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Energy Statement

Pouparts Yard &
Land R/o 84a Hampton Rd,
Twickenham

JC Properties

April 2009

Revision 2

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Development site:	Pouparts Yard & Land R/o 84a Hampton Road, Twickenham
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Executive Summary

NHBC Services Ltd has been asked by Stuart Mead Associates on behalf of JC Properties to prepare an Energy Statement for its proposed development of 9 residential units and office accommodation at Pouparts Yard and Land R/o 84a Hampton Road, Twickenham. The Energy Statement is required to address the planning requirement to reduce the CO_2 emissions from the development through the use of renewable energy technology. Revision 2 addresses the CO_2 emissions reduction target of 20%, revised from the 10% reduction target addressed in previous versions of this Energy Statement.

The calculated base-case CO_2 emissions for the development are 29,007 $kgCO_2$/year. Therefore the 20% CO_2 emissions reduction target requires 5,801 $kgCO_2$/year to be 'avoided' through the use of renewable energy technology.

Taking into account the nature and location of the site and the details provided for the proposed development, the most suitable renewable energy technology solution has been chosen as a combination of Solar Thermal and Photovoltaic panels integrated into the roof.

An installed panel area of approximately $25m^2$ of Solar Thermal panels and $56m^2$ of Photovoltaic panels has been proposed. This combination will contribute to hot water provision for upper floor flats (solar thermal) and electricity demand for both dwellings and office space by feeding into the landlord's supply (photovoltaic), equating to 100% of required CO_2 emissions reduction.

1 Introduction

NHBC Services Ltd has been asked by Stuart Mead Associates on behalf of JC Properties to prepare an Energy Statement for the proposed development of 9 residential units and office accommodation at Pouparts Yard and Land R/o 84a Hampton Road, Twickenham.

1.1 Requirement

The Energy Statement is required to address item 5.1 of the London Borough of Richmond upon Thames' Sustainable Construction Checklist:

"Reduce predicted site CO2 emissions by at least 20% through the use of on site renewable energy" (2008 revision)

The Checklist details that:

1. Carbon emissions from the total energy needs (heat and power) of the development should be reduced by at least 20% by the on site generation of renewable energy. The following approach should be adopted:
   - Calculate predicted electricity and heat demand for the site (kWh)
   - Convert energy demand (kWh) to carbon dioxide emissions (CO2)
   - Identify renewable energy technologies that are suitable for the site
   - Calculate level of carbon dioxide emissions offset through use of renewable energy technology (should be at least 20% to comply with policy)
2. All external lighting is to be solar-powered, wherever possible.

1.2 Methodology

To prepare this energy statement, the characteristics of the development site and design have been considered. NHER Plan Assessor software has been used to calculate the predicted baseline energy performance of the proposed design/specification and the options for improving energy efficiency for the housing. The baseline for the office element has been established using benchmark figures given in CIBSE Guide F. From this data, the amount of renewable energy required for the development to satisfy the target has been determined.

The calculations and considerations are based on the information provided by the design team, and as previously submitted to the Planning Portal – site plan, floor plans, elevations, sustainability statement and EcoHomes pre-assessment report.

It is also noted that the Sustainability Statement states the development is predicted to achieve EcoHomes Excellent and/or Code for Sustainable Homes level 4.

1.3 Site Analysis

The site is in a residential suburban setting, located on an infill site to the rear of the existing 84a Hampton Rd, Twickenham. It is a broadly level site surrounded on all sides by existing buildings, predominantly two-storey housing to the South and industrial units to the North. The proposed development comprises nine one- and two-bedroom flats plus approximately 193m^2 net lettable area of office accommodation located in a single three storey block, with basement. The building has been designed

to compliment the architectural character of the area. There are small private amenity spaces for some dwellings to the front and rear of the block.

In keeping with the layout and orientation of the surrounding buildings, the proposed building is oriented South/Southeast (rear elevation) to North/Northwest (front elevation) and has a medium pitched roof line with hips and mansard slopes to the top storey.

