

**SULBY STREET
MOSTON
MANCHESTER**

**ENVIRONMENTAL
STANDARDS STATEMENT**

PREPARED BY:



**21 ARGYLE STREET
BIRKENHEAD
WIRRAL CH41 1AD**

Tel: 0151 647 0857

Email : admin@psdltd.co.uk

Reference : CF/EF/2004_Issue 1

Date : March 2022

CONTENTS

SECTION 1	Executive Summary
SECTION 2	Introduction
SECTION 2.1	National Policy
SECTION 2.2	Local Planning Policy
SECTION 2.3	Building Regulations
SECTION 2.4	The Energy Hierarchy
SECTION 2.5	The Development
SECTION 3	Fabric Design Proposals
SECTION 4	Mechanical & Electrical Services
SECTION 4.1	Heating
SECTION 4.2	Hot Water
SECTION 4.3	Ventilation
SECTION 4.4	Lighting
SECTION 4.5	Water
SECTION 4.6	Photovoltaic (PV) System
SECTION 5	Renewable Technology
SECTION 5.1	Combined Heat & Power
SECTION 5.2	Solar Photovoltaic (PV) Systems
SECTION 5.3	Solar Thermal
SECTION 5.4	Wind Turbines
SECTION 5.5	Ground Source Heat Pumps
SECTION 5.6	Air Source Heat Pumps
SECTION 5.7	Bio Renewable Energy Sources
SECTION 5.8	Fuel Cells
SECTION 5.9	Rainwater Collection and Harvesting
SECTION 6	Summer Overheating
SECTION 7	Conclusion
APPENDIX 1	Floor plans
APPENDIX 2	SAP Results 2009
APPENDIX 3	SAP Results 2012

SECTION 1 **EXECUTIVE SUMMARY**

This report has been undertaken to review the alternative sources of energy to provide heat and power to the development and also to explore alternative renewable technologies that can be utilised to enhance the overall carbon footprint and energy consumption of the building.

The development is located in Sulby Street, Moston, Greater Manchester and is a mixture of eight townhouses and twelve one bedroom apartments giving a total of 20 dwellings.

The methodology for this report is to take a 'first fabric' approach as set out in Policy EN6 of Manchester city Council's Core Strategy, making improvements to the envelope first, reviewing the results due to these fabric improvements and then reviewing suitable technologies to enhance this design philosophy where feasible.

An analysis of the energy consumption of the buildings has been undertaken using SAP calculations for a sample number of town houses and apartments to provide an overall assessment.

This has been modelled to comply with the Building Regulations Part L1A 2013 (with 2016 amendments) for the apartments.

The overall concept for the mechanical and electrical services of the scheme follows on from the 'fabric first' approach.

Electric heating is to be provided by panel heaters with integral time clock and thermostats.

Hot water is to be provided by all electric immersion cylinders located within each town house and apartment, reducing the requirement for large communal storage and pumps etc.

Ventilation is provided by Mechanical Ventilation Heat Recovery system to each apartment which allow for recovering significant amounts of energy from warm exhaust air, again aiding in reducing CO2 emissions.

Lighting will be full LED low energy lighting throughout the development with appropriate controls.

The proposed fabric specification is described in Section 3.

SECTION 2 **INTRODUCTION**

This report has been undertaken to consider the alternative sources of energy that could be utilised on this new development in Sulby Street, Moston, Greater Manchester.

In order to comply with the Local Planning Policies, various strategies have been reviewed to provide the most economic and efficient system. The various planning policies are as follows.

2.1 National Policy

The National Planning Policy Framework (NPPF) was issued in March 2012 and states the need for local authority planning conditions to integrate the aims of a sustainable development. The policy also refers to the Government energy policies and objectives in relation to renewable energy setting out principles that local planning authorities should adhere to.

The Building Regulations Part L1A and L2A also will be complied with which relate to the conservation of fuel and power in dwellings and non-domestic buildings respectively.

2.2 Local Planning Policies

The locality of the development site means it falls under the jurisdiction of Manchester City Council. As such the policies adopted by Manchester City Council must be adhered to.

The document that details Manchester's strategy for development is 'Manchester's Local Development Framework – Core Strategy Development Plan Document'. The Core Strategy was adopted 11th July 2012.

The main policy relating to energy and sustainability that must be addressed for this particular development is Policy EN6: Target Framework for CO₂ reductions from low or zero carbon energy supplies

Policy EN6

Target Framework for CO₂ reductions from low or zero carbon energy supplies

Applications for residential development of 10 or more units and all other development over 1,000 sq m will be expected as a minimum to meet the target shown in Tables 12.1 or 12.2, unless this can be shown not to be viable.

This should be demonstrated through an energy statement, submitted as part of the Design and Access Statement.

Such a statement will be expected to set out the projected regulated energy demand and associated CO₂ emissions for all phases of the development.

Developments smaller than the above threshold, but involving the erection of a building or substantial improvement to an existing building will also be expected to meet the minimum target, where viable, but will not be expected to submit an energy statement.

The target framework relates to three broad development locations and their potential for low and zero carbon, decentralised energy. The areas are defined as follows:

- Target 1 Network development areas: Locations where the proximity of new and existing buildings, the mix of uses and density of development provide the right conditions to support district heating (and cooling).*

- *Target 2 Electricity intense areas: Locations where the predominant building type has an all electric fit-out such as retail units and leisure complexes.*

- *Target 3 MICRO-GENERATION AREAS: Locations where lower densities and a fragmented mix of uses tend to mean that only building scale solutions are practical.*

Domestic CO2 emission targets

Table 12.1

Target	% Minimum requirement
<i>Target 1: Network development area</i>	<i>CHP/district heating connection or where not feasible a 15% increase on Part L 2010</i>
<i>Target 2: Electricity intense buildings</i>	<i>+15% increase on Part L 2010</i>
<i>Target 3: Micro generation area</i>	<i>+15% increase on Part L 2010</i>

Table 12.2

Target	% Minimum requirement
<i>Target 1: Network development area</i>	<i>CHP/district heating connection or where not feasible a 15% increase on Part L 2010</i>
<i>Target 2: Electricity intense buildings (applies to commercial uses with a high proportion of emissions from electricity use (>45kgCO2/m2))</i>	<i>+15% increase on Part L 2010</i>
<i>Target 3: Micro generation area</i>	<i>+15% increase on Part L 2010</i>

Where the CO2 emissions reduction required under any future revision to Part L of the building regulations become greater than the ‘% minimum requirement’, the reduction required under building regulations would apply.

