LK ACCREDITATION LIMITED

PART OF THE LK GROUP

DEVELOPMENT AT

The Close, Lundwood, Barnsley

Energy and Environmental Report with Code for Sustainable Homes Pre-Assessment



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Date: February 2013

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Document Verification

This Energy and Environmental Report with the Code for Sustainable Homes Pre-Assessment is in support of the Planning Application for the Development at The Close, Lundwood.

Site Address	The Close, Off Lund Lane, Lundwood, Barnsley		
Job Number	LKACC 13 1250		
Report Title	Energy and Environmental Report with Code for Sustainable Homes, Pre-Assessment.		
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Prepared By	Gwyn Roberts Code for Sustainable Homes Assessor STRO007454	Signature	
Checked By	Peter Isherwood Sustainability Manager Accredited Energy Assessor EES/007293	Signature	

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All information within this document has been assumed correct at the time of issue.

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Appendix 1 - Stroma Code For Sustainable Homes Pre-Assessment Report

Appendix 2 – Sample Design Stage SAP

(i) Executive Summary

Outlined below are the key sustainability achievements of this development:

- A development of 26 mixed residential dwellings which will help meet a well-established and accepted need for housing in the area.
- Proposing to achieve a minimum of Code Level 3.
- Following a Fabric First Approach to reduce energy demand from non-renewable sources to a minimum.
- Meeting and exceeding Approved Document part L1a (2010) of the Building Regulations, with high levels of insulation, efficient heating systems and low levels of air permeability.
- 100% energy efficient lights throughout the development.
- Internal water use within all dwellings to be reduced to a projected 90 litres per person per day through the provision of water saving fittings.
- The use of materials with low embodied energy which are locally sourced where available.
- A suitably qualified hydrologist has been employed and the drainage system will be designed in accordance with the requirements.
- Reducing the site impact using considerate construction techniques and utilising local labour where applicable.
- Ecology of the Application Site will be examined by a qualified Ecologist. All key ecological recommendations are expected to be adopted.
- Sustainable transport promoted by locating all dwellings within 200m of a bus stop and providing all new residents with comprehensive information on the public transport provision.
- Cycle Storage is expected to be included in the development to encourage cycle commuting a recreation.
- Waste minimisation principles adopted both during construction and in the lifespan of the development through promotion of recycling/composting measures.
- Initiatives developed to ensure a high quality place to live, including measures to minimise crime, improve security, provide outside spaces and achieve acceptable noise levels.

The proposed development has been assessed using Stroma's Code for Sustainable Homes pre-assessment tool, to illustrate how a Level 3 rating could be obtained.

Initial energy calculations (SAP) have been completed on Elmhurst approved software by a licensed energy assessor.

A thorough assessment of the sustainability-related planning policies for the Application Site has been carried out, to ensure that the development is actively responding to them.

Following these assessments it is our view that a sustainable development will be created and delivered, with some good standards being developed.

(ii) Introduction

This Sustainability Report has been prepared by LK Accreditation, appointed by Cornell Group. The report and its associated Appendices describe the sustainable design and construction measures included in the proposals for the development of the site.

The Application Site proposal is for a mixture of 26 semi-detached and mews residential dwellings.

Our report is based upon a comprehensive review of the design proposals that have been prepared by Cornell Group along with assumptions based upon current best practise.

The report sets out to show how performance set out in policy CSP5 of the Core Strategy will be achieved; through agreeing a Fabric First Approach to reduce carbon emissions from non-renewable sources.

This introduction outlines the development proposals and our methodology for assessing and guiding sustainability issues within the scheme.

(iii) Scheme Description – The Application Site

The proposed site is in a residential area, close to shops and amenities on Pontefract Road as shown in the Google image below.

The dwellings are a mixture of 26, high quality homes.



(iv) Methodology and Structure

The policies analysed have been at local, regional and national levels, all of which are pertinent to this scheme.

The Local and National Policies relating to sustainability of this scheme are:

- Barnsley Local Development Framework Core Strategy [2010, Barnsley Metropolitan Borough Council]
- National Planning Policy Framework (NPPF) [*March 2010, HM Government*]
- The Code for Sustainable Homes Technical Guidance documents [*November 2010, HM Government*].
- Approved Document L1A: Conservation of fuel and power (New Dwellings), [*December 2010, HM Government*]
- Definition of Zero Carbon Homes [*December 2008, HM Government*]
- Water Efficiency Calculator for New Dwellings [*September 2009, HM Government*]

At this early stage it is important to note the significant importance of the Barnsley Local Development Core Strategy. This document is a key document in the Local Development Framework as it sets out the overall vision and strategy for place making and will provide the context for all subsequent Local Development Documents and their proposals. It is based up guidance set out in the National Planning Policy Framework.

We have also carried out a sustainability assessment for the proposed development using a Code for Sustainable Homes pre assessment. This assessment illustrates how the proposals for York Street perform against a wide range of sustainability issues pertinent at local, regional and national levels, to assess the likely sustainability of individual dwellings and the development as a whole.

- The Code for Sustainable Homes pre assessment is attached at Appendix 1.

The pre-assessment illustrates a way in which Code Level 3 could be achieved by the developer. At this stage it is not possible to make firm commitments for each issue as the information available is not yet at detailed stage, however the pre-assessment identifies how the achievement could be made and provides comments upon which issues may change and how improvements could be made in other areas.

(v) Relevant Policy

The Code for Sustainable Homes is the government owned national standard for the sustainable design and construction of new homes. It aims to reduce our carbon emissions and create homes that are more sustainable. The Code is not a set of regulations and it goes further than Building Regulations. The Code measures the sustainability of a new home against nine categories of sustainable design, rating the 'whole home' as a complete package.
It covers;

- Energy and CO2 emissions
- Water Efficiency
- Environmental Impact of Materials
- Surface Water Runoff (flooding and flood prevention)
- Construction and Household Waste
- Pollution
- Health and Well-being
- Site Management
- Ecology.

The assessment uses a one to six star rating system to communicate the overall sustainability performance of a new home against these nine categories. The Code sets minimum standards for energy and water use at each level.

Once the dwelling has been independently assessed a Post Construction certificate similar to the one below can be issued.



THE CODE FOR SUSTAINABLE HOMES

FINAL CERTIFICATE
(Issued at the Post Construction Stage)

ISSUED TO:

Sutton
London, Greater London
SM2 6RH

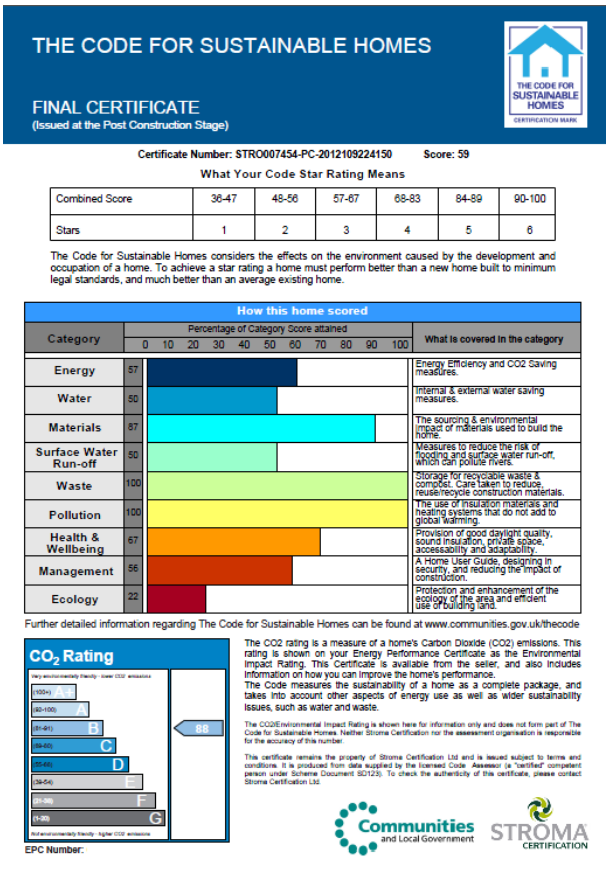
The sustainability of this home has been independently assessed at the Post Construction Stage and has achieved a Code rating of 3 out of 6 stars under the November 2010 version.

Above Regulatory Standards | Current Best Practice | Highly Sustainable/ Zero Carbon

The next page sets out how this home achieved its rating in the nine categories.

Licensed Assessor	Assessor Organisation
Gwyn Roberts	LK Accreditation
Client	Developer
Sutton Greater London,	Road, Sutton Greater London,
Architect Orange Key Unit 9, Lowesden Business Park Lambourn Woodlands, Hungerford, RG17 7RY	Certificate Number STRO007454-PC-2012109224150
Date 09/10/2012	Signed for & on behalf of Stroma Certification

This certificate remains the property of Stroma Certification Ltd and is issued subject to terms and conditions. It is produced from data supplied by the licensed Code Assessor (a "certified" competent person under Scheme Document SD123). To check the authenticity of this certificate, please contact Stroma Certification Ltd.



THE CODE FOR SUSTAINABLE HOMES

FINAL CERTIFICATE
(Issued at the Post Construction Stage)

Certificate Number: STRO007454-PC-2012109224150 Score: 59

What Your Code Star Rating Means

Combined Score	36-47	48-56	57-67	68-83	84-89	90-100
Stars	1	2	3	4	5	6

The Code for Sustainable Homes considers the effects on the environment caused by the development and occupation of a home. To achieve a star rating a home must perform better than a new home built to minimum legal standards, and much better than an average existing home.

How this home scored

Category	Percentage of Category Score attained (0 10 20 30 40 50 60 70 80 90 100)	What is covered in the category
Energy	57	Energy Efficiency and CO2 Saving measures.
Water	50	Internal & external water saving measures.
Materials	87	The sourcing & environmental impact of materials used to build the home.
Surface Water Run-off	50	Measures to reduce the risk of flooding and surface water run-off, which can pollute rivers.
Waste	100	Storage for recyclable waste & compost. Care taken to reduce, reuse/recycle construction materials.
Pollution	100	The use of insulation materials and heating systems that do not add to global warming.
Health & Wellbeing	67	Provision of good daylight quality, sound insulation, private space, accessability and adaptability.
Management	56	A Home User Guide, designing in security, and reducing the impact of construction.
Ecology	22	Protection and enhancement of the ecology of the area and efficient use of building land.

Further detailed information regarding The Code for Sustainable Homes can be found at www.communities.gov.uk/thecode

CO_2 Rating

The CO2 rating is a measure of a home's Carbon Dioxide (CO2) emissions. This rating is shown on your Energy Performance Certificate as the Environmental Impact Rating. This Certificate is available from the seller, and also includes information on how you can improve the home's performance.
The Code measures the sustainability of a home as a complete package, and takes into account other aspects of energy use as well as wider sustainability issues, such as water and waste.

The CO2/Environmental Impact Rating is shown here for information only and does not form part of The Code for Sustainable Homes. Neither Stroma Certification nor the assessment organisation is responsible for the accuracy of this number.

This certificate remains the property of Stroma Certification Ltd and is issued subject to terms and conditions. It is produced from data supplied by the licensed Code Assessor (a "certified" competent person under Scheme Document SD123). To check the authenticity of this certificate, please contact Stroma Certification Ltd.

EPC Number:

(vi) Fabric First Approach – Reducing Energy Demand

Policy CSP 5 of Barnsley Core Strategy talks about the inclusion of renewable energy technologies in developments. The reason for this is to meet the Government's carbon-cutting ambition.

This section explains, because of the way regulations work, incorporating renewables is likely to increase final site carbon emissions. Installing certain renewables at build stage over increased fabric efficiency also means that there is less opportunity for potential improvement later in the homes lives.

Renewable Technologies Feasibility

There are a number of different renewable technologies which *could* be used to reduce 15% of total CO2 emissions. However, most are not suitable for the site in question. The Table 1 below details the feasibility of potential renewable technologies

Table 1 feasibility of Renewable Technologies

Technology	Feasibility *			Comments
	H	M	L	
Air Source Heat Pumps	✓			Air source heat pumps would be suitable for the new build and refurbished dwellings as they deliver low-carbon heat. Typically, for each 1kw of electricity used, 3kw of heat are delivered offering real carbon savings. However, Air Source Heat Pumps to work efficiently, require very high levels of insulation and air tightness. Currently, the way the regulations work, to achieve the same Building Regulations / Code for Sustainable Homes standards means that to be cost effective the insulation and air tightness are likely to be not as high as efficient gas boilers. Because ASHPs use mains electricity the NOx emissions associated from their use (based upon grid electricity) is significantly higher than condensing gas boilers.
Wind Power			✓	Wind power can provide significant amount of power at relatively low cost. However, this site is within an urban environment with average wind speeds at 2.4 meters per second. The Department for Energy and Climate Change suggest that wind speeds must be at least 5 m/s for Wind Power to be effective.
Biomass and Combined Heat and Power		✓		Biomass could technically reach the 15% target and theoretically reduces CO2 levels. However, Biomass is not suitable for this site because of a number of factors; •There is not enough storage space for the biomass on site

				•Biomass deliveries via HGV would increase traffic and noise in a residential area. •There is no local supply of biomass so reductions in CO2 on site will be overshadowed by increase transport emissions. •Biomass produces more harmful particles than gas boilers, both NOx emissions and PM10 / PM6 particles are damaging to human health, by reducing local air quality. •Biomass requires specialist maintenance which would increase costs for residents of the properties.
Ground Sourced Heating and Cooling		✓		The use of ground source heating (cooling is not required for residential) depends on the availability of space to lay horizontal collectors (under gardens) or suitable ground conditions for vertical collectors. The soil is heavy clay and therefore installation of this would make the site economically unviable. In a similar way as ASHP, the dwellings built with Ground Sourced Heating would likely have worse fabric than if the heating was provided by gas.
Photovoltaics	✓			Photovoltaic cells and tiles can be installed on southeast through southwest facing roofs. It is important that PV arrays are not over-shadowed during the day as this has a significant effect on the output. Photovoltaics (PV) have little or no maintenance and are easy to install. Excess power can also be exported to the grid. Because PV is easy to install it does not necessarily have to be installed when the house is built, therefor it makes it an ideal technology for retrofit opportunities.
Solar Hot Water Systems	✓			Suitable for houses. Delivers good calculated carbon and fuel cost savings, however it is unlikely to achieve 15% reduction in energy demand. Solar hot water relies upon thermal heat, rather than light (unlike solar PV) therefore it is most effective on hotter days. These are the days when the requirement for heating and hot water is at its lowest. Because there is a limit to useful heat from the Solar hot water, and there is no (or proposed) heat network in the area any excess heat is wasted. There for, as the size of the PV system is only restricted by the roof size (rather than usefulness) PV can better utilise more of the roof.

The feasibility of the different renewable technologies suggests that Solar PV is the most suitable renewable technology for this site.

Reducing Energy Demand – Fabric First Approach.

The reason given for the 15% requirement for renewable energy is "to help meet the Government's carbon-cutting ambitions". However, due to the way that the regulations work requiring 15% renewables is likely to mean an overall **increase** in Carbon Emissions.

Full architectural drawings were not available for modelling purposes at this stage, but similar house types from other developments have been used.

The Code for Sustainable Homes energy requirement to achieve Level 3 (required under condition 10 of the outline planning condition) is based upon calculations (Standard Assessment Procedure, SAP) also used in Building Regulations Part L.

Part L requires that all dwellings are calculated to produce less CO2 than a theatrical target. This Target Emission Rate (TER) is often known as the *notional building*. The calculated Dwelling Emission Rate (DER) must be a percentage improvement over the TER.

In order to calculate the TER and DER the following elements are taken into consideration within the SAP calculation;

Long Term Elements

- Floor space, Orientation, Exposure and Location in the UK, number and size of openings for doors and windows.
- U Values (heat loss) of Walls, Floors, Roofs, Windows and Doors.
- Details of junctions between elements and thermal breaks.
- Air Permeability of the building (a home can be well insulated, but if there are gaps in the construction; warmed air will escape)

Shorter Term Elements

- Space Heating System
- Hot Water Heating System
- Control of Heating System
- Ventilation
- Lighting
- Renewable Energy Technologies.

All the elements play a role in the calculated DER and the regulations allow the developer to choose which elements they wish to focus on in order to be the most cost effective way to achieve the required CO2 target.

Part L does have limiting backstops for the Longer Term Elements (the Fabric of the building), but otherwise they are tradable. Specifying renewable energy technologies means that to achieve the DER, the fabric is likely to be worse than without. Equally because the regulations are based upon Carbon, not Energy demand this means the actual energy demand for the design dwellings with renewables is likely to be significantly higher – as detailed in the below table 2.

Calculated Primary Energy Demand

Table 2, Initial Calculated Primary Energy Demand from similar site (15% would give similar results)

	Mid House Type		**End House Type**	
	10% renewables specification	**Fabric First Approach**	**10% renewables specification**	**Fabric First Approach**
Space Heating (kWh/year)	3504	1732	4565	2594
Water Heating (kWh/year)	2719	1777	2823	1788
Pumps and Fans (kWh/year)	175	175	175	175
Energy for Lighting (kWh/year)	480	281	505	291
Total (kWh/year)	**6952**	**3965**	**8068**	**4848**
Reduction from ~10% renewables (kWh/year)	-652	0	708	0
Total Energy Demand from non-renewable sources. (kWh/year)	**6299**	**3965**	**7360**	**4848**
Dwelling Emission Rate	**19.63**	**16.73**	**22.08**	**19.43**
Target Emission Rate	**22.17**	**18.09**	**24.96**	**20.31**
Approximate % Reduction in CO_2 Emissions over 2006 base regulations	**11%**	**12.5%**	**10%**	**9%**

Because the fabric is of the dwelling is not so good under the renewables option, the fabric first approach still requires less energy over all.

The fabric is detailed in the table 3 below (full indicative SAP Calculation within the Appendix)

Table 3, Expect Fabric proposals

Element	Proposed Fabric First Approach minimum Standards	15% Renewables	Part L 2010 Back Stop
Main Wall W/m3.K	0.24	0.30	0.30
Average Roof W/m3.K	0.13	0.2	0.20
Ground Floor W/m3.K	0.15	0.25	0.25
Windows and Doors W/m3.K	1.20	1.8	2.00
Thermal Bridging	Accredited construction	Standard construction	Standard
Air Tightness Test m3/(h.m2)@ 50 Pa	5.00	10.00	15.00
Heating System	Highly Efficient Condensing Gas	Standard Efficient Gas	Standard Efficient Gas
Control System	Time, Temp zone control with intelligent internal and external Thermostats	Time and Temperature control.	Time and Temperature control.

Fabric First Approach; local and national policy

This Fabric First Approach is set out in a number of relevant policies. Initially in the 2008 Zero Carbon Definition[i] the "Energy Hierarchy" was initially created with the emphasis put on Energy Efficiency before Carbon Compliance. Literally Energy Efficiency is the fabric of the building, while Carbon Compliance is renewable technologies.

Fabric First Approach Proposals

It is proposed that the dwellings are built to Fabric First standards because this will reduce the energy demand from non-renewable sources the most. This in turn will save a greater amount of CO2 and keep residents bills to a minimum.

Not only will following the fabric first approach be technically superior, it will also allow home owners to easily fit renewables of their choice as and when the wish. This ensures the most flexibility and long term sustainability of the dwellings, also enabling them to take full advantage of financial rewards such as the feed in tariff.

(vii) Code for Sustainable Homes credit allocation

This Pre-Assessment / Credit Allocation is an overarching look at what credits are likely to be achieved for the above development.

The Code for Sustainable Homes assesses each home individually, therefore there are likely to be variations between individual dwellings and also at Design and Post Construction.

Table 4 gives a suggested credit allocation for various house types to achieve Code Level 3.

Category		Maximum Score	Predicted Score
Ene 1	Dwelling Emission Rate	10	1
Ene 2	Fabric Energy Efficiency	9	6.8
Ene 3	Energy Display Devices	2	2
Ene 4	Drying Space	1	1
Ene 5	Energy Labelled White Goods	2	1
Ene 6	External Lighting	2	2
Ene 7	Low and Zero Carbon Tech	2	0
Ene 8	Cycle Storage	2	0
Ene 9	Home Office	1	1
Wat 1	Indoor Water Use	5	4
Wat 2	External Water Use	1	1
Mat 1	Environmental Impact of Materials	15	12
Mat 2	Sourcing Basic Building Elements	6	3
Mat 3	Sourcing Finishing Elements	3	2
Sur 1	Surface Water Run-off	2	0
Sur 2	Flood Risk	2	2
Was 1	Storage of household waste	4	4
Was 2	Construction Site Waste	3	2
Was 3	Composting	1	1
Pol 1	GWP of Insulants	1	1
Pol 2	NOx Emissions	3	3
Hea 1	Daylighting	3	1
Hea 2	Sound Insulation	4	3
Hea 3	Private Space	1	1
Hea 4	Lifetime Homes	4	0
Man 1	Home User Guide	3	3
Man 2	Considerate Construction	2	1
Man 3	Construction Site Impact	2	2
Man 4	Security	2	2
Eco 1	Ecological Value of the Site	1	1
Eco 2	Ecological Enhancement	1	1
Eco 3	Protection of Ecological Features	1	1
Eco 4	Change in Ecological Value of site	4	1
Eco 5	Building Footprint.	2	0
		Score	59.53
		Code Level	3

Table 4 – Code For Sustainable Homes Credit Allocation

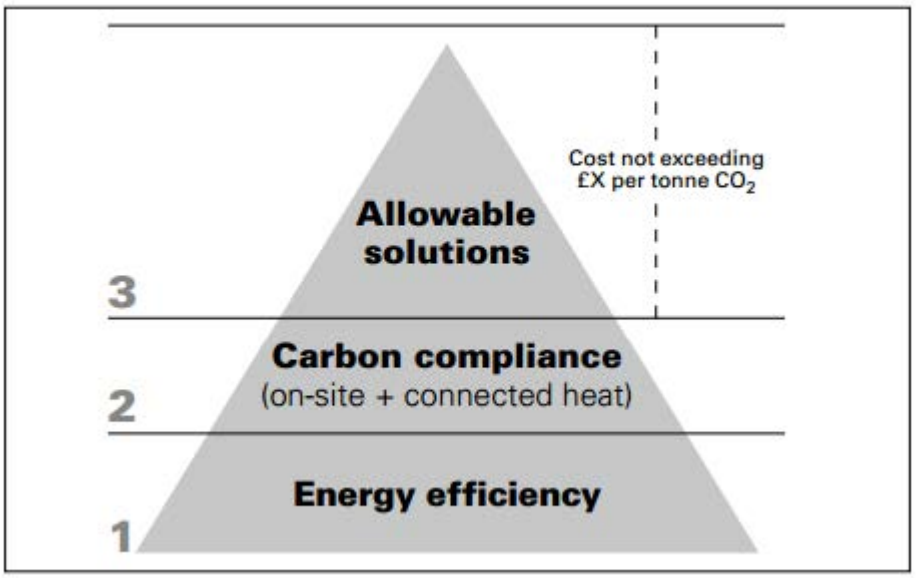
Ene 1 and Ene 2 Dwelling Emission Rate and Fabric Energy Efficiency	Minimum Credits 7.8	Potential 19

Ene 1 and Ene 2 within the Code for Sustainable Homes are based upon SAP, the Standard Assessment Procedure that calculates improvements for Part L 1a of the Building Regulations.

In 2010, the Government changed Part L 1a which meant that the minimum Building Regulations standards were the equivalent mandatory standard of Code Level 3. Therefore, if minimum Building Regulations are achieved, the mandatory element of Code Level 3 has been met.

Following the Government's preferred hierarchy (first set out in the 2008 Zero Carbon Homes Definition) *figure 1* it is best to follow an Energy Efficiency "Fabric First" approach. Most of the fabric of the building is likely to last the lifetime of the dwelling (an average of 50 years), whilst bolt on technologies are likely to last around 20 years. Building the fabric to the best feasible standards with little or no renewables also means that the dwellings are easier to improve in the future by adding renewables. Improving the fabric is much more difficult. Building new dwellings with lower fabric standards and renewables makes the homes more difficult to improve later in life. This is a similar approach as set out in the consultation for 2013 Part L.

Fig 1: Government's preferred hierarchy



As part of considering the applicability of enhanced insulation standards, the Developer will examine further measures within the detailed design of all dwellings to reduce the energy load and provide cost-saving benefits to the end user.

1 Credit within Ene 1 is equal to an 8% improvement over 2010 Building Regulations and 2 credits are equal to a 16% improvement. Therefore achieving 5.3 credits across Ene 1 and 2 will mean the dwelling is significantly more energy efficient than Building Regulations.
Doing this through improving the fabric of the building will have a longer lasting impact than using renewable technologies.

Additionally the developer will include the following features to improve energy efficiency;

- 100% low energy lighting throughout the site.
- Using low energy external lighting with daylight cut-off devices
- Efficient positioning of radiators
- Providing comprehensive advice to new occupants on energy efficiency via a Home User Guide.

Ene 3 Energy Display Devices	**Minimum Credits** 2	**Potential** 2
Having a dwelling that is highly efficient does not always mean a reduction in energy consumption. People often change their habits when moving into highly efficient home, simply by having it warmer for longer. Or leaving more electrical items on standby for longer. Energy Display Devices are one tool that can help residents understand how much energy they are using and when. With this knowledge they are more likely to cut their use.		

Ene 4 Drying Space	**Minimum Credits** 1	**Potential** 1
Providing an external (e.g. a rotary dryer) or an internal (e.g. A Tidy Dry with appropriate ventilation) facility for the natural drying of clothes, reducing the need for electrically driven dryers.		

Ene 5 Energy Labelled White Goods	**Minimum Credits** 1	**Potential** 2
To achieve 1 credit, the developer is required to give the occupier information about the European Energy Labelling of White goods scheme.		

Ene 6 External Lighting	**Minimum Credits** 2	**Potential** 2
External lighting can help improve security and it also improves access for partially sighted people. To improve Energy Efficiency this lighting should perform well, with minimum standards for Lumens (light output) per Watt of energy used. Equally it is important that this lighting is only used when it is needed, there for daylight sensors and / or movement sensors will be appropriately fitted.		

Ene 7 Low and Zero Carbon Technologies	Minimum Credits 0	Potential 2
It is expected that there will be no renewable technology specified for this development as the developer plans to take a Fabric First Approach.		

Ene 8 Cycle Storage	Minimum Credits 0	Potential 2
There may be the possible inclusion of secure cycle storage.		

Ene 9 Home Office	Minimum Credits 1	Potential 1
Encouraging people to live and work in the same locality is central to the sustainability agenda as it reduces the need to travel and the negative externalities associated with this. It is anticipated that the dwellings will have provision for home working in accordance with the requirements of the Code for Sustainable Homes. This credit may be difficult to achieve on all plots because of the daylight factor required.		

Wat 1 Indoor Water Use	Minimum Credits 4	Potential 5

By conforming to the Code for Sustainable Homes Level 3/4 standard for all dwellings, water use by the residents will be minimised through the specification of water saving sanitary features. The Code mandatory target for water consumption of 105 litres per person per day will be met for the dwellings. This represents a 30% reduction in terms of typical water consumption behaviour and a 16% improvement on the 125 litre per person per day requirement set by the amended Part G of Building Regulations (approved April 2010).