The site is constrained with access by means of a right of way off Third Cross Road. Basement car parking is to be provided accessed by means of a car lift from the ground floor.

Trees along the existing southeast boundary between the development site and 84a Hampton Road are to be removed and replaced with newly planted trees of a smaller more suitable garden species. This will improve the suitability of the site for solar renewables as the overshading risk from the trees will be removed.

There are no watercourses running through or adjacent the site.

The mean annual windspeed for this location at 10m above ground level is 4.6m/s (source: DTI wind speed database – NOABL). Actual wind resource will be affected by the surrounding topography, in particular the proximity of trees and neighbouring buildings will 'spoil' the wind negatively affecting its local speed and increasing turbulence.

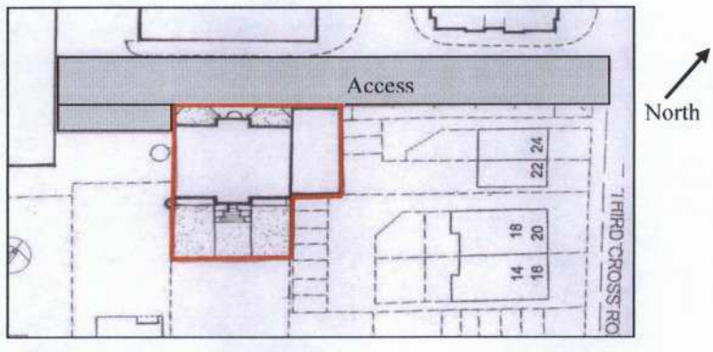

Figure 1: Proposed site plan

2 Energy Requirements

The Standard Assessment Procedure (SAP) 2005 calculates the heating, hot water and lighting consumption for a modelled dwelling. The National Home Energy Rating (NHER) methodology takes into account the dwelling location and includes a calculation of energy consumption of appliances and cooking. Energy demand for the dwellings has been determined from calculations for the proposed development using the NHER Plan Assessor software and the worksheet calculations applied through (SAP) 2005 formulae.

Energy demand for the offices has been based on the 'natural ventilated, cellular' best-practice benchmark figures given in CIBSE Guide F (2nd Edition January 2004). Furthermore a 15% improvement factor has also been applied to the heating element to bring the benchmark in line with the requirement of Approved Document L2a 2006.

2.1 Base Case Energy Demand

Calculations have been undertaken to establish the notional energy demand and related CO_2 emissions for the development, before application of renewable technologies.

The specification for this 'base case' takes into account the following details given in the Sustainability Statement and EcoHomes pre-assessment:

- The development is to be 'gas-free'
- average Heat Loss Parameter (HLP) to be less than 1.10
- combined heat pump and air to air heat exchanger to provide heating and ventilation to each flat and the office building. *Note: Air source heat pumps are not classified as renewable energy technology by the GLA.*

For the dwellings, compliance with the requirements of Part L1a (2006) of the Building Regulations has also been specifically considered. The predicted 'base case' energy demand for the development is as follows:

Figure 2. – 'Base Case' Energy Demand

	Fuel	Energy Consumption (kWh/year)
Offices(naturally ventilated, cellular)		
Heating	Electricity	9,283
Lighting & Equipment	Electricity	10,160
Dwellings		
Space Heating, Hot Water & Ventilation	Electricity	23,089
Cooking, Appliances & Lighting	Electricity	26,204
Whole Development	Gas	0
Total demand (kWh/year)		**68,736**

Note: the proposed average HLP for the residential units can be achieved with the following design specification:

- Ground/Exposed Upper Floor U-value – 0.15 W/m^{2}K
- External/Heat Loss Wall U-value – 0.23 W/m^{2}K
- Roof/ceilings U-value – 0.15 W/m^{2}K
- Windows U-value – 1.4 W/m^{2}K
- Air Permeability Rate - 5m^3/hm^2 (@50Pa)
- Ventilation - SAP Appendix Q MVHR system (SFP 0.95, efficiency 90%)
- Designed and built to 'Accredited Construction Details'

2.2 Base Case CO_2 Emissions

The predicted 'base case' CO_2 emissions for the development have been calculated by converting the Energy Demand above into $kgCO_2$ using the conversion factor for electricity taken from Table 12 of SAP 2005, i.e. 0.422 $kgCO_2$ / kWh. As the base case is wholly electric, no gas conversion factor needs to be applied.

