Trustees of the Standen Estate

Land South of Clitheroe

Energy Statement Report

October 2012

AMEC Environment & Infrastructure UK Limited

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Report for

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Document Revisions

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1	Draft to Client	29 May 2012
2	Final	October 2012

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1. Introduction

1.1 Purpose of Report

This report provides a preliminary assessment of the projected energy demand associated with the proposed development and how compliance with relevant local planning policies in relation to on site energy generation can be ensured.

While the number of dwellings and other buildings has been outlined in the masterplan, the precise mix and number of dwelling types has not yet been finalised. As such, this assessment is subject to a significant degree of uncertainty. It is intended that these details should be revised accordingly as details emerge during progression of the development.

1.2 Site and Surroundings

The location of the proposed development is centred on National Grid Reference (NGR) SD374850 440689. The site has been identified as a Strategic Site within the Submission Version of the Draft Core Strategy (A Local Plan for Ribble Valley).

The site comprises an area of land of 50.1 ha located directly adjacent to the southern eastern boundary of Clitheroe together with a further 13.4 ha to accommodate changes to the local road network.

The site boundary to the northeast is formed by hedgerows with trees bordering Pendle Road and then follows a south-westerly route that is defined by a hedgerow with trees dividing agricultural fields. Beyond the fields to the south is the Worston Old Road minor road, with the A59 further beyond. The southern boundary then follows the edge of woodland which surrounds Standen Hall and its associated grounds to the south, before tracking the route of Pendleton Brook, a small tributary of the River Ribble, north-westwards towards the Dent Plant Hire Depot off Whalley Road (A671) to the west.

Two public rights of way (PRoW) cross the site, towards the western and eastern boundaries respectively, and Ordnance Survey maps show the course of a Roman road traversing the site in a northeast-southwest direction.

1.3 Proposed Development Details

The proposed development would predominantly comprise residential properties (up to a total of 1,040 dwellings), with some business uses proposed towards the north-eastern part of the site. It is also proposed to include public open space and amenity areas, as well as land for a primary school, if required, within the site. Residential living space for retired people and community facilities are also included in the masterplan. Whilst the site layout has yet to be finalised, a preliminary masterplan has been produced (see Appendix A) which shows the potential layout of the development.

1.4 Planning Requirements

In meeting the requirements of Policy G1 of the Ribble Valley Districtwide Local Plan, a minimum of 10% of the energy demand of the proposed development should be supplied via on-site generation. Key Statement EN3 (Sustainable Development and Climate Change) of the Ribble Valley Core Strategy states the following:

> *"All development should optimise energy efficiency by using new technologies and minimising the use of energy through appropriate design, layout, material and landscaping...*
>
> *On larger schemes, planning permission will only be granted for developments on sites that deliver a proportion of renewable or low carbon energy on site based on targets elaborated within the relevant Development Management policy and also incorporate recycled or reclaimed materials or minimise the use of energy by using energy efficiency solutions and technologies."*
>
> *Key Statement DME5 (Renewable Energy) states that ..."on all residential developments of 10 or more units [that] at least 10% of their predicted energy requirements should come from decentralised and renewable or low carbon sources unless the applicant can demonstrate that this is not feasible or viable."*

At this stage no further guidance has been provided in terms of the nature of such on-site generation and any exclusions that might apply.

It is presumed that passive design techniques will be used within the development as a means of reducing as far as practicable the energy requirements of the site. In considering such energy requirements only those technologies best suited to the site will be considered; further details are provided in Section3.

2. Projected Baseline Energy Demand

2.1 Methodology

An indicative mix of dwelling types and business units has been used to calculate a projected baseline energy demand for the development. Energy demand for each dwelling type and business unit has been estimated using the SAP (Standard Assessment Protocol) methodology, as per SAP 2009 v9.90[1]. It is noted that these figures do not constitute a formal SAP assessment of the proposed development. Rather the numbers here are generated as a guide to the likely order of magnitude of energy demand that will be output from future calculations carried out in line with building regulation requirements. The formal calculations, with full access to all relevant construction details, will therefore represent a further iteration of this process when carried out at a later date.

The baseline energy demand, estimated in line with the requirements of ADL 2010[2], is summarised in Table 2.1.