With careful choices for sanitary ware it is possible to achieve higher levels of indoor water efficiency above that of the mandatory level of Code Level 3. The homes could achieve 90 litres per person per day, but still use products which have good performance for residents.

The following devices will be incorporated within each dwelling to assist in achieving this requirement:

- Water efficient taps determined through the use of water restrictors
- Water efficient and dual flush toilets
- Shower flow rates no more than 9L/min
- Bath sizes will be in keeping with national practice

Information on ways to reduce water use will be included as part of the Home User Guide which all residents will be given on occupation of their dwelling.

Wat 2 External Water Use	Minimum Credits 1	Potential 1
By installing rain water butts, not only can residents use the water collected in them for garden use, they also can be helpful as water attenuation when heavy rainfall occurs.		

Mat 1, 2 and 3 Materials	Minimum Credits 15	Potential 24

The choice of construction materials affects the level of embodied energy being used by the development and it has a wide impact on the environment. Embodied energy is the energy consumed in the processes associated with the construction of the building. The following practices will be adopted by the developer to assist in reducing levels of embodied energy being used.

- Where feasible, the developer will use materials that are locally sourced.
- In doing this they will be supporting the local economy and will be minimising transportation of materials to the site.
- In selecting the construction materials the developer will endeavour to select materials which are from sustainable sources. BRE have created a Guide which rates construction materials according to sustainability criteria and where possible materials will have the highest sustainability rating, 'A+' or 'A'. Such materials have lower environmental impacts compared with 'B' and 'C' rated materials. Where an A+ or A rated material is not feasible the next level of B would be selected.
- The use of recycled materials would be carefully considered from a sustainability perspective and where they can be incorporated in the development, this will be determined at the detailed design stage.
- The developer intends that basic building materials are responsibly sourced and will be specified as such when suppliers are sought.
- Suppliers of timber products will be required to seek to evidence a full chain of custody e.g. Forest Stewardship Council and the Programme for the Enforcement of Forest Certification

As there materials have not been decided upon yet, the credits allocated within the pre-assessment are indicative of other similar sites.

Sur 1 Surface Water	Minimum Credits 0	Potential 2

As pictured below in the Google earth image of 2004, the site is a former housing site. There is some hardstanding where the buildings have been demolished.

A suitably qualified hydrologist has been employed and the drainage system will be designed in accordance with the requirements.



Sur 2 Flood Risk	Minimum Credits 2	Potential 2

A Flood Risk Assessment and Drainage Strategy has been carried out to Code Standards by a suitably qualified consultant.

It is expected that the Site is located in Flood Zone 1 and the flood risk is less than 1 in 1000 in any year, which is classified as 'low'.

Was 1 Storage of Waste	Minimum Credits 4	Potential 4
For all dwellings, external spaces and internal facilities will be provided for waste storage in accordance with the Code for Sustainable Homes (November 2010) requirements and BS 5906. The developer will undertake early discussions with the Local Authority to establish their requirements for the recycling and general refuse collection service to ensure integration between the two. Information on how to minimise waste and how and what to recycle will be included in a Home User Guide provided to all residents of the development. The Mandatory element of this credit that requires level access to the bin storage (assessed through the IDP checklist) will also be achieved.		

Was 2 Construction Waste	Minimum Credits 2	Potential 3
Construction operations generate waste materials as a result of general handling losses and surpluses. These wastes can be reduced through the appropriate selection of construction methods, good site waste management practices and spotting opportunities to avoid creating unnecessary waste. In accordance with regulatory requirements the developer will prepare a Site Waste Management Plan (SWMP) at the appropriate stage of development. Implementing the SWMP could result in various benefits for the development, which include: • Better control of risks relating to the materials and waste on the site. • Demonstrating compliance with the legislative framework. • Demonstrating to clients how waste is managed and minimised and how associated costs are controlled.		

Was 3 Composting	Minimum Credits 1	Potential 1
Full composting facilities will be considered for all houses within the development for inclusion in the gardens. The Composting facilities also need to be accessible and adhere to the IDP checklist.		

Pol 1 GWP of Insulants	Minimum Credits 1	Potential 1
All insulation materials specified by the developer would have an Ozone Depleting Potential of Zero and Global Warming Potential of less than 5.		

Pol 2 NOx Emissions	Minimum Credits 3	Potential 3
Highly efficient gas boilers that will be needed to achieve Ene 1 credits are almost certainly going to achieve 3 credits in this category.		

Hea 1 Daylighting	Minimum Credits 1	Potential 3
Many plots are likely to achieve this credit, however this will depend on daylight calculations. For the purpose of pre-assessment we are assuming worse case.		

Hea 2 Sound Insulation	Minimum Credits 3	Potential 4
During construction, adverse noise and vibration effects will be mitigated as far a possible through specific site practices, and the management and use of appropriate construction techniques. Party Walls will achieve a standard of at least 5dB better than Building Regulations Part E either through the use of Robust Details.		

Hea 3 Private Space	Minimum Credits 1	Potential 1
The provision of outdoor space around or close to the home is one of the key aspects affecting the quality of life of residents. Consideration will be given for the homes to have private or semi-private gardens. In addition to achieving Code credits, the Developers open space proposals would respect the topographical, ecological and hydrological constraints of the Application Site. This includes protecting existing vegetation as well as planting new trees and shrubs. The outdoor space will be designed in accordance with the Inclusive Design Principles (IDP Checklist).		

Man 1 Home User Guide	Minimum Credits 3	Potential 3
The Home User Guide enables occupants of the dwellings to understand how best to use their homes and local area. With new technology, controls and displays some residents may not be sure how to best operate their homes. The Home User Guide also gives important information about amenities and services in the local area and details of sustainable transport.		

Man 2 Considerate Construction Scheme	Minimum Credits 1	Potential 2
The Developer will develop the proposed scheme in accordance with the principles of Considerate Constructors Scheme thereby achieving credits under the Code for Sustainable Homes. Part of this accreditation includes waste management measures and re use of materials and recycling. Other components of good construction practice are to be undertaken, including regular consultation with the existing neighbouring community and residents (with a complaints procedure established) and monitoring of site impacts before, during and post construction. Appropriate mitigation measures will then be able to take place to minimise the effects. With appropriate practises maximum credits can be achieved here, however worst case scenario has been used for this Pre-Assessment.		

Man 3 Construction Site Impacts	Minimum Credits 2	Potential 2
Reducing the impacts of the building work during construction also helps to reduce the impact upon the environment. Procedures such as reducing the amount of dust, reducing the amount of water pollution. Measuring on site electricity and water will also be considered by the developer.		

Man 4 Security	Minimum Credits 2	Potential 2
The proposed development is expected to be designed to address the principles and objectives of the 'Secured by Design' award scheme. This will allow credits to be achieved in the Security section of Code for Sustainable Homes. A Local Police Crime Prevention advice will be sought during the design period and recommendations considered and incorporated into the detailed design of the development.		

Ecology Section	Minimum Credits 4	Potential 9

A detailed assessment of the ecology of the site will be prepared in accordance with the requirements set out in the Code for Sustainable Homes by a suitably qualified ecologist.

Before this has been completed, the credit allocation is based upon previous experience with similar sites. How much of this will be changed in the development will be determined leading up to design stage.



(viii) Conclusion

This Sustainability Report sets out the approach to the creation of a sustainable development at the Close Lundwood

The report is based upon a review of the proposals and a thorough analysis of relevant national, regional and local planning policy requirements, and includes a Code for Sustainable Homes pre-assessment.

The development at Lundwood sets out to satisfy all key planning policy requirements, and in some cases exceeds them.

It is planned to achieve a Level 3 rating under the Code for Sustainable Homes

(November 2010). The developer will set out its strategy for ensuring that the proposed development is sustainable and will continue to review this as the design progresses.

As a result we consider that the design is a sustainable development, which sensitively addresses the Application Site's constraints and optimise its opportunities at the same time as meeting a known housing need.

This sustainable development has been created through the implementation of many measures, including the following key points:

- A development of 26 mixed residential dwellings which will help meet a well-established and accepted need for housing in the area.
- Proposing to achieve a minimum of Code Level 3.
- Following a Fabric First Approach to reduce energy demand from non-renewable sources to a minimum.
- Meeting and exceeding Approved Document part L1a (2010) of the Building Regulations, with high levels of insulation, efficient heating systems and low levels of air permeability.
- 100% energy efficient lights throughout the development.
- Internal water use within all dwellings to be reduced to a projected 90 litres per person per day through the provision of water saving fittings.
- The use of materials with low embodied energy which are locally sourced where available.
- A suitably qualified hydrologist has been employed and the drainage system will be designed in accordance with the requirements.
- Reducing the site impact using considerate construction techniques and utilising local labour where applicable.
- Ecology of the Application Site will be examined by a qualified Ecologist. All key ecological recommendations are expected to be adopted.
- Sustainable transport promoted by locating all dwellings within 200m of a bus stop and providing all new residents with comprehensive information on the public transport provision.
- Cycle Storage is expected to be included in the development to encourage cycle commuting a recreation.
- Waste minimisation principles adopted both during construction and in the lifespan of the development through promotion of recycling/composting measures.
- Initiatives developed to ensure a high quality place to live, including measures to minimise crime, improve security, provide outside spaces and achieve acceptable noise levels.

[i] http://www.zerocarbonhub.org/definition.aspx

Appendix 1

Stroma

Code for Sustainable Homes

Pre-Assessment

Code for Sustainable Homes

Technical Guide November 2010 - Full Technical Guide

Pre-Assessment Report

Report Reference:	**LKACC 13 1250**
Site Registration:	
Site Name:	**The Close**
Assessor Number:	**STRO007454**
Company:	**LK Accreditation**
Assessor:	**Gwyn Roberts**

Site Details	
Site Name:	The Close
Site Registration:	
Site Address:	Lundwood
City/Town:	Barnsley
County:	South Yorkshire
Postcode:	S71 5NT
No. of Dwellings:	1
No. of Dwelling Types:	3
Planning Authority:	Doncaster Metropolitan Borough Council
Funding Body:	

Assessor Details	
Company:	LK Accreditation
Assessor Name:	Gwyn Roberts
Cert Number:	STRO007454
Address:	Bury Business Park Kay Street Bury
City/Town:	Manchester
County:	Greater Manchester
Postcode:	BL9 6BU
Tel:	016176372000
Email:	G.Roberts@theLKgroup.com

Client Details	
Company:	R P Tyson Construction Ltd
Contact Name:	Jeremy Whittle
Job Title:	Director
Email:	
Tel:	01253 696800
Address:	1 Mitcham Road
City/Town:	Blackpool
County:	Lancashire
Postcode:	FY4 4QN

Architect Details	
Company:	
Contact Name:	
Job Title:	
Email:	
Tel:	
Address:	
City/Town:	
County:	
Postcode:	

Developer Details	
Company:	R P Tyson Construction Ltd
Contact Name:	Jeremy Whittle
Job Title:	Director
Email:	
Tel:	01253 696800
Address:	1 Mitcham Road
City/Town:	Blackpool
County:	Lancashire
Postcode:	FY4 4QN

Dwelling ID	Plot No.	Address	Social Unit
1	5	Mid Telford Street	No

Development Summary & Ratings

Dwelling ID	Dwelling Type	Description	Level	Score
5	Mid Terrace		3	59.5336193

Deviations from Standard

No deviations from standard

Score Sheet for The Close

	ENE									WAT		MAT			SUR		WAS			POL		HEA				MAN				ECO					Summary	
Dwelling ID	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**1**	**2**	**1**	**2**	**3**	**1**	**2**	**1**	**2**	**3**	**1**	**2**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**5**	**Score**	**Level**
1	1	6.8	2	1	1	2	0	0	1	4	1	12	3	2	0	2	4	2	1	1	3	1	3	1	0	3	1	2	2	1	1	1	1	0	59.53	3

Summary Score Sheet
Dwelling Type: Mid Terrace

Dwelling ID: 1

	Credit Score	Credits Available	Score Assessment Sub Total	Credits Available	%	Weighting Factor	Points Score
Energy & CO2 Emissions							
ENE 1 Dwelling Emission Rate	1	10	14.8	31	47.74	36.4	17.38
ENE 2 Fabric Energy Efficiency	6.8	9					
ENE 3 Energy Display Device	2	2					
ENE 4 Drying Space	1	1					
ENE 5 Energy Labelled White Goods	1	2					
ENE 6 External Lighting	2	2					
ENE 7 Low or Zero Carbon Energy Technologies	0	2					
ENE 8 Cycle Storage	0	2					
ENE 9 Home Office	1	1					
Water							
WAT 1 Internal Water Use	4	5	5	6	83.33	9	7.5
WAT 2 External Water Use	1	1					
Materials							
MAT 1 Environmental Impact of Materials	12	15	17	24	70.83	7.2	5.1
MAT 2 Responsible Sourcing (Basic Building Elements)	3	6					
MAT 3 Responsible Sourcing (Finishing Elements)	2	3					
Surface Water Run-off							
SUR 1 Management of Surface Water Run-Off from Site	0	2	2	4	50	2.2	1.1
SUR 2 Flood Risk	2	2					
Waste							
WAS 1 Household Waste Storage and Recycling Facilities	4	4	7	8	87.5	6.4	5.6
WAS 2 Construction Site Waste Management	2	3					
WAS 3 Composting	1	1					
Pollution							
POL 1 Global Warming Potential of Insulants	1	1	4	4	100	2.8	2.8
POL 2 NOx Emissions	3	3					
Health & Wellbeing							
HEA 1 Daylighting	1	3	5	12	41.67	14	5.83
HEA 2 Sound Insulation	3	4					
HEA 3 Private Space	1	1					
HEA 4 Lifetime Homes	0	4					
Management							
MAN 1 Home User Guide	3	3	8	9	88.89	10	8.89
MAN 2 Considerate Constructors Scheme	1	2					
MAN 3 Construction Site Impacts	2	2					
MAN 4 Security	2	2					
Ecology							
ECO 1 Ecological Value of Site	1	1	4	9	44.44	12	5.33
ECO 2 Ecological Enhancement	1	1					
ECO 3 Protection of Ecological Features	1	1					
ECO 4 Change of Ecological Value of Site	1	4					
ECO 5 Building Footprint	0	2					
	Level Achieved: 3		Total Points Scored: 59.53				

Evidence for ENE 1 (Dwelling Emission Rate) - Mid Terrace
Improvement above Part L Building Regulations 2010. 1 credits allocated
Assumptions for ENE 1
Assuming that all properties will equal or exceed worst case design SAP

Evidence for ENE 2 (Fabric Energy Efficiency) - Mid Terrace
Mid Terrace 6.8 credits allocated
Assumptions for ENE 2
Assuming that all properties will equal or exceed worst case design SAP

Evidence for ENE 3 (Energy Display Device) - Mid Terrace
Correctly specified display device showing current primary heating fuel consumption data. Correctly specified display device showing current consumption data.
Assumptions for ENE 3
Assuming that a energy display devices for both gas and electricity will be installed. (with appropriate smart meter)

Evidence for ENE 4 (Drying Space) - Mid Terrace
Compliant external drying space
Assumptions for ENE 4
That a rotary dryer with suitable footings is installed in all properties.

Evidence for ENE 5 (Energy Labelled White Goods) - Mid Terrace
EU energy efficiency labelling scheme leaflet provision/provided
Assumptions for ENE 5
EU Energy Efficiency Labelling Leaflet will be provided to all units.

Evidence for ENE 6 (External Lighting) - Mid Terrace
Complaint space lighting, no security lighting installed Dual lamp luminaries with compliant space & security lamps
Assumptions for ENE 6
That all external and common space lighting will be energy efficient and have appropriate controls.

Evidence for ENE 7 (Low or Zero Carbon Energy Technologies) - Mid Terrace
Credit(s) not sought or contribution of low or zero carbon technologies less than 10%
Assumptions for ENE 7

Evidence for ENE 8 (Cycle Storage) - Mid Terrace
Credit(s) not sought or no compliant cycle storage
Assumptions for ENE 8

Evidence for ENE 9 (Home Office) - Mid Terrace
Compliant home office
Assumptions for ENE 9

Evidence for WAT 1 (Internal Water Use) - Mid Terrace
Internal water use less than or equal to 90 litres per person per day

Assumptions for WAT 1
That using the Water Calculator for New Dwellings internal Water Consumption will be less than or equal to 90l/p/d.

Evidence for WAT 2 (External Water Use) - Mid Terrace
Compliant individual rainwater collection system
Assumptions for WAT 2
Rain Water butts may not be needed in order to achieve Code level 3.

Evidence for MAT 1 (Environmental Impact of Materials) - Mid Terrace
Mandatory requirements met: At least 3 elements rated A+ to D, 12 credits scored
Assumptions for MAT 1
Using the Green Guide the impact of the environmental impact of materials will be minimal.

Evidence for MAT 2 (Responsible Sourcing (Basic Building Elements)) - Mid Terrace
3 credits scored
Assumptions for MAT 2
Basical Building Elements will be sourced from responsible suppliers.

Evidence for MAT 3 (Responsible Sourcing (Finishing Elements)) - Mid Terrace
2 credits scored
Assumptions for MAT 3
Finishing Building Elements will be sourced from responsible suppliers.

Evidence for SUR 1 (Management of Surface Water Run-Off from Site) - Mid Terrace
Mandatory Met: Peak rate of run-off and annual volume of run-off is no greater for the developed than for the pre-development. The system has also been designed for local drainage system failure.
Assumptions for SUR 1
Mandatory elements will be achieved.

Evidence for SUR 2 (Flood Risk) - Mid Terrace
Low flood risk - zone 1
Assumptions for SUR 2
The Site is within a low flood risk Zone, with confirmation from suitable expert.

Evidence for WAS 1 (Household Waste Storage and Recycling Facilities) - Mid Terrace
Mandatory requirements met: Adequate storage of household waste with accessibility in line with checklist WAS 1. Local authority collection: After collection sorting with appropriate internal storage of recyclable materials
Assumptions for WAS 1
IDP checklist will be adheard to Internal recycling bins will be fixed and within cupboards and of a compliant size.

Evidence for WAS 2 (Construction Site Waste Management) - Mid Terrace
Compliant site waste management plan containing benchmarks, procedures and commitments for the minimizing and diverting 50% waste from landfill in line with the criteria and with Checklist WAS 2a, 2b & 2c
Assumptions for WAS 2
It is likely that achieving 85% of waste diverted from landfill. SWMP will be followed.

Evidence for WAS 3 (Composting) - Mid Terrace
Individual compositing facility/facilities

Assumptions for WAS 3
Individual home composting bins will be delivered to all properties. IDP checklist will be adheard to.

Evidence for POL 1 (Global Warming Potential of Insulants) - Mid Terrace
All insulants have a GWP of less than 5
Assumptions for POL 1
That insulation materials are chosen that have a GWP of less than 5.

Evidence for POL 2 (NOx Emissions) - Mid Terrace
NOx emissions less than or equal to 40mg/kWh
Assumptions for POL 2
That a Gas boiler is chosen with Low NOx Emissions.

Evidence for HEA 1 (Daylighting) - Mid Terrace
All rooms (kitchen, living, dining and where applicable the home office) have 80% of the working plane with direct light from the sky
Assumptions for HEA 1
Daylight calculations may need to be carried out (likely not to be)

Evidence for HEA 2 (Sound Insulation) - Mid Terrace
Robust details have been incorporated Airborne 5dB higher, impact 5dB lower
Assumptions for HEA 2
4 Credits (Robust Details website) E-WM-20

Evidence for HEA 3 (Private Space) - Mid Terrace
Individual private space provided
Assumptions for HEA 3
Private Space will be of a suitible size and have correct access. IDP checklist is adhered to.

Evidence for HEA 4 (Lifetime Homes) - Mid Terrace
Credits not sought
Credit not saught
Assumptions for HEA 4

Evidence for MAN 1 (Home User Guide) - Mid Terrace
All criteria inline with checklist MAN 1 Part 1 - Operational Issues will be met All criteria inline with checklist MAN 1 Part 2 - Site and Surroundings will be met
Assumptions for MAN 1
A Home User Guide will be wirtten and delivered to all plots.

Evidence for MAN 2 (Considerate Constructors Scheme) - Mid Terrace
Considerate constructors scheme: Best practise only, a score of between 24 and 31.5 and at least a score of 3 in every section
Assumptions for MAN 2
The site will be signed up to the Considerate Constructors Scheme before any work is started on site.

Evidence for MAN 3 (Construction Site Impacts) - Mid Terrace
Monitor, report and set targets for water consumption from site activities Adopt best practise policies in respects to air (dust) pollution from site activities Adopt best practise policies in respects to water (ground and surface) pollution 80% of timer reclaimed, re-used or responsibly sourced
Assumptions for MAN 3
That records, targets and graphs, will be kept / produced detailing the sites impact.

Evidence for MAN 4 (Security) - Mid Terrace
Secured by design section 1 & 2 compliant
Assumptions for MAN 4
The site will be registered and achieve Secure By Design Compliance.

Evidence for ECO 1 (Ecological Value of Site) - Mid Terrace
Land of low ecological value, achieved through checklist ECO 1. Development site has been identified as low ecological value by a suitably qualified ecologist
Assumptions for ECO 1
A Suitible Qualified Ecologist will be employed

Evidence for ECO 2 (Ecological Enhancement) - Mid Terrace
Key recommendations and 30% additional recommendations by a suitably qualified ecologist
Assumptions for ECO 2

Evidence for ECO 3 (Protection of Ecological Features) - Mid Terrace
Land of low ecological value as identified under ECO 1
Assumptions for ECO 3
A Suitible Qualified Ecologist will be employed

Evidence for ECO 4 (Change of Ecological Value of Site) - Mid Terrace
Minor negative change: Between -9 and less than or equal to -3
Assumptions for ECO 4
A Suitible Qualified Ecologist will be employed and recommendations will be followed.

Evidence for ECO 5 (Building Footprint) - Mid Terrace
Credit not sought
Assumptions for ECO 5
Caclculation of NIFGA and NIFA will be carried out.

Assessor Declaration

I Gwyn Roberts, can confirm that I have compiled this report to the best of my ability, I have based all findings on the information that is referenced within this report, and that this report is appropriate for the registered site.

To the best of my knowledge all the information contained within this report is correct and accurate. I have within my possession all the reference material that relates to this report, which is available for inspection by the client, the clients representative or Stroma Certification for Quality Assurance monitoring.

Signed:



Gwyn Roberts
LK Accreditation
08 March 2013

Information about Code for Sustainable Homes

The Code for Sustainable Homes (the Code) is an environmental assessment method for rating and certifying the performance of new homes. It is a national standard for use in the design and construction of new homes with a view to encouraging continuous improvement in sustainable home building. The Code is based on EcoHomes©.

It was launched in December 2006 with the publication of 'Code for Sustainable Homes: A stepchange in sustainable home building practice' (Communities and Local Government, 2006), and became operational in England from April 2007.

The Code for Sustainable Homes covers nine categories of sustainable design. Each category includes a number of environmental issues. Each issue is a source of impact on the environment which can be assessed against a performance target and awarded one or more credits. Performance targets are more demanding than the minimum standards needed to satisfy Building Regulations or other legislation. They represent good or best practice, are technically feasible, and can be delivered by the building industry. The issues and categories are as follows:

- Energy & CO2 Emissions
  - Dwelling Emission Rate
  - Building Fabric
  - Internal Lighting
  - Drying Space
  - Energy Labelled White Goods
  - External Lighting
  - Low or Zero Carbon Technologies
  - Cycle Storage
  - Home Office
- Water
  - Internal Water Use
  - External Water Use
- Materials
  - Environmental Impact of Materials
  - Responsible Sourcing of Materials - Basic Building Elements
  - Responsible Sourcing of Materials - Finishing Elements
- Surface Water Run-off
  - Management of Surface Water Run-off from the Development
  - Flood Risk
- Waste
  - Storage of Non-Recyclable Waste and Recyclable Household Waste
  - Construction Site Waste Management
  - Composting
- Pollution
  - Global Warming Potential of Insulants
  - NOx Emissions

- Health & Wellbeing
  - Daylighting
  - Sound Insulation
  - Private Space
  - Lifetime Homes
- Management
  - Home User Guide
  - Considerate Constructors Scheme
  - Construction Site Impacts
  - Security
- Ecology
  - Ecological Value of Site
  - Ecological Enhancement
  - Protection of Ecological Features
  - Change in Ecological Value of Site
  - Building Footprint

The Code assigns one or more performance requirements (assessment criteria) to all of the above environmental issues. When each performance requirement is achieved a credit is awarded (with the exception of the four mandatory requirements which have no associated credits). The total number of credits available to a category is the sum of credits available for all the issues within it.

Mandatory minimum performance standards are set for some issues. For four of these, a single mandatory requirement is set which must be met, whatever Code level rating is sought. Credits are not awarded for these issues. Confirmation that the performance requirements are met for all four is a minimum entry requirement for achieving a level 1 rating. The four un-credited issues are:

- Environmental Impacts of Materials
- Management of Surface Water Run-off from Developments
- Storage of Non-Recyclable Waste and Recyclable Household Waste
- Construction Site Waste Management

If the mandatory minimum performance standard is met for the four un-credited issues, four further mandatory issues need to be considered. These are agreed to be such important issues that separate Government policies are being pursued to mitigate their effects. For two of these, credits are awarded for every level of achievement recognised within the Code, and minimum mandatory standards increase with increasing rating levels.

The two issues with increasing mandatory minimum standards are:

- Dwelling Emission Rate
- Indoor Water Use

For one issue a mandatory requirement at Level 5 or 6:

- Fabric Energy Efficiency

The final issue with a mandatory requirement for Level 6 of the Code is:

- Lifetime Homes

Further credits are available on a free-choice or tradable basis from other issues so that the developer may choose how to add performance credits (converted through weighting to percentage points) achieve the rating which they are aiming for.

The environmental impact categories within the Code are not of equal importance. Their relative value is conveyed by applying a consensus-based environmental weighting factor (see details below) to the sum of all the raw credit scores in a category, resulting in a score expressed as percentage points. The points for each category add up to 100.

The weighting factors used in the Code have been derived from extensive studies involving a wide range of stakeholders who were asked to rank (in order of importance) a range of environmental impacts. Stakeholders included international experts and industry representatives.

It is also important to note that achieving a high performance in one category of environmental impact can sometimes result in a lower level of performance for another. For instance, if biomass is used to meet heating demands, credits will be available for performance in respect of energy supplied from a renewable source, but credits cannot be awarded for low NOX emission. It is therefore impossible to achieve a total percentage points score of 100.

The Code uses a rating system of one to six stars. A star is awarded for each level achieved. Where an assessment has taken place by where no rating is achieved, the certificate states that zero stars have been awarded:

Code Levels	Total Points Score (Equal to or Greater Than)
Level 1 ★☆☆☆☆☆	**36 Points**
Level 2 ★★☆☆☆☆	**48 Points**
Level 3 ★★★☆☆☆	**57 Points**
Level 4 ★★★★☆☆	**68 Points**
Level 5 ★★★★★☆	**84 Points**
Level 6 ★★★★★★	**90 Points**

Formal assessment of dwellings using the Code for Sustainable Homes may only be carried out using Certified assessors, who are qualified ‘competent persons’ for the purpose of carrying out Code assessments.