Where the Council identifies an ‘allowable solution’, for example within an energy proposals plan, that would produce higher carbon reductions at no extra cost than that of achieving the ‘% Minimum requirement’ (or required under building regulations if greater) the higher percentage reduction will be required. The cost comparison is based on the cost of incorporating the ‘allowable solution’ at design stage.

The energy statement will be required to be submitted at the outset of any proposed development (outline application or before). Developers will be permitted to use green infrastructure elements such as green roofs, green walls, street trees and waterways to contribute to compliance with CO2 mitigation, subject to the energy statement incorporating evidence such as modelling to demonstrate compliance.

The above policy states that this specific development requires a 15% betterment with CO2 emission reduction over 2010 Building Regulations. However, the development will be constructed to adhere to 2013 Building Regulations. 2013 Part L1A Building Regulations is widely recognised within the industry as being 6% better than 2010. Meaning that it is already more onerous to achieve just a Building Regulations pass.

2.3 Building Regulations

2.3.1 Part L1A

Approved document L1A – Conservation of fuel and Power sets the standard for carbon emissions for new dwellings and was revised last in April 2014 (Part L: 2013). Dwellings will need to comply with the criteria set out in the document, as follows:

- 1) The predicted Dwelling CO2 Emission Rate (DER) should not be greater than the Target CO2 Emission Rate (TER).
- 2) The performance of the building fabric and fixed building services should be no more than the design limits set out in Table 2 of the approved Document.
- 3) The dwelling will have appropriate passive control measures to limit the effect of solar gains on indoor temperatures in summer.
- 4) That the performance of dwellings as-built comply with DER values achieved, including site testing or a representative sample of dwellings, demonstrating that the 'air permeability' rate achieved is as per that specified, or better.
- 5) The necessary provisions for energy efficient operation of dwellings are put in place, including operation and maintenance instructions

Compliance with the Approved Document Part L1A should be demonstrated at detailed design stage, prior to construction in the detail design phase of the project.

2.3.2 Part F Ventilation

Building Regulations Part F 2013 states that all newly constructed dwellings are required to comply with the following criteria:-

- Criterion 1 – Extract ventilation to outside is required in each kitchen, utility room and bathroom. The extract can be either intermittent or continuously operating. The rate required are as shown in extracted (table 5.1a) below.
- Criterion 2 – The whole dwelling ventilation rate for the supply of air to the habitable room shall be no less than specified in the extracted (table 5.1a).
- Criterion 3 – Purge ventilation is required in each habitable room and should be capable of extracting a minimum of four air changes per hour (ach) per room directly to outside.

Table 5.1a Extract ventilation rates

Room	Intermittent extract	Continuous extract	
	Minimum rate	Minimum high rate	Minimum low rate
Kitchen	30 l/s adjacent to hob; or 60 l/s elsewhere	13 l/s	Total extract rate should be at least the whole dwelling ventilation rate given in Table 5.1b
Utility room	30 l/s	8 l/s	
Bathroom	15 l/s	8 l/s	
Sanitary accommodation	6 l/s	6 l/s	

Table 5.1b Whole dwelling ventilation rates

	Number of bedrooms in dwelling				
	1	2	3	4	5
Whole dwelling ventilation rate ^{a, b} (l/s)	13	17	21	25	29

Notes:

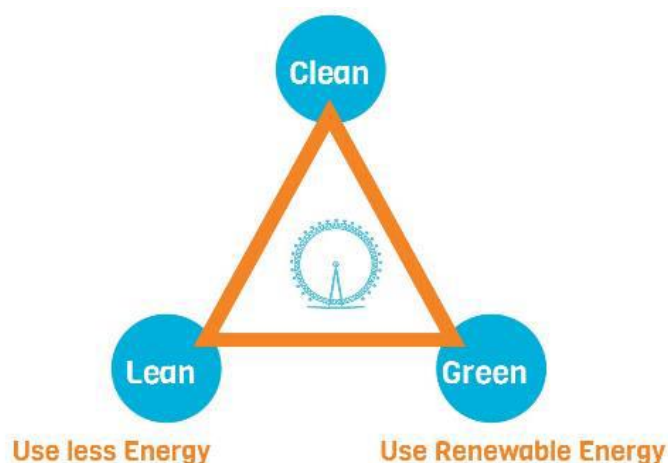
- a. In addition, the minimum ventilation rate should be not less than 0.3 l/s per m² of internal floor area. (This includes all floors, e.g. for a two-storey building add the ground and first floor areas.)
- b. This is based on two occupants in the main bedroom and a single occupant in all other bedrooms. This should be used as the default value. If a greater level of occupancy is expected add 4 l/s per occupant.

It is proposed that the ventilation strategy for each apartment will satisfy these requirements. The exact specification will be determined at detailed design stage. The whole house ventilation strategy with heat recovery will be adopted to ensure that the air quality and the noise levels at all times of the day are acceptable.

2.4 The Energy Hierarchy

The Carbon Strategy adopts a set of principles to guide design development and decisions regarding energy, balanced with the need to optimise environmental and economic benefits. The following hierarchy should be used to assess applications:

- Using less energy, in particular by adopting sustainable design and construction measures;
- Supplying energy efficiency, in particular by prioritising decentralised energy generation; and
- Using renewable energy.



The development Carbon strategy has adopted the following design ethos:

- **BE LEAN** – By using less energy and taking into account the further energy efficiency measure in comparison to the baseline building.
- **BE CLEAN** – By supplying energy efficiently. The clean building looks at further carbon dioxide emission savings over the lean building by taking into consideration the use of decentralise energy via CHP.
- **BE GREEN** – By integrating renewable energy into the scheme which can further reduce the carbon dioxide emission rate.

It is stated within the Manchester Core Strategies policies that the Energy Hierarchy is to be utilised with the energy strategy to form the basis of the methodology. In essence ensuring a 'Fabric First' approach is adopted. This approach reduces heat losses and energy demand initially by ensuring the dwellings in question are thermally efficient and reduce heat losses.

2.5 The Development

A development consisting of 8 town houses and 12 apartments over two floors is proposed to be constructed in Sulby Street, Moston, Manchester

SAP Calculations have been undertaken for a sample of the apartments and the town houses.

Site Plan



Notes
This document is © Falconer Chester Hall Limited.
All drawing measurements shall not be obtained by scaling. Any discrepancies on this document to be immediately reported to the architect. Verify all dimensions and levels prior to construction. This Document shall be read in conjunction with related documents, specifications and associated models.



