visual impact potential noise issues and lack of space to locate a wind turbine on the site it is not possible to generate large amounts of energy from the wind turbines at the development.

Although small scale wind turbines (<1 kW) can be sited on the roofs of buildings the low wind regime (around 4 m/s) means energy Yields would be low (around 1 MWh per turbine). Additionally the densely built nature of the area is likely to cause turbulent wind conditions, further reducing energy yields and causing accelerated wear to the turbines.

Further problems arise due to the potential visual impact of roof mounted turbines and potential structural vibration. The inclusion of small scale wind turbines in the Development would impact on the conservation agenda of the surrounding area in an unacceptable manner.

For this reason small scale wind turbines are not considered further for any element of the Development

Solar Photovoltaic cells

Solar photovoltaic (PV) cells transform the photons within sunlight into useful electrical energy. They are made from semi-conductor material and can be integrated into the fabric of the building, as a roof covering or as glazing, or mounted on the building.

To achieve optimum electrical generation throughout the year, the PV arrays should be approximately south facing and inclined at an angle of 30 degrees to the horizontal. However, should planning restrictions prohibit this due to the visual impact, or the system selected directly replaces a roofing element, the PV system can be laid flat. However, this results in a reduction in the efficiency of the system. It is therefore considered appropriate that roof mounted panels inclined at an angle will be considered for this development.

PV systems require little maintenance. Regular inspection of the PV arrays for damage or dirt and annual servicing of inverters and electric controls is required. PV is ideally suited to residential applications due to its low maintenance requirement and visibility. It is however usually more expensive than other forms of renewable electricity generation.

The PV array system considered at this stage is the Sharp NE-Q5E2E Polycrystalline stand-alone panel system. The modules would be within a standard frame attached to the roof, not as an building integrated system. Dimensions are 0.826m x 1.575m, giving an area of 1.30 m^2 per panel. This area provides 165Wp per panel, equal to 127 Wp/ m^2. Annual output of the UK is estimated to be equal to 750 kWh/kWp. Therefore panel annual output is 124 kWh per unit or, by area, 95 kWh/ m^2.

The roof areas will have space where PV cells can be collected. With approximately 160 m^2 available to locate PV arrays at a density of 50% of the roof area to ensure no overshadowing (thereby allowing 75 m^2 of PV array to be located on the roof), the total energy generated would be in the region of 7,125 MWh per annum, equating to a CO_2 reduction of 3.06 tonnes.

Although, this system will yield a reduction in overall CO_2 emissions, unfortunately, it will not meet the target and therefore will not be considered as an appropriate choice.

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Solar Thermal Collectors

A solar thermal collector system provides hot water by using the energy present in sunlight to heat a collector, this energy is then transferred to a circulating fluid and used to heat hot water.

There are two types of solar thermal collector. The lowest cost type, flat plate collectors, must be mounted at 30 degrees to the horizontal, usually on roof mounted A-frames. This type of collector produces around 250 kWh/ m^2 /annum. A 20 m^2 system would produce around 1,000 litres per day during summer. However, such a system would be visible and potentially visually intrusive.

A vacuum tube system can be mounted on any surface with a south facing aspect, including walls, although they will operate at a lower efficiency when vertically mounted. These collectors are more efficient than the flat plate type, typically producing up to 550 kWh/ m^2 /annum for small systems and in excess of 600 kWh/m^2/annum for large scale systems when they are orientated approximately south facing and inclined at an angle of 30 degrees to the horizontal.

Solar thermal collectors generate the highest volume of hot water in the summer months, due to the longer daylight hours and more intense insolation.

Solar thermal systems require little maintenance. Regular inspection and servicing are required including checks to: the collector glazing for damage or dirt; electric controls and temperature sensors; pump sets. This is over and above maintenance required in addition to the maintenance requirements of a gas fired boiler installation.