Energy & CO2 Emissions
ENE 1: Dwelling Emission Rate **Available Credits:**10 **Aim:**To limit CO2 emissions arising from the operation of a dwelling and its services in line with current policy on the future direction of regulations.
ENE 2: Fabric Energy Efficiency **Available Credits:**9 **Aim:**To improve fabric energy efficiency performance thus future-proofing reductions in CO2 for the life of the dwelling.
ENE 3: Energy Display Device **Available Credits:**2 **Aim:**To promote the specification of equipment to display energy consumption data, thus empowering dwelling occupants to reduce energy use.
ENE 4: Drying Space **Available Credits:**1 **Aim:**To promote a reduced energy means of drying clothes.
ENE 5: Energy Labelled White Goods **Available Credits:**2 **Aim:**To promote the provision or purchase of energy efficient white goods, thus reducing the CO2 emissions from appliance use in the dwelling.
ENE 6: External Lighting **Available Credits:**2 **Aim:**To promote the provision of energy efficient external lighting, thus reducing CO2 emissions associated with the dwelling.
ENE 7: Low or Zero Carbon Technologies **Available Credits:**2 **Aim:**To limit CO2 emissions and running costs arising from the operation of a dwelling and its services by encouraging the specification of low and zero carbon energy sources to supply a significant proportion of energy demand.
ENE 8: Cycle Storage **Available Credits:**2 **Aim:**To promote the wider use of bicycles as transport by providing adequate and secure cycle storage facilities, thus reducing the need for short car journeys and the associated CO2 emissions.
ENE 9: Home Office **Available Credits:**1 **Aim:**To promote working from home by providing occupants with the necessary space and services thus reducing the need to commute.

Water
WAT 1: Indoor Water Use **Available Credits:**5 **Aim:**To reduce the consumption of potable water in the home from all sources, including borehole well water, through the use of water efficient fittings, appliances and water recycling systems.
WAT 2: External Water Use **Available Credits:**1 **Aim:**To promote the recycling of rainwater and reduce the amount of mains potable water used for external water uses.

Materials
MAT 1: Environmental Impact of Materials **Available Credits:**15 **Aim:**To specify materials with lower environmental impacts over their life-cycle.
MAT 2: Responsible Sourcing of Materials - Basic Building Elements **Available Credits:**6 **Aim:**To promote the specification of responsibly sourced materials for the basic building elements.
MAT 3: Responsible Sourcing of Materials - Finishing Elements **Available Credits:**3 **Aim:**To promote the specification of responsibly sourced materials for the finishing elements.

Surface Water Run-off
SUR 1: Management of Surface Water Run-off from developments **Available Credits:**2 **Aim:**To design surface water drainage for housing developments which avoid, reduce and delay the discharge of rainfall run-off to watercourses and public sewers using SuDS techniques. This will protect receiving waters from pollution and minimise the risk of flooding and other environmental damage in watercourses.
SUR 2: Flood Risk **Available Credits:**2 **Aim:**To promote housing development in low flood risk areas, or to take measures to reduce the impact of flooding on houses built in areas with a medium or high risk of flooding.

Waste
WAS 1: Storage of non-recyclable waste and recyclable household waste **Available Credits:**4 **Aim:**To promote resource efficiency via the effective and appropriate management of construction site waste.
WAS 2: Construction Site Waste Management **Available Credits:**3 **Aim:**To promote resource efficiency via the effective and appropriate management of construction site waste.
WAS 3: Composting **Available Credits:**1 **Aim:**To promote the provision of compost facilities to reduce the amount of household waste send to landfill.

Pollution
POL 1: Global Warming Potential of Insulants **Available Credits:**1 **Aim:**To promote the reduction of emissions of gases with high GWP associated with the manufacture, installation, use and disposal of foamed thermal and acoustic insulating materials.
POL 2:NOx Emissions **Available Credits:**3 **Aim:**To promote the reduction of nitrogen oxide (NOX) emissions into the atmosphere.

Health & Wellbeing
HEA 1: Daylighting **Available Credits:**3 **Aim:**To promote good daylighting and thereby improve quality of life and reduce the need for energy to light the home.
HEA 2: Sound Insulation **Available Credits:**4 **Aim:**To promote the provision of improved sound insulation to reduce the likelihood of noise complaints from neighbours.
HEA 3: Private Space **Available Credits:**1 **Aim:**To improve quality of life by promoting the provision of an inclusive outdoor space which is at least partially private.
HEA 4: Lifetime Homes **Available Credits:**4 **Aim:**To encourage the construction of homes that are accessible and easily adaptable to meet the changing needs of current and future occupants.

Management
MAN 1: Home User Guide **Available Credits:**3 **Aim:**To promote the provision of guidance enabling occupants to understand and operate their home efficiently and make the best use of local facilities.
MAN 2: Considerate Constructors Scheme **Available Credits:**3 **Aim:**To promote the environmentally and socially considerate, and accountable management of construction sites.
MAN 3: Construction Site Impacts **Available Credits:**2 **Aim:**To promote construction sites managed in a manner that mitigates environmental impacts.
MAN 4: Security **Available Credits:**2 **Aim:**To promote the design of developments where people feel safe and secure- where crime and disorder, or the fear of crime, does not undermine quality of life or community cohesion.

Ecology
ECO 1: Ecological value of site **Available Credits:**1 **Aim:**To promote development on land that already has a limited value to wildlife, and discourage the development of ecologically valuable sites.
ECO 2: Ecological enhancement **Available Credits:**1 **Aim:**To enhance the ecological value of a site.
ECO 3: Protection of ecological features **Available Credits:**1 **Aim:**To promote the protection of existing ecological features from substantial damage during the clearing of the site and the completion of construction works.
ECO 4: Change in ecological value of site **Available Credits:**4 **Aim:**To minimise reductions and promote an improvement in ecological value.
ECO 5: Building footprint **Available Credits:**2 **Aim:**To promote the most efficient use of a building’s footprint by ensuring that land and material use is optimised across the development.

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Full SAP Calculation Printout

Users Ref: Maine Rd_Type B End_Renew

Issued on: 14.December.2012

Prop Type Ref:

Property: Type B End, Maine Road

DER: 22.39

TER: 24.96

SAP Rating: **85 B** **SAP Energy Cost:** £157.51 **CO2 Emissions:** 1.32 t/year

EI Rating: **84 B** **Energy used:** 135 kWh/m2/year **Ene1:** 1 **ZC:** 0.00

Surveyor: 7112-0003, Peter Isherwood, Tel: 0161 763 7200, Fax: 0161 763 7318

Address: Bury Business Centre, Kay Street, Bury, BL9 6BU

Client:

Software Version: EES SAP 2005.018.03, October 2009 (Design System), BRE SAP Worksheet 9.81

SAP version: 9.81 Regs Region: England and Wales (Part L1A 2006), Calculation Type: New Build

CALCULATION DETAILS for survey reference no 'Maine Rd_Type B End_Renew' Page: 1

SAP2005 - 9.81 input data (DesignData) -

Regs Region:	England
Calculation Type:	NewDwellingAsDesigned
Region:	WP West Pennines (15.5)
Orientation:	E East
PropType:	H House, E End Terrace
Storeys:	2
Property Age:	2012
Sheltered Sides:	2
Sunlight Shade:	A Average or unknown
Wall Perimeter:	16.84 m, 15.66 m
Floor Area:	31.81 m2, 30.64 m2
Living Floor Area:	10.40 m2, fraction:0.00
Storey Height:	2.40 m, 2.60 m
Conservatory:	None
Doors	
Front Door:	Solid Wood, uvalue: 2.20 (M), area: 2.17 m2, argon: No, solar tra
Rear Door:	Double,Low E,Hard Coat, Glazed PVC, 6 mm, uvalue: 2.20 (M), area:
Windows	
Side Windows1:	Double,Low E,Hard Coat, PVC, 16 mm, North (90°), uvalue: 2.20 (M)
Side Windows2:	Double,Low E,Hard Coat, PVC, 16 mm, South (270°), uvalue: 2.20 (M
Draught Lobby:	No
Draught Proofing:	100%
Roof Lights	
Pressure Test:	Air permeability 10.0 m³/h.m² (assumed)
Mechanical Ventilation:	None, Windows open during hot weather: Windows fully open
	Cross ventilation possible: Yes
Fans, Chimneys, Flues:	3, 0, 0
Lighting:	Light fittings: 12, L.E.L. fittings: 4, External lights: None
Main Wall Type:	U: 0.35 A: X(68.53 m2)
Extented Wall Types:	
Timber Frame Wall Area:	0
Plane Roof	U: 0.25 A: 30.64 m2
Flat Roof	U: 0.25 A: 1.21 m2
Main Floor Type:	U: 0.25 A: 31.81 m2
Thermal Mass:	Thermal Mass Parameter entered as: 1.00
Timber Floor:	No Timber Floor
Fixed Air Conditioning:	No
Main Heating:	BGB Post 98 Gas condens. (incl combis) with auto ign. F.A.F., Pum
Main Heating Manufacturer:	Manufacturer's data: tba, tba, 86.0%
Heating Controls:	CBD Programmer, room thermostat and TRVs
	Boiler interlock - Yes
Underfloor Heating:	None
Combi Type:	StandardCombi
Combi Keep Hot:	WithoutKeepHot
Secondary Heating:	None
Manufacturer:	

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Thermal Store:	None
Hot Water Heating:	HWP From the primary heating system
Solar Water Heating:	None
Thermal Store:	None
Hot Water Cylinder:	None
Community Heating:	None
CHP Unit:	
Electricity Tariff:	S - Standard
Thermal Bridges:	DefaultRobustConstr, Thermal bridging factor y = 0.08
PV Cells:	PV cells Peak Power: 0.85
	Orientation: South, Elevation: 30°, Overshading: None or little (
Energy Saved:	
Energy Used:	
Terrain Type:	Urban
Number of Wind Turbines:	0

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1. Overall dwelling dimensions			
Ground floor	31.810 * 2.400	76.3440	
First floor	30.640 * 2.600	79.6640	
Total floor area	62.450		(5)
Total house volume		156.0080	(6)
2. Ventilation rate			
Number of chimneys	0 * 40	0	(7)
Number of flues	0 * 20	0	(8)
Number of fans	3 * 10	30	(9)
Flueless gas fire	0 * 40	0	(9a)
Infiltration		0.1923	(10)
Pressure test value		10.0000	(q50)
Infiltration rate		0.6923	(19)
Sides sheltered		2	(20)
Shelter factor		0.8500	(21)
Adjusted infiltration rate		0.5885	(22)
Air change natural ventilation		0.6731	(24)
Effective air change rate		0.6731	(25)
3. Heat losses and heat loss parameter			
Front Door	2.1700 * 2.20	4.7740	(26)
Rear Door	2.1800 * 2.20	4.7960	(26)
Side Windows1	4.1200 * (2.20) 2.02	8.3309	(27)
Side Windows2	4.1300 * (2.20) 2.02	8.3511	(27)
Ground Floor	31.8100 * 0.25	7.9525	(28)
Main Wall	68.5320 * 0.35	23.9862	(29)
Plane Roof	30.6400 * 0.25	7.6600	(30)
Flat Roof	1.2100 * 0.25	0.3025	(30)
Total area of elements		144.7920	(32)
Fabric heat loss		66.1532	(33)
Appendix K: Thermal bridging		0.0800	(y)
Effect of thermal bridges		11.5834	(34)
Total fabric heat loss		77.7365	(35)
Ventilation heat loss		34.6550	(36)
Heat loss coefficient		112.3915	(37)
Heat loss parameter (HLP)		1.7997	(38)
4. Water heating energy requirements			
Energy content of heated water		1610.4994	(39)
Distribution loss		284.2058	(40)
Cylinder loss factor (kWh/litre/day)		0.0000	(44)
Volume factor from Table 2a		0.0000	(44a)
Temperature factor from Table 2b		1.0000	(44b)
Energy lost from water storage, kWh/year		0.0000	(45)
Energy lost from cylinder in kWh/year		0.0000	(47)
Primary circuit loss		0.0000	(48)
Combi loss from Table 3a		533.6325	(49)
Output from water heater		2428.3377	(51)
Gains from water heating		763.3976	(52)
5. Internal gains			
Lighting, appliances, cooking and metabolic (Table 5)		393.9520	(53)

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Reduction of internal gains due to LE lighting (Appendix L)		
Correction factor for low-energy outlets	0.8350	(C1)
Window 1 0.9 * 4.120 * 0.80 * 0.7 * 0.83 / 62.450	0.0276	
Window 2 0.9 * 4.130 * 0.80 * 0.7 * 0.83 / 62.450	0.0277	
Ratio of glass area to floor area	0.0553	(GL)
Correction factor for daylighting	1.0431	(C2)
Annual energy used for lighting in the house	505.8604	(EL)
Reduction in lighting use due to low energy lights	99.9604	(deltaEL)
Low energy lighting	-14.9941	(53a)
Additional gains - central heating pump	10.0000	
Additional gains (Table 5a)	10.0000	(53b)
Water heating	87.1458	(54)
Total internal gains	476.1038	(55)

6. Solar gains

	Area (m2)	Flux	g	FF	Access Factor	Gains (W)	
Windows 'N '	0.9 * 4.1200 *	29 * 0.72	* 0.7000 * 0.77			41.7310	(56)
Windows (1) 'S '	0.9 * 4.1300 *	72 * 0.72	* 0.7000 * 0.77			103.8595	(60)
Total solar gains						145.5905	(65)
Total gains, W						621.6943	(66)
Gains/loss ratio (GLR)						5.5315	(67)
Utilisation factor						0.9614	(68)
Useful gains, W						597.6869	(69)

7. Mean internal temperature

Mean internal temperature of living zone (heating type = 1)	18.8620	(70)
Temperature addjustment	0.0000	(71)
Adjustment for gains	0.2636	(72)
Adjusted room temperature	19.1256	(73)
Temperature difference between zones	1.5380	(74)
Living area fraction	0.1665	(75)
Rest of house floor fraction	0.8335	(76)
Mean internal temperature	17.8438	(77)

8. Degree-days

Temperature raise from gains	5.3179	(78)
Base temperature	12.5259	(79)
Degree days	1455.6901	(80)

9a. Energy requirements - individual heating systems, including Micro CHP

Space heating requirement (useful)	3926.5724	(81)
Test Method :		
Model name : tba		
Manufacturer: tba		
MHS efficiency	86.0000	
Main system efficiency	86.0000	(83)
Space heating fuel - main HS	4565.7819	(85)
Space heating fuel - secondary HS	0.0000	(85a)
Efficiency of water heater	86.0000	(86)
Energy required for water heating	2428.3377	
Energy used for water heating	2823.6484	(86a)
For each central heating pump	130.0000	(87a)
For each boiler with F.A.F	45.0000	(87b)
Electricity for pumps and fans	175.0000	(87)
Electricity for pumps and fans - total	175.0000	
Electricity for lighting (33% fixed LEL)	505.8604	(87g)

10a. Fuel costs - individual heating systems

MHS heating cost	4565.7819 * 1.6300	74.4222	(88)
SHS heating cost	0.0000 * 0.0000	0.0000	(89)
Water heating cost	2823.6484 * 1.6300	46.0255	(91)
Pump/fan energy	175.0000 * 7.1200	12.4600	(92)
Lighting energy	505.8604 * 7.1200	36.0173	(93)
Additional standing charges		34.0000	(94)

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Appendix M1: Energy from Photovoltaic (PV) technology ----------			
Effective price depends on a factor	0.5000 (Beta)		
Normal electricity price	7.1200		
Exported electricity price	5.7000		
Effective fuel price	6.4100		
Photovoltaic energy	0.80 * 0.85 * 1042.0 * 1.00	708.5600	(95)
Produced energy	-708.5600 * 6.4100	-45.4187	(95a)
Total energy cost		157.5063	(97)
Total energy cost using Sedbuk db prices		358.4976	
11a. SAP rating			
Energy cost deflator		0.9100	(98)
Energy cost factor (ECF)		1.0547	(99)
ECF unrounded = 1.05472975165256			
SAP value		85.2760	(99a)
SAP value unrounded = 85.2759726669303			
SAP Energy rating		85	(100)
SAP Energy rating band		B	
12a. Carbon dioxide emissions			
MHS heating CO2 - box (85)	4565.7819 * 0.1940	885.7617	(101)
WHS heating CO2 - box (86a)	2823.6484 * 0.1940	547.7878	(103)
Space and water heating CO2		1433.5495	(107)
Pumps and fans CO2 - box (87)	175.0000 * 0.4220	73.8500	(108)
Electricity for lighting	505.8604 * 0.4220	213.4731	(109)
Produced energy - PV - CO2	-708.5600 * 0.5680	-402.4621	(110)
Total CO2 emissions in kg/year		1318.4105	(112)
CO2 emissions per m?		21.1115	
Dwelling's Carbon Factor		12.2700	(CF)
EI value		83.5582	(113a)
EI rating		84	(114)
EI band		B	
13a. Primary energy			
MHS heating P.E. - box (85)	4565.7819 * 1.1500	5250.6492	
WHS heating P.E. - box (86a)	2823.6484 * 1.1500	3247.1957	
Space and water heating P.E.		8497.8449	(107)
Pumps and fans P.E. - box (87)	175.0000 * 2.8000	490.0000	(108)
Electricity for lighting	505.8604 * 2.8000	1416.4090	(109)
Produced energy - PV - P.E.	-708.5600 * 2.8000	-1983.9680	(110)
Primary energy kWh/year		8420.2859	(112)
Primary energy kWh/m2/year		134.8324	

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DER calculation (New Dwelling as Designed)

1. Overall dwelling dimensions			
Ground floor	31.810 * 2.400	76.3440	
First floor	30.640 * 2.600	79.6640	
Total floor area	62.450		(5)
Total house volume		156.0080	(6)
2. Ventilation rate			
Number of chimneys	0 * 40	0	(7)
Number of flues	0 * 20	0	(8)
Number of fans	3 * 10	30	(9)
Flueless gas fire	0 * 40	0	(9a)
Infiltration		0.1923	(10)
Pressure test value		10.0000	(q50)
Infiltration rate		0.6923	(19)
Sides sheltered		2	(20)
Shelter factor		0.8500	(21)
Adjusted infiltration rate		0.5885	(22)
Air change natural ventilation		0.6731	(24)
Effective air change rate		0.6731	(25)
3. Heat losses and heat loss parameter			
Front Door	2.1700 * 2.20	4.7740	(26)
Rear Door	2.1800 * 2.20	4.7960	(26)
Side Windows1	4.1200 * (2.20) 2.02	8.3309	(27)
Side Windows2	4.1300 * (2.20) 2.02	8.3511	(27)
Ground Floor	31.8100 * 0.25	7.9525	(28)
Main Wall	68.5320 * 0.35	23.9862	(29)
Plane Roof	30.6400 * 0.25	7.6600	(30)
Flat Roof	1.2100 * 0.25	0.3025	(30)
Total area of elements		144.7920	(32)
Fabric heat loss		66.1532	(33)
Appendix K: Thermal bridging		0.0800	(y)
Effect of thermal bridges		11.5834	(34)
Total fabric heat loss		77.7365	(35)
Ventilation heat loss		34.6550	(36)
Heat loss coefficient		112.3915	(37)
Heat loss parameter (HLP)		1.7997	(38)
4. Water heating energy requirements			
Energy content of heated water		1610.4994	(39)
Distribution loss		284.2058	(40)
Cylinder loss factor (kWh/litre/day)		0.0000	(44)
Volume factor from Table 2a		0.0000	(44a)
Temperature factor from Table 2b		1.0000	(44b)
Energy lost from water storage, kWh/year		0.0000	(45)
Energy lost from cylinder in kWh/year		0.0000	(47)
Primary circuit loss		0.0000	(48)
Combi loss from Table 3a		533.6325	(49)
Output from water heater		2428.3377	(51)
Gains from water heating		763.3976	(52)
5. Internal gains			
Lighting, appliances, cooking and metabolic (Table 5)		393.9520	(53)

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Reduction of internal gains due to LE lighting (Appendix L)		
Correction factor for low-energy outlets	0.8500	(C1)
Window 1 0.9 * 4.120 * 0.80 * 0.7 * 0.83 / 62.450	0.0276	
Window 2 0.9 * 4.130 * 0.80 * 0.7 * 0.83 / 62.450	0.0277	
Ratio of glass area to floor area	0.0553	(GL)
Correction factor for daylighting	1.0431	(C2)
Annual energy used for lighting in the house	514.9477	(EL)
Reduction in lighting use due to low energy lights	90.8731	(deltaEL)
Low energy lighting	-13.6310	(53a)
Additional gains - central heating pump	10.0000	
Additional gains (Table 5a)	10.0000	(53b)
Water heating	87.1458	(54)
Total internal gains	477.4669	(55)

6. Solar gains

	Area (m2)	Flux	g	FF	Access Factor	Gains (W)	
Windows 'N '	0.9 * 4.1200 *	29 * 0.72	* 0.7000 * 0.77			41.7310	(56)
Windows (1) 'S '	0.9 * 4.1300 *	72 * 0.72	* 0.7000 * 0.77			103.8595	(60)
Total solar gains						145.5905	(65)
Total gains, W						623.0574	(66)
Gains/loss ratio (GLR)						5.5436	(67)
Utilisation factor						0.9611	(68)
Useful gains, W						598.8255	(69)

7. Mean internal temperature

Mean internal temperature of living zone (heating type = 1)	18.8620	(70)
Temperature addjustment	0.0000	(71)
Adjustment for gains	0.2656	(72)
Adjusted room temperature	19.1276	(73)
Temperature difference between zones	1.5380	(74)
Living area fraction	0.1665	(75)
Rest of house floor fraction	0.8335	(76)
Mean internal temperature	17.8458	(77)

8. Degree-days

Temperature raise from gains	5.3280	(78)
Base temperature	12.5178	(79)
Degree days	1453.9071	(80)

9a. Energy requirements - individual heating systems, including Micro CHP

Space heating requirement (useful)	3921.7632	(81)
Fraction of heat from secondary system	0.1000	(82)
Test Method :		
Model name : tba		
Manufacturer: tba		
MHS efficiency	86.0000	
Main system efficiency	86.0000	(83)
Secondary system efficiency	100.0000	(84)
Space heating fuel - main HS	4104.1707	(85)
Space heating fuel - secondary HS	392.1763	(85a)
Efficiency of water heater	86.0000	(86)
Energy required for water heating	2428.3377	
Energy used for water heating	2823.6484	(86a)
For each central heating pump	130.0000	(87a)
For each boiler with F.A.F	45.0000	(87b)
Electricity for pumps and fans	175.0000	(87)
Electricity for pumps and fans - total	175.0000	
Electricity for lighting (30% fixed LEL)	514.9477	(87g)

12a. Carbon dioxide emissions

MHS heating CO2 - box (85)	4104.1707 * 0.1940	796.2091	(101)
SHS heating CO2 - box (85a)	392.1763 * 0.4220	165.4984	(102)
WHS heating CO2 - box (86a)	2823.6484 * 0.1940	547.7878	(103)

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Space and water heating CO2		1509.4953	(107)
Pumps and fans CO2 - box (87)	175.0000 * 0.4220	73.8500	(108)
Electricity for lighting	514.9477 * 0.4220	217.3079	(109)
Produced energy - PV - CO2	-708.5600 * 0.5680	-402.4621	(110)
Total CO2 emissions in kg/year		1398.1912	(112)
CO2 emissions per m?		22.3890	
Dwelling's Carbon Emission Rate (DER) - orientation: E		22.3890	(113)

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TER calculation (New Dwelling as Designed)

1. Overall dwelling dimensions			
Ground floor	31.810 * 2.400	76.3440	
First floor	30.640 * 2.600	79.6640	
Total floor area	62.450		(5)
Total house volume		156.0080	(6)
2. Ventilation rate			
Number of chimneys	0 * 40	0	(7)
Number of flues	0 * 20	0	(8)
Number of fans	2 * 10	20	(9)
Flueless gas fire	0 * 40	0	(9a)
Infiltration		0.1282	(10)
Pressure test value		10.0000	(q50)
Infiltration rate		0.6282	(19)
Sides sheltered		2	(20)
Shelter factor		0.8500	(21)
Adjusted infiltration rate		0.5340	(22)
Air change natural ventilation		0.6426	(24)
Effective air change rate		0.6426	(25)
3. Heat losses and heat loss parameter			
One opaque door	1.8500 * 2.00	3.7000	(26)
Windows Double glazed, low-E	13.7625 * (2.00) 1.85	25.4861	(27)
Ground Floor	31.8100 * 0.25	7.9525	(28)
Main Wall	65.5195 * 0.35	22.9318	(29)
Plane Roof	30.6400 * 0.16	4.9024	(30)
Flat Roof	1.2100 * 0.16	0.1936	(30)
Total area of elements		144.7920	(32)
Fabric heat loss		65.1664	(33)
Appendix K: Thermal bridging		0.1100	(y)
Effect of thermal bridges		15.9271	(34)
Total fabric heat loss		81.0936	(35)
Ventilation heat loss		33.0808	(36)
Heat loss coefficient		114.1743	(37)
Heat loss parameter (HLP)		1.8283	(38)
4. Water heating energy requirements			
Energy content of heated water		1610.4994	(39)
Distribution loss		284.2058	(40)
Cylinder volume		150.0000	(43)
Cylinder loss factor (kWh/litre/day)		0.0191	(44)
Volume factor from Table 2a		0.9283	(44a)
Temperature factor from Table 2b		0.5400	(44b)
Energy lost from water storage, kWh/year		524.2835	(45)
Energy lost from cylinder in kWh/year		524.2835	(47)
Primary circuit loss		610.0000	(48)
Output from water heater		3028.9887	(51)
Gains from water heating		1537.4163	(52)
5. Internal gains			
Lighting, appliances, cooking and metabolic (Table 5)		393.9520	(53)
Reduction of internal gains due to LE lighting (Appendix L)			
Correction factor for low-energy outlets		0.8500	(C1)

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Window 1	0.9 * 13.763 * 0.80 * 0.7 * 0.83 / 62.450	0.0922	
Ratio of glass area to floor area		0.0922	(GL)
Correction factor for daylighting		0.9603	(C2)
Annual energy used for lighting in the house		474.0586	(EL)
Reduction in lighting use due to low energy lights		83.6574	(deltaEL)
Low energy lighting		-12.5486	(53a)
Additional gains - central heating pump		10.0000	
Additional gains (Table 5a)		10.0000	(53b)
Water heating		175.5041	(54)
Total internal gains		566.9075	(55)

6. Solar gains

	Area (m2)	Flux	g	FF	Access Factor	Gains (W)	
Windows 'E '	0.9 * 13.7625 *	48 *	0.72	* 0.7000 *	0.77	230.7291	(58)
Total solar gains						230.7291	(65)
Total gains, W						797.6366	(66)
Gains/loss ratio (GLR)						6.9861	(67)
Utilisation factor						0.9240	(68)
Useful gains, W						736.9866	(69)

7. Mean internal temperature

Mean internal temperature of living zone (heating type = 1)	18.8603	(70)
Temperature addjustment	0.0000	(71)
Adjustment for gains	0.4910	(72)
Adjusted room temperature	19.3513	(73)
Temperature difference between zones	1.5425	(74)
Living area fraction	0.1665	(75)
Rest of house floor fraction	0.8335	(76)
Mean internal temperature	18.0657	(77)

8. Degree-days

Temperature raise from gains	6.4549	(78)
Base temperature	11.6107	(79)
Degree days	1263.2523	(80)