The predicted 'Base Case' CO_2 emissions for the development are **29,007 $kgCO_2$/year**.

2.3 Target CO_2 Reduction

The 20% CO_2 emissions reduction target for the development requires that 5,801 $kgCO_2$/year is 'avoided' through renewable energy contributions.

As the renewable energy contributions for this development are offsetting electricity, this reduction of **5,801 $kgCO_2$/year** equates to a saving of 13,747 kWh/year of electricity.

3 Renewable Energy Assessment

The site is a small site with limited viable options for incorporating renewable energy. The technologies considered focus on those suitable for application on a small/ individual building scale.

Technology	Class*	Feasible	Reason	Comment
Solar water heating	RE	Yes	Technology developed and readily available for building integration. Suitable for use for individual dwellings. Suitable roof area, slope & orientation can be accommodated on this development to make this technology viable.	Dependent on the final location of the solar panels on the south-east facing roof, some shading by other roof features (notably ventilation chimneys) may occur. Routing of solar thermal piping through to the flats at lower levels needs to be fully considered in the detailed system design.
Photovoltaic	RE	Yes	As for solar water heating	As for solar water heating. Shading can be a more significant factor for PV compared with solar hot water, however the PV can be fed into the 'Landlord's supply' thus requiring less inverter/metering infrastructure.
Ground source heat pump	LC/RE	No	Restricted site with limited space suitable for installation of a heat collection loop(s).	(Not strictly renewable but classified as such in GLA renewables toolkit).
Building Integrated Wind Turbines	RE	No	Wind speed too low exacerbated by 'wind spoiling' features, e.g. trees and adjacent buildings.	Feedback from early installations of small building mounted wind turbines indicates that their performance is unsatisfactory.
Biomass boilers	RE	No	Technically possible but a suitably sized plant room and wood pellet storage would be required. A biomass boiler system would be suitable if a communal heating and hot water system was provided for the whole building.	Space required for boiler and fuel storage. Management issues regarding boiler operation and fuel supply – the development is not considered to be large enough to support this.
Micro hydro	RE	No	No watercourse on site – requires site with watercourse with high head or high flow.	
Fuel cells	LC	No	Reliable technology not available – still in early stage of development for domestic application.	
CHP – e.g. biomass fired	LC/RE	No	Development is too small to support this technology.	Commercial and technical viability of mini and micro CHP plant not yet proven.

* LC = low carbon; RE = renewable/zero carbon

3.1 Renewable Energy Requirement

Due to familiarity with the technology and acceptability for potential purchasers, the preferred renewable technology choice for this development is solar. The following table shows the respective area requirements for a solar thermal system and a solar PV system to achieve the 20% renewables contribution.

Technology	System requirements
Solar water heating	Area of flat plate collector panels required for solar thermal system to yield 13,747 kWh/year (saving 5,801kgCO_2/year) is approximately 36m^2 active absorber area, requiring an overall panel area of approximately 40m^2. *(based on realisable output of approx 375 kWh/m^2 absorber area/year and an active absorber to overall panel area ratio of 0.9)*
Photovoltaic panels	Area of PV system using monocrystalline panels required to yield 13,747 kWh/year (saving 5,801kgCO_2/year) is approximately 128m^2 at 30° tilt, Southeast/Southwest orientation *(based on size and output information from DTI's 'Photovoltaics in Buildings – a design guide' first published in 1999. i.e. for the London area, a reasonably positioned, efficient monocrystalline PV array will generate approx 107kWh/m^2/year.)*
Combination of Solar water heating and photovoltaic panels	To achieve the required 13,747 kWh/year (saving 5,801kgCO_2/year) using a combination of solar water heating and photovoltaic panels requires approximately 25m^2 of reasonably efficient flat plate collectors and approximately 50m^2 of monocrystalline PV panels.