PD1 10.02.22 AM MS First Issue
Rev: | Date: | By: | Chk By: | Rev Note:

**FALCONER
CHESTER
HALL**



London | Liverpool | Manchester | www.fcharchitects.com | +44(0)151 243 5800

Project Title
Sulby Street, Moston, Manchester

Client
Abacus Solicitors

Drawing Title
Proposed Ground Floor Site Plan

Drawing No.
P20064-FCH-XX-00-DR-A-1200

Status Issue suitable for: Date
S2 INFORMATION 09.02.22

Job No. Drawing Stage Scale
P20-064 PLANNING 1:500 @ A3

Rev:
PD1
Drawn By
AM
Checked By
MS



Notes
This document is © Falconer Chester Hall Limited.
All drawing measurements shall not be obtained by scaling. Any discrepancies on this document to be immediately reported to the architect. Verify all dimensions and levels prior to construction. This Document shall be read in conjunction with related documents, specifications and associated models.



PD1 10.02.22 AM MS First Issue
Rev: | Date: | By: | Chk By: | Rev Note:

**FALCONER
CHESTER
HALL**



London | Liverpool | Manchester | www.fcharchitects.com | +44(0)151 243 5800

Project Title
Sulby Street, Moston, Manchester

Client
Abacus Solicitors

Drawing Title
Proposed First Floor Site Plan

Drawing No.
P20064-FCH-XX-01-DR-A-1201

Status Issue suitable for: Date
S2 INFORMATION 09.02.22

Job No. Drawing Stage Scale
P20-064 PLANNING 1:500 @ A3

Rev:
PD1
Drawn By
AM
Checked By
MS

SECTION 3 **FABRIC DESIGN PROPOSALS**

The Standard Assessment Procedure (SAP) is the Government's approved methodology for assessing the predicted energy consumption and carbon dioxide emissions for new dwellings. Results are derived in respect of floor area and consider energy use (kWh/m²/yr) and associated CO₂ emissions (kg.CO₂/m²/yr) from the following:

- Space heating
- Domestic hot water
- Ventilation
- Lighting
- Ancillary pumps and fans
- Energy generation technology

SAP is compliant with the EU Energy Performance of Buildings Directive and is carried out using approved software. For the purpose of this report, data has been produced by an accredited domestic energy assessor, PB Sustainability, using Stroma 2012 software.

To enable a review of how the proposed development will achieve an improvement, firstly the baseline CO₂ emission figures were established. These figures are based on Part L1a 2013's 'Notional Dwelling', a specific set of specification criteria.

A 'fabric first' approach has been undertaken looking at improvements to the thermal envelope initially to understand the improvements that can be gained prior to any renewable / low carbon technologies are included.

The 'fabric first' approach follows the guidance highlighted within Energy Hierarchy.

Renewable / low carbon technologies have then been considered with regards to special constraints and the amounts required, giving specific consideration to the surrounding areas.

An overall area weighted average figure has then been assessed to comply with the policies set out by the Core Strategy.

The requirement of the Local Planning Policy and National Policies is to ensure the development complies with the Building Regulations Approved Document L1A and L2A.

The Council policy EN4 states that the initial proposal to minimise carbon dioxide emissions is to follow the principle of the energy hierarchy and reduce the need for energy consumption.

EN6 of the Manchester City Council Core Strategy states that the energy efficient measures include:

- a) Inclusion of better U-values than the minimum U-values set in the ADL1A
- b) Designing for a buildings air permeability exceeding ADL1A target values
- c) Utilising the highly efficient heating and hot water systems
- d) Utilising low energy efficient lighting such as LED lighting

In accordance with EN6 the scheme should show an improvement of 15% of the CO₂ emissions over Part L2010 regulations which can be achieved via the fabric improvements, efficient heating systems and the inclusion of renewable technology.

Various energy efficiencies measures were reviewed to ensure the most efficient scheme is proposed and these included the following proposal.

The table below outlines the improvements made to the building fabric elements compared against both the Building Regulations limiting U-values and the 'Notional Dwelling' U-values which the baseline is derived from.

	Part L1A Value (W/m ² k)	Proposed U-Value (W/m ² k)
Floors	0.25	0.15
External Wall	0.30	0.24
Common Areas Walls	0.30	0.00
Roofs	0.20	0.12
General External Doors	2.0	1.4
Windows	2.0	1.4

Air permeability, in order to reduce heat losses, the air leakage was reduced from the default value of 10m³/hr/m² to 4.5m³/hr/m².

The improvement in the fabric and air permeability had the effect of improving the energy consumption and CO₂ emissions from the notional building which were calculated on the SAP formats.

Further improvements could be made on the fabric U-Values, however, at this stage it was proposed that this was the most cost-effective proposal for limiting the U-Value.

SECTION 4 **SERVICES STRATEGY**

The second requirement is the policy is to utilise energy efficiently as such in order to provide an energy efficient development, the following strategies have been proposed to compliance.

4.1 Heating System

The heating energy demand will be reduced by providing good insulation of the building envelope in order to minimise heat losses.

Gas fired boilers were reviewed as a possible source of heat energy however due to the maintenance, route of gas mains and flue penetrations these were discounted. It is also suggested that domestic gas boilers are being phased out in the future editions of the regulations to reduce emissions.

Apartment electrical panel heaters were reviewed and are to be used, these are to be complete with integral time clock and thermostat and to be in full compliance with LOT20 requirements.

This offers reduced heat loss through any centralised systems e.g. pipe / ductwork. This also reduces the amount of plant that will be required to service this aspect of the building.

At the moment the carbon factor provided for an all electrical system is significantly greater than one that utilises gas. It has been announced by the BRE that the intention is to lower the carbon factor by over 50% of what in currently stands to bring this in line with gas. This is due the lesser reliance on fossil fuels by the grid for electrical generation. This change enhances the merits of utilising an all-electric system, and although the SAP methodology does not yet take account of this, it is believed that this strategy is a more efficient and cost-effective way of providing heating and hot water for developments such as this.

4.2 Hot Water

Hot water is to be provided by electric immersion heaters located in cylinders located in each apartment fully insulated with time clock and thermostat control.

4.3 Ventilation System

The ventilation systems within the apartments have been proposed with continuous ventilation with heat recovery in accordance with System 4 of the Building Regulations Part F.

The MVHR Systems proposed have high efficiency plate heat exchangers which remove the heat from the extract air and pre-heat the supply air into the habitable rooms. This assists with reducing energy demand by heating the dwelling by recovering otherwise wasted heat.

The system extracts warm stale air from within the dwelling, at the same time drawing in cooler fresh air from outside. These are then ducted into the MVHR unit, at which point the heat is exchanged without mixing the air, therefore fresh, warm air is vented into the dwelling.