9a. Energy requirements - individual heating systems, including Micro CHP

Space heating requirement (useful)	3461.5431	(81)
Fraction of heat from secondary system	0.1000	(82)
Test Method :		
Model name : tba		
Manufacturer: tba		
MHS efficiency	78.0000	
Main system efficiency	78.0000	(83)
Secondary system efficiency	100.0000	(84)
Space heating fuel - main HS	3994.0881	(85)
Space heating fuel - secondary HS	346.1543	(85a)
Efficiency of water heater	78.0000	(86)
Energy required for water heating	3028.9887	
Energy used for water heating	3883.3188	(86a)
For each central heating pump	130.0000	(87a)
For each boiler with F.A.F	45.0000	(87b)
Electricity for pumps and fans	175.0000	(87)
Electricity for pumps and fans - total	175.0000	
Electricity for lighting (30% fixed LEL)	474.0586	(87g)

12a. Carbon dioxide emissions

MHS heating CO2 - box (85)	3994.0881 * 0.1940	774.8531	(101)
SHS heating CO2 - box (85a)	346.1543 * 0.4220	146.0771	(102)
WHS heating CO2 - box (86a)	3883.3188 * 0.1940	753.3639	(103)
Space and water heating CO2		1674.2941	(107)
Pumps and fans CO2 - box (87)	175.0000 * 0.4220	73.8500	(108)
Electricity for lighting	474.0586 * 0.4220	200.0527	(109)
Total CO2 emissions in kg/year		1948.1968	(112)

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CO2 emissions per m?	31.1961	
CO2 for heating and hot water	1748.1441	(CH)
CO2 emissions from internal lighting	200.0527	(CL)
ADL1A - Table 1 Fuel factor	1.0000	(FuelFactor)
Level of reduction in CO2 - Improvement factor	20	(%)
Total floor area	62.4500	(TFA)
Target Carbon Dioxide Emission Rate (TER)	24.9569	(113)

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Regulation compliance checklist

1 TER and DER OK

1.1 Target Carbon Dioxide Emission Rate

Main fuel - Gas, Fuel factor = 1.00, TER = 24.96

1.2 Dwelling Carbon Dioxide Emission Rate - DER = 22.39

1.3 DER 22.39 < TER 24.96

2.1 Fabric U-values OK

Wall	0.35 (0.35)	0.35 (0.70)	OK
Roof	0.25 (0.25)	0.25 (0.35)	OK
Floor	0.25 (0.25)	0.25 (0.70)	OK
Openings	2.20 (2.20)	2.20 (3.30)	OK

2.3 Heating efficiency OK

Post 98 Gas condens. (incl combis) with auto ign. F.A.F., Pumped: pump in heated space

Efficiency - Manufacturer data: 86.0%

Minimum permitted: 86.0% - OK

Secondary heating: None

2.4 Cylinder insulation OK

No cylinder

2.5 Controls OK

Programmer, room thermostat and TRVs - OK

2.7 Low energy lighting OK

Light fittings: 12, L.E.L. fittings: 4 = 33.00% > 25% - OK

L.E.L. fittings required per 25m2 or part of TFA: 3 < 4 - OK

2.8 External lighting OK

External lights: None

3.1 Summertime temperature OK

Region: West Pennines (15.5)

Thermal mass parameter = 1.0

Ventilation rate in hot weather = 8.0

Overheating risk (Orientation 'E') = Not significant - OK

4.1 Key features

Photovoltaic Array

4.5 Design air permeability OK

Design air permeability = 10.0

Overall result: OK

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Recommendation Level E

```
E Low energy lighting          : 100%
  Recommendation result        : Recommended
E Recommendation no            : 35
E Recommendation text          : Low energy lighting for all fixed outlets
  CO2 emissions                :  1257.297 (change =   -61.114)
  Total energy cost (97)       :   145.117 (change =    12.389)
  Total energy cost (Sedbuk)   :   336.923 (change =   -21.574)
  SAP rating                   :    87     (value =  86.741)
  EI rating                    :    84     (value =  84.320)
E Recommendation               : SAP change (86.741 - 85.276), increase = 1.465
```

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Recommendation Level N

```
N Solar Panel                  : installed
  Recommendation result        : Recommended
N Recommendation no            : 19
N Recommendation text          : Solar water heating
  CO2 emissions                :  1090.580 (change =  -166.717)
  Total energy cost (97)       :   133.790 (change =    11.327)
  Total energy cost (Sedbuk)   :   312.012 (change =   -24.911)
  SAP rating                   :    88     (value =  88.080)
  EI rating                    :    86     (value =  86.399)
N Recommendation               : SAP change (88.080 - 86.741), increase = 1.339
```

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Recommendation Level U

```
  Recommendation result       : AlreadyInstalled
U Recommendation text         : PV Cells recommendation
```

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Recommendation Level

```
V Wind turbine                 : blade diameter 1.75 m
  Recommendation result        : Recommended
V Recommendation no            : 44
V Recommendation text          : Wind turbine
  CO2 emissions                :  1063.821 (change =   -26.759)
  Total energy cost (97)       :   130.637 (change =     3.154)
  Total energy cost (Sedbuk)   :   306.015 (change =    -5.997)
  SAP rating                   :    88     (value =  88.453)
  EI rating                    :    87     (value =  86.733)
V Recommendation               : SAP change (88.453 - 88.080), increase = 0.373
                                 EffectTooSmall
```

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Recommendation Total

E Low energy lighting : 100%
N Solar Panel : installed

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SAP2005 - 9.81 input data (DesignData) -

Regs Region:	England
Calculation Type:	NewDwellingAsDesigned
Region:	WP West Pennines (15.5)
Orientation:	E East
PropType:	H House, E End Terrace
Storeys:	2
Property Age:	2012
Sheltered Sides:	2
Sunlight Shade:	A Average or unknown
Wall Perimeter:	16.84 m, 15.66 m
Floor Area:	31.81 m2, 30.64 m2
Living Floor Area:	10.40 m2, fraction:0.17
Storey Height:	2.40 m, 2.60 m
Conservatory:	None
Doors	
Front Door:	Solid Wood, uvalue: 2.20 (M), area: 2.17 m2, argon: No, solar tra
Rear Door:	Double,Low E,Hard Coat, Glazed PVC, 6 mm, uvalue: 2.20 (M), area:
Windows	
Side Windows1:	Double,Low E,Hard Coat, PVC, 16 mm, North (90°), uvalue: 2.20 (M)
Side Windows2:	Double,Low E,Hard Coat, PVC, 16 mm, South (270°), uvalue: 2.20 (M
Draught Lobby:	No
Draught Proofing:	100%
Roof Lights	
Pressure Test:	Air permeability 10.0 $m^3/h.m^2$ (assumed)
Mechanical Ventilation:	None, Windows open during hot weather: Windows fully open
	Cross ventilation possible: Yes
Fans, Chimneys, Flues:	3, 0, 0
Lighting:	Light fittings: 12, L.E.L. fittings: 12, External lights: None
Main Wall Type:	U: 0.35 A: X(68.53 m2)
Extented Wall Types:	
Timber Frame Wall Area:	0
Plane Roof	U: 0.25 A: 30.64 m2
Flat Roof	U: 0.25 A: 1.21 m2
Main Floor Type:	U: 0.25 A: 31.81 m2
Thermal Mass:	Thermal Mass Parameter entered as: 1.00
Timber Floor:	No Timber Floor
Fixed Air Conditioning:	No
Main Heating:	BGB Post 98 Gas condens. (incl combis) with auto ign. F.A.F., Pum
Main Heating Manufacturer:	Manufacturer's data: tba, tba, 86.0%
Heating Controls:	CBD Programmer, room thermostat and TRVs
	Boiler interlock - Yes
Underfloor Heating:	None
Combi Type:	StandardCombi
Combi Keep Hot:	WithoutKeepHot
Secondary Heating:	None
Manufacturer:	
Thermal Store:	None
Hot Water Heating:	HWP From the primary heating system
Solar Water Heating:	Solar panel: Yes, aperture area: 3.00 m2, Type: ME Evacuated tube
	Collector zero-loss efficiency: 0.70
	Collector heat loss coefficient: 1.80
	Solar panel ratio A/G: 1.00
	Orientation: South, Elevation: 30°, Overshading: Modest (20% - 60
	Electrically powered pump, Dedicated solar store volume: 75 litre
Thermal Store:	None
Hot Water Cylinder:	None
Community Heating:	None
CHP Unit:	
Electricity Tariff:	S - Standard
Thermal Bridges:	DefaultRobustConstr, Thermal bridging factor y = 0.08
PV Cells:	PV cells Peak Power: 0.85
	Orientation: South, Elevation: 30°, Overshading: None or little (

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```
Energy Saved:
Energy Used:
Terrain Type:                   Urban
Number of Wind Turbines:        0
```

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Recommendations calculation (New Dwelling as Designed)

1. Overall dwelling dimensions			
Ground floor	31.810 * 2.400	76.3440	
First floor	30.640 * 2.600	79.6640	
Total floor area	62.450		(5)
Total house volume		156.0080	(6)
2. Ventilation rate			
Number of chimneys	0 * 40	0	(7)
Number of flues	0 * 20	0	(8)
Number of fans	3 * 10	30	(9)
Flueless gas fire	0 * 40	0	(9a)
Infiltration		0.1923	(10)
Pressure test value		10.0000	(q50)
Infiltration rate		0.6923	(19)
Sides sheltered		2	(20)
Shelter factor		0.8500	(21)
Adjusted infiltration rate		0.5885	(22)
Air change natural ventilation		0.6731	(24)
Effective air change rate		0.6731	(25)
3. Heat losses and heat loss parameter			
Front Door	2.1700 * 2.20	4.7740	(26)
Rear Door	2.1800 * 2.20	4.7960	(26)
Side Windows1	4.1200 * (2.20) 2.02	8.3309	(27)
Side Windows2	4.1300 * (2.20) 2.02	8.3511	(27)
Ground Floor	31.8100 * 0.25	7.9525	(28)
Main Wall	68.5320 * 0.35	23.9862	(29)
Plane Roof	30.6400 * 0.25	7.6600	(30)
Flat Roof	1.2100 * 0.25	0.3025	(30)
Total area of elements		144.7920	(32)
Fabric heat loss		66.1532	(33)
Appendix K: Thermal bridging		0.0800	(y)
Effect of thermal bridges		11.5834	(34)
Total fabric heat loss		77.7365	(35)
Ventilation heat loss		34.6550	(36)
Heat loss coefficient		112.3915	(37)
Heat loss parameter (HLP)		1.7997	(38)
4. Water heating energy requirements			
Energy content of heated water		1610.4994	(39)
Distribution loss		284.2058	(40)
Cylinder loss factor (kWh/litre/day)		0.0000	(44)
Volume factor from Table 2a		0.0000	(44a)
Temperature factor from Table 2b		1.0000	(44b)
Energy lost from water storage, kWh/year		0.0000	(45)
Energy lost from cylinder in kWh/year		0.0000	(47)
Primary circuit loss		0.0000	(48)
Combi loss from Table 3a		533.6325	(49)
Aperture area of solar collector		3.0000	(H1)
Zero-loss collector efficiency		0.7000	(H2)
Collector heat loss coefficient		1.8000	(H3)
Collector performance ratio		2.5714	(H4)
Annual solar radiation per m2		1042.0000	(H5)

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Overshading factor	0.8000	(H6)
Solar energy available	1750.5600	(H7)
Solar-to-load ratio	0.9239	(H8)
Utilisation factor	0.6612	(H9)
Collector performance factor	0.7865	(H10)
Dedicated solar storage volume	75.0000	(H11)
Total volume of cylinder	0.0000	(H12)
Effective solar volume	75.0000	(H13)
Daily hot water demand	88.9387	(H14)
Volume ratio Veff/V	0.8433	(H15)
Solar storage volume factor	0.9659	(H16)
Solar input	879.3567	(H17)
Solar input	-879.3567	(50)
Output from water heater	1548.9809	(51)
Gains from water heating	763.3976	(52)

5. Internal gains

Lighting, appliances, cooking and metabolic (Table 5)	393.9520	(53)
Low energy lighting	-45.4366	(53a)
Additional gains - central heating pump	10.0000	
Additional gains (Table 5a)	10.0000	(53b)
Water heating	87.1458	(54)
Total internal gains	445.6613	(55)

6. Solar gains

	Area (m2)	Flux	g	FF	Access Factor	Gains (W)	
Windows 'N '	0.9 *	4.1200 *	29 * 0.72	* 0.7000 *	0.77	41.7310	(56)
Windows (1) 'S '	0.9 *	4.1300 *	72 * 0.72	* 0.7000 *	0.77	103.8595	(60)
Total solar gains						145.5905	(65)
Total gains, W						591.2518	(66)
Gains/loss ratio (GLR)						5.2606	(67)
Utilisation factor						0.9673	(68)
Useful gains, W						571.9421	(69)

7. Mean internal temperature

Mean internal temperature of living zone (heating type = 1)	18.8620	(70)
Temperature addjustment	0.0000	(71)
Adjustment for gains	0.2178	(72)
Adjusted room temperature	19.0798	(73)
Temperature difference between zones	1.5380	(74)
Living area fraction	0.1665	(75)
Rest of house floor fraction	0.8335	(76)
Mean internal temperature	17.7980	(77)

8. Degree-days

Temperature raise from gains	5.0888	(78)
Base temperature	12.7091	(79)
Degree days	1496.0053	(80)

9a. Energy requirements - individual heating systems, including Micro CHP

Space heating requirement (useful)	4035.3185	(81)
Test Method :		
Model name : tba		
Manufacturer: tba		
MHS efficiency	86.0000	
Main system efficiency	86.0000	(83)
Space heating fuel - main HS	4692.2308	(85)
Space heating fuel - secondary HS	0.0000	(85a)
Efficiency of water heater	86.0000	(86)
Energy required for water heating	1548.9809	
Energy used for water heating	1801.1406	(86a)
For each central heating pump	130.0000	(87a)
For each boiler with F.A.F	45.0000	(87b)
For solar water heating pump	75.0000	(87f)

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Electricity for pumps and fans		250.0000	(87)
Electricity for pumps and fans - total		250.0000	
Electricity for lighting (100% fixed LEL)		302.9104	(87g)
10a. Fuel costs - individual heating systems			
MHS heating cost	4692.2308 * 1.6300	76.4834	(88)
SHS heating cost	0.0000 * 0.0000	0.0000	(89)
Water heating cost	1801.1406 * 1.6300	29.3586	(91)
Pump/fan energy	250.0000 * 7.1200	17.8000	(92)
Lighting energy	302.9104 * 7.1200	21.5672	(93)
Additional standing charges		34.0000	(94)
Appendix M1: Energy from Photovoltaic (PV) technology ----------			
Effective price depends on a factor	0.5000 (Beta)		
Normal electricity price	7.1200		
Exported electricity price	5.7000		
Effective fuel price	6.4100		
Photovoltaic energy	0.80 * 0.85 * 1042.0 * 1.00	708.5600	(95)
Produced energy	-708.5600 * 6.4100	-45.4187	(95a)

Total energy cost		133.7905	(97)
Total energy cost using Sedbuk db prices		312.0124	
11a. SAP rating			
Energy cost deflator		0.9100	(98)
Energy cost factor (ECF)		0.8539	(99)
ECF unrounded = 0.853879347209511			
SAP value		88.0798	(99a)
SAP value unrounded = 88.0798443129552			
SAP Energy rating		88	(100)
SAP Energy rating band		B	
12a. Carbon dioxide emissions			
MHS heating CO2 - box (85)	4692.2308 * 0.1940	910.2928	(101)
WHS heating CO2 - box (86a)	1801.1406 * 0.1940	349.4213	(103)
Space and water heating CO2		1259.7141	(107)
Pumps and fans CO2 - box (87)	250.0000 * 0.4220	105.5000	(108)
Electricity for lighting	302.9104 * 0.4220	127.8282	(109)
Produced energy - PV - CO2	-708.5600 * 0.5680	-402.4621	(110)
Total CO2 emissions in kg/year		1090.5802	(112)
CO2 emissions per m?		17.4633	
Dwelling's Carbon Factor		10.1497	(CF)
EI value		86.3995	(113a)
EI rating		86	(114)
EI band		B	
13a. Primary energy			
MHS heating P.E. - box (85)	4692.2308 * 1.1500	5396.0655	
WHS heating P.E. - box (86a)	1801.1406 * 1.1500	2071.3117	
Space and water heating P.E.		7467.3772	(107)
Pumps and fans P.E. - box (87)	250.0000 * 2.8000	700.0000	(108)
Electricity for lighting	302.9104 * 2.8000	848.1491	(109)
Produced energy - PV - P.E.	-708.5600 * 2.8000	-1983.9680	(110)
Primary energy kWh/year		7031.5583	(112)
Primary energy kWh/m2/year		112.5950	

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Full SAP Calculation Printout

Users Ref: Maine Rd_Type B End_Fabric

Issued on: 14.December.2012

Prop Type Ref:

Property: Type B End, Maine Road

DER: 22.05

TER: 24.96

SAP Rating: **84 B** **SAP Energy Cost:** £169.63 **CO2 Emissions:** 1.32 t/year

EI Rating: **83 B** **Energy used:** 129 kWh/m2/year **Ene1:** 1 **ZC:** 0.00

Surveyor: 7112-0003, Peter Isherwood, Tel: 0161 763 7200, Fax: 0161 763 7318

Address: Bury Business Centre, Kay Street, Bury, BL9 6BU

Client:

Software Version: EES SAP 2005.018.03, October 2009 (Design System), BRE SAP Worksheet 9.81

SAP version: 9.81 Regs Region: England and Wales (Part L1A 2006), Calculation Type: New Build

CALCULATION DETAILS for survey reference no 'Maine Rd_Type B End_Fabric' Page: 1

SAP2005 - 9.81 input data (DesignData) -

Regs Region:	England
Calculation Type:	NewDwellingAsDesigned
Region:	WP West Pennines (15.5)
Orientation:	E East
PropType:	H House, E End Terrace
Storeys:	2
Property Age:	2012
Sheltered Sides:	4
Sunlight Shade:	A Average or unknown
Wall Perimeter:	16.84 m, 15.66 m
Floor Area:	31.81 m2, 30.64 m2
Living Floor Area:	10.40 m2, fraction:0.00
Storey Height:	2.40 m, 2.60 m
Conservatory:	None
Doors	
Front Door:	Solid Wood, uvalue: 1.10 (M), area: 2.17 m2, argon: No, solar tra
Rear Door:	Double,Low E,Hard Coat, Glazed PVC, 6 mm, uvalue: 1.40 (M), area:
Windows	
Side Windows1:	Double,Low E,Hard Coat, PVC, 16 mm, North (90°), uvalue: 1.40 (M)
Side Windows2:	Double,Low E,Hard Coat, PVC, 16 mm, South (270°), uvalue: 1.40 (M
Draught Lobby:	No
Draught Proofing:	100%
Roof Lights	
Pressure Test:	Air permeability 5.0 m³/h.m² (assumed)
Mechanical Ventilation:	None, Windows open during hot weather: Windows fully open
	Cross ventilation possible: Yes
Fans, Chimneys, Flues:	3, 0, 0
Lighting:	Light fittings: 12, L.E.L. fittings: 4, External lights: None
Main Wall Type:	U: 0.26 A: X(68.53 m2)
Extented Wall Types:	
Timber Frame Wall Area:	0
Plane Roof	U: 0.11 A: 30.64 m2
Flat Roof	U: 0.11 A: 1.21 m2
Main Floor Type:	U: 0.13 A: 31.81 m2
Thermal Mass:	Thermal Mass Parameter entered as: 1.00
Timber Floor:	No Timber Floor
Fixed Air Conditioning:	No
Main Heating:	BGB Post 98 Gas condens. (incl combis) with auto ign. F.A.F., Pum
Main Heating Manufacturer:	Ideal, Logic+ combi, 24, 91.00%
Heating Controls:	CBD Programmer, room thermostat and TRVs
	Boiler interlock - Yes
Underfloor Heating:	None
Combi Type:	StandardCombi
Combi Keep Hot:	GasTimeClock
Secondary Heating:	None
Manufacturer:	

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Thermal Store:	None
Hot Water Heating:	HWP From the primary heating system
Solar Water Heating:	None
Thermal Store:	None
Hot Water Cylinder:	None
Community Heating:	None
CHP Unit:	
Electricity Tariff:	S - Standard
Thermal Bridges:	CalculateBridges
Bridge 1	Length: 10.52, Psi: 0.210, Other lintels
Bridge 2	Length: 8.42, Psi: 0.040, Sill
Bridge 3	Length: 21.48, Psi: 0.050, Jamb
Bridge 4	Length: 14.46, Psi: 0.160, Ground floor
Bridge 5	Length: 15.66, Psi: 0.070, Interm. floor within a dwelling
Bridge 6	Length: 8.00, Psi: 0.060, Eaves (insul. at ceiling level)
Bridge 7	Length: 7.66, Psi: 0.240, Gable (insul. at ceiling level)
Bridge 8	Length: 24.80, Psi: 0.090, Corner (normal)
Bridge 9	Length: 4.80, Psi: -0.090, Corner (inverted)
Bridge 10	Length: 10.00, Psi: 0.060, Party wall between dwellings
PV Cells:	None
Energy Saved:	
Energy Used:	
Terrain Type:	Urban
Number of Wind Turbines:	0

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1. Overall dwelling dimensions			
Ground floor	31.810 * 2.400	76.3440	
First floor	30.640 * 2.600	79.6640	
Total floor area	62.450		(5)
Total house volume		156.0080	(6)
2. Ventilation rate			
Number of chimneys	0 * 40	0	(7)
Number of flues	0 * 20	0	(8)
Number of fans	3 * 10	30	(9)
Flueless gas fire	0 * 40	0	(9a)
Infiltration		0.1923	(10)
Pressure test value		5.0000	(q50)
Infiltration rate		0.4423	(19)
Sides sheltered		4	(20)
Shelter factor		0.7000	(21)
Adjusted infiltration rate		0.3096	(22)
Air change natural ventilation		0.5479	(24)
Effective air change rate		0.5479	(25)
3. Heat losses and heat loss parameter			
Front Door	2.1700 * 1.10	2.3870	(26)
Rear Door	2.1800 * 1.40	3.0520	(26)
Side Windows1	4.1200 * (1.40) 1.33	5.4621	(27)
Side Windows2	4.1300 * (1.40) 1.33	5.4754	(27)
Ground Floor	31.8100 * 0.13	4.1353	(28)
Main Wall	68.5320 * 0.26	17.8183	(29)
Plane Roof	30.6400 * 0.11	3.3704	(30)
Flat Roof	1.2100 * 0.11	0.1331	(30)
Total area of elements		144.7920	(32)
Fabric heat loss		41.8336	(33)
Thermal Bridges			
Other lintels	10.52 * 0.210	2.2092	
Sill	8.42 * 0.040	0.3368	
Jamb	21.48 * 0.050	1.0740	
Ground floor	14.46 * 0.160	2.3136	
Interm. floor within a dwelling	15.66 * 0.070	1.0962	
Eaves (insul. at ceiling level)	8.00 * 0.060	0.4800	
Gable (insul. at ceiling level)	7.66 * 0.240	1.8384	
Corner (normal)	24.80 * 0.090	2.2320	
Corner (inverted)	4.80 * -0.090	-0.4320	
Party wall between dwellings	10.00 * 0.060	0.6000	
Effect of thermal bridges		11.7482	(34)
Total fabric heat loss		53.5818	(35)
Ventilation heat loss		28.2088	(36)
Heat loss coefficient		81.7906	(37)
Heat loss parameter (HLP)		1.3097	(38)
4. Water heating energy requirements			
Energy content of heated water		1610.4994	(39)
Distribution loss		284.2058	(40)
Cylinder loss factor (kWh/litre/day)		0.0000	(44)
Volume factor from Table 2a		0.0000	(44a)

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Temperature factor from Table 2b	1.0000	(44b)
Energy lost from water storage, kWh/year	0.0000	(45)
Energy lost from cylinder in kWh/year	0.0000	(47)
Primary circuit loss	0.0000	(48)
Combi loss from Table 3a	600.0000	(49)
Output from water heater	2494.7052	(51)
Gains from water heating	779.9895	(52)

5. Internal gains

Lighting, appliances, cooking and metabolic (Table 5)	393.9520	(53)
Reduction of internal gains due to LE lighting (Appendix L)		
Correction factor for low-energy outlets	0.8350	(C1)
Window 1 0.9 * 4.120 * 0.80 * 0.7 * 0.83 / 62.450	0.0276	
Window 2 0.9 * 4.130 * 0.80 * 0.7 * 0.83 / 62.450	0.0277	
Ratio of glass area to floor area	0.0553	(GL)
Correction factor for daylighting	1.0431	(C2)
Annual energy used for lighting in the house	505.8604	(EL)
Reduction in lighting use due to low energy lights	99.9604	(deltaEL)
Low energy lighting	-14.9941	(53a)
Additional gains - central heating pump	10.0000	
Additional gains (Table 5a)	10.0000	(53b)
Water heating	89.0399	(54)
Total internal gains	477.9978	(55)

6. Solar gains

	Area (m2)	Flux	g	FF	Access Factor	Gains (W)	
Windows 'N '	0.9 * 4.1200 *	29 *	0.72	* 0.7000 *	0.77	41.7310	(56)
Windows (1) 'S '	0.9 * 4.1300 *	72 *	0.72	* 0.7000 *	0.77	103.8595	(60)
Total solar gains						145.5905	(65)
Total gains, W						623.5884	(66)
Gains/loss ratio (GLR)						7.6242	(67)
Utilisation factor						0.9057	(68)
Useful gains, W						564.7622	(69)

7. Mean internal temperature

Mean internal temperature of living zone (heating type = 1)	18.8800	(70)
Temperature addjustment	0.0000	(71)
Adjustment for gains	0.5810	(72)
Adjusted room temperature	19.4610	(73)
Temperature difference between zones	1.4596	(74)
Living area fraction	0.1665	(75)
Rest of house floor fraction	0.8335	(76)
Mean internal temperature	18.2445	(77)

8. Degree-days

Temperature raise from gains	6.9050	(78)
Base temperature	11.3395	(79)
Degree days	1207.9067	(80)

9a. Energy requirements - individual heating systems, including Micro CHP

Space heating requirement (useful)	2371.0910	(81)
Database boiler reference number : 16212		
Model name : Logic+ combi		
Manufacturer: Ideal Boilers		
MHS efficiency	91.0000	
Main system efficiency	91.0000	(83)
Space heating fuel - main HS	2605.5945	(85)
Space heating fuel - secondary HS	0.0000	(85a)
Efficiency of water heater	91.0000	(86) (from SED
Energy required for water heating	2494.7052	
Energy used for water heating	2741.4342	(86a)
For each central heating pump	130.0000	(87a)
For each boiler with F.A.F	45.0000	(87b)
Electricity for pumps and fans	175.0000	(87)

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Electricity for pumps and fans - total		175.0000	
Electricity for lighting (33% fixed LEL)		505.8604	(87g)
10a. Fuel costs - individual heating systems			
MHS heating cost	2605.5945 * 1.6300	42.4712	(88)
SHS heating cost	0.0000 * 0.0000	0.0000	(89)
Water heating cost	2741.4342 * 1.6300	44.6854	(91)
Pump/fan energy	175.0000 * 7.1200	12.4600	(92)
Lighting energy	505.8604 * 7.1200	36.0173	(93)
Additional standing charges		34.0000	(94)
Total energy cost		169.6338	(97)
Total energy cost using Sedbuk db prices		379.8684	
11a. SAP rating			
Energy cost deflator		0.9100	(98)
Energy cost factor (ECF)		1.1574	(99)
ECF unrounded = 1.15743864929681			
SAP value		83.8422	(99a)
SAP value unrounded = 83.8421564558165			
SAP Energy rating		84	(100)
SAP Energy rating band		B	
12a. Carbon dioxide emissions			
MHS heating CO2 - box (85)	2605.5945 * 0.1940	505.4853	(101)
WHS heating CO2 - box (86a)	2741.4342 * 0.1940	531.8382	(103)
Space and water heating CO2		1037.3236	(107)
Pumps and fans CO2 - box (87)	175.0000 * 0.4220	73.8500	(108)
Electricity for lighting	505.8604 * 0.4220	213.4731	(109)
Total CO2 emissions in kg/year		1324.6467	(112)
CO2 emissions per m?		21.2113	
Dwelling's Carbon Factor		12.3280	(CF)
EI value		83.4804	(113a)
EI rating		83	(114)
EI band		B	
13a. Primary energy			
MHS heating P.E. - box (85)	2605.5945 * 1.1500	2996.4337	
WHS heating P.E. - box (86a)	2741.4342 * 1.1500	3152.6494	
Space and water heating P.E.		6149.0831	(107)
Pumps and fans P.E. - box (87)	175.0000 * 2.8000	490.0000	(108)
Electricity for lighting	505.8604 * 2.8000	1416.4090	(109)
Primary energy kWh/year		8055.4921	(112)
Primary energy kWh/m2/year		128.9911	

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DER calculation (New Dwelling as Designed)

1. Overall dwelling dimensions			
Ground floor	31.810 * 2.400	76.3440	
First floor	30.640 * 2.600	79.6640	
Total floor area	62.450		(5)
Total house volume		156.0080	(6)
2. Ventilation rate			
Number of chimneys	0 * 40	0	(7)
Number of flues	0 * 20	0	(8)
Number of fans	3 * 10	30	(9)
Flueless gas fire	0 * 40	0	(9a)
Infiltration		0.1923	(10)
Pressure test value		5.0000	(q50)
Infiltration rate		0.4423	(19)
Sides sheltered		4	(20)
Shelter factor		0.7000	(21)
Adjusted infiltration rate		0.3096	(22)
Air change natural ventilation		0.5479	(24)
Effective air change rate		0.5479	(25)
3. Heat losses and heat loss parameter			
Front Door	2.1700 * 1.10	2.3870	(26)
Rear Door	2.1800 * 1.40	3.0520	(26)
Side Windows1	4.1200 * (1.40) 1.33	5.4621	(27)
Side Windows2	4.1300 * (1.40) 1.33	5.4754	(27)
Ground Floor	31.8100 * 0.13	4.1353	(28)
Main Wall	68.5320 * 0.26	17.8183	(29)
Plane Roof	30.6400 * 0.11	3.3704	(30)
Flat Roof	1.2100 * 0.11	0.1331	(30)
Total area of elements		144.7920	(32)
Fabric heat loss		41.8336	(33)
Thermal Bridges			
Other lintels	10.52 * 0.210	2.2092	
Sill	8.42 * 0.040	0.3368	
Jamb	21.48 * 0.050	1.0740	
Ground floor	14.46 * 0.160	2.3136	
Interm. floor within a dwelling	15.66 * 0.070	1.0962	
Eaves (insul. at ceiling level)	8.00 * 0.060	0.4800	
Gable (insul. at ceiling level)	7.66 * 0.240	1.8384	
Corner (normal)	24.80 * 0.090	2.2320	
Corner (inverted)	4.80 * -0.090	-0.4320	
Party wall between dwellings	10.00 * 0.060	0.6000	
Effect of thermal bridges		11.7482	(34)
Total fabric heat loss		53.5818	(35)
Ventilation heat loss		28.2088	(36)
Heat loss coefficient		81.7906	(37)
Heat loss parameter (HLP)		1.3097	(38)
4. Water heating energy requirements			
Energy content of heated water		1610.4994	(39)
Distribution loss		284.2058	(40)
Cylinder loss factor (kWh/litre/day)		0.0000	(44)
Volume factor from Table 2a		0.0000	(44a)

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Temperature factor from Table 2b	1.0000	(44b)
Energy lost from water storage, kWh/year	0.0000	(45)
Energy lost from cylinder in kWh/year	0.0000	(47)
Primary circuit loss	0.0000	(48)
Combi loss from Table 3a	600.0000	(49)
Output from water heater	2494.7052	(51)
Gains from water heating	779.9895	(52)

5. Internal gains

Lighting, appliances, cooking and metabolic (Table 5)	393.9520	(53)
Reduction of internal gains due to LE lighting (Appendix L)		
Correction factor for low-energy outlets	0.8500	(C1)
Window 1 0.9 * 4.120 * 0.80 * 0.7 * 0.83 / 62.450	0.0276	
Window 2 0.9 * 4.130 * 0.80 * 0.7 * 0.83 / 62.450	0.0277	
Ratio of glass area to floor area	0.0553	(GL)
Correction factor for daylighting	1.0431	(C2)
Annual energy used for lighting in the house	514.9477	(EL)
Reduction in lighting use due to low energy lights	90.8731	(deltaEL)
Low energy lighting	-13.6310	(53a)
Additional gains - central heating pump	10.0000	
Additional gains (Table 5a)	10.0000	(53b)
Water heating	89.0399	(54)
Total internal gains	479.3609	(55)

6. Solar gains

	Area (m2)	Flux	g	FF	Access Factor	Gains (W)	
Windows 'N '	0.9 * 4.1200 *	29 *	0.72	* 0.7000 *	0.77	41.7310	(56)
Windows (1) 'S '	0.9 * 4.1300 *	72 *	0.72	* 0.7000 *	0.77	103.8595	(60)
Total solar gains						145.5905	(65)
Total gains, W						624.9515	(66)
Gains/loss ratio (GLR)						7.6409	(67)
Utilisation factor						0.9052	(68)
Useful gains, W						565.6923	(69)

7. Mean internal temperature

Mean internal temperature of living zone (heating type = 1)	18.8800	(70)
Temperature addjustment	0.0000	(71)
Adjustment for gains	0.5833	(72)
Adjusted room temperature	19.4633	(73)
Temperature difference between zones	1.4596	(74)
Living area fraction	0.1665	(75)
Rest of house floor fraction	0.8335	(76)
Mean internal temperature	18.2468	(77)

8. Degree-days

Temperature raise from gains	6.9163	(78)
Base temperature	11.3304	(79)
Degree days	1206.0872	(80)

9a. Energy requirements - individual heating systems, including Micro CHP

Space heating requirement (useful)	2367.5193	(81)
Fraction of heat from secondary system	0.1000	(82)
Database boiler reference number : 16212		
Model name : Logic+ combi		
Manufacturer: Ideal Boilers		
MHS efficiency	91.0000	
Main system efficiency	91.0000	(83)
Secondary system efficiency	100.0000	(84)
Space heating fuel - main HS	2341.5026	(85)
Space heating fuel - secondary HS	236.7519	(85a)
Efficiency of water heater	91.0000	(86) (from SED
Energy required for water heating	2494.7052	
Energy used for water heating	2741.4342	(86a)
For each central heating pump	130.0000	(87a)

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For each boiler with F.A.F		45.0000	(87b)
Electricity for pumps and fans		175.0000	(87)
Electricity for pumps and fans - total		175.0000	
Electricity for lighting (30% fixed LEL)		514.9477	(87g)

12a. Carbon dioxide emissions

MHS heating CO2 - box (85)	2341.5026 * 0.1940	454.2515	(101)
SHS heating CO2 - box (85a)	236.7519 * 0.4220	99.9093	(102)
WHS heating CO2 - box (86a)	2741.4342 * 0.1940	531.8382	(103)
Space and water heating CO2		1085.9991	(107)
Pumps and fans CO2 - box (87)	175.0000 * 0.4220	73.8500	(108)
Electricity for lighting	514.9477 * 0.4220	217.3079	(109)
Total CO2 emissions in kg/year		1377.1570	(112)
CO2 emissions per m?		22.0522	
Dwelling's Carbon Emission Rate (DER) - orientation: E		22.0522	(113)

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TER calculation (New Dwelling as Designed)

1. Overall dwelling dimensions			
Ground floor	31.810 * 2.400	76.3440	
First floor	30.640 * 2.600	79.6640	
Total floor area	62.450		(5)
Total house volume		156.0080	(6)
2. Ventilation rate			
Number of chimneys	0 * 40	0	(7)
Number of flues	0 * 20	0	(8)
Number of fans	2 * 10	20	(9)
Flueless gas fire	0 * 40	0	(9a)
Infiltration		0.1282	(10)
Pressure test value		10.0000	(q50)
Infiltration rate		0.6282	(19)
Sides sheltered		2	(20)
Shelter factor		0.8500	(21)
Adjusted infiltration rate		0.5340	(22)
Air change natural ventilation		0.6426	(24)
Effective air change rate		0.6426	(25)
3. Heat losses and heat loss parameter			
One opaque door	1.8500 * 2.00	3.7000	(26)
Windows Double glazed, low-E	13.7625 * (2.00) 1.85	25.4861	(27)
Ground Floor	31.8100 * 0.25	7.9525	(28)
Main Wall	65.5195 * 0.35	22.9318	(29)
Plane Roof	30.6400 * 0.16	4.9024	(30)
Flat Roof	1.2100 * 0.16	0.1936	(30)
Total area of elements		144.7920	(32)
Fabric heat loss		65.1664	(33)
Appendix K: Thermal bridging		0.1100	(y)
Effect of thermal bridges		15.9271	(34)
Total fabric heat loss		81.0936	(35)
Ventilation heat loss		33.0808	(36)
Heat loss coefficient		114.1743	(37)
Heat loss parameter (HLP)		1.8283	(38)
4. Water heating energy requirements			
Energy content of heated water		1610.4994	(39)
Distribution loss		284.2058	(40)
Cylinder volume		150.0000	(43)
Cylinder loss factor (kWh/litre/day)		0.0191	(44)
Volume factor from Table 2a		0.9283	(44a)
Temperature factor from Table 2b		0.5400	(44b)
Energy lost from water storage, kWh/year		524.2835	(45)
Energy lost from cylinder in kWh/year		524.2835	(47)
Primary circuit loss		610.0000	(48)
Output from water heater		3028.9887	(51)
Gains from water heating		1537.4163	(52)
5. Internal gains			
Lighting, appliances, cooking and metabolic (Table 5)		393.9520	(53)
Reduction of internal gains due to LE lighting (Appendix L)			
Correction factor for low-energy outlets		0.8500	(C1)

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Window 1	0.9 * 13.763 * 0.80 * 0.7 * 0.83 / 62.450	0.0922	
Ratio of glass area to floor area		0.0922	(GL)
Correction factor for daylighting		0.9603	(C2)
Annual energy used for lighting in the house		474.0586	(EL)
Reduction in lighting use due to low energy lights		83.6574	(deltaEL)
Low energy lighting		-12.5486	(53a)
Additional gains - central heating pump		10.0000	
Additional gains (Table 5a)		10.0000	(53b)
Water heating		175.5041	(54)
Total internal gains		566.9075	(55)

6. Solar gains

	Area (m2)	Flux	g	FF	Access Factor	Gains (W)	
Windows 'E '	0.9 * 13.7625 *	48 *	0.72	* 0.7000 *	0.77	230.7291	(58)
Total solar gains						230.7291	(65)
Total gains, W						797.6366	(66)
Gains/loss ratio (GLR)						6.9861	(67)
Utilisation factor						0.9240	(68)
Useful gains, W						736.9866	(69)

7. Mean internal temperature

Mean internal temperature of living zone (heating type = 1)	18.8603	(70)
Temperature addjustment	0.0000	(71)
Adjustment for gains	0.4910	(72)
Adjusted room temperature	19.3513	(73)
Temperature difference between zones	1.5425	(74)
Living area fraction	0.1665	(75)
Rest of house floor fraction	0.8335	(76)
Mean internal temperature	18.0657	(77)

8. Degree-days

Temperature raise from gains	6.4549	(78)
Base temperature	11.6107	(79)
Degree days	1263.2523	(80)

9a. Energy requirements - individual heating systems, including Micro CHP

Space heating requirement (useful)	3461.5431	(81)
Fraction of heat from secondary system	0.1000	(82)
Test Method :		
Model name : Any		
Manufacturer: Any		
MHS efficiency	78.0000	
Main system efficiency	78.0000	(83)
Secondary system efficiency	100.0000	(84)
Space heating fuel - main HS	3994.0881	(85)
Space heating fuel - secondary HS	346.1543	(85a)
Efficiency of water heater	78.0000	(86)
Energy required for water heating	3028.9887	
Energy used for water heating	3883.3188	(86a)
For each central heating pump	130.0000	(87a)
For each boiler with F.A.F	45.0000	(87b)
Electricity for pumps and fans	175.0000	(87)
Electricity for pumps and fans - total	175.0000	
Electricity for lighting (30% fixed LEL)	474.0586	(87g)

12a. Carbon dioxide emissions

MHS heating CO2 - box (85)	3994.0881 * 0.1940	774.8531	(101)
SHS heating CO2 - box (85a)	346.1543 * 0.4220	146.0771	(102)
WHS heating CO2 - box (86a)	3883.3188 * 0.1940	753.3639	(103)
Space and water heating CO2		1674.2941	(107)
Pumps and fans CO2 - box (87)	175.0000 * 0.4220	73.8500	(108)
Electricity for lighting	474.0586 * 0.4220	200.0527	(109)
Total CO2 emissions in kg/year		1948.1968	(112)

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CO2 emissions per m?	31.1961	
CO2 for heating and hot water	1748.1441	(CH)
CO2 emissions from internal lighting	200.0527	(CL)
ADL1A - Table 1 Fuel factor	1.0000	(FuelFactor)
Level of reduction in CO2 - Improvement factor	20	(%)
Total floor area	62.4500	(TFA)
Target Carbon Dioxide Emission Rate (TER)	24.9569	(113)

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Regulation compliance checklist

1 TER and DER OK
1.1 Target Carbon Dioxide Emission Rate
Main fuel - Gas, Fuel factor = 1.00, TER = 24.96
1.2 Dwelling Carbon Dioxide Emission Rate - DER = 22.05
1.3 DER 22.05 < TER 24.96

2.1 Fabric U-values OK

Wall	0.26 (0.35)	0.26 (0.70)	OK
Roof	0.11 (0.25)	0.11 (0.35)	OK
Floor	0.13 (0.25)	0.13 (0.70)	OK
Openings	1.35 (2.20)	1.40 (3.30)	OK

2.3 Heating efficiency OK
Post 98 Gas condens. (incl combis) with auto ign. F.A.F., Pumped: pump in heated space
Efficiency - Database: 91.0%
Minimum permitted: 86.0% - OK
Secondary heating: None

2.4 Cylinder insulation OK
No cylinder

2.5 Controls OK
Programmer, room thermostat and TRVs - OK

2.7 Low energy lighting OK
Light fittings: 12, L.E.L. fittings: 4 = 33.00% > 25% - OK
L.E.L. fittings required per 25m2 or part of TFA: 3 < 4 - OK

2.8 External lighting OK
External lights: None

3.1 Summertime temperature OK
Region: West Pennines (15.5)
Thermal mass parameter = 1.0
Ventilation rate in hot weather = 8.0
Overheating risk (Orientation 'E') = Not significant - OK

4.1 Key features
Wall U-value 0.26 < 0.28
Floor U-value 0.13 < 0.20
Design air permeability = 5.0 < 7.0
Roof U-value 0.11 < 0.15
Boiler efficiency 91.0% (> 90.0%)
Openings U-value 1.10 < 1.80
Openings U-value 1.40 < 1.80

4.5 Design air permeability OK
Design air permeability = 5.0

Overall result: OK

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Recommendation Level E