Note, above sizes are indicative as actual installed size will be dependent on the chosen manufacturers system – both in terms of efficiency and standard sizes available. If significant shading is encountered from other roof features, the panel areas given above will need to be increased to provide the same solar energy yield.

3.2 Solar thermal water heating

Solar thermal water heating is a reliable and proven technology that is highly suited to building integrated application for individual buildings and upper floor flats. The preferred location for solar thermal panels on this development is on the pitched roof on the South facing elevation.

To meet the renewable energy contribution requirements for this development by solar water heating alone would have an installed cost of approximately £45,000, for a total installed flat plate solar collector area of approximately 40m^2 with individual systems serving each flat.

However for a four storey building due consideration needs to be given to the challenges and space requirements for routing solar thermal pipework from the flat plate solar collectors through to the individual flats, and the potential loss of efficiency from long pipe runs.

Additional Considerations for detailed design/installation:

The solar thermal system will need to be designed such that the hot water cylinder(s) and solar panel(s) are compatible to ensure cost effective and efficient operation. A certified supplier/installer should be used to assist with detailed design/installation – as per the government's Low Carbon Buildings Programme and the Microgeneration Certification Scheme.

Operating instructions and maintenance recommendations should be provided to homeowners in the homeowner's pack.

3.3 Solar Photovoltaic (PV)

Solar PV is a reliable and proven technology that is highly suited to roof integration on buildings with a suitable roof pitch and orientation. It offers an advantage in terms of ease of installation for a multi-storey flatted development when compared to solar hot water, as the PV system can be connected to feed the landlords supply rather than having to be distributed to feed the individual residential properties. This can considerably reduce the complexity and cost of wiring installation, inverters and net metering compared to supplying individual systems to each flat.

The preferred location for solar thermal panels on this development is on the pitched roof on the South facing elevation.

To meet the renewable energy contribution requirements for this development by PV alone would have an installed cost of approximately £80,000, applying rules of thumb for monocrystalline PV of $8m^2$ panel area per kWpeak and £5,000 installed cost per kWpeak to the required $128m^2$ PV area.

As a rule of thumb installed cost of £5000 per kWpeak, occupying an area of 8, an approximate installed cost for a PV solution for this development is £80,000.

Additional Considerations for detailed design/installation:

Detailed design of the PV system should be carried out in conjunction with the selected specialist supplier. A certified supplier/installer should be used as per the government's Low Carbon Buildings Programme and the Microgeneration Certification Scheme.

Operating instructions and maintenance recommendations should be provided to homeowners in the homeowner's pack.

3.4 Preferred Renewable technology solution

Due to the potential problems associated with providing solar thermal water heating to lower floor flats on a four storey development, the most suitable renewable energy technology solution has been chosen as a combination of solar thermal water heating to serve the upper floor flats and PV electricity generation to feed into the landlord's supply offsetting electricity use in both dwellings and office space. The flat plate solar thermal panels and the PV panels will be integrated into the south-facing pitched roof.

An installed panel area of approximately $25m^2$ of Solar Thermal panels and $56m^2$ of Photovoltaic panels will satisfy the renewable energy contribution required for this development. The approximate installed cost for this solution will be £60,000.

The final CO_2 reduction required and resulting plant sizing will be fine-tuned at detailed design stage when the energy calculations are finalised for building control approval.

4 Further Guidance

NHBC Guide to Renewable Energy. NHBC, May 2007

Low Carbon Buildings Programme, Phase 2
http://www.lowcarbonbuildingsphase2.org.uk/

Solar Trade Association http://www.greenenergy.org.uk/sta/index.html