This system recovers heat from within the dwelling which otherwise would be lost, therefore reducing the amount of energy required to maintain temperature within the dwelling.

The fans will achieve low specific fan power to further improve the SAP calculations and efficiency.

In addition, openable windows will be utilised for Purge ventilation scenarios and to allow further fresh air to enter to the dwellings, thus further increasing the minimum amount of air changes per hour.

4.4 Lighting

High efficient LED Lighting has been installed throughout the development, these improved the overall energy consumption and are based on a minimum of 65l/w. Absence/presence detection has been applied to all circulation and communal areas with manual switching in apartments.

4.5 Water

The water supplies to each apartment have been based on a consumption of 110litre/person/day, this will be achieved with a selection of the outlets and the inclusion of flow restrictors.

4.6 Photovoltaic (PV) System

A PV array of 0.75kwp per apartment and 1.5kwp per townhouse has been included for the scheme.

5.0 RENEWABLE TECHNOLOGY CONSIDERED

The use of renewable energy technology has been considered to improve the carbon footprint and also provide energy savings and reduced CO₂ emissions.

The following technologies were considered:

5.1 Combined Heat & Power

There is differing opinions by local Councils whether CHP can be included as a renewable technology. In this instance the CHP was reviewed to see if it could be used to improve the overall energy consumption and reduce CO₂ emissions by reducing the amount of electricity from the grid.

Combined heat and power consist of an electrical generator which is used to provide a proportion of the total electrical load. The generation of electricity results in heat also being generated in a normal electrical generator, this heat is removed and discharged to atmosphere, in a CHP plant this heat is used to generate heating water and is used as the lead boiler on a central plant.

On this development with individual apartments and town houses the use of CHP was investigated. The most suitable application for a CHP unit is where it can run for 8000 hours a year providing power and developing useful heat throughout the year. In order to use the power source a continuous electrical load and a continuous heat sink would be required, on this particular development it was not envisaged that this would be available. In addition, with central plant the Landlord would be responsible for maintaining and operating the plant, they would be responsible for metering and collecting payment for energy used which would be an ongoing commitment and cost. This was deemed as being unviable and would be suitable for this development and as such has been discounted.

5.2 Solar Photovoltaic (PV) Systems

Solar Photovoltaic panels convert solar radiation into electrical energy through semiconductor cells. They are not to be confused with solar panels which use the sun's energy to heat water (or air) for water and space heating.

Photovoltaic panels are available in a number of forms including mono-crystalline, polycrystalline, amorphous silicon (thin film) or hybrid panels. They are fixed or integrated into a buildings un shaded south facing façade or pitched roof ideally at an incline of 30° to the horizontal for maximum energy yield. It is essential that the panels remain un-shaded as even a small shadow can significantly reduce output. The individual modules are connected to an inverter to convert their direct current (DC) into alternative current (AC) which is usable in buildings.

Photovoltaic technology may be feasibly incorporated into the building design with little/no ongoing maintenance or costs.

The installation of PV panels has been reviewed in line with an all electric heating and hot water energy infrastructure for each apartment. It has been shown that the SAP calculations will be satisfied if photovoltaic panels of 0.75kwp is used for each apartment and 1.5kwp for each townhouse with areas of approximately

10m² for each townhouse and 5m² for each apartment. The total energy produced for the development as a whole will be 21kwp.

5.3 Solar Thermal

Solar thermal energy can be used to contribute towards space heating and hot water requirements. In the UK, most applications focus on hot water installation as the solar availability during the space heating season is limited.

The use of solar water heating installations is widespread throughout Europe. The systems use a heat collector, generally located at roof level on support frames, orientated in a southerly direction to maximise solar heat absorption.

A working fluid is used to heat water that is stored in either a separate hot water cylinder or more commonly a twin coil hot water cylinder with the second coil providing top-up heating from a conventional boiler.

The two commonest forms of collector are panel and evacuated tube. The panel type collectors are generally more robust and reliable while manufacturers claim that the evacuated tube versions offer better winter all-round performance.

Solar thermal heating could be used to provide a proportion of the hot water demand as such solar hot water generation would be suitable but would require each cylinder to incorporate solar hot water coils in addition to the immersion heaters and panels for each townhouse and apartment.

This means of providing renewable energy is not as cost effective or efficient as the use of photovoltaic panels to provide renewable energy, in addition the use of electricity from pv panels would be used for greater periods of time than the hot water generation.

5.4 Wind Turbines

Wind generation equipment operate on the basis of wind turning a propeller, which is used to drive an alternator to generate electricity. Small scale wind turbines are typically in the range of 1kW -15kW with rotor diameters of 2.5m – 9.0m respectively. These systems can be stand alone or, in some cases, building mounted.

The efficiency and effectiveness of wind turbines depends on many factors, not least the average wind speed and wind pattern of the proposed site. Exposed sites, free from obstacles such as buildings and greenery, are more viable than sheltered sites. Column mounted (stand-alone) wind turbines installed at a suitable height above the building line are more effective than wind turbines located at roof level. There are often some planning difficulties associated with the use of wind turbines. Background noise and a phenomenon known as shadow flicker are also potential issues.

Typical noise levels measured 20m from the base of an operating 5kW wind turbine (both upstream and downstream) in the range 4m/s to 8m/s are 48-50dB(A) . At 100m, the predicted noise level would be below 35dB(A).

The use of wind turbines is often seen as an obvious statement of a development's dedication to the use of sustainable technologies.

The proposed Sulby Street development site is bounded by a number of residential properties, a small-scale wind turbine should be located at least 100m from the nearest neighbour to avoid any issues with noise or shadow flicker.

Small-scale wind turbines have a hub height of approximately 15m above ground level. They are normally supplied with a single-phase grid connection kit, (The installer will contact the local electricity supplier to get permission to connect to the grid). In order to change the electricity supplier for any energy that is exported to the grid, a bi-directional electricity meter will have to be installed.

For sites with a restricted building footprint, roof-mounted vertical axis helical wind turbines could be considered. These are the latest developments to the market and are less susceptible to turbulence and wind orientation.

Roof mounted wind turbines can be employed to gain the necessary height above the building line.

The structural nature of the roof/building would have to be investigate further to ascertain which fixing system would be employed to minimise vibration through the structure.

It is not anticipated that wind turbines would be a suitable system for this type of project due to the area and potential disturbance to other properties.