```
E Low energy lighting          : 100%
  Recommendation result        : Recommended
E Recommendation no            : 35
E Recommendation text          : Low energy lighting for all fixed outlets
  CO2 emissions                :  1256.541 (change =   -68.106)
  Total energy cost (97)       :   156.657 (change =    12.976)
  Total energy cost (Sedbuk)   :   357.080 (change =   -22.789)
  SAP rating                   :    85     (value =  85.376)
  EI rating                    :    84     (value =  84.330)
E Recommendation               : SAP change (85.376 - 83.842), increase = 1.534
```

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Recommendation Level N

```
N Solar Panel                  : installed
  Recommendation result        : Recommended
N Recommendation no            : 19
N Recommendation text          : Solar water heating
  CO2 emissions                :  1100.723 (change =  -155.817)
  Total energy cost (97)       :   146.246 (change =    10.411)
  Total energy cost (Sedbuk)   :   334.062 (change =   -23.018)
  SAP rating                   :    87     (value =  86.607)
  EI rating                    :    86     (value =  86.273)
N Recommendation               : SAP change (86.607 - 85.376), increase = 1.231
```

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Recommendation Level U

```
U Photovoltaics                : 2.5 kWp
  Recommendation result        : Recommended
U Recommendation no            : 34
U Recommendation text          : Solar photovoltaic panels, 2.5 kWp
  CO2 emissions                :   153.754 (change =  -946.970)
  Total energy cost (97)       :    39.379 (change =   106.868)
  Total energy cost (Sedbuk)   :   121.827 (change =  -212.235)
  SAP rating                   :    99     (value =  99.242)
  EI rating                    :    98     (value =  98.083)
U Recommendation               : SAP change (99.242 - 86.607), increase = 12.635
```

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Recommendation Level