Table 2.1 Proposed Site Projected Baseline Energy Demand

All Dwellings	Units of Measurement	Electricity	Non-Electrical Heat	Total (All Fuel Sources)
Total Energy Demand	MWh/yr	4,139	10,167	14,306
of which:				
Residential	MWh/yr	4,065	9,954	14,019
Non-residential	MWh/yr	74	213	287
Associated Carbon Emissions	tCO_{2e}/yr	2,140	2,013	4,153
of which:				
Residential	tCO_{2e}/yr	2,102	1,971	4,073
Non-residential	tCO_{2e}/yr	38	42	80

To generate the baseline energy demand figures a number of working assumptions have been made, primarily:

1. Mains gas is available for supply to the site. Primary heating is therefore provided via mains gas fuelled systems; and

[1] http://www.bre.co.uk/filelibrary/SAP/2009/SAP-2009_9-90.pdf (Accessed March 2012)

[2] http://www.planningportal.gov.uk/uploads/br/AD_L1A_wm.pdf (Accessed March 2012)

2. In calculating hot water demand it is assumed that all dwellings will be designed to achieve a water target of not more than 125 L per person per day (all water use, hot and cold). This reduces baseline hot water demand by 5%.

The target requirement for compliance is therefore 10% of the total energy demand baseline, equivalent to approximately 1,431 MWh/yr from renewable sources.

3. Technology Options

At this stage it is assumed that there are no restrictions in terms of the technologies that could be used in on-site energy generation to fulfil planning policy requirements. This will be clarified with the Borough Council as the development proposal progresses.

This section provides an overview of the technologies that could therefore be considered in meeting the on-site energy generation needs.

3.1 Technologies for Electricity Generation

3.1.1 Solar Photovoltaics (Solar PV)

Photovoltaic panels (Solar PV) convert sunlight into electricity. A well oriented 1 kWp PV system (facing ~ due south and mounted at an angle of ~ 30 ° to the horizontal) will generate approximately 800 kWh per year. Mounting PV arrays at less favourable angles will reduce output; however, there are a range of positions (from South East to South West) that achieve greater than 90% of the available peak output. Arrays which experience significant shading will also have their output reduced and this needs to be considered at site design stage to maximise the potential for Solar PV provision.

An initial estimate suggests that if well orientated unshaded Solar PV arrays were installed on every building across the proposed development then the resultant generation capacity would be in excess of the 10% figure required for the site.

Whilst Solar PV arrays remain a more expensive option than other technologies it is noted that the availability of feed in tariffs (FITs) should be considered when costing any Solar PV installation. The developer, for example, could lease roof space from future occupants thereby maintaining ownership of the Solar PV arrays and therefore the FIT revenue accrued by those panels over the allotted 25 year period.

3.1.2 Small Scale Wind

Small scale turbines are typically rated at between 5 kW and 20 kW. They commonly have a hub height of *ca*. 15 m and a rotor diameter of 9 m. Indicative costs for these turbines are in the region of £3,000 per kW.

The constraints and buffer zones relating to existing infrastructure and their proximity to small scale turbines are similar to those applied for large scale developments. However, given the reduced noise levels in the case of the smaller turbines, buffers around noise receptors can be reduced from 350–450 m to 70–100 m. Similarly distance buffers for road, rail and overhead power lines remains topple distance, but the reduced height of the smaller turbines means that they can be situated much closer to these constraints than the larger turbines.

Surface conditions and site surroundings can have a larger effect on small scale wind turbines than larger ones. As air travels over local obstructions it becomes turbulent and requires a ‘recovery length’, which is typically a distance of *ca*. ten times the height of the obstacle.

3.2 Technology for Water Heating

3.2.1 Solar Water Heating

Solar thermal panels can be used to provide heating of hot water; systems consist of panels on the roof and a pre-heat store where water is warmed prior to being passed into the building's normal hot water system.

Systems are normally sized so that on a hot summer's day the hot water yield will meet 100% of the demand for the building. This means that on less sunny days the system will produce less hot water. A system sized in this way will typically meet around 50% of the building's hot water load.

Domestic hot water demand for each dwelling was estimated using SAP based calculations. A potential solar water heating system for each dwelling was then sized on the basis that around 50% of the total hot water demand could be met in each case, which is typical for a domestic system. The area of collector required in each case was then cross-checked with the estimated available roof area, in turn calculated from the floor area figures. It assumed that 25% of the total floor area of each flat is available as roof space; 50% in the case of houses.

3.3 Technology for Space and Water Heating

3.3.1 Biomass Boilers

Biomass is considered to be solid material of recent biogenic origin that is suitable for use as a feedstock for an energy raising process. Examples of such material include recycled wood, energy crops, fibrous biomass and waste derived fuel.

Individual boilers capable of feeding space and water heating systems are typically fed via either:

a) Chips – these are larger than pellets with a higher moisture content. While cheaper than pellets, their lower energy density means that they tend to be used for larger scale applications such as community scale heating or CHP; and

b) Pellets – smaller than chips, typically produced from sawdust these pellets have a lower moisture content and therefore higher energy density. While more expensive than chips, their more uniform, energy dense from makes them well suited to domestic scale boilers.