Solar thermal collectors can generate between 40% and 50% of annual domestic hot water needs and can therefore meet the 10% requirement associated with the residential element of the development. The system proposed will be arranged such that the inclusion of solar thermal collector systems to meet part of the hot water requirements does not obviate the need for another hot water generating system, since the winter hot water demand will only be partially met by the solar thermal collectors.

Using the following assumptions, the energy output of a system can be calculated-.

Assume

550 kWh/ m^2 /annum output and seasonal efficiency of 0.9.

A 80 m^2 system produces a CO_2 saving of in excess of 7.524 tonnes when compared against a gas fired hot water system. This size system would require approximately 160 m^2 of roof area, which is available on the roof of the building.

Therefore, the incorporation of a 80 m^2 evacuated tube solar thermal tube collector system will exceed total reduction in CO_2 emissions targets associated with the development.

A system of this size is likely to cost in the region of £86,750 for collectors, pumps and storage tank. There is additionally a space requirement for the additional storage tanks located in the lower ground floor.

Although, such a system would require centralised boiler plant from which the hot water is fed to the apartments. This would in turn require metering, and subsequently billing of the heat supplied and maintenance of the plant However, it is unlikely in a development of this size that the responsibility of metering and billing for heat to domestic premises will be attractive to the client unless the system could be reconfigured to address these issues. This can be considered at at detailed development stage.

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Alternatively, there exists the opportunity to incorporate solar thermal collectors which each serve individual apartments. Therefore, should all apartments be provided with a dedicated solar thermal collectors panel at roof level linked directly to the hot water cylinders within each apartment, up to 50% of the annual hot water demands can be met

Assuming the following conditions apply:

6 No. 1 bedroom apartments - 4 m^2 solar thermal collector each
6 No. 2 bedroom apartments - 5 m^2 solar thermal collector each
1 No. 3 bedroom apartments - 6 m^2 solar thermal collector each
1 No. 4 bedroom apartment – 7 m^2 solar thermal collector each

Therefore 20 No. 2 m^2 and 9 No. 3 m^2 evacuated tube collectors gives a total approximate area of 67 m^2, with an output of approximately 550 kWh/ m^2 /annum results carbon dioxide emission reduction in the region of 6.301 tonnes per annum.

The cost of a 2 m^2 solar thermal collector system is approximately £4,000 including the cylinder. The cost of a 3 m^2 solar thermal collector system, including cylinder is approximately £5,000. Therefore the approximate cost of the total solar thermal collectors and cylinders for the development is £95,000..

With this system, there will be a M and E servicing impact on the roof. All the individual units will be served by service risers linking to the panels and this will affect the internal layouts.

Supplying energy efficiently

This section outlines how energy is supplied efficiently to the elements of the Development in line with the Mayor's Energy Hierarchy.

Natural gas fired condensing boilers will be provided to individual units of the development.

Heating will also be provided to common areas of the refurbishment through the incorporation of a solar PVs or solar thermal collectors as described previously. This low grade heating circuit will be kept separate from the boiler circuit to allow operation at lower, more efficient temperatures, A buffer vessel will be incorporated into this circuit to even out load and minimise frequent start / stop operation of the heat pumps.

All plant operations will be automated and will be programmed to function so as minimise energy use and CO_2 emissions. To this end, the heat pumps will be prioritised over the boilers.

Conclusions

The following section summarises the energy strategy for the elements of the Development to meet the Mayor of London's Energy strategy and London Borough of Camden's UDP policy requirements.

The solution which will be adopted to provide the required 20% reduction in CO_2 emissions and 20% energy generation through the incorporation of renewable energy technologies is the incorporation of roof mounted solar thermal collectors systems. This equates to approximately 80 m^2 of solar thermal collector area and twice this area is required on the roof for mounting to ensure that overshadowing issues are addressed.

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This solution was selected for the following reasons:

1. It is the most cost effective and efficient solution
2. The energy output achieved the 20% reduction target
3. The area required on the roof is significantly less than a solar PV solution
4. There are methodologies using existing technology to address the issues of metering and billing.

5 CHANCE STREET, LONDON E1 6JT T: 0207 729 9348 F: 0207 729 8818