```
V Wind turbine                 : blade diameter 1.75 m
  Recommendation result        : Recommended
V Recommendation no            : 44
V Recommendation text          : Wind turbine
  CO2 emissions                :   126.994 (change =   -26.759)
  Total energy cost (97)       :    36.225 (change =     3.154)
  Total energy cost (Sedbuk)   :   115.830 (change =    -5.997)
  SAP rating                   :   100     (value =  99.615)
  EI rating                    :    98     (value =  98.416)
V Recommendation               : SAP change (99.615 - 99.242), increase = 0.373
                                 EffectTooSmall
```

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Recommendation Total

E Low energy lighting : 100%
N Solar Panel : installed
U Photovoltaics : 2.5 kWp

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SAP2005 - 9.81 input data (DesignData) -

Regs Region:	England
Calculation Type:	NewDwellingAsDesigned
Region:	WP West Pennines (15.5)
Orientation:	E East
PropType:	H House, E End Terrace
Storeys:	2
Property Age:	2012
Sheltered Sides:	4
Sunlight Shade:	A Average or unknown
Wall Perimeter:	16.84 m, 15.66 m
Floor Area:	31.81 m2, 30.64 m2
Living Floor Area:	10.40 m2, fraction:0.17
Storey Height:	2.40 m, 2.60 m
Conservatory:	None
Doors	
Front Door:	Solid Wood, uvalue: 1.10 (M), area: 2.17 m2, argon: No, solar tra
Rear Door:	Double,Low E,Hard Coat, Glazed PVC, 6 mm, uvalue: 1.40 (M), area:
Windows	
Side Windows1:	Double,Low E,Hard Coat, PVC, 16 mm, North (90°), uvalue: 1.40 (M)
Side Windows2:	Double,Low E,Hard Coat, PVC, 16 mm, South (270°), uvalue: 1.40 (M
Draught Lobby:	No
Draught Proofing:	100%
Roof Lights	
Pressure Test:	Air permeability 5.0 $m^3/h.m^2$ (assumed)
Mechanical Ventilation:	None, Windows open during hot weather: Windows fully open
	Cross ventilation possible: Yes
Fans, Chimneys, Flues:	3, 0, 0
Lighting:	Light fittings: 12, L.E.L. fittings: 12, External lights: None
Main Wall Type:	U: 0.26 A: X(68.53 m2)
Extented Wall Types:	
Timber Frame Wall Area:	0
Plane Roof	U: 0.11 A: 30.64 m2
Flat Roof	U: 0.11 A: 1.21 m2
Main Floor Type:	U: 0.13 A: 31.81 m2
Thermal Mass:	Thermal Mass Parameter entered as: 1.00
Timber Floor:	No Timber Floor
Fixed Air Conditioning:	No
Main Heating:	BGB Post 98 Gas condens. (incl combis) with auto ign. F.A.F., Pum
Main Heating Manufacturer:	Ideal, Logic+ combi, 24, 91.00%
Heating Controls:	CBD Programmer, room thermostat and TRVs
	Boiler interlock - Yes
Underfloor Heating:	None
Combi Type:	StandardCombi
Combi Keep Hot:	GasTimeClock
Secondary Heating:	None
Manufacturer:	
Thermal Store:	None
Hot Water Heating:	HWP From the primary heating system
Solar Water Heating:	Solar panel: Yes, aperture area: 3.00 m2, Type: ME Evacuated tube
	Collector zero-loss efficiency: 0.70
	Collector heat loss coefficient: 1.80
	Solar panel ratio A/G: 1.00
	Orientation: South, Elevation: 30°, Overshading: Modest (20% - 60
	Electrically powered pump, Dedicated solar store volume: 75 litre
Thermal Store:	None
Hot Water Cylinder:	None
Community Heating:	None
CHP Unit:	
Electricity Tariff:	S - Standard
Thermal Bridges:	CalculateBridges
Bridge 1	Length: 10.52, Psi: 0.210, Other lintels
Bridge 2	Length: 8.42, Psi: 0.040, Sill

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Bridge 3	Length: 21.48, Psi: 0.050, Jamb
Bridge 4	Length: 14.46, Psi: 0.160, Ground floor
Bridge 5	Length: 15.66, Psi: 0.070, Interm. floor within a dwelling
Bridge 6	Length: 8.00, Psi: 0.060, Eaves (insul. at ceiling level)
Bridge 7	Length: 7.66, Psi: 0.240, Gable (insul. at ceiling level)
Bridge 8	Length: 24.80, Psi: 0.090, Corner (normal)
Bridge 9	Length: 4.80, Psi: -0.090, Corner (inverted)
Bridge 10	Length: 10.00, Psi: 0.060, Party wall between dwellings
PV Cells:	PV cells Peak Power: 2.50
	Orientation: South, Elevation: 30°, Overshading: Modest (20% - 60
Energy Saved:	
Energy Used:	
Terrain Type:	Urban
Number of Wind Turbines:	0

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Recommendations calculation (New Dwelling as Designed)

1. Overall dwelling dimensions			
Ground floor	31.810 * 2.400	76.3440	
First floor	30.640 * 2.600	79.6640	
Total floor area	62.450		(5)
Total house volume		156.0080	(6)
2. Ventilation rate			
Number of chimneys	0 * 40	0	(7)
Number of flues	0 * 20	0	(8)
Number of fans	3 * 10	30	(9)
Flueless gas fire	0 * 40	0	(9a)
Infiltration		0.1923	(10)
Pressure test value		5.0000	(q50)
Infiltration rate		0.4423	(19)
Sides sheltered		4	(20)
Shelter factor		0.7000	(21)
Adjusted infiltration rate		0.3096	(22)
Air change natural ventilation		0.5479	(24)
Effective air change rate		0.5479	(25)
3. Heat losses and heat loss parameter			
Front Door	2.1700 * 1.10	2.3870	(26)
Rear Door	2.1800 * 1.40	3.0520	(26)
Side Windows1	4.1200 * (1.40) 1.33	5.4621	(27)
Side Windows2	4.1300 * (1.40) 1.33	5.4754	(27)
Ground Floor	31.8100 * 0.13	4.1353	(28)
Main Wall	68.5320 * 0.26	17.8183	(29)
Plane Roof	30.6400 * 0.11	3.3704	(30)
Flat Roof	1.2100 * 0.11	0.1331	(30)
Total area of elements		144.7920	(32)
Fabric heat loss		41.8336	(33)
Thermal Bridges			
Other lintels	10.52 * 0.210	2.2092	
Sill	8.42 * 0.040	0.3368	
Jamb	21.48 * 0.050	1.0740	
Ground floor	14.46 * 0.160	2.3136	
Interm. floor within a dwelling	15.66 * 0.070	1.0962	
Eaves (insul. at ceiling level)	8.00 * 0.060	0.4800	
Gable (insul. at ceiling level)	7.66 * 0.240	1.8384	
Corner (normal)	24.80 * 0.090	2.2320	
Corner (inverted)	4.80 * -0.090	-0.4320	
Party wall between dwellings	10.00 * 0.060	0.6000	
Effect of thermal bridges		11.7482	(34)
Total fabric heat loss		53.5818	(35)
Ventilation heat loss		28.2088	(36)
Heat loss coefficient		81.7906	(37)
Heat loss parameter (HLP)		1.3097	(38)
4. Water heating energy requirements			
Energy content of heated water		1610.4994	(39)
Distribution loss		284.2058	(40)
Cylinder loss factor (kWh/litre/day)		0.0000	(44)
Volume factor from Table 2a		0.0000	(44a)

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Temperature factor from Table 2b	1.0000	(44b)
Energy lost from water storage, kWh/year	0.0000	(45)
Energy lost from cylinder in kWh/year	0.0000	(47)
Primary circuit loss	0.0000	(48)
Combi loss from Table 3a	600.0000	(49)
Aperture area of solar collector	3.0000	(H1)
Zero-loss collector efficiency	0.7000	(H2)
Collector heat loss coefficient	1.8000	(H3)
Collector performance ratio	2.5714	(H4)
Annual solar radiation per m2	1042.0000	(H5)
Overshading factor	0.8000	(H6)
Solar energy available	1750.5600	(H7)
Solar-to-load ratio	0.9239	(H8)
Utilisation factor	0.6612	(H9)
Collector performance factor	0.7865	(H10)
Dedicated solar storage volume	75.0000	(H11)
Total volume of cylinder	0.0000	(H12)
Effective solar volume	75.0000	(H13)
Daily hot water demand	88.9387	(H14)
Volume ratio Veff/V	0.8433	(H15)
Solar storage volume factor	0.9659	(H16)
Solar input	879.3567	(H17)
Solar input	-879.3567	(50)
Output from water heater	1615.3484	(51)
Gains from water heating	779.9895	(52)

5. Internal gains

Lighting, appliances, cooking and metabolic (Table 5)	393.9520	(53)
Low energy lighting	-45.4366	(53a)
Additional gains - central heating pump	10.0000	
Additional gains (Table 5a)	10.0000	(53b)
Water heating	89.0399	(54)
Total internal gains	447.5554	(55)

6. Solar gains

	Area (m2)	Flux	g	FF	Access Factor	Gains (W)	
Windows 'N '	0.9 * 4.1200 *	29 * 0.72	* 0.7000 *	0.77		41.7310	(56)
Windows (1) 'S '	0.9 * 4.1300 *	72 * 0.72	* 0.7000 *	0.77		103.8595	(60)
Total solar gains						145.5905	(65)
Total gains, W						593.1459	(66)
Gains/loss ratio (GLR)						7.2520	(67)
Utilisation factor						0.9164	(68)
Useful gains, W						543.5768	(69)

7. Mean internal temperature

Mean internal temperature of living zone (heating type = 1)	18.8800	(70)
Temperature addjustment	0.0000	(71)
Adjustment for gains	0.5292	(72)
Adjusted room temperature	19.4092	(73)
Temperature difference between zones	1.4596	(74)
Living area fraction	0.1665	(75)
Rest of house floor fraction	0.8335	(76)
Mean internal temperature	18.1927	(77)

8. Degree-days

Temperature raise from gains	6.6460	(78)
Base temperature	11.5467	(79)
Degree days	1249.8173	(80)

9a. Energy requirements - individual heating systems, including Micro CHP

Space heating requirement (useful)	2453.3604	(81)

Database boiler reference number : 16212
Model name : Logic+ combi
Manufacturer: Ideal Boilers

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MHS efficiency		91.0000	
Main system efficiency		91.0000	(83)
Space heating fuel - main HS		2696.0005	(85)
Space heating fuel - secondary HS		0.0000	(85a)
Efficiency of water heater		91.0000	(86) (from SED
Energy required for water heating		1615.3484	
Energy used for water heating		1775.1082	(86a)
For each central heating pump		130.0000	(87a)
For each boiler with F.A.F		45.0000	(87b)
For solar water heating pump		75.0000	(87f)
Electricity for pumps and fans		250.0000	(87)
Electricity for pumps and fans - total		250.0000	
Electricity for lighting (100% fixed LEL)		302.9104	(87g)

10a. Fuel costs - individual heating systems

MHS heating cost	2696.0005 * 1.6300	43.9448	(88)
SHS heating cost	0.0000 * 0.0000	0.0000	(89)
Water heating cost	1775.1082 * 1.6300	28.9343	(91)
Pump/fan energy	250.0000 * 7.1200	17.8000	(92)
Lighting energy	302.9104 * 7.1200	21.5672	(93)
Additional standing charges		34.0000	(94)
Appendix M1: Energy from Photovoltaic (PV) technology ----------			
Effective price depends on a factor	0.5000 (Beta)		
Normal electricity price	7.1200		
Exported electricity price	5.7000		
Effective fuel price	6.4100		
Photovoltaic energy	0.80 * 2.50 * 1042.0 * 0.80	1667.2000	(95)
Produced energy	-1667.2000 * 6.4100	-106.8675	(95a)
Total energy cost		39.3788	(97)
Total energy cost using Sedbuk db prices		121.8273	

11a. SAP rating

Energy cost deflator	0.9100	(98)
Energy cost factor (ECF)	0.0543	(99)
ECF unrounded = 0.0543013638350426		
SAP value	99.2420	(99a)
SAP value unrounded = 99.2419529608628		
SAP Energy rating	99	(100)
SAP Energy rating band	A	

12a. Carbon dioxide emissions

MHS heating CO2 - box (85)	2696.0005 * 0.1940	523.0241	(101)
WHS heating CO2 - box (86a)	1775.1082 * 0.1940	344.3710	(103)
Space and water heating CO2		867.3951	(107)
Pumps and fans CO2 - box (87)	250.0000 * 0.4220	105.5000	(108)
Electricity for lighting	302.9104 * 0.4220	127.8282	(109)
Produced energy - PV - CO2	-1667.2000 * 0.5680	-946.9696	(110)
Total CO2 emissions in kg/year		153.7537	(112)
CO2 emissions per m?		2.4620	
Dwelling's Carbon Factor		1.4309	(CF)
EI value		98.0826	(113a)
EI rating		98	(114)
EI band		A	

13a. Primary energy

MHS heating P.E. - box (85)	2696.0005 * 1.1500	3100.4005	
WHS heating P.E. - box (86a)	1775.1082 * 1.1500	2041.3744	
Space and water heating P.E.		5141.7749	(107)
Pumps and fans P.E. - box (87)	250.0000 * 2.8000	700.0000	(108)
Electricity for lighting	302.9104 * 2.8000	848.1491	(109)
Produced energy - PV - P.E.	-1667.2000 * 2.8000	-4668.1600	(110)
Primary energy kWh/year		2021.7640	(112)

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Primary energy kWh/m2/year	32.3741

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Full SAP Calculation Printout

Users Ref: Maine Rd_Type A Mid_Renew

Issued on: 14.December.2012

Prop Type Ref:

Property: Type A Mid, Maine Road

DER: 19.70

TER: 22.17

SAP Rating: **87 B** **SAP Energy Cost:** £143.28 **CO2 Emissions:** 1.14 t/year

EI Rating: **86 B** **Energy used:** 120 kWh/m2/year **Ene1:** 1 **ZC:** 0.00

Surveyor: 7112-0003, Peter Isherwood, Tel: 0161 763 7200, Fax: 0161 763 7318

Address: Bury Business Centre, Kay Street, Bury, BL9 6BU

Client:

Software Version: EES SAP 2005.018.03, October 2009 (Design System), BRE SAP Worksheet 9.81

SAP version: 9.81 Regs Region: England and Wales (Part L1A 2006), Calculation Type: New Build

CALCULATION DETAILS for survey reference no 'Maine Rd_Type A Mid_Renew' Page: 1

SAP2005 - 9.81 input data (DesignData) -

Regs Region:	England
Calculation Type:	NewDwellingAsDesigned
Region:	WP West Pennines (15.5)
Orientation:	N North
PropType:	H House, M Mid Terrace
Storeys:	2
Property Age:	2012
Sheltered Sides:	2
Sunlight Shade:	A Average or unknown
Wall Perimeter:	8.00 m, 8.00 m
Floor Area:	30.60 m2, 30.60 m2
Living Floor Area:	13.57 m2, fraction:0.00
Storey Height:	2.40 m, 2.60 m
Conservatory:	None
Doors	
Front Door:	Solid Wood, uvalue: 2.20 (M), area: 2.17 m2, argon: No, solar tra
Rear Door:	Double,Low E,Hard Coat, Glazed PVC, 6 mm, uvalue: 2.20 (M), area:
Windows	
Front Windows:	Double,Low E,Hard Coat, PVC, 16 mm, North (0°), uvalue: 2.20 (M),
Rear Windows:	Double,Low E,Hard Coat, PVC, 16 mm, South (180°), uvalue: 2.20 (M
Draught Lobby:	No
Draught Proofing:	100%
Roof Lights	
Pressure Test:	Air permeability 10.0 m³/h.m² (assumed)
Mechanical Ventilation:	None, Windows open during hot weather: Windows fully open
	Cross ventilation possible: Yes
Fans, Chimneys, Flues:	3, 0, 0
Lighting:	Light fittings: 12, L.E.L. fittings: 4, External lights: None
Main Wall Type:	U: 0.35 A: X(26.35 m2)
Extented Wall Types:	
Timber Frame Wall Area:	0
Plane Roof	U: 0.25 A: 30.60 m2
Main Floor Type:	U: 0.25 A: 30.60 m2
Thermal Mass:	Thermal Mass Parameter entered as: 1.00
Timber Floor:	No Timber Floor
Fixed Air Conditioning:	No
Main Heating:	BGB Post 98 Gas condens. (incl combis) with auto ign. F.A.F., Pum
Main Heating Manufacturer:	Manufacturer's data: tba, tba, 86.0%
Heating Controls:	CBD Programmer, room thermostat and TRVs
	Boiler interlock - Yes
Underfloor Heating:	None
Combi Type:	StandardCombi
Combi Keep Hot:	WithoutKeepHot
Secondary Heating:	None
Manufacturer:	
Thermal Store:	None

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Hot Water Heating:	HWP From the primary heating system
Solar Water Heating:	None
Thermal Store:	None
Hot Water Cylinder:	None
Community Heating:	None
CHP Unit:	
Electricity Tariff:	S - Standard
Thermal Bridges:	DefaultRobustConstr, Thermal bridging factor y = 0.08
PV Cells:	PV cells Peak Power: 0.75
	Orientation: South, Elevation: 30°, Overshading: None or little (
Energy Saved:	
Energy Used:	
Terrain Type:	Urban
Number of Wind Turbines:	0

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1. Overall dwelling dimensions			
Ground floor	30.600 * 2.400	73.4400	
First floor	30.600 * 2.600	79.5600	
Total floor area	61.200		(5)
Total house volume		153.0000	(6)
2. Ventilation rate			
Number of chimneys	0 * 40	0	(7)
Number of flues	0 * 20	0	(8)
Number of fans	3 * 10	30	(9)
Flueless gas fire	0 * 40	0	(9a)
Infiltration		0.1961	(10)
Pressure test value		10.0000	(q50)
Infiltration rate		0.6961	(19)
Sides sheltered		2	(20)
Shelter factor		0.8500	(21)
Adjusted infiltration rate		0.5917	(22)
Air change natural ventilation		0.6750	(24)
Effective air change rate		0.6750	(25)
3. Heat losses and heat loss parameter			
Front Door	2.1700 * 2.20	4.7740	(26)
Rear Door	2.1700 * 2.20	4.7740	(26)
Front Windows	4.1300 * (2.20) 2.02	8.3511	(27)
Rear Windows	5.1800 * (2.20) 2.02	10.4743	(27)
Ground Floor	30.6000 * 0.25	7.6500	(28)
Main Wall	26.3500 * 0.35	9.2225	(29)
Plane Roof	30.6000 * 0.25	7.6500	(30)
Total area of elements		101.2000	(32)
Fabric heat loss		52.8959	(33)
Appendix K: Thermal bridging		0.0800	(y)
Effect of thermal bridges		8.0960	(34)
Total fabric heat loss		60.9919	(35)
Ventilation heat loss		34.0825	(36)
Heat loss coefficient		95.0744	(37)
Heat loss parameter (HLP)		1.5535	(38)
4. Water heating energy requirements			
Energy content of heated water		1593.2956	(39)
Distribution loss		281.1698	(40)
Cylinder loss factor (kWh/litre/day)		0.0000	(44)
Volume factor from Table 2a		0.0000	(44a)
Temperature factor from Table 2b		1.0000	(44b)
Energy lost from water storage, kWh/year		0.0000	(45)
Energy lost from cylinder in kWh/year		0.0000	(47)
Primary circuit loss		0.0000	(48)
Combi loss from Table 3a		527.9510	(49)
Output from water heater		2402.4164	(51)
Gains from water heating		755.2475	(52)
5. Internal gains			
Lighting, appliances, cooking and metabolic (Table 5)		387.7673	(53)
Reduction of internal gains due to LE lighting (Appendix L)			

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Correction factor for low-energy outlets		0.8350	(C1)
Window 1	0.9 * 4.130 * 0.80 * 0.7 * 0.83 / 61.200	0.0282	
Window 2	0.9 * 5.180 * 0.80 * 0.7 * 0.83 / 61.200	0.0354	
Ratio of glass area to floor area		0.0636	(GL)
Correction factor for daylighting		1.0118	(C2)
Annual energy used for lighting in the house		480.8766	(EL)
Reduction in lighting use due to low energy lights		95.0235	(deltaEL)
Low energy lighting		-14.2535	(53a)
Additional gains - central heating pump		10.0000	
Additional gains (Table 5a)		10.0000	(53b)
Water heating		86.2155	(54)
Total internal gains		469.7293	(55)

6. Solar gains

	Area (m2)	Flux	g	FF	Access Factor	Gains (W)	
Windows 'N '	0.9 * 4.1300 *	29 *	0.72	* 0.7000 *	0.77	41.8323	(56)
Windows (1) 'S '	0.9 * 5.1800 *	72 *	0.72	* 0.7000 *	0.77	130.2645	(60)
Total solar gains						172.0968	(65)
Total gains, W						641.8261	(66)
Gains/loss ratio (GLR)						6.7508	(67)
Utilisation factor						0.9305	(68)
Useful gains, W						597.2160	(69)

7. Mean internal temperature

Mean internal temperature of living zone (heating type = 1)		18.8768	(70)
Temperature addjustment		0.0000	(71)
Adjustment for gains		0.4563	(72)
Adjusted room temperature		19.3331	(73)
Temperature difference between zones		1.4986	(74)
Living area fraction		0.2217	(75)
Rest of house floor fraction		0.7783	(76)
Mean internal temperature		18.1668	(77)

8. Degree-days

Temperature raise from gains		6.2816	(78)
Base temperature		11.8853	(79)
Degree days		1320.9034	(80)

9a. Energy requirements - individual heating systems, including Micro CHP

Space heating requirement (useful)		3014.0175	(81)
Test Method :			
Model name : tba			
Manufacturer: tba			
MHS efficiency		86.0000	
Main system efficiency		86.0000	(83)
Space heating fuel - main HS		3504.6715	(85)
Space heating fuel - secondary HS		0.0000	(85a)
Efficiency of water heater		86.0000	(86)
Energy required for water heating		2402.4164	
Energy used for water heating		2793.5074	(86a)
For each central heating pump		130.0000	(87a)
For each boiler with F.A.F		45.0000	(87b)
Electricity for pumps and fans		175.0000	(87)
Electricity for pumps and fans - total		175.0000	
Electricity for lighting (33% fixed LEL)		480.8766	(87g)

10a. Fuel costs - individual heating systems

MHS heating cost	3504.6715 * 1.6300	57.1261	(88)
SHS heating cost	0.0000 * 0.0000	0.0000	(89)
Water heating cost	2793.5074 * 1.6300	45.5342	(91)
Pump/fan energy	175.0000 * 7.1200	12.4600	(92)
Lighting energy	480.8766 * 7.1200	34.2384	(93)
Additional standing charges		34.0000	(94)

Appendix M1: Energy from Photovoltaic (PV) technology ----------

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Effective price depends on a factor	0.5000 (Beta)		
Normal electricity price	7.1200		
Exported electricity price	5.7000		
Effective fuel price	6.4100		
Photovoltaic energy	0.80 * 0.75 * 1042.0 * 1.00	625.2000	(95)
Produced energy	-625.2000 * 6.4100	-40.0753	(95a)
Total energy cost		143.2834	(97)
Total energy cost using Sedbuk db prices		329.1538	

11a. SAP rating

Energy cost deflator		0.9100	(98)
Energy cost factor (ECF)		0.9453	(99)
ECF unrounded = 0.945272171532442			
SAP value		86.8040	(99a)
SAP value unrounded = 86.8040004854071			
SAP Energy rating		87	(100)
SAP Energy rating band		B	

12a. Carbon dioxide emissions

MHS heating CO2 - box (85)	3504.6715 * 0.1940	679.9063	(101)
WHS heating CO2 - box (86a)	2793.5074 * 0.1940	541.9404	(103)
Space and water heating CO2		1221.8467	(107)
Pumps and fans CO2 - box (87)	175.0000 * 0.4220	73.8500	(108)
Electricity for lighting	480.8766 * 0.4220	202.9299	(109)
Produced energy - PV - CO2	-625.2000 * 0.5680	-355.1136	(110)
Total CO2 emissions in kg/year		1143.5130	(112)
CO2 emissions per m?		18.6849	
Dwelling's Carbon Factor		10.7675	(CF)
EI value		85.5715	(113a)
EI rating		86	(114)
EI band		B	

13a. Primary energy

MHS heating P.E. - box (85)	3504.6715 * 1.1500	4030.3723	
WHS heating P.E. - box (86a)	2793.5074 * 1.1500	3212.5336	
Space and water heating P.E.		7242.9058	(107)
Pumps and fans P.E. - box (87)	175.0000 * 2.8000	490.0000	(108)
Electricity for lighting	480.8766 * 2.8000	1346.4545	(109)
Produced energy - PV - P.E.	-625.2000 * 2.8000	-1750.5600	(110)
Primary energy kWh/year		7328.8003	(112)
Primary energy kWh/m2/year		119.7516	

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DER calculation (New Dwelling as Designed)

1. Overall dwelling dimensions			
Ground floor	30.600 * 2.400	73.4400	
First floor	30.600 * 2.600	79.5600	
Total floor area	61.200		(5)
Total house volume		153.0000	(6)
2. Ventilation rate			
Number of chimneys	0 * 40	0	(7)
Number of flues	0 * 20	0	(8)
Number of fans	3 * 10	30	(9)
Flueless gas fire	0 * 40	0	(9a)
Infiltration		0.1961	(10)
Pressure test value		10.0000	(q50)
Infiltration rate		0.6961	(19)
Sides sheltered		2	(20)
Shelter factor		0.8500	(21)
Adjusted infiltration rate		0.5917	(22)
Air change natural ventilation		0.6750	(24)
Effective air change rate		0.6750	(25)
3. Heat losses and heat loss parameter			
Front Door	2.1700 * 2.20	4.7740	(26)
Rear Door	2.1700 * 2.20	4.7740	(26)
Front Windows	4.1300 * (2.20) 2.02	8.3511	(27)
Rear Windows	5.1800 * (2.20) 2.02	10.4743	(27)
Ground Floor	30.6000 * 0.25	7.6500	(28)
Main Wall	26.3500 * 0.35	9.2225	(29)
Plane Roof	30.6000 * 0.25	7.6500	(30)
Total area of elements		101.2000	(32)
Fabric heat loss		52.8959	(33)
Appendix K: Thermal bridging		0.0800	(y)
Effect of thermal bridges		8.0960	(34)
Total fabric heat loss		60.9919	(35)
Ventilation heat loss		34.0825	(36)
Heat loss coefficient		95.0744	(37)
Heat loss parameter (HLP)		1.5535	(38)
4. Water heating energy requirements			
Energy content of heated water		1593.2956	(39)
Distribution loss		281.1698	(40)
Cylinder loss factor (kWh/litre/day)		0.0000	(44)
Volume factor from Table 2a		0.0000	(44a)
Temperature factor from Table 2b		1.0000	(44b)
Energy lost from water storage, kWh/year		0.0000	(45)
Energy lost from cylinder in kWh/year		0.0000	(47)
Primary circuit loss		0.0000	(48)
Combi loss from Table 3a		527.9510	(49)
Output from water heater		2402.4164	(51)
Gains from water heating		755.2475	(52)
5. Internal gains			
Lighting, appliances, cooking and metabolic (Table 5)		387.7673	(53)
Reduction of internal gains due to LE lighting (Appendix L)			

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Correction factor for low-energy outlets	0.8500	(C1)
Window 1 0.9 * 4.130 * 0.80 * 0.7 * 0.83 / 61.200	0.0282	
Window 2 0.9 * 5.180 * 0.80 * 0.7 * 0.83 / 61.200	0.0354	
Ratio of glass area to floor area	0.0636	(GL)
Correction factor for daylighting	1.0118	(C2)
Annual energy used for lighting in the house	489.5151	(EL)
Reduction in lighting use due to low energy lights	86.3850	(deltaEL)
Low energy lighting	-12.9578	(53a)
Additional gains - central heating pump	10.0000	
Additional gains (Table 5a)	10.0000	(53b)
Water heating	86.2155	(54)
Total internal gains	471.0250	(55)

6. Solar gains

	Area (m2)	Flux	g	FF	Access Factor	Gains (W)	
Windows 'N '	0.9 * 4.1300 *	29 *	0.72	* 0.7000 *	0.77	41.8323	(56)
Windows (1) 'S '	0.9 * 5.1800 *	72 *	0.72	* 0.7000 *	0.77	130.2645	(60)
Total solar gains						172.0968	(65)
Total gains, W						643.1218	(66)
Gains/loss ratio (GLR)						6.7644	(67)
Utilisation factor						0.9301	(68)
Useful gains, W						598.1810	(69)

7. Mean internal temperature

Mean internal temperature of living zone (heating type = 1)	18.8768	(70)
Temperature addjustment	0.0000	(71)
Adjustment for gains	0.4583	(72)
Adjusted room temperature	19.3351	(73)
Temperature difference between zones	1.4986	(74)
Living area fraction	0.2217	(75)
Rest of house floor fraction	0.7783	(76)
Mean internal temperature	18.1689	(77)

8. Degree-days

Temperature raise from gains	6.2917	(78)
Base temperature	11.8771	(79)
Degree days	1319.1984	(80)

9a. Energy requirements - individual heating systems, including Micro CHP

Space heating requirement (useful)	3010.1269	(81)
Fraction of heat from secondary system	0.1000	(82)
Test Method :		
Model name : tba		
Manufacturer: tba		
MHS efficiency	86.0000	
Main system efficiency	86.0000	(83)
Secondary system efficiency	100.0000	(84)
Space heating fuel - main HS	3150.1328	(85)
Space heating fuel - secondary HS	301.0127	(85a)
Efficiency of water heater	86.0000	(86)
Energy required for water heating	2402.4164	
Energy used for water heating	2793.5074	(86a)
For each central heating pump	130.0000	(87a)
For each boiler with F.A.F	45.0000	(87b)
Electricity for pumps and fans	175.0000	(87)
Electricity for pumps and fans - total	175.0000	
Electricity for lighting (30% fixed LEL)	489.5151	(87g)

12a. Carbon dioxide emissions

MHS heating CO2 - box (85)	3150.1328 * 0.1940	611.1258	(101)
SHS heating CO2 - box (85a)	301.0127 * 0.4220	127.0274	(102)
WHS heating CO2 - box (86a)	2793.5074 * 0.1940	541.9404	(103)
Space and water heating CO2		1280.0936	(107)

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Pumps and fans CO2 - box (87)	175.0000 * 0.4220	73.8500	(108)
Electricity for lighting	489.5151 * 0.4220	206.5754	(109)
Produced energy - PV - CO2	-625.2000 * 0.5680	-355.1136	(110)
Total CO2 emissions in kg/year		1205.4053	(112)
CO2 emissions per m?		19.6962	
Dwelling's Carbon Emission Rate (DER) - orientation: N		19.6962	(113)

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TER calculation (New Dwelling as Designed)

1. Overall dwelling dimensions			
Ground floor	30.600 * 2.400	73.4400	
First floor	30.600 * 2.600	79.5600	
Total floor area	61.200		(5)
Total house volume		153.0000	(6)
2. Ventilation rate			
Number of chimneys	0 * 40	0	(7)
Number of flues	0 * 20	0	(8)
Number of fans	2 * 10	20	(9)
Flueless gas fire	0 * 40	0	(9a)
Infiltration		0.1307	(10)
Pressure test value		10.0000	(q50)
Infiltration rate		0.6307	(19)
Sides sheltered		2	(20)
Shelter factor		0.8500	(21)
Adjusted infiltration rate		0.5361	(22)
Air change natural ventilation		0.6437	(24)
Effective air change rate		0.6437	(25)
3. Heat losses and heat loss parameter			
One opaque door	1.8500 * 2.00	3.7000	(26)
Windows Double glazed, low-E	13.4500 * (2.00) 1.85	24.9074	(27)
Ground Floor	30.6000 * 0.25	7.6500	(28)
Main Wall	24.7000 * 0.35	8.6450	(29)
Plane Roof	30.6000 * 0.16	4.8960	(30)
Total area of elements		101.2000	(32)
Fabric heat loss		49.7984	(33)
Appendix K: Thermal bridging		0.1100	(y)
Effect of thermal bridges		11.1320	(34)
Total fabric heat loss		60.9304	(35)
Ventilation heat loss		32.5008	(36)
Heat loss coefficient		93.4312	(37)
Heat loss parameter (HLP)		1.5267	(38)
4. Water heating energy requirements			
Energy content of heated water		1593.2956	(39)
Distribution loss		281.1698	(40)
Cylinder volume		150.0000	(43)
Cylinder loss factor (kWh/litre/day)		0.0191	(44)
Volume factor from Table 2a		0.9283	(44a)
Temperature factor from Table 2b		0.5400	(44b)
Energy lost from water storage, kWh/year		524.2835	(45)
Energy lost from cylinder in kWh/year		524.2835	(47)
Primary circuit loss		610.0000	(48)
Output from water heater		3008.7489	(51)
Gains from water heating		1530.6866	(52)
5. Internal gains			
Lighting, appliances, cooking and metabolic (Table 5)		387.7673	(53)
Reduction of internal gains due to LE lighting (Appendix L)			
Correction factor for low-energy outlets		0.8500	(C1)
Window 1	0.9 * 13.450 * 0.80 * 0.7 * 0.83 / 61.200	0.0919	

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Ratio of glass area to floor area	0.0919	(GL)
Correction factor for daylighting	0.9604	(C2)
Annual energy used for lighting in the house	464.6101	(EL)
Reduction in lighting use due to low energy lights	81.9900	(deltaEL)
Low energy lighting	-12.2985	(53a)
Additional gains - central heating pump	10.0000	
Additional gains (Table 5a)	10.0000	(53b)
Water heating	174.7359	(54)
Total internal gains	560.2047	(55)

6. Solar gains

	Area (m2)	Flux	g	FF	Access Factor	Gains (W)	
Windows 'E '	0.9 * 13.4500 *	48 *	0.72	* 0.7000 *	0.77	225.4900	(58)
Total solar gains						225.4900	(65)
Total gains, W						785.6947	(66)
Gains/loss ratio (GLR)						8.4093	(67)
Utilisation factor						0.8824	(68)
Useful gains, W						693.2980	(69)

7. Mean internal temperature

Mean internal temperature of living zone (heating type = 1)	18.8784	(70)
Temperature addjustment	0.0000	(71)
Adjustment for gains	0.6841	(72)
Adjusted room temperature	19.5625	(73)
Temperature difference between zones	1.4943	(74)
Living area fraction	0.2217	(75)
Rest of house floor fraction	0.7783	(76)
Mean internal temperature	18.3995	(77)

8. Degree-days

Temperature raise from gains	7.4204	(78)
Base temperature	10.9791	(79)
Degree days	1136.0352	(80)

9a. Energy requirements - individual heating systems, including Micro CHP

Space heating requirement (useful)	2547.3872	(81)
Fraction of heat from secondary system	0.1000	(82)
Test Method :		
Model name : tba		
Manufacturer: tba		
MHS efficiency	78.0000	
Main system efficiency	78.0000	(83)
Secondary system efficiency	100.0000	(84)
Space heating fuel - main HS	2939.2930	(85)
Space heating fuel - secondary HS	254.7387	(85a)
Efficiency of water heater	78.0000	(86)
Energy required for water heating	3008.7489	
Energy used for water heating	3857.3704	(86a)
For each central heating pump	130.0000	(87a)
For each boiler with F.A.F	45.0000	(87b)
Electricity for pumps and fans	175.0000	(87)
Electricity for pumps and fans - total	175.0000	
Electricity for lighting (30% fixed LEL)	464.6101	(87g)

12a. Carbon dioxide emissions

MHS heating CO2 - box (85)	2939.2930 * 0.1940	570.2228	(101)
SHS heating CO2 - box (85a)	254.7387 * 0.4220	107.4997	(102)
WHS heating CO2 - box (86a)	3857.3704 * 0.1940	748.3299	(103)
Space and water heating CO2		1426.0524	(107)
Pumps and fans CO2 - box (87)	175.0000 * 0.4220	73.8500	(108)
Electricity for lighting	464.6101 * 0.4220	196.0655	(109)
Total CO2 emissions in kg/year		1695.9679	(112)
CO2 emissions per m?		27.7119	

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CO2 for heating and hot water	1499.9024	(CH)
CO2 emissions from internal lighting	196.0655	(CL)
ADL1A - Table 1 Fuel factor	1.0000	(FuelFactor)
Level of reduction in CO2 - Improvement factor	20	(%)
Total floor area	61.2000	(TFA)
Target Carbon Dioxide Emission Rate (TER)	22.1695	(113)

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Regulation compliance checklist

1 TER and DER OK
1.1 Target Carbon Dioxide Emission Rate
Main fuel - Gas, Fuel factor = 1.00, TER = 22.17
1.2 Dwelling Carbon Dioxide Emission Rate - DER = 19.70
1.3 DER 19.70 < TER 22.17

2.1 Fabric U-values OK

Wall	0.35 (0.35)	0.35 (0.70)	OK
Roof	0.25 (0.25)	0.25 (0.35)	OK
Floor	0.25 (0.25)	0.25 (0.70)	OK
Openings	2.20 (2.20)	2.20 (3.30)	OK

2.3 Heating efficiency OK
Post 98 Gas condens. (incl combis) with auto ign. F.A.F., Pumped: pump in heated space
Efficiency - Manufacturer data: 86.0%
Minimum permitted: 86.0% - OK
Secondary heating: None

2.4 Cylinder insulation OK
No cylinder

2.5 Controls OK
Programmer, room thermostat and TRVs - OK

2.7 Low energy lighting OK
Light fittings: 12, L.E.L. fittings: 4 = 33.00% > 25% - OK
L.E.L. fittings required per 25m2 or part of TFA: 3 < 4 - OK

2.8 External lighting OK
External lights: None

3.1 Summertime temperature OK
Region: West Pennines (15.5)
Thermal mass parameter = 1.0
Ventilation rate in hot weather = 8.0
Overheating risk (Orientation 'N') = Not significant - OK

4.1 Key features
Photovoltaic Array

4.5 Design air permeability OK
Design air permeability = 10.0

Overall result: OK

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Recommendation Level E