In the case of biomass boilers serving individual dwellings, these units are larger than their mains gas supplied counterparts and are therefore not suitable for small dwellings. There is, in addition, the need for fuel storage accommodation in the vicinity of the dwelling. For these reasons such systems are only considered viable in the larger dwellings, namely 3, 4 and 5 bedroom houses. It is assumed that the boilers can supply 90% of the heating requirement of each dwelling.

3.3.2 Combined Heat and Power (CHP) Generation

CHP generation describes a process by which both electricity and useful heat are generated. Typically fuel is burned and the heat energy produced from this is used to generate electricity, recovering energy that would otherwise have been wasted to the atmosphere.

The key issue for an effective CHP system is meeting the simultaneous demand for both electricity and heat. Given the seasonal and daily variations in heat demand, the ratio of electricity and heat demand will change continually throughout a 12 month period. The size and capacity of a CHP plant must therefore be carefully considered to ensure that it can meet the range of demand expected over the course of a year.

A standard grid connection is also required for any CHP plant in order to allow for electricity import during periods when demand is greater than supply and export in the event of more electricity being produced than is required by the development.

There are a number of different CHP technology options:

Combustion – This is the most established and proven technology option, where energy is recovered from combustion gases to generate steam, which in turn drives a turbine to generate electricity. This is only viable on a large scale above ca. 2 MW electrical output (2 MW_e).

ORC – For systems between 0.5 – 2 MW_e output, organic rankine cycle (ORC) devices (based on a conventional steam cycle but with a working fluid such as thermal oil rather than water) are generally more thermally efficient than steam based systems.

Other – Other options include indirect fired gas turbine systems and biomass gasification systems. While affording smaller module size (less than 0.5 MW_e), these are less mature technologies with fewer operational units to base model performance on. Given their smaller size a greater number of units would be required in comparison to the other two options outlined above.

CHP units can be fuelled via natural gas, biogas (generated from anaerobic digestion of organic waste) or biomass.

3.4 Excluded Technologies

Hydro electricity generation has also been ruled out on the proposed development site due to the lack of potential for a suitable run-of-the-river type scheme. Heat pumps (either Air Source Heat Pumps or Ground Source Heat Pumps) have also been excluded from the present assessment since they require electricity in order to operate. As such they aren't truly renewable energy sources unless the electrical demand is met via additional renewable energy sources (wind or solar PV notably).

3.5 Technology Appraisal Summary

As a preliminary assessment technologies installed at an individual building level have been considered. The working assumptions in each case are outlined here.

3.5.1 Solar Water Heating

Domestic hot water demand for each dwelling was estimated using SAP based calculations. A potential solar water heating system for each dwelling was then sized on the basis that around 50% of the total hot water demand could be met in each case, which is typical for a domestic system. The area of collector required in each case was then cross-checked with the estimated available roof area, in turn calculated from the floor area figures. It is assumed that 25% of the total floor area of each flat is available as roof space; 50% in the case of houses.

3.5.2 Solar PV

In this instance the annual energy output from such systems was calculated using a SAP based approach. This assumes both the orientation of the available roof space (preferably south facing) and the degree of overshading resulting from neighbouring buildings, trees etc. Similar working assumptions regarding available roof area were made in line with those in the solar water heating case. The combination of solar water heating and solar PV for each dwelling was sized so as to ensure that it did not exceed a total of 75% of the estimated available roof area.

3.5.3 Biomass Boilers

In the case of biomass boilers, these units are larger than their mains gas supplied counterparts and are therefore not suitable for small dwellings. There is, in addition, the need for fuel storage accommodation in the vicinity of the dwelling. For these reasons such systems are only considered viable in the larger dwellings, namely 3, 4 and 5 bedroom houses. It is assumed that the boilers can supply 90% of the heating requirement of each dwelling.

3.5.4 Analysis Results

The results of the analysis suggest that it is feasible to meet on site renewable energy generation targets using dwelling based technologies, as described above. While this does not preclude consideration of a centralised energy generation option this is not required for the purposes of meeting the energy generation target.

At this stage residential energy systems have sufficient potential to meet the target requirement for both residential and non-residential demand. As such there is a large flexibility in considering what, if any, energy supply systems should be installed along with any proposed non-residential development.

The amount of solar PV installed on dwellings can be minimised via the use of solar thermal and biomass boilers as primary technologies thereby reducing the overall costs associated with the installation of energy generation on site.

Further details regarding installation requirements can only be developed once the application has progressed to a point where there is a clear design brief. At this point there can also be a more informed design consideration given to any potential communal energy supply systems as opposed to individual technologies supplying each building.