5.5 Ground Source Heat Pumps

The design, installation and operation of Ground Source Heat Pumps (GSHP) is well established. These geothermal systems tap into the earth's considerable energy store to provide both heating and cooling to buildings. They take advantage of the fact that at a depth of a few metres, the temperature of the ground remains at a constant 12°C throughout the year.

In heating mode, GSHPs absorb energy from the earth and transfer it into the building using highly efficient heat pumps. The effectiveness of heat pumps is measured by the ratio of the heating capacity to the power input, referred to as the Coefficient of Performance (COP). Typically, manufacturers state that for every 1 unit of electrical energy used to drive the pump, around 4 to 5 units of thermal energy can be produced. When operating in cooling mode, during the summer months, the system reverses its cycle and heat is extracted from the building and dissipated into the earth.

The ground loops can be installed either vertically in boreholes (typically 50m – 100m deep), or horizontally in trenches at a depth of 1.5m – 2.0m. Either method is dependent upon local geology conditions and space available. The system also benefits from the fact that most of the components are hidden below ground or in plant room enclosures.

Costs for drilling vary according to the location and ground conditions. A preliminary site investigation, by means of a desktop study, can usually determine the viability of a ground source heating and cooling system. Fine tuning of the design may be required once actual site ground conditions are established.

For the Sulby Street development and the site footprint a closed loop vertical borehole installation would be more viable than a horizontal system. This is because horizontal closed loop trench systems require a significant amount of suitable land where the surface above the collector is permeable (not paved or tarmaced).

For example, with a 250kW GSHP horizontal system, pipework in excess of 10,000m would be required (dependant on ground conditions). For efficient collection of energy, a pipe spacing of at least 1m would be necessary. 'Slinky' arrangements can be installed which offer a reduced footprint but at the expense of overall operating efficiency. In practical terms, an area approximating the size of 3 football pitches would be needed for the trenching of a 250kW installation.

The use of horizontal GSHP's is not possible for this development due to the area required, vertical ground source heat pumps are expensive and would require a large number of boreholes each at approximately 100m deep as such are not viable for this project.

5.6 Air Source Heat Pumps

Air source heat pumps are a common method of providing heating and cooling to a building and utilise the external ambient air to provide a heat sink for the refrigeration cycle.

In heating mode, the heat within the external air is used on the refrigeration cycle, the refrigerant gas absorbs the heat and through the cycle increases the temperature to discharge heat into the space through the efficient heat pumps. In cooling mode, the internal heat within the building is absorbed by the refrigerant gas and is discharged to atmosphere through the refrigeration cycle.

The ratio of heating or cooling performance against the power input is the Coefficient of Performance and measures the efficiency of the heat pumps, typically for these type of heat pumps COP's of 2.5 to 3.5 can be expected.

With this type of system, it uses internal cassette or fan coil units and external condensers mounted in an area where a free flow of air can be provided.

Heating can be provided in the apartments and town houses with floor mounted heat pump units providing the full heating demand but will require individual outdoor units and because of the limited space, noise issues and refrigeration pipework requirements this has been disregarded.

5.7 Bio Renewable Energy Sources – Wood Fuel Boiler Plant

Bio-renewable energy sources are considered to be those which are grown, harvested and replaced by new stock. Modern wood-fuel boilers are highly efficient, clean and smokeless. Wood-fuel is almost carbon neutral as an energy source (the tree growing process effectively absorbs the CO₂ that is emitted during combustion).

The use of wood fuel boilers at Sulby Street is not considered a viable option as similar to the CHP technology a central district heating system would be required which would require a plant area, regular maintenance and individual metering for each apartment. In addition bulk fuel storage is required on site to avoid constant

deliveries and mechanical handling systems between storage silo and boiler plant are recommended.

With larger boilers (say 250kW), these requirements create the need for substantial amount of external plant space (typically 30m²). A large area would have to be sacrificed to accommodate the wood-fuel facilities. An underground fuel bunker 3m x 4m x 3m deep would be needed for a boiler of 250kW capacity. Furthermore, the logistics of fuel deliveries and ongoing maintenance costs would be a potential issue.

Bulk delivery to the hopper (usually every 6/8 weeks) would be by means of an articulated lorry which would 'blow' the wood pellets (up to a distance of 30m) via flexible hosing into the store.

Due to the space requirements and potential disruptions to the area the use of biomass boilers has been disregarded.

5.8 Fuel Cells

Fuel cells convert chemical energy directly into electricity by combining hydrogen and oxygen in a controlled reaction. They emit virtually no pollution as the products of this reaction are electricity, heat and water vapour.

There are a number of fuel cell types of which the PEM (Proton exchange membrane) fuel cell is widely regarded as the most practical technology for many applications.

Fuel cells are very expensive compared with many other technologies due primarily to the cost of the component pieces. Potential use of hydrogen fuel cell technology is to generate on-site power. But systems are on the early stages of commercialisation and so projects have substantial technology risk. For this reason, fuel cells have not been considered for use on this project.

5.9 Rainwater Collection & Harvesting

Rainwater Harvesting uses rainwater for internal and external tasks where mains water would normally be used. Although not strictly a renewable technology, harvesting provides the benefit of collecting rainwater that would otherwise go straight into the surface water drains.

Rainwater is stored either at low level or below ground, filtered (and sometimes chemically treated) before being returned to the building for use in non-potable applications usually WC's and urinals. When water is required a pressure switch activates the pump located in the storage tank ensuring water is available on demand. The benefits of mains water served should be balanced with any increase in electricity consumption.

A simple rainwater recovery system, as described above, with an appropriately sized underground tank would cost in the region of £50,000.00 - £75,000.00 (including builderswork). Some plant space would be required to accommodate the pressure vessel and processor unit. If necessary, an external GRP enclosure could be used.

The capital outlay and expected payback period is very large and this is unlikely to justify the installation.

In addition to the capital cost for the equipment the pipework distribution would not be suitable for this service to feed each apartment.