```
E Low energy lighting          : 100%
  Recommendation result        : Recommended
E Recommendation no            : 35
E Recommendation text          : Low energy lighting for all fixed outlets
  CO2 emissions                :  1082.006 (change =   -61.507)
  Total energy cost (97)       :   131.220 (change =    12.064)
  Total energy cost (Sedbuk)   :   308.053 (change =   -21.101)
  SAP rating                   :    88     (value =  88.247)
  EI rating                    :    86     (value =  86.348)
E Recommendation               : SAP change (88.247 - 86.804), increase = 1.443
```

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Recommendation Level N

```
N Solar Panel                  : installed
  Recommendation result        : Recommended
N Recommendation no            : 19
N Recommendation text          : Solar water heating
  CO2 emissions                :   916.035 (change =  -165.972)
  Total energy cost (97)       :   119.955 (change =    11.264)
  Total energy cost (Sedbuk)   :   283.271 (change =   -24.782)
  SAP rating                   :    90     (value =  89.594)
  EI rating                    :    88     (value =  88.442)
N Recommendation               : SAP change (89.594 - 88.247), increase = 1.347
```

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Recommendation Level U

```
  Recommendation result       : AlreadyInstalled
U Recommendation text         : PV Cells recommendation
```

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Recommendation Level

```
V Wind turbine                : blade diameter 1.75 m
  Recommendation result       : Recommended
V Recommendation no           : 44
V Recommendation text         : Wind turbine
  CO2 emissions               :   889.276 (change =   -26.759)
  Total energy cost (97)      :   116.802 (change =     3.154)
  Total energy cost (Sedbuk)  :   277.274 (change =    -5.997)
  SAP rating                  :    90     (value =  89.972)
  EI rating                   :    89     (value =  88.779)
V Recommendation              : SAP change (89.972 - 89.594), increase = 0.378
                                EffectTooSmall
```

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Recommendation Total

E Low energy lighting : 100%
N Solar Panel : installed

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SAP2005 - 9.81 input data (DesignData) -

Regs Region:	England
Calculation Type:	NewDwellingAsDesigned
Region:	WP West Pennines (15.5)
Orientation:	N North
PropType:	H House, M Mid Terrace
Storeys:	2
Property Age:	2012
Sheltered Sides:	2
Sunlight Shade:	A Average or unknown
Wall Perimeter:	8.00 m, 8.00 m
Floor Area:	30.60 m2, 30.60 m2
Living Floor Area:	13.57 m2, fraction:0.22
Storey Height:	2.40 m, 2.60 m
Conservatory:	None
Doors	
Front Door:	Solid Wood, uvalue: 2.20 (M), area: 2.17 m2, argon: No, solar tra
Rear Door:	Double,Low E,Hard Coat, Glazed PVC, 6 mm, uvalue: 2.20 (M), area:
Windows	
Front Windows:	Double,Low E,Hard Coat, PVC, 16 mm, North (0°), uvalue: 2.20 (M),
Rear Windows:	Double,Low E,Hard Coat, PVC, 16 mm, South (180°), uvalue: 2.20 (M
Draught Lobby:	No
Draught Proofing:	100%
Roof Lights	
Pressure Test:	Air permeability 10.0 m³/h.m² (assumed)
Mechanical Ventilation:	None, Windows open during hot weather: Windows fully open
	Cross ventilation possible: Yes
Fans, Chimneys, Flues:	3, 0, 0
Lighting:	Light fittings: 12, L.E.L. fittings: 12, External lights: None
Main Wall Type:	U: 0.35 A: X(26.35 m2)
Extented Wall Types:	
Timber Frame Wall Area:	0
Plane Roof	U: 0.25 A: 30.60 m2
Main Floor Type:	U: 0.25 A: 30.60 m2
Thermal Mass:	Thermal Mass Parameter entered as: 1.00
Timber Floor:	No Timber Floor
Fixed Air Conditioning:	No
Main Heating:	BGB Post 98 Gas condens. (incl combis) with auto ign. F.A.F., Pum
Main Heating Manufacturer:	Manufacturer's data: tba, tba, 86.0%
Heating Controls:	CBD Programmer, room thermostat and TRVs
	Boiler interlock - Yes
Underfloor Heating:	None
Combi Type:	StandardCombi
Combi Keep Hot:	WithoutKeepHot
Secondary Heating:	None
Manufacturer:	
Thermal Store:	None
Hot Water Heating:	HWP From the primary heating system
Solar Water Heating:	Solar panel: Yes, aperture area: 3.00 m2, Type: ME Evacuated tube
	Collector zero-loss efficiency: 0.70
	Collector heat loss coefficient: 1.80
	Solar panel ratio A/G: 1.00
	Orientation: South, Elevation: 30°, Overshading: Modest (20% - 60
	Electrically powered pump, Dedicated solar store volume: 75 litre
Thermal Store:	None
Hot Water Cylinder:	None
Community Heating:	None
CHP Unit:	
Electricity Tariff:	S - Standard
Thermal Bridges:	DefaultRobustConstr, Thermal bridging factor y = 0.08
PV Cells:	PV cells Peak Power: 0.75
	Orientation: South, Elevation: 30°, Overshading: None or little (
Energy Saved:	

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Energy Used:
Terrain Type: Urban
Number of Wind Turbines: 0

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Recommendations calculation (New Dwelling as Designed)

1. Overall dwelling dimensions			
Ground floor	30.600 * 2.400	73.4400	
First floor	30.600 * 2.600	79.5600	
Total floor area	61.200		(5)
Total house volume		153.0000	(6)
2. Ventilation rate			
Number of chimneys	0 * 40	0	(7)
Number of flues	0 * 20	0	(8)
Number of fans	3 * 10	30	(9)
Flueless gas fire	0 * 40	0	(9a)
Infiltration		0.1961	(10)
Pressure test value		10.0000	(q50)
Infiltration rate		0.6961	(19)
Sides sheltered		2	(20)
Shelter factor		0.8500	(21)
Adjusted infiltration rate		0.5917	(22)
Air change natural ventilation		0.6750	(24)
Effective air change rate		0.6750	(25)
3. Heat losses and heat loss parameter			
Front Door	2.1700 * 2.20	4.7740	(26)
Rear Door	2.1700 * 2.20	4.7740	(26)
Front Windows	4.1300 * (2.20) 2.02	8.3511	(27)
Rear Windows	5.1800 * (2.20) 2.02	10.4743	(27)
Ground Floor	30.6000 * 0.25	7.6500	(28)
Main Wall	26.3500 * 0.35	9.2225	(29)
Plane Roof	30.6000 * 0.25	7.6500	(30)
Total area of elements		101.2000	(32)
Fabric heat loss		52.8959	(33)
Appendix K: Thermal bridging		0.0800	(y)
Effect of thermal bridges		8.0960	(34)
Total fabric heat loss		60.9919	(35)
Ventilation heat loss		34.0825	(36)
Heat loss coefficient		95.0744	(37)
Heat loss parameter (HLP)		1.5535	(38)
4. Water heating energy requirements			
Energy content of heated water		1593.2956	(39)
Distribution loss		281.1698	(40)
Cylinder loss factor (kWh/litre/day)		0.0000	(44)
Volume factor from Table 2a		0.0000	(44a)
Temperature factor from Table 2b		1.0000	(44b)
Energy lost from water storage, kWh/year		0.0000	(45)
Energy lost from cylinder in kWh/year		0.0000	(47)
Primary circuit loss		0.0000	(48)
Combi loss from Table 3a		527.9510	(49)
Aperture area of solar collector		3.0000	(H1)
Zero-loss collector efficiency		0.7000	(H2)
Collector heat loss coefficient		1.8000	(H3)
Collector performance ratio		2.5714	(H4)
Annual solar radiation per m2		1042.0000	(H5)
Overshading factor		0.8000	(H6)

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Solar energy available	1750.5600	(H7)
Solar-to-load ratio	0.9339	(H8)
Utilisation factor	0.6573	(H9)
Collector performance factor	0.7865	(H10)
Dedicated solar storage volume	75.0000	(H11)
Total volume of cylinder	0.0000	(H12)
Effective solar volume	75.0000	(H13)
Daily hot water demand	87.9918	(H14)
Volume ratio Veff/V	0.8524	(H15)
Solar storage volume factor	0.9680	(H16)
Solar input	876.0542	(H17)
Solar input	-876.0542	(50)
Output from water heater	1526.3622	(51)
Gains from water heating	755.2475	(52)

5. Internal gains

Lighting, appliances, cooking and metabolic (Table 5)	387.7673	(53)
Low energy lighting	-43.1925	(53a)
Additional gains - central heating pump	10.0000	
Additional gains (Table 5a)	10.0000	(53b)
Water heating	86.2155	(54)
Total internal gains	440.7903	(55)

6. Solar gains

	Area (m2)	Flux	g	FF	Access Factor	Gains (W)	
Windows 'N '	0.9 * 4.1300 *	29 * 0.72	* 0.7000 * 0.77			41.8323	(56)
Windows (1) 'S '	0.9 * 5.1800 *	72 * 0.72	* 0.7000 * 0.77			130.2645	(60)
Total solar gains						172.0968	(65)
Total gains, W						612.8871	(66)
Gains/loss ratio (GLR)						6.4464	(67)
Utilisation factor						0.9387	(68)
Useful gains, W						575.3277	(69)

7. Mean internal temperature

Mean internal temperature of living zone (heating type = 1)	18.8768	(70)
Temperature addjustment	0.0000	(71)
Adjustment for gains	0.4103	(72)
Adjusted room temperature	19.2871	(73)
Temperature difference between zones	1.4986	(74)
Living area fraction	0.2217	(75)
Rest of house floor fraction	0.7783	(76)
Mean internal temperature	18.1208	(77)

8. Degree-days

Temperature raise from gains	6.0513	(78)
Base temperature	12.0694	(79)
Degree days	1359.5810	(80)

9a. Energy requirements - individual heating systems, including Micro CHP

Space heating requirement (useful)	3102.2713	(81)
Test Method :		
Model name : tba		
Manufacturer: tba		
MHS efficiency	86.0000	
Main system efficiency	86.0000	(83)
Space heating fuel - main HS	3607.2922	(85)
Space heating fuel - secondary HS	0.0000	(85a)
Efficiency of water heater	86.0000	(86)
Energy required for water heating	1526.3622	
Energy used for water heating	1774.8397	(86a)
For each central heating pump	130.0000	(87a)
For each boiler with F.A.F	45.0000	(87b)
For solar water heating pump	75.0000	(87f)
Electricity for pumps and fans	250.0000	(87)

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Electricity for pumps and fans - total		250.0000	
Electricity for lighting (100% fixed LEL)		287.9501	(87g)
10a. Fuel costs - individual heating systems			
MHS heating cost	3607.2922 * 1.6300	58.7989	(88)
SHS heating cost	0.0000 * 0.0000	0.0000	(89)
Water heating cost	1774.8397 * 1.6300	28.9299	(91)
Pump/fan energy	250.0000 * 7.1200	17.8000	(92)
Lighting energy	287.9501 * 7.1200	20.5020	(93)
Additional standing charges		34.0000	(94)
Appendix M1: Energy from Photovoltaic (PV) technology ----------			
Effective price depends on a factor	0.5000 (Beta)		
Normal electricity price	7.1200		
Exported electricity price	5.7000		
Effective fuel price	6.4100		
Photovoltaic energy	0.80 * 0.75 * 1042.0 * 1.00	625.2000	(95)
Produced energy	-625.2000 * 6.4100	-40.0753	(95a)

Total energy cost		119.9555	(97)
Total energy cost using Sedbuk db prices		283.2709	
11a. SAP rating			
Energy cost deflator		0.9100	(98)
Energy cost factor (ECF)		0.7454	(99)
ECF unrounded = 0.74538119187496			
SAP value		89.5945	(99a)
SAP value unrounded = 89.5944785614255			
SAP Energy rating		90	(100)
SAP Energy rating band		B	
12a. Carbon dioxide emissions			
MHS heating CO2 - box (85)	3607.2922 * 0.1940	699.8147	(101)
WHS heating CO2 - box (86a)	1774.8397 * 0.1940	344.3189	(103)
Space and water heating CO2		1044.1336	(107)
Pumps and fans CO2 - box (87)	250.0000 * 0.4220	105.5000	(108)
Electricity for lighting	287.9501 * 0.4220	121.5149	(109)
Produced energy - PV - CO2	-625.2000 * 0.5680	-355.1136	(110)
Total CO2 emissions in kg/year		916.0349	(112)
CO2 emissions per m?		14.9679	
Dwelling's Carbon Factor		8.6256	(CF)
EI value		88.4417	(113a)
EI rating		88	(114)
EI band		B	
13a. Primary energy			
MHS heating P.E. - box (85)	3607.2922 * 1.1500	4148.3861	
WHS heating P.E. - box (86a)	1774.8397 * 1.1500	2041.0657	
Space and water heating P.E.		6189.4517	(107)
Pumps and fans P.E. - box (87)	250.0000 * 2.8000	700.0000	(108)
Electricity for lighting	287.9501 * 2.8000	806.2602	(109)
Produced energy - PV - P.E.	-625.2000 * 2.8000	-1750.5600	(110)
Primary energy kWh/year		5945.1519	(112)
Primary energy kWh/m2/year		97.1430	

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Full SAP Calculation Printout

Users Ref: Maine Rd_Type A Mid_Fabric

Issued on: 14.December.2012

Prop Type Ref:

Property: Type A Mid, Maine Road

DER: 19.55

TER: 22.17

SAP Rating: **85 B** **SAP Energy Cost:** £154.79 **CO2 Emissions:** 1.16 t/year

EI Rating: **85 B** **Energy used:** 115 kWh/m2/year **Ene1:** 1 **ZC:** 0.00

Surveyor: 7112-0003, Peter Isherwood, Tel: 0161 763 7200, Fax: 0161 763 7318

Address: Bury Business Centre, Kay Street, Bury, BL9 6BU

Client:

Software Version: EES SAP 2005.018.03, October 2009 (Design System), BRE SAP Worksheet 9.81

SAP version: 9.81 Regs Region: England and Wales (Part L1A 2006), Calculation Type: New Build

CALCULATION DETAILS for survey reference no 'Maine Rd_Type A Mid_Fabric' Page: 1

SAP2005 - 9.81 input data (DesignData) -

Regs Region:	England
Calculation Type:	NewDwellingAsDesigned
Region:	WP West Pennines (15.5)
Orientation:	N North
PropType:	H House, M Mid Terrace
Storeys:	2
Property Age:	2012
Sheltered Sides:	4
Sunlight Shade:	A Average or unknown
Wall Perimeter:	8.00 m, 8.00 m
Floor Area:	30.60 m2, 30.60 m2
Living Floor Area:	13.57 m2, fraction:0.00
Storey Height:	2.40 m, 2.60 m
Conservatory:	None
Doors	
Front Door:	Solid Wood, uvalue: 1.10 (M), area: 2.17 m2, argon: No, solar tra
Rear Door:	Double,Low E,Hard Coat, Glazed PVC, 6 mm, uvalue: 1.40 (M), area:
Windows	
Front Windows:	Double,Low E,Hard Coat, PVC, 16 mm, North (0°), uvalue: 1.40 (M),
Rear Windows:	Double,Low E,Hard Coat, PVC, 16 mm, South (180°), uvalue: 1.40 (M
Draught Lobby:	No
Draught Proofing:	100%
Roof Lights	
Pressure Test:	Air permeability 5.0 m³/h.m² (assumed)
Mechanical Ventilation:	None, Windows open during hot weather: Windows fully open
	Cross ventilation possible: Yes
Fans, Chimneys, Flues:	3, 0, 0
Lighting:	Light fittings: 12, L.E.L. fittings: 4, External lights: None
Main Wall Type:	U: 0.26 A: X(26.35 m2)
Extented Wall Types:	
Timber Frame Wall Area:	0
Plane Roof	U: 0.11 A: 30.60 m2
Main Floor Type:	U: 0.13 A: 30.60 m2
Thermal Mass:	Thermal Mass Parameter entered as: 1.00
Timber Floor:	No Timber Floor
Fixed Air Conditioning:	No
Main Heating:	BGB Post 98 Gas condens. (incl combis) with auto ign. F.A.F., Pum
Main Heating Manufacturer:	Ideal, Logic+ combi, 24, 91.00%
Heating Controls:	CBD Programmer, room thermostat and TRVs
	Boiler interlock - Yes
Underfloor Heating:	None
Combi Type:	StandardCombi
Combi Keep Hot:	GasTimeClock
Secondary Heating:	None
Manufacturer:	
Thermal Store:	None

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Hot Water Heating:	HWP From the primary heating system
Solar Water Heating:	None
Thermal Store:	None
Hot Water Cylinder:	None
Community Heating:	None
CHP Unit:	
Electricity Tariff:	S - Standard
Thermal Bridges:	CalculateBridges
Bridge 1	Length: 11.61, Psi: 0.210, Other lintels
Bridge 2	Length: 9.21, Psi: 0.040, Sill
Bridge 3	Length: 24.16, Psi: 0.050, Jamb
Bridge 4	Length: 5.63, Psi: 0.160, Ground floor
Bridge 5	Length: 8.00, Psi: 0.070, Interm. floor within a dwelling
Bridge 6	Length: 8.00, Psi: 0.060, Eaves (insul. at ceiling level)
Bridge 7	Length: 20.00, Psi: 0.060, Party wall between dwellings
PV Cells:	None
Energy Saved:	
Energy Used:	
Terrain Type:	Urban
Number of Wind Turbines:	0

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1. Overall dwelling dimensions			
Ground floor	30.600 * 2.400	73.4400	
First floor	30.600 * 2.600	79.5600	
Total floor area	61.200		(5)
Total house volume		153.0000	(6)
2. Ventilation rate			
Number of chimneys	0 * 40	0	(7)
Number of flues	0 * 20	0	(8)
Number of fans	3 * 10	30	(9)
Flueless gas fire	0 * 40	0	(9a)
Infiltration		0.1961	(10)
Pressure test value		5.0000	(q50)
Infiltration rate		0.4461	(19)
Sides sheltered		4	(20)
Shelter factor		0.7000	(21)
Adjusted infiltration rate		0.3123	(22)
Air change natural ventilation		0.5488	(24)
Effective air change rate		0.5488	(25)
3. Heat losses and heat loss parameter			
Front Door	2.1700 * 1.10	2.3870	(26)
Rear Door	2.1700 * 1.40	3.0380	(26)
Front Windows	4.1300 * (1.40) 1.33	5.4754	(27)
Rear Windows	5.1800 * (1.40) 1.33	6.8674	(27)
Ground Floor	30.6000 * 0.13	3.9780	(28)
Main Wall	26.3500 * 0.26	6.8510	(29)
Plane Roof	30.6000 * 0.11	3.3660	(30)
Total area of elements		101.2000	(32)
Fabric heat loss		31.9628	(33)
Thermal Bridges			
Other lintels	11.61 * 0.210	2.4381	
Sill	9.21 * 0.040	0.3684	
Jamb	24.16 * 0.050	1.2080	
Ground floor	5.63 * 0.160	0.9008	
Interm. floor within a dwelling	8.00 * 0.070	0.5600	
Eaves (insul. at ceiling level)	8.00 * 0.060	0.4800	
Party wall between dwellings	20.00 * 0.060	1.2000	
Effect of thermal bridges		7.1553	(34)
Total fabric heat loss		39.1181	(35)
Ventilation heat loss		27.7065	(36)
Heat loss coefficient		66.8246	(37)
Heat loss parameter (HLP)		1.0919	(38)
4. Water heating energy requirements			
Energy content of heated water		1593.2956	(39)
Distribution loss		281.1698	(40)
Cylinder loss factor (kWh/litre/day)		0.0000	(44)
Volume factor from Table 2a		0.0000	(44a)
Temperature factor from Table 2b		1.0000	(44b)
Energy lost from water storage, kWh/year		0.0000	(45)
Energy lost from cylinder in kWh/year		0.0000	(47)
Primary circuit loss		0.0000	(48)

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Combi loss from Table 3a	600.0000	(49)
Output from water heater	2474.4654	(51)
Gains from water heating	773.2598	(52)

5. Internal gains

Lighting, appliances, cooking and metabolic (Table 5)	387.7673	(53)
Reduction of internal gains due to LE lighting (Appendix L)		
Correction factor for low-energy outlets	0.8350	(C1)
Window 1 0.9 * 4.130 * 0.80 * 0.7 * 0.83 / 61.200	0.0282	
Window 2 0.9 * 5.180 * 0.80 * 0.7 * 0.83 / 61.200	0.0354	
Ratio of glass area to floor area	0.0636	(GL)
Correction factor for daylighting	1.0118	(C2)
Annual energy used for lighting in the house	480.8766	(EL)
Reduction in lighting use due to low energy lights	95.0235	(deltaEL)
Low energy lighting	-14.2535	(53a)
Additional gains - central heating pump	10.0000	
Additional gains (Table 5a)	10.0000	(53b)
Water heating	88.2717	(54)
Total internal gains	471.7855	(55)

6. Solar gains

	Area (m2)	Flux	g	FF	Access Factor	Gains (W)	
Windows 'N '	0.9 * 4.1300 *		29 * 0.72	* 0.7000 *	0.77	41.8323	(56)
Windows (1) 'S '	0.9 * 5.1800 *		72 * 0.72	* 0.7000 *	0.77	130.2645	(60)
Total solar gains						172.0968	(65)
Total gains, W						643.8823	(66)
Gains/loss ratio (GLR)						9.6354	(67)
Utilisation factor						0.8456	(68)
Useful gains, W						544.4569	(69)

7. Mean internal temperature

Mean internal temperature of living zone (heating type = 1)	18.8800	(70)
Temperature addjustment	0.0000	(71)
Adjustment for gains	0.8295	(72)
Adjusted room temperature	19.7095	(73)
Temperature difference between zones	1.4247	(74)
Living area fraction	0.2217	(75)
Rest of house floor fraction	0.7783	(76)
Mean internal temperature	18.6007	(77)

8. Degree-days

Temperature raise from gains	8.1476	(78)
Base temperature	10.4532	(79)
Degree days	1036.0991	(80)

9a. Energy requirements - individual heating systems, including Micro CHP

Space heating requirement (useful)	1661.6850	(81)
Database boiler reference number : 16212		
Model name : Logic+ combi		
Manufacturer: Ideal Boilers		
MHS efficiency	91.0000	
Main system efficiency	91.0000	(83)
Space heating fuel - main HS	1826.0274	(85)
Space heating fuel - secondary HS	0.0000	(85a)
Efficiency of water heater	91.0000	(86) (from SED
Energy required for water heating	2474.4654	
Energy used for water heating	2719.1928	(86a)
For each central heating pump	130.0000	(87a)
For each boiler with F.A.F	45.0000	(87b)
Electricity for pumps and fans	175.0000	(87)
Electricity for pumps and fans - total	175.0000	
Electricity for lighting (33% fixed LEL)	480.8766	(87g)

10a. Fuel costs - individual heating systems

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MHS heating cost	1826.0274 * 1.6300	29.7642	(88)
SHS heating cost	0.0000 * 0.0000	0.0000	(89)
Water heating cost	2719.1928 * 1.6300	44.3228	(91)
Pump/fan energy	175.0000 * 7.1200	12.4600	(92)
Lighting energy	480.8766 * 7.1200	34.2384	(93)
Additional standing charges		34.0000	(94)
Total energy cost		154.7855	(97)
Total energy cost using Sedbuk db prices		349.6670	

11a. SAP rating

Energy cost deflator		0.9100	(98)
Energy cost factor (ECF)		1.0438	(99)

ECF unrounded = 1.04383058741157

SAP value		85.4281	(99a)

SAP value unrounded = 85.4281249997345

SAP Energy rating		85	(100)
SAP Energy rating band		B	

12a. Carbon dioxide emissions

MHS heating CO2 - box (85)	1826.0274 * 0.1940	354.2493	(101)
WHS heating CO2 - box (86a)	2719.1928 * 0.1940	527.5234	(103)
Space and water heating CO2		881.7727	(107)
Pumps and fans CO2 - box (87)	175.0000 * 0.4220	73.8500	(108)
Electricity for lighting	480.8766 * 0.4220	202.9299	(109)
Total CO2 emissions in kg/year		1158.5526	(112)
CO2 emissions per m?		18.9306	
Dwelling's Carbon Factor		10.9092	(CF)
EI value		85.3817	(113a)
EI rating		85	(114)
EI band		B	

13a. Primary energy

MHS heating P.E. - box (85)	1826.0274 * 1.1500	2099.9316	
WHS heating P.E. - box (86a)	2719.1928 * 1.1500	3127.0717	
Space and water heating P.E.		5227.0032	(107)
Pumps and fans P.E. - box (87)	175.0000 * 2.8000	490.0000	(108)
Electricity for lighting	480.8766 * 2.8000	1346.4545	(109)
Primary energy kWh/year		7063.4577	(112)
Primary energy kWh/m2/year		115.4160	

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DER calculation (New Dwelling as Designed)

1. Overall dwelling dimensions			
Ground floor	30.600 * 2.400	73.4400	
First floor	30.600 * 2.600	79.5600	
Total floor area	61.200		(5)
Total house volume		153.0000	(6)
2. Ventilation rate			
Number of chimneys	0 * 40	0	(7)
Number of flues	0 * 20	0	(8)
Number of fans	3 * 10	30	(9)
Flueless gas fire	0 * 40	0	(9a)
Infiltration		0.1961	(10)
Pressure test value		5.0000	(q50)
Infiltration rate		0.4461	(19)
Sides sheltered		4	(20)
Shelter factor		0.7000	(21)
Adjusted infiltration rate		0.3123	(22)
Air change natural ventilation		0.5488	(24)
Effective air change rate		0.5488	(25)
3. Heat losses and heat loss parameter			
Front Door	2.1700 * 1.10	2.3870	(26)
Rear Door	2.1700 * 1.40	3.0380	(26)
Front Windows	4.1300 * (1.40) 1.33	5.4754	(27)
Rear Windows	5.1800 * (1.40) 1.33	6.8674	(27)
Ground Floor	30.6000 * 0.13	3.9780	(28)
Main Wall	26.3500 * 0.26	6.8510	(29)
Plane Roof	30.6000 * 0.11	3.3660	(30)
Total area of elements		101.2000	(32)
Fabric heat loss		31.9628	(33)
Thermal Bridges			
Other lintels	11.61 * 0.210	2.4381	
Sill	9.21 * 0.040	0.3684	
Jamb	24.16 * 0.050	1.2080	
Ground floor	5.63 * 0.160	0.9008	
Interm. floor within a dwelling	8.00 * 0.070	0.5600	
Eaves (insul. at ceiling level)	8.00 * 0.060	0.4800	
Party wall between dwellings	20.00 * 0.060	1.2000	
Effect of thermal bridges		7.1553	(34)
Total fabric heat loss		39.1181	(35)
Ventilation heat loss		27.7065	(36)
Heat loss coefficient		66.8246	(37)
Heat loss parameter (HLP)		1.0919	(38)
4. Water heating energy requirements			
Energy content of heated water		1593.2956	(39)
Distribution loss		281.1698	(40)
Cylinder loss factor (kWh/litre/day)		0.0000	(44)
Volume factor from Table 2a		0.0000	(44a)
Temperature factor from Table 2b		1.0000	(44b)
Energy lost from water storage, kWh/year		0.0000	(45)
Energy lost from cylinder in kWh/year		0.0000	(47)
Primary circuit loss		0.0000	(48)

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Combi loss from Table 3a	600.0000	(49)
Output from water heater	2474.4654	(51)
Gains from water heating	773.2598	(52)

5. Internal gains

Lighting, appliances, cooking and metabolic (Table 5)	387.7673	(53)
Reduction of internal gains due to LE lighting (Appendix L)		
Correction factor for low-energy outlets	0.8500	(C1)
Window 1 0.9 * 4.130 * 0.80 * 0.7 * 0.83 / 61.200	0.0282	
Window 2 0.9 * 5.180 * 0.80 * 0.7 * 0.83 / 61.200	0.0354	
Ratio of glass area to floor area	0.0636	(GL)
Correction factor for daylighting	1.0118	(C2)
Annual energy used for lighting in the house	489.5151	(EL)
Reduction in lighting use due to low energy lights	86.3850	(deltaEL)
Low energy lighting	-12.9578	(53a)
Additional gains - central heating pump	10.0000	
Additional gains (Table 5a)	10.0000	(53b)
Water heating	88.2717	(54)
Total internal gains	473.0812	(55)

6. Solar gains

	Area (m2)	Flux	g	FF	Access Factor	Gains (W)	
Windows 'N '	0.9 * 4.1300 *	29 * 0.72	* 0.7000 *	0.77		41.8323	(56)
Windows (1) 'S '	0.9 * 5.1800 *	72 * 0.72	* 0.7000 *	0.77		130.2645	(60)
Total solar gains						172.0968	(65)
Total gains, W						645.1780	(66)
Gains/loss ratio (GLR)						9.6548	(67)
Utilisation factor						0.8450	(68)
Useful gains, W						545.1781	(69)

7. Mean internal temperature

Mean internal temperature of living zone (heating type = 1)	18.8800	(70)
Temperature addjustment	0.0000	(71)
Adjustment for gains	0.8317	(72)
Adjusted room temperature	19.7117	(73)
Temperature difference between zones	1.4247	(74)
Living area fraction	0.2217	(75)
Rest of house floor fraction	0.7783	(76)
Mean internal temperature	18.6029	(77)

8. Degree-days

Temperature raise from gains	8.1583	(78)
Base temperature	10.4445	(79)
Degree days	1034.4586	(80)

9a. Energy requirements - individual heating systems, including Micro CHP

Space heating requirement (useful)	1659.0540	(81)
Fraction of heat from secondary system	0.1000	(82)
Database boiler reference number : 16212		
Model name : Logic+ combi		
Manufacturer: Ideal Boilers		
MHS efficiency	91.0000	
Main system efficiency	91.0000	(83)
Secondary system efficiency	100.0000	(84)
Space heating fuel - main HS	1640.8227	(85)
Space heating fuel - secondary HS	165.9054	(85a)
Efficiency of water heater	91.0000	(86) (from SED
Energy required for water heating	2474.4654	
Energy used for water heating	2719.1928	(86a)
For each central heating pump	130.0000	(87a)
For each boiler with F.A.F	45.0000	(87b)
Electricity for pumps and fans	175.0000	(87)
Electricity for pumps and fans - total	175.0000	
Electricity for lighting (30% fixed LEL)	489.5151	(87g)

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12a. Carbon dioxide emissions			
MHS heating CO2 - box (85)	1640.8227 * 0.1940	318.3196	(101)
SHS heating CO2 - box (85a)	165.9054 * 0.4220	70.0121	(102)
WHS heating CO2 - box (86a)	2719.1928 * 0.1940	527.5234	(103)
Space and water heating CO2		915.8551	(107)
Pumps and fans CO2 - box (87)	175.0000 * 0.4220	73.8500	(108)
Electricity for lighting	489.5151 * 0.4220	206.5754	(109)
Total CO2 emissions in kg/year		1196.2805	(112)
CO2 emissions per m?		19.5471	
Dwelling's Carbon Emission Rate (DER) - orientation: N		19.5471	(113)

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1. Overall dwelling dimensions			
Ground floor	30.600 * 2.400	73.4400	
First floor	30.600 * 2.600	79.5600	
Total floor area	61.200		(5)
Total house volume		153.0000	(6)
2. Ventilation rate			
Number of chimneys	0 * 40	0	(7)
Number of flues	0 * 20	0	(8)
Number of fans	2 * 10	20	(9)
Flueless gas fire	0 * 40	0	(9a)
Infiltration		0.1307	(10)
Pressure test value		10.0000	(q50)
Infiltration rate		0.6307	(19)
Sides sheltered		2	(20)
Shelter factor		0.8500	(21)
Adjusted infiltration rate		0.5361	(22)
Air change natural ventilation		0.6437	(24)
Effective air change rate		0.6437	(25)
3. Heat losses and heat loss parameter			
One opaque door	1.8500 * 2.00	3.7000	(26)
Windows Double glazed, low-E	13.4500 * (2.00) 1.85	24.9074	(27)
Ground Floor	30.6000 * 0.25	7.6500	(28)
Main Wall	24.7000 * 0.35	8.6450	(29)
Plane Roof	30.6000 * 0.16	4.8960	(30)
Total area of elements		101.2000	(32)
Fabric heat loss		49.7984	(33)
Appendix K: Thermal bridging		0.1100	(y)
Effect of thermal bridges		11.1320	(34)
Total fabric heat loss		60.9304	(35)
Ventilation heat loss		32.5008	(36)
Heat loss coefficient		93.4312	(37)
Heat loss parameter (HLP)		1.5267	(38)
4. Water heating energy requirements			
Energy content of heated water		1593.2956	(39)
Distribution loss		281.1698	(40)
Cylinder volume		150.0000	(43)
Cylinder loss factor (kWh/litre/day)		0.0191	(44)
Volume factor from Table 2a		0.9283	(44a)
Temperature factor from Table 2b		0.5400	(44b)
Energy lost from water storage, kWh/year		524.2835	(45)
Energy lost from cylinder in kWh/year		524.2835	(47)
Primary circuit loss		610.0000	(48)
Output from water heater		3008.7489	(51)
Gains from water heating		1530.6866	(52)
5. Internal gains			
Lighting, appliances, cooking and metabolic (Table 5)		387.7673	(53)
Reduction of internal gains due to LE lighting (Appendix L)			
Correction factor for low-energy outlets		0.8500	(C1)
Window 1	0.9 * 13.450 * 0.80 * 0.7 * 0.83 / 61.200	0.0919	

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Ratio of glass area to floor area	0.0919	(GL)
Correction factor for daylighting	0.9604	(C2)
Annual energy used for lighting in the house	464.6101	(EL)
Reduction in lighting use due to low energy lights	81.9900	(deltaEL)
Low energy lighting	-12.2985	(53a)
Additional gains - central heating pump	10.0000	
Additional gains (Table 5a)	10.0000	(53b)
Water heating	174.7359	(54)
Total internal gains	560.2047	(55)

6. Solar gains

	Area (m2)	Flux	g	FF	Access Factor	Gains (W)	
Windows 'E '	0.9 * 13.4500 *	48 *	0.72	* 0.7000 *	0.77	225.4900	(58)
Total solar gains						225.4900	(65)
Total gains, W						785.6947	(66)
Gains/loss ratio (GLR)						8.4093	(67)
Utilisation factor						0.8824	(68)
Useful gains, W						693.2980	(69)

7. Mean internal temperature

Mean internal temperature of living zone (heating type = 1)	18.8784	(70)
Temperature addjustment	0.0000	(71)
Adjustment for gains	0.6841	(72)
Adjusted room temperature	19.5625	(73)
Temperature difference between zones	1.4943	(74)
Living area fraction	0.2217	(75)
Rest of house floor fraction	0.7783	(76)
Mean internal temperature	18.3995	(77)

8. Degree-days

Temperature raise from gains	7.4204	(78)
Base temperature	10.9791	(79)
Degree days	1136.0352	(80)

9a. Energy requirements - individual heating systems, including Micro CHP

Space heating requirement (useful)	2547.3872	(81)
Fraction of heat from secondary system	0.1000	(82)
Test Method :		
Model name : Any		
Manufacturer: Any		
MHS efficiency	78.0000	
Main system efficiency	78.0000	(83)
Secondary system efficiency	100.0000	(84)
Space heating fuel - main HS	2939.2930	(85)
Space heating fuel - secondary HS	254.7387	(85a)
Efficiency of water heater	78.0000	(86)
Energy required for water heating	3008.7489	
Energy used for water heating	3857.3704	(86a)
For each central heating pump	130.0000	(87a)
For each boiler with F.A.F	45.0000	(87b)
Electricity for pumps and fans	175.0000	(87)
Electricity for pumps and fans - total	175.0000	
Electricity for lighting (30% fixed LEL)	464.6101	(87g)

12a. Carbon dioxide emissions

MHS heating CO2 - box (85)	2939.2930 * 0.1940	570.2228	(101)
SHS heating CO2 - box (85a)	254.7387 * 0.4220	107.4997	(102)
WHS heating CO2 - box (86a)	3857.3704 * 0.1940	748.3299	(103)
Space and water heating CO2		1426.0524	(107)
Pumps and fans CO2 - box (87)	175.0000 * 0.4220	73.8500	(108)
Electricity for lighting	464.6101 * 0.4220	196.0655	(109)
Total CO2 emissions in kg/year		1695.9679	(112)
CO2 emissions per m?		27.7119	

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CO2 for heating and hot water	1499.9024	(CH)
CO2 emissions from internal lighting	196.0655	(CL)
ADL1A - Table 1 Fuel factor	1.0000	(FuelFactor)
Level of reduction in CO2 - Improvement factor	20	(%)
Total floor area	61.2000	(TFA)
Target Carbon Dioxide Emission Rate (TER)	22.1695	(113)

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Regulation compliance checklist

1 TER and DER OK
1.1 Target Carbon Dioxide Emission Rate
Main fuel - Gas, Fuel factor = 1.00, TER = 22.17
1.2 Dwelling Carbon Dioxide Emission Rate - DER = 19.55
1.3 DER 19.55 < TER 22.17

2.1 Fabric U-values OK

Wall	0.26 (0.35)	0.26 (0.70)	OK
Roof	0.11 (0.25)	0.11 (0.35)	OK
Floor	0.13 (0.25)	0.13 (0.70)	OK
Openings	1.35 (2.20)	1.40 (3.30)	OK

2.3 Heating efficiency OK
Post 98 Gas condens. (incl combis) with auto ign. F.A.F., Pumped: pump in heated space
Efficiency - Database: 91.0%
Minimum permitted: 86.0% - OK
Secondary heating: None

2.4 Cylinder insulation OK
No cylinder

2.5 Controls OK
Programmer, room thermostat and TRVs - OK

2.7 Low energy lighting OK
Light fittings: 12, L.E.L. fittings: 4 = 33.00% > 25% - OK
L.E.L. fittings required per 25m2 or part of TFA: 3 < 4 - OK

2.8 External lighting OK
External lights: None

3.1 Summertime temperature OK
Region: West Pennines (15.5)
Thermal mass parameter = 1.0
Ventilation rate in hot weather = 8.0
Overheating risk (Orientation 'N') = Not significant - OK

4.1 Key features
Thermal bridging (7.16) less than the accredited construction default (8.10)
Wall U-value 0.26 < 0.28
Floor U-value 0.13 < 0.20
Design air permeability = 5.0 < 7.0
Roof U-value 0.11 < 0.15
Boiler efficiency 91.0% (> 90.0%)
Openings U-value 1.10 < 1.80
Openings U-value 1.40 < 1.80

4.5 Design air permeability OK
Design air permeability = 5.0

Overall result: OK

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Recommendation Level E