Table 3.1 Demand Analysis Results

Estimated Potential Annual Energy Output and Indicative Install Costs			
Technology	**Estimated Potential Energy Generation Available (kWh/yr)**	**% of Total Site Energy Demand**	**Estimated Install Cost (£M)**
Solar Thermal	1,269	89%	£1.8
Solar PV	3,569	249%	£22.0
Biomass Boilers	4,341	303%	£14.2
All Technologies	**9,179**		**£38.0**

Appendix A
Outline Development Summary

2 Pages

Figure A.1 Development Site Summary

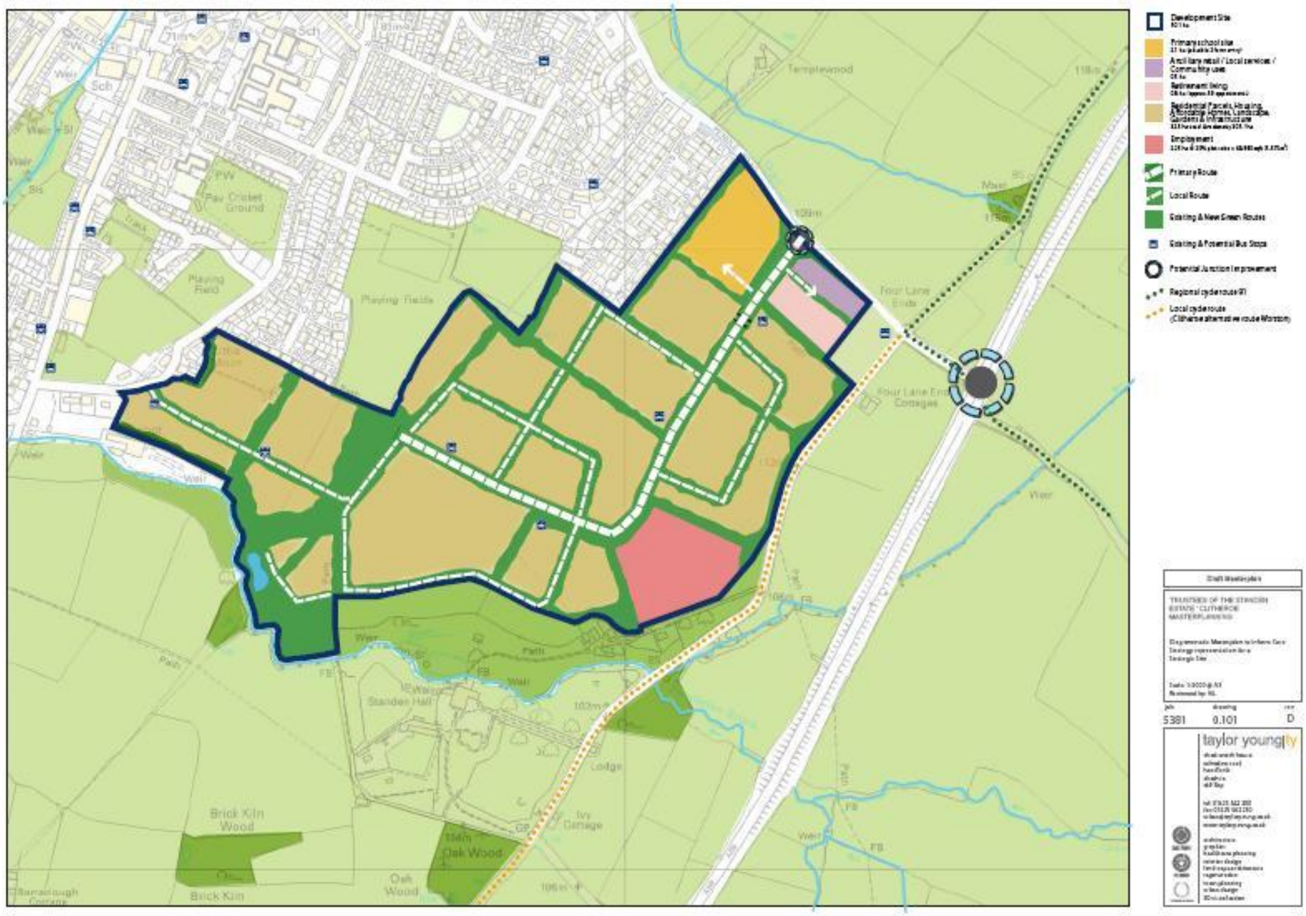

Table A.1 Outline Development Summary

Building Type	No. of Bedrooms	No. of Units	Floor Area/ Unit (m^2)
Flat	1	15	60
Flat	2	25	65
Flat	3	10	70
House	2	250	75
House	3	400	105
House	4	300	140
House	5	40	150
Primary School	NA	1	900
Light Industrial/ Offices	NA	6	5,575