Summary of the Technical Feasibility Assessment of Renewable and Low Carbon Technology Energy options

The technical feasibility of installing each LZC technology at the Sulby Street development has been assessed in order to discount any unsuitable options at an early stage. A summary of the feasibility process is tabulated below

Technology	Brief Description	Benefits	Issues/Limitations	Feasible for site
Solar Photovoltaic	Solar photovoltaic panels convert solar radiation into electrical energy. They are not to be confused with solar panels which use the sun's energy to heat water (or air) for water and space heating	Low maintenance/no moving parts. Feed in tariffs suitable for scheme. Easily integrated into building design. Excess electricity can be exposed to grid. No ongoing costs.	Any overshadowing affects panel performance Panels ideally inclined at 30° to the horizontal facing a southerly direction	Yes
Solar Thermal	Solar thermal energy can be used to contribute towards space heating and hot water requirements	Low Maintenance Little/no ongoing costs Suitable for renewable heat incentive scheme	Must be sized for a proportion of the building hot water requirements Panels ideally inclined at 30° to the horizontal	No
Ground Source Heat Pump (GSHP)	GSHP systems tap into the earth's considerable energy store to provide both heating and cooling to building. The design, installation and operation of GSHP is well established.	Minimal maintenance Unobtrusive technology Suitable for renewable heat incentive scheme	Large are required for horizontal pipes – space limitations on site. Boreholes required for vertical type of collectors. Full ground survey required to determine geology. More beneficial to the development if cooling is required.	Limited
Air Source Heat Pumps	Air source heat pumps utilise the external air temperature to provide heating and cooling to buildings. These are a common technology used in buildings.	Relatively low cost. Reliable technology minimal maintenance Cooling and heating provided	External condensers required. Refrigerant pipework required throughout the building.	No
Wind turbine (Stand alone column mounted)	Wind generation equipment operates on the basis of wind turning a propeller, which is used to drive an alternator to generate electricity. Small scale (1kW – 15kW) wind turbines can be pole or roof	Low maintenance/ongoing costs Minimum wind speed available (www.dti.gov.uk) Excess electricity can be exported to the grid. Suitable for feed in tariff scheme.	Planning issues Aesthetic impact and background noise. Space limitations on site.	No

	mounted.			
Wind Turbine (Roof Mounted)	As above	Low maintenance/ongoing costs Minimum wind speed available (www.dti.gov.uk) Excess electricity can be exported to the grid Suitable for feed in tariff scheme	Planning issues Aesthetic impact and background noise Structural/vibration impact on building to be assessed Proximity of other buildings raises issues with downstream turbulence	No
Combined Heat & Power	A combined heat & power (CHP) installation is effectively a mini on-site power plant providing both electrical power and thermal heat. CHP is strictly an energy efficiency measure rather than a renewable technology	Potential high CO₂ saving available. Efficient use of fuel Suitable for feed in tariff scheme. Excess electricity can be exported back to the grid	Maintenance incentive Sufficient base thermal and electrical demand required Additional plant space required Noise Pollution Pollution discharge from CHP	No
Bio-Renewable Energy Sources (automated feed-wood-fuel boiler plant)	Modern wood fuel boilers are highly efficient, clean and almost carbon neutral (the tree growing process effectively absorbs the CO ₂ that is emitted during combustion). Automated systems require mechanical and fuel handling and a large storage silo.	Stable long-term running costs Potential food CO₂ saving Suitable for Renewable Heat Incentive Scheme.	Large area needed for fuel delivery and storage Reliable fuel supply chain required Regular maintenance required Significant plant space required	No
Fuel Cells	Fuel cells convert chemical energy directly into electricity by combining hydrogen and oxygen in a controlled reaction	Virtually no pollution High electrical efficiency Suitable for feed in tariff scheme	Expensive Early stages of commercialisation High technology risk	No

SECTION 6 **SUMMER OVERHEATING**

With the improvement of thermal transmittance and air permeability within buildings the possibility of overheating within rooms is now becoming a regular occurrence, especially where windows are either sealed or have restricted openings.

The overheating is mainly attributable to solar gains where brise soleil, solar control glass or solar blinds is not incorporated within the design. The radiated heat from the solar gains is absorbed by the surfaces in the room and radiated into the space. As the thermal resistance is now highly efficient and the air leakage is limited the heat stays within the room causing overheating.

The SAP calculations undertaken indicate that the apartments and town houses do not include a risk of overheating and comply with criterion 3 of Part L1A of the Building Regulations.

It should be noted that the SAP Calculations for overheating is very basic and has taken into account the proposal to use a glazing g-value of 0.63 with windows being opened during the day but not the night, also dark coloured blinds are assessed as being fully closed during daylight hours as a default on the calculation.

A further dynamic simulation is recommended to be undertaken using computer software to assess the apartments under the CIBSE TM 59 criteria. This assessment will give a more accurate assessment as to whether the apartments will suffer from overheating.

SECTION 7

CONCLUSION

The report has been compiled to appraise the alternative energy strategies that can be utilised on this project at Sulby Street, Moston, Manchester.

In order to comply with the Manchester Core Strategy Policy EN6 and requirement that the development should exceed the national standards set out in Part L1A of the Building Regulations.

The development consists of 12 one bed apartments and 8 townhouses.

SAP calculations have been undertaken on a sample of the apartments and town houses to provide an overall average of the CO² emissions and energy usage; these sample calculations have provided an overall compliance pass.

The following results have been obtained utilising SAP 2012, based on an area weighted average block compliance calculation method to adhere to the site wide requirements set out within the Local Authority Policies. These results are based on a sample of apartments and town houses which have been multiplied to the actual number of townhouses and apartments.

- Target Carbon Dioxide Emission Rate (TER) 25.92kgCO₂/m²/year
- Dwelling Carbon Dioxide Emission Rate (DER) 25.25kgCO₂/m²/year

This provides a total percentage improvement of 2.59% of kgCO₂/year or 909.86kgCO₂/year emissions for the total of the sample apartments and townhouses including fabric, lights, power, PV installation and ventilation savings.

The fabric improvements would provide 31234kwh/yr. reduction (DFEE/TFEE) against Building Regulations 2013 for the sample of apartments and townhouses on this development multiplied up to the actual number of apartments and townhouses. This equates to 2.67% reduction in kgCO₂ or 6564kgCO₂/year over Building Regulations 2013 based on a factor of 0.21016 to convert kwh into kgCO₂ as published in UK Government GHG greenhouse gas conversion January 2022.

Further calculations have been undertaken to compare the new building against the Building Regulations 2010 using SAP 2009 and the results are as follows multiplied up to represent the total number of townhouses and apartments

- Target Carbon Dioxide Emission Rate (TER) 29.79kgCO₂/m²/year
- Dwelling Carbon Dioxide Emission Rate (DER) 24.77kgCO₂/m²/year

This indicates an improvement of 16.85% over the 2010 Building Regulations and results in an overall carbon saving of 136614kgCO₂/year over the total number of apartments and townhouses. The 2009 SAP calculations do not give values for fabric efficiency and are based on the whole building performance including fabric, lights, power, PV installation and ventilation savings.

Following the First Fabric approach of the EN6 Policy of Manchester City Council the following has been calculated.

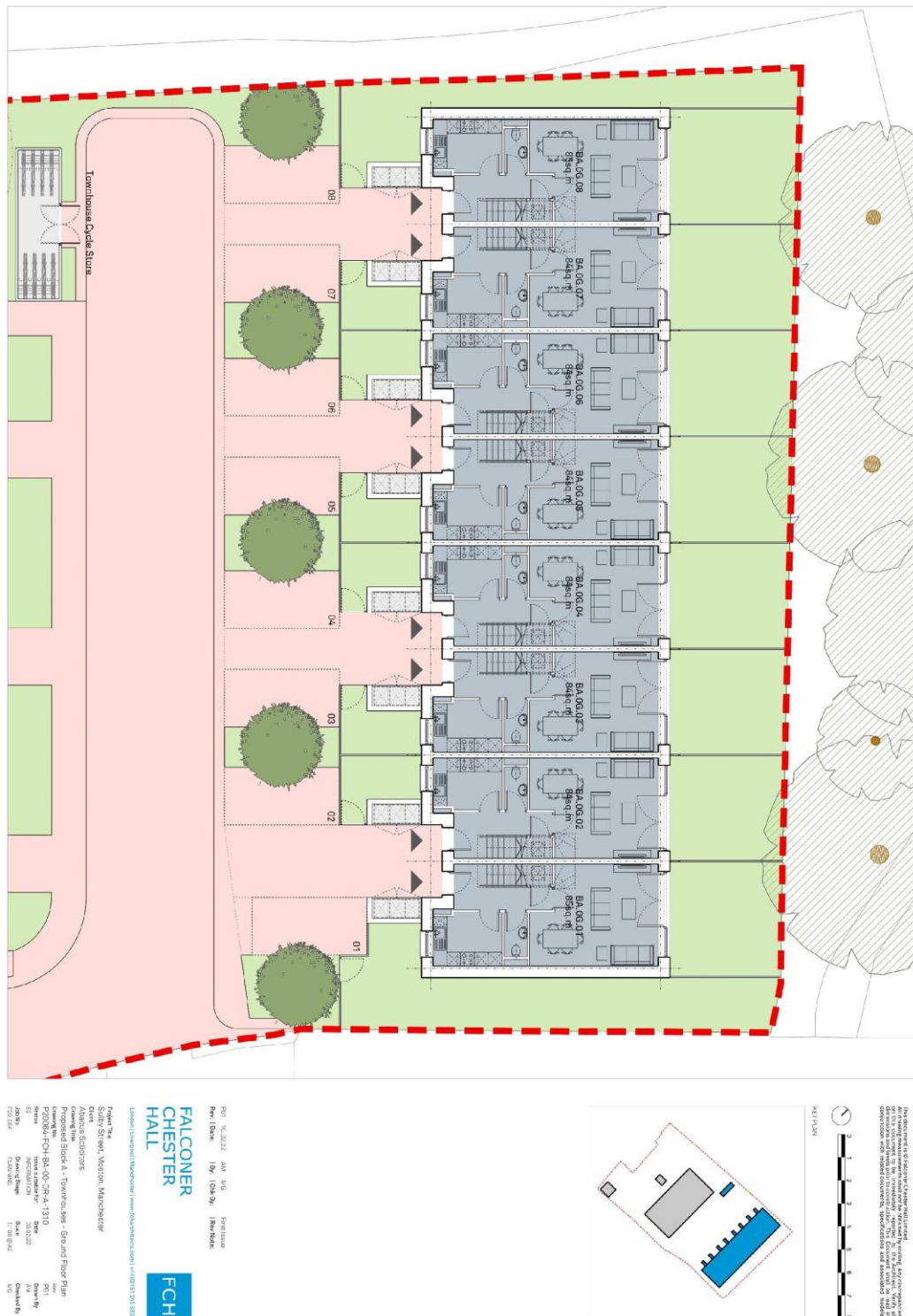
The Fabric Energy Efficiency of the entire development has been reduced by 2.34% over the 2013 Building Regulations

- Target Fabric Energy Efficiency (TFEE) 43.2kwh/m²/year
- Dwelling Fabric Energy Efficiency (DFEE) 44.05kwh/m²/year

The following strategy has been implemented to obtain the results of the calculations and obtain the improvements over that notional building.

- The fabric thermal resistance values have been improved upon from the Building Regulations minimum requirements.
- The air permeability has been taken as being 4.5m³/h/m² an improvement from the notional building value of 10m³/h/m².
- The glazing g-values have been selected at a value of 0.63
- Electric heating with integral timeclock and integral thermostat.
- Electric hot water via thermally insulated cylinders.
- A PV Array of 1.5kwp per townhouse and 0.75kwp per apartment has been included in the scheme to achieve further CO₂ emission reduction to ensure the 15% reduction required in EN6 is maintained over 2010 Building Regulations.

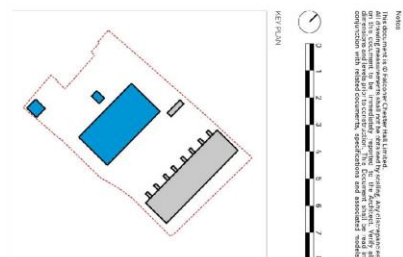
APPENDIX 1 FLOOR PLANS



BLOCK A, GROUND FLOOR PLAN

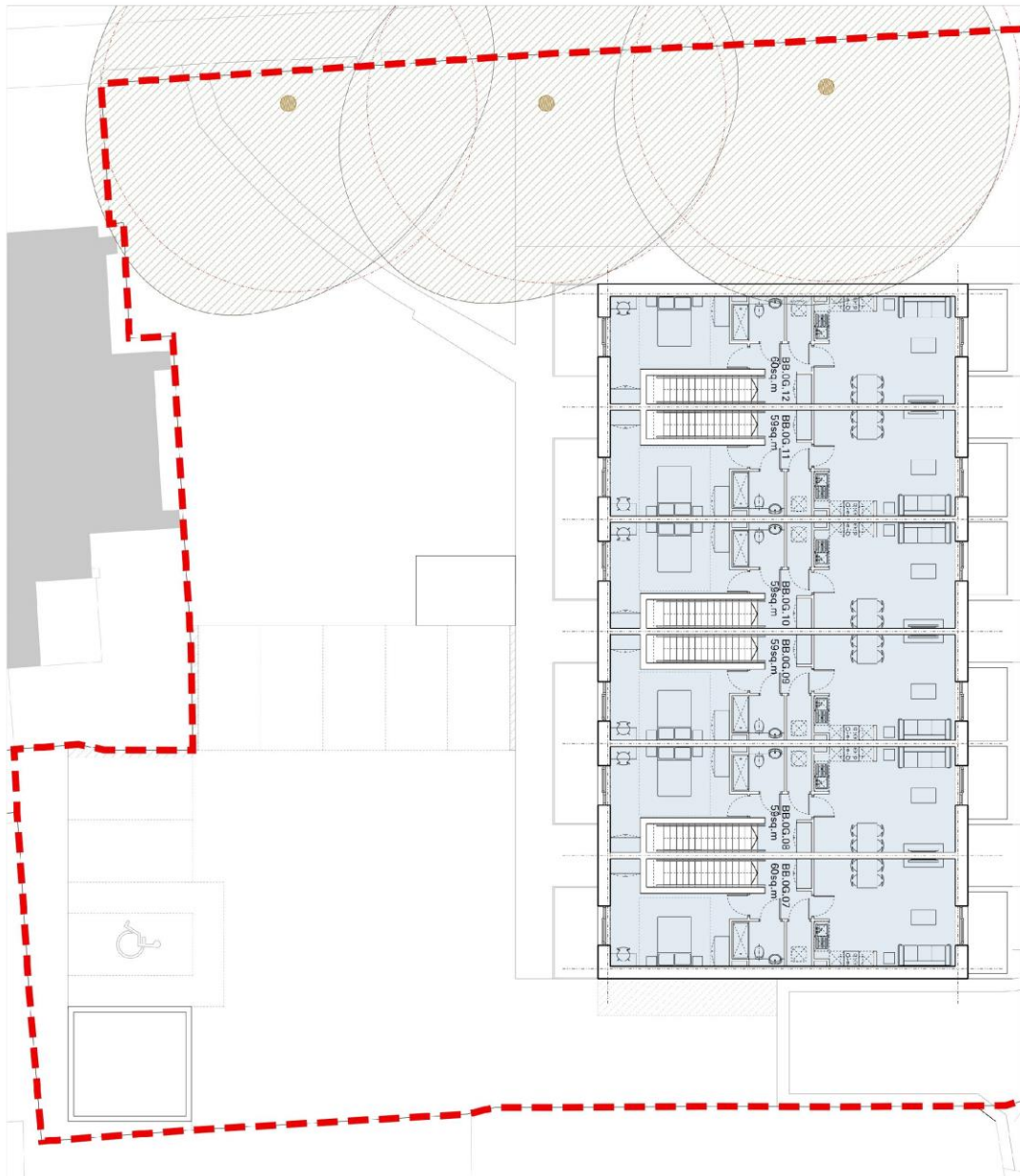


FCH
FALCONER
CHESTER
HALL



Project Title: Sulby Street, Moston, Manchester
 Project Number: P20004-FCH-BB-00-GR-A-1315
 Project Date: 15/03/22
 Project Status: Approved
 Project Manager: PSD
 Project Engineer: PSD
 Project Designer: PSD
 Project Checker: PSD
 Project Approver: PSD
 Project Date: 15/03/22
 Project Status: Approved
 Project Manager: PSD
 Project Engineer: PSD
 Project Designer: PSD
 Project Checker: PSD
 Project Approver: PSD

BLOCK B – GROUND FLOOR PLAN



THE DESIGN OF THIS BUILDING HAS BEEN COMPLETED BY PSD PROGRESSIVE SERVICES DESIGN LTD. THE DESIGN HAS BEEN COMPLETED IN ACCORDANCE WITH THE BUILDING REGULATION 2010. THE DESIGN HAS BEEN COMPLETED IN ACCORDANCE WITH THE BUILDING REGULATION 2010. THE DESIGN HAS BEEN COMPLETED IN ACCORDANCE WITH THE BUILDING REGULATION 2010.

Project Title: **FALCONER CHESTER HALL**

Project Location: **SULBY STREET, MOSTON, MANCHESTER**

Project Description: **APARTMENTS - FIRST FLOOR PLAN**

Project Number: **P2008-FCH-BB-07-SK-A-1318**

Project Date: **10/03/22**

Project Status: **Final Design**

Project Manager: **PSD**

Project Engineer: **PSD**

Project Designer: **PSD**

Project Checker: **PSD**

Project Approver: **PSD**

Project Client: **FCH**

Project Contact: **PSD**

Project Address: **Sulby Street, Moston, Manchester**

Project Postcode: **M20 2JL**

Project Phone: **0161 275 1234**

Project Email: **info@psd.co.uk**

Project Website: **www.psd.co.uk**

Project Social Media: **Facebook: PSD, Twitter: PSD, LinkedIn: PSD**

Project Notes: **See attached drawings for details.**

BLOCK B – FIRST FLOOR

APPENDIX 2 SAP RESULTS 2009

PB Sustainability Ltd
Paul Byrne
0151 691 6685
info@pbsustainability.co.uk

Block Compliance WorkSheet: Sample Units



User Details

Assessor Name: **Stroma Number:**
Software Name: Stroma FSAP **Software Version:** Version: 1.5.1.8

Calculation Details

Dwelling	DER	TER	TFA
End Terrace TH	27.33	31.54	86
Mid Terrace TH	22.21	27.53	86
End Terrace GF Apt	30.87	35.37	50.9
End Terrace 1F Apt	27.84	31.44	60.9
Mid Terrace GF Apt	24.94	30.92	50.9
Mid Terrace 1F Apt	22.49	27.6	60.9

Calculation Summary

Total Floor Area	395.60
Average TER	30.46
Average DER	25.70
Compliance	Pass
% Improvement	15.63

APPENDIX 3 SAP RESULTS 2012

Block Compliance WorkSheet: Sample Units



User Details

Assessor Name: Stroma FSAP Stroma Number: Software Name: Software Version: Version: 1.0.5.51

Calculation Details

Dwelling	DER	TER	DFEE	TFEE	TFA
End Terrace TH	27.94	28.52	54.3	53.9	86
Mid Terrace TH	22.84	24.31	44.2	46.5	86
End Terrace GF Apt	31.39	30.06	51.2	51	50.9
End Terrace 1F Apt	28.27	28.93	45.3	44.1	60.9
Mid Terrace GF Apt	25.35	26.67	39.5	39.4	50.9
Mid Terrace 1F Apt	22.83	24.72	34.8	36.6	60.9

Calculation Summary

Total Floor Area	395.60
Average TER	26.30
Average DER	26.21
Average DFEE	45.41
Average TFEE	45.88
Compliance	Pass
% Improvement DER TER	0.34
% Improvement DFEE TFEE	1.02