```
E Low energy lighting          : 100%
  Recommendation result        : Recommended
E Recommendation no            : 35
E Recommendation text          : Low energy lighting for all fixed outlets
  CO2 emissions                :  1089.953 (change =   -68.599)
  Total energy cost (97)       :   142.126 (change =    12.660)
  Total energy cost (Sedbuk)   :   327.334 (change =   -22.333)
  SAP rating                   :    87     (value =  86.942)
  EI rating                    :    86     (value =  86.247)
E Recommendation               : SAP change (86.942 - 85.428), increase = 1.514
```

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Recommendation Level N

```
N Solar Panel                  : installed
  Recommendation result        : Recommended
N Recommendation no            : 19
N Recommendation text          : Solar water heating
  CO2 emissions                :   934.840 (change =  -155.113)
  Total energy cost (97)       :   131.774 (change =    10.352)
  Total energy cost (Sedbuk)   :   304.438 (change =   -22.895)
  SAP rating                   :    88     (value =  88.181)
  EI rating                    :    88     (value =  88.204)
N Recommendation               : SAP change (88.181 - 86.942), increase = 1.239
```

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Recommendation Level U

```
U Photovoltaics                : 2.5 kWp
  Recommendation result        : Recommended
U Recommendation no            : 34
U Recommendation text          : Solar photovoltaic panels, 2.5 kWp
  CO2 emissions                :   -12.129 (change =  -946.970)
  Total energy cost (97)       :    24.906 (change =   106.868)
  Total energy cost (Sedbuk)   :    92.204 (change =  -212.235)
  SAP rating                   :   101     (value = 100.964)
  EI rating                    :   100     (value = 100.153)
U Recommendation               : SAP change (100.964 - 88.181), increase = 12.783
```

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Recommendation Level

```
V Wind turbine                 : blade diameter 1.75 m
  Recommendation result        : Recommended
V Recommendation no            : 44
V Recommendation text          : Wind turbine
  CO2 emissions                :   -38.889 (change =   -26.759)
  Total energy cost (97)       :    21.753 (change =     3.154)
  Total energy cost (Sedbuk)   :    86.206 (change =    -5.997)
  SAP rating                   :   101     (value = 101.341)
  EI rating                    :   100     (value = 100.491)
V Recommendation               : SAP change (101.341 - 100.964), increase = 0.377
                                 EffectTooSmall
```

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Recommendation Total

E Low energy lighting : 100%
N Solar Panel : installed
U Photovoltaics : 2.5 kWp

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SAP2005 - 9.81 input data (DesignData) -

Regs Region:	England
Calculation Type:	NewDwellingAsDesigned
Region:	WP West Pennines (15.5)
Orientation:	N North
PropType:	H House, M Mid Terrace
Storeys:	2
Property Age:	2012
Sheltered Sides:	4
Sunlight Shade:	A Average or unknown
Wall Perimeter:	8.00 m, 8.00 m
Floor Area:	30.60 m2, 30.60 m2
Living Floor Area:	13.57 m2, fraction:0.22
Storey Height:	2.40 m, 2.60 m
Conservatory:	None
Doors	
Front Door:	Solid Wood, uvalue: 1.10 (M), area: 2.17 m2, argon: No, solar tra
Rear Door:	Double,Low E,Hard Coat, Glazed PVC, 6 mm, uvalue: 1.40 (M), area:
Windows	
Front Windows:	Double,Low E,Hard Coat, PVC, 16 mm, North (0°), uvalue: 1.40 (M),
Rear Windows:	Double,Low E,Hard Coat, PVC, 16 mm, South (180°), uvalue: 1.40 (M
Draught Lobby:	No
Draught Proofing:	100%
Roof Lights	
Pressure Test:	Air permeability 5.0 m³/h.m² (assumed)
Mechanical Ventilation:	None, Windows open during hot weather: Windows fully open
	Cross ventilation possible: Yes
Fans, Chimneys, Flues:	3, 0, 0
Lighting:	Light fittings: 12, L.E.L. fittings: 12, External lights: None
Main Wall Type:	U: 0.26 A: X(26.35 m2)
Extented Wall Types:	
Timber Frame Wall Area:	0
Plane Roof	U: 0.11 A: 30.60 m2
Main Floor Type:	U: 0.13 A: 30.60 m2
Thermal Mass:	Thermal Mass Parameter entered as: 1.00
Timber Floor:	No Timber Floor
Fixed Air Conditioning:	No
Main Heating:	BGB Post 98 Gas condens. (incl combis) with auto ign. F.A.F., Pum
Main Heating Manufacturer:	Ideal, Logic+ combi, 24, 91.00%
Heating Controls:	CBD Programmer, room thermostat and TRVs
	Boiler interlock - Yes
Underfloor Heating:	None
Combi Type:	StandardCombi
Combi Keep Hot:	GasTimeClock
Secondary Heating:	None
Manufacturer:	
Thermal Store:	None
Hot Water Heating:	HWP From the primary heating system
Solar Water Heating:	Solar panel: Yes, aperture area: 3.00 m2, Type: ME Evacuated tube
	Collector zero-loss efficiency: 0.70
	Collector heat loss coefficient: 1.80
	Solar panel ratio A/G: 1.00
	Orientation: South, Elevation: 30°, Overshading: Modest (20% - 60
	Electrically powered pump, Dedicated solar store volume: 75 litre
Thermal Store:	None
Hot Water Cylinder:	None
Community Heating:	None
CHP Unit:	
Electricity Tariff:	S - Standard
Thermal Bridges:	CalculateBridges
Bridge 1	Length: 11.61, Psi: 0.210, Other lintels
Bridge 2	Length: 9.21, Psi: 0.040, Sill
Bridge 3	Length: 24.16, Psi: 0.050, Jamb

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Bridge 4	Length: 5.63, Psi: 0.160, Ground floor
Bridge 5	Length: 8.00, Psi: 0.070, Interm. floor within a dwelling
Bridge 6	Length: 8.00, Psi: 0.060, Eaves (insul. at ceiling level)
Bridge 7	Length: 20.00, Psi: 0.060, Party wall between dwellings
PV Cells:	PV cells Peak Power: 2.50
	Orientation: South, Elevation: 30°, Overshading: Modest (20% - 60
Energy Saved:	
Energy Used:	
Terrain Type:	Urban
Number of Wind Turbines:	0

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Recommendations calculation (New Dwelling as Designed)

1. Overall dwelling dimensions			
Ground floor	30.600 * 2.400	73.4400	
First floor	30.600 * 2.600	79.5600	
Total floor area	61.200		(5)
Total house volume		153.0000	(6)
2. Ventilation rate			
Number of chimneys	0 * 40	0	(7)
Number of flues	0 * 20	0	(8)
Number of fans	3 * 10	30	(9)
Flueless gas fire	0 * 40	0	(9a)
Infiltration		0.1961	(10)
Pressure test value		5.0000	(q50)
Infiltration rate		0.4461	(19)
Sides sheltered		4	(20)
Shelter factor		0.7000	(21)
Adjusted infiltration rate		0.3123	(22)
Air change natural ventilation		0.5488	(24)
Effective air change rate		0.5488	(25)
3. Heat losses and heat loss parameter			
Front Door	2.1700 * 1.10	2.3870	(26)
Rear Door	2.1700 * 1.40	3.0380	(26)
Front Windows	4.1300 * (1.40) 1.33	5.4754	(27)
Rear Windows	5.1800 * (1.40) 1.33	6.8674	(27)
Ground Floor	30.6000 * 0.13	3.9780	(28)
Main Wall	26.3500 * 0.26	6.8510	(29)
Plane Roof	30.6000 * 0.11	3.3660	(30)
Total area of elements		101.2000	(32)
Fabric heat loss		31.9628	(33)
Thermal Bridges			
Other lintels	11.61 * 0.210	2.4381	
Sill	9.21 * 0.040	0.3684	
Jamb	24.16 * 0.050	1.2080	
Ground floor	5.63 * 0.160	0.9008	
Interm. floor within a dwelling	8.00 * 0.070	0.5600	
Eaves (insul. at ceiling level)	8.00 * 0.060	0.4800	
Party wall between dwellings	20.00 * 0.060	1.2000	
Effect of thermal bridges		7.1553	(34)
Total fabric heat loss		39.1181	(35)
Ventilation heat loss		27.7065	(36)
Heat loss coefficient		66.8246	(37)
Heat loss parameter (HLP)		1.0919	(38)
4. Water heating energy requirements			
Energy content of heated water		1593.2956	(39)
Distribution loss		281.1698	(40)
Cylinder loss factor (kWh/litre/day)		0.0000	(44)
Volume factor from Table 2a		0.0000	(44a)
Temperature factor from Table 2b		1.0000	(44b)
Energy lost from water storage, kWh/year		0.0000	(45)
Energy lost from cylinder in kWh/year		0.0000	(47)
Primary circuit loss		0.0000	(48)

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Combi loss from Table 3a	600.0000	(49)
Aperture area of solar collector	3.0000	(H1)
Zero-loss collector efficiency	0.7000	(H2)
Collector heat loss coefficient	1.8000	(H3)
Collector performance ratio	2.5714	(H4)
Annual solar radiation per m2	1042.0000	(H5)
Overshading factor	0.8000	(H6)
Solar energy available	1750.5600	(H7)
Solar-to-load ratio	0.9339	(H8)
Utilisation factor	0.6573	(H9)
Collector performance factor	0.7865	(H10)
Dedicated solar storage volume	75.0000	(H11)
Total volume of cylinder	0.0000	(H12)
Effective solar volume	75.0000	(H13)
Daily hot water demand	87.9918	(H14)
Volume ratio Veff/V	0.8524	(H15)
Solar storage volume factor	0.9680	(H16)
Solar input	876.0542	(H17)
Solar input	-876.0542	(50)
Output from water heater	1598.4112	(51)
Gains from water heating	773.2598	(52)

5. Internal gains

Lighting, appliances, cooking and metabolic (Table 5)	387.7673	(53)
Low energy lighting	-43.1925	(53a)
Additional gains - central heating pump	10.0000	
Additional gains (Table 5a)	10.0000	(53b)
Water heating	88.2717	(54)
Total internal gains	442.8465	(55)

6. Solar gains

	Area (m2)	Flux	g	FF	Access Factor	Gains (W)	
Windows 'N '	0.9 * 4.1300 *	29 * 0.72	* 0.7000 *	0.77		41.8323	(56)
Windows (1) 'S '	0.9 * 5.1800 *	72 * 0.72	* 0.7000 *	0.77		130.2645	(60)
Total solar gains						172.0968	(65)
Total gains, W						614.9433	(66)
Gains/loss ratio (GLR)						9.2024	(67)
Utilisation factor						0.8586	(68)
Useful gains, W						527.9780	(69)

7. Mean internal temperature

Mean internal temperature of living zone (heating type = 1)	18.8800	(70)
Temperature addjustment	0.0000	(71)
Adjustment for gains	0.7802	(72)
Adjusted room temperature	19.6602	(73)
Temperature difference between zones	1.4247	(74)
Living area fraction	0.2217	(75)
Rest of house floor fraction	0.7783	(76)
Mean internal temperature	18.5514	(77)

8. Degree-days

Temperature raise from gains	7.9010	(78)
Base temperature	10.6504	(79)
Degree days	1073.5822	(80)

9a. Energy requirements - individual heating systems, including Micro CHP

Space heating requirement (useful)	1721.8000	(81)
Database boiler reference number : 16212		
Model name : Logic+ combi		
Manufacturer: Ideal Boilers		
MHS efficiency	91.0000	
Main system efficiency	91.0000	(83)
Space heating fuel - main HS	1892.0879	(85)
Space heating fuel - secondary HS	0.0000	(85a)

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Efficiency of water heater		91.0000	(86) (from SED
Energy required for water heating		1598.4112	
Energy used for water heating		1756.4958	(86a)
For each central heating pump		130.0000	(87a)
For each boiler with F.A.F		45.0000	(87b)
For solar water heating pump		75.0000	(87f)
Electricity for pumps and fans		250.0000	(87)
Electricity for pumps and fans - total		250.0000	
Electricity for lighting (100% fixed LEL)		287.9501	(87g)

10a. Fuel costs - individual heating systems

MHS heating cost	1892.0879 * 1.6300	30.8410	(88)
SHS heating cost	0.0000 * 0.0000	0.0000	(89)
Water heating cost	1756.4958 * 1.6300	28.6309	(91)
Pump/fan energy	250.0000 * 7.1200	17.8000	(92)
Lighting energy	287.9501 * 7.1200	20.5020	(93)
Additional standing charges		34.0000	(94)
Appendix M1: Energy from Photovoltaic (PV) technology ----------			
Effective price depends on a factor	0.5000 (Beta)		
Normal electricity price	7.1200		
Exported electricity price	5.7000		
Effective fuel price	6.4100		
Photovoltaic energy	0.80 * 2.50 * 1042.0 * 0.80	1667.2000	(95)
Produced energy	-1667.2000 * 6.4100	-106.8675	(95a)
Total energy cost		24.9064	(97)
Total energy cost using Sedbuk db prices		92.2038	

11a. SAP rating

Energy cost deflator	0.9100	(98)
Energy cost factor (ECF)	-0.0691	(99)
ECF unrounded = -0.0690691180614815		
SAP value	100.9642	(99a)
SAP value unrounded = 100.964204888138		
SAP Energy rating	101	(100)
SAP Energy rating band	A	

12a. Carbon dioxide emissions

MHS heating CO2 - box (85)	1892.0879 * 0.1940	367.0651	(101)
WHS heating CO2 - box (86a)	1756.4958 * 0.1940	340.7602	(103)
Space and water heating CO2		707.8252	(107)
Pumps and fans CO2 - box (87)	250.0000 * 0.4220	105.5000	(108)
Electricity for lighting	287.9501 * 0.4220	121.5149	(109)
Produced energy - PV - CO2	-1667.2000 * 0.5680	-946.9696	(110)
Total CO2 emissions in kg/year		-12.1294	(112)
CO2 emissions per m?		-0.1982	
Dwelling's Carbon Factor		-0.1142	(CF)
EI value		100.1530	(113a)
EI rating		100	(114)
EI band		A	

13a. Primary energy

MHS heating P.E. - box (85)	1892.0879 * 1.1500	2175.9011	
WHS heating P.E. - box (86a)	1756.4958 * 1.1500	2019.9702	
Space and water heating P.E.		4195.8713	(107)
Pumps and fans P.E. - box (87)	250.0000 * 2.8000	700.0000	(108)
Electricity for lighting	287.9501 * 2.8000	806.2602	(109)
Produced energy - