CHeSS A&D

Site: 12 Scots Hill, Croxley Green, Rickmansworth

5% Carbon Reduction Report

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Introduction

This report has been prepared on behalf of *CHeSS AD* to demonstrate a 5% carbon reduction on site. The carbon reduction should be measured over Part L 2013 standards, the methodology for which is an assessment of the carbon footprint of each dwelling using the tool SAP 2012.

A 5% reduction in the annual carbon requirement of the development is to be met on site. The baseline for the carbon reduction is the TER (Target Emission Rate) associated with each dwelling based upon Part L1a 2013. This measurement of the TER ($kgCO^2/m^2$.year) expresses the maximum permissible carbon emissions associated with the dwelling type to comply with the Building Regulations.

A 5% reduction in the DER is a 5% carbon saving per dwelling. The DER (Dwelling Emission Rate) expresses the actual carbon footprint per dwelling type which must be an improvement over the TER, in this case by an average of 5%.

The Site

There is one plot on the site at 12 Scots Hill, Croxley Green, Rickmansworth. The plot is a detached dwelling

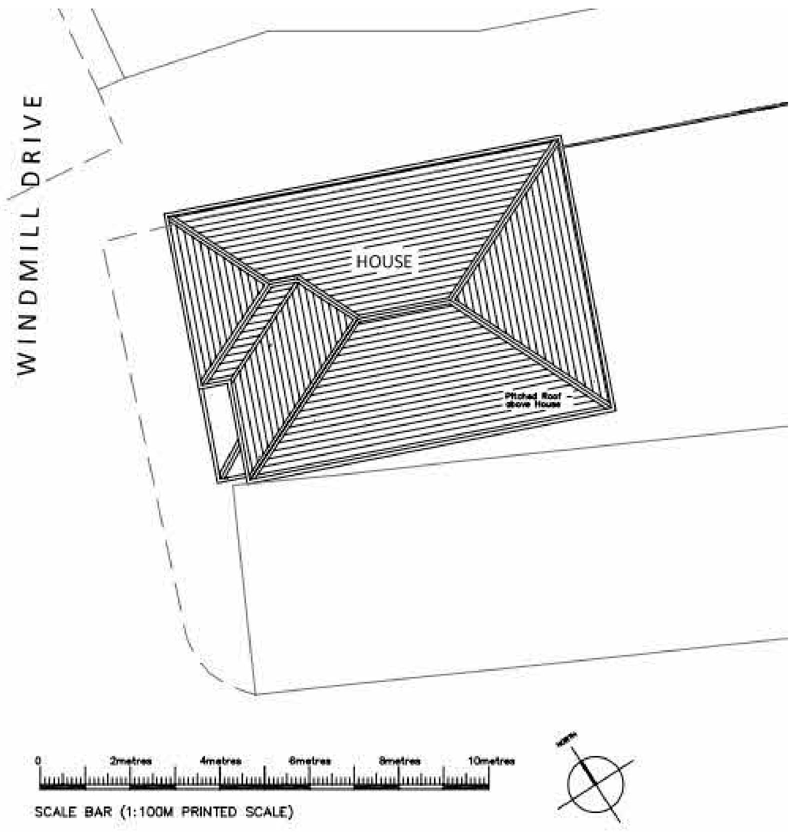


Figure 1 – Site plan

Table 1: Carbon Target

Dwelling	TER ($kgCO_2/m^2/yr$)
Plot 1	29.62

5% Carbon reduction calculation

The total Carbon footprint of the dwelling based upon the TER is 29.62kgCO_2/m^2/year. A 5% reduction would bring the actual carbon footprint of the dwelling to 28.14kgCO_2/m^2.year, meaning that a total of 1.48kg CO_2/m^2/year would need to be saved to achieve the reduction target.

Strategy to achieve 5% carbon reduction

To achieve the carbon reduction on site, a fabric first approach along with a renewable heating source is to be used.

As the main improvements will be built into the fabric this will ensure the reduction lasts for the lifetime of the dwelling as opposed to 'bolt on' technology often used to make a carbon or energy saving.

Low carbon strategies for the site also include enhanced building fabric e.g. limiting thermal bridge heat loss, energy efficient fixed building services including, low energy lighting and additional heating controls.

All the carbon reduction strategies are discussed in more details below.

1.Enhanced fabric specification

CHeSS A&D have proposed an enhanced fabric specification for the dwelling at Scots Hill which will exceed the requirements of the current building regulations. The external wall will be insulated with 90mm Full Fill PIR (k=0.022) to achieve a U-Value of 0.18Wm^2K., this is a 40% improvement over the maximum permissible external wall U value of 0.30Wm^2K.

Another area of significant enhancement is the ground floor which will have 150mm PIR board to achieve a U value of 0.12Wm^2K. This demonstrates a 52% improvement over the standard for a ground floor, currently required to achieve a maximum of 0.25Wm^2K.

2. Limiting thermal bridge heat loss

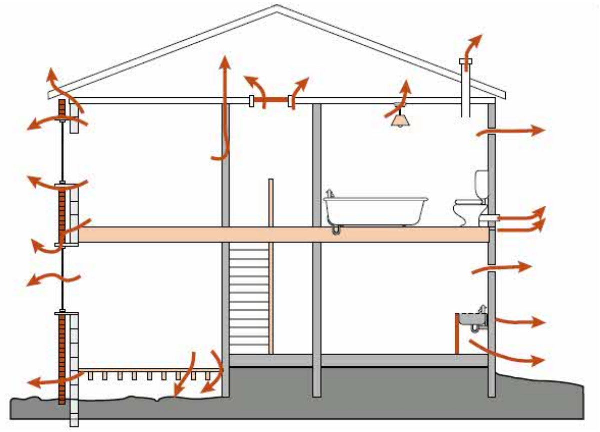
Thermal bridging occurs at junctions and is the heat loss associated between the internal and external environments. Examples include sill, jamb and lintel details around openings and junctions within the fabric such as corners, party wall abutment and intermediate floors.

These linear junctions can be measured, and a psi value (measure of heat loss) is applied to the length. With dwellings becoming more fabric efficient and with better U values and air tightness, the need to limit heat loss at thermal junctions is imperative, as a significant temperature change between elements can be detrimental to the building's functionality.

CHeSS A&D will build to calculated thermal details, which will limit the effect of thermal bridging through continuity of insulation and effective sealing at junctions.

3. Fabric air tightness

Good fabric air tightness would limit the heat loss from the dwelling, reducing the demand for space heating. Therefore, air tightness can indirectly lower carbon emissions and energy requirement.



For the dwelling at Scots Hill, a design air permeability figure of $4m^3/hm^2$ has been used in the SAP calculations. This is a considerable improvement over the baseline set out in Part L 2013 (a maximum design figure of 10 m^3/hm^2).

4. Low energy lighting

Dedicated low energy lighting using energy saving light bulbs reduces the electricity needed for lighting by up to 80%. This produces less carbon dioxide from energy consumption. The houses on site will be fitted with 100% dedicated low energy lighting. Guidance from Approved Document Part L1a 2013 suggests a minimum of 75%.

Therefore, by making all light fittings within the dwelling energy efficient will primarily reduce significant amounts of carbon and is an improvement over the current Building Regulations.

5. Heating systems and controls

The chosen heating system and heating controls within a property will have a large impact on the emissions expelled into the environment. An Air Source Heat Pump with a hot water cylinder will be installed. that are energy efficient and will ensure suitable heating controls are also installed to help achieve the 5% carbon reduction**.**

Air Source Heat Pumps work by extracting heat from the air itself. The process works similar to a refrigeration technology in that heat is extracted from a source – the outside. Heat is drawn into a heat exchanger where the useable temperature can be used to heat up air or water.

Any unwanted air is then sent back out to the external environment. As temperatures in the UK drop during winter months, heat pump technology has been tested to still work in temperatures at -15 Degrees Celsius as some heat is still extracted.

The efficiency of an ASHP is measured in coefficient of performance (CoP). The CoP figure identifies how much heat the pump can generate for each unit of power it receives. For example, if an ASHP has a CoP of 3, this means 3 units of heat can be generated per one unit of electricity. Typically, air source heat pumps have a CoP between 2.4 and 4.

Time and temperature zone controls divide the dwelling into two separate heating zones that are independently programmed (e.g. ground floor and first floor may be timed separately) according to occupation so that only the parts of the dwelling that are used are heated. This helps to save on fuel bills and carbon emissions as certain areas of the house are not heated unnecessarily.

Evaluation of carbon reduction

Through the proposed construction specification including carbon lowering strategies, a reduction of 9.88kgCO_2/m^2/year would be achieved (shown below). This represents a total carbon saving of 33.4% for the development.

Table 2: Carbon saving

Dwelling	DER(kgCO_2/m^2/yr)
Plot 1	19.74

Summary

This report details the low carbon strategies for Scots Hill to achieve the 5% carbon reduction required as part of the planning conditions. In summary, the following will be used on the site to achieve a 33.4% carbon reduction:

- Enhanced fabric U values
- Limiting thermal bridge heat loss
- Fabric air tightness
- Energy efficient heating and controls

Appendix A – Construction Specification

External wall (Brick):

Brickwork
5-10mm Cavity
90-95mm Insulation (Kingspan K106, Unilin Cavitytherm CT/PIR or Celotex Thermaclass 21 K=0.021)

100mm Plasmor Aglite
Plasterboard on dabs

Plaster skim
U-Value = 0.18W/m^{2}K

External wall (Render):

Render

100mm Plasmor Aglite*

5-10mm Cavity
90-95mm Insulation (Kingspan K106, Unilin Cavitytherm CT/PIR or Celotex Thermaclass 21 K=0.021)

100mm Plasmor Aglite

Plasterboard on dabs
Plaster skim
U-Value = 0.18W/m^{2}K
**block suitability to be checked with render supplier/render type*

Ground floor:

Screed
150mm Insulation (K=0.022 Kingspan, Celotex, Unilin)
Plasmor Aglite beam and block or Solid Concrete
U-Value = 0.12W/m^{2}K

Plane roof:

250mm Mineral Wool K=0.040 over joists
200mm Mineral Wool K=0.040 between joists
12.5mm Plasterboard
Plaster skim
U-Value = 0.09W/m^{2}K

Doors:

To achieve **U-Value of 1.1W/m^{2}K**

Windows:

To achieve **U-Value of 1.3W/m^{2}K**
Double glazed, uPVC, g value of glazing = 0.63

Heating system:

Air Source Heat Pump to be installed
To underfloor heating & radiators
Daikin Altherma EDLA06 used in the calculations, please inform technical if an alternate boiler is to be used to confirm compliance

Heating controls:	Time and Temperature Zone Control
Hot water:	From cylinder – size, make and model to be confirmed. Cylinder to have:
Primary pipework insulated Cylinder stat	Water heating timed separately
And to be in heated space	
Showers (flow rate): From hot water cylinder	9 litres/min
Secondary heating:	None
Air pressure:	To achieve a design figure of $4.0m^3/hm^2$
Ventilation:	Natural with extract fans
Efficacy of all fixed lighting:	Minimum 80lm/W
Renewables:	None required
Thermal bridging:	Calculated in SAP 10 based on the use of independently assessed & Plasmor calculated junction details.
Lintels:	Keystone Hi-therm or equivalent thermally broken lintels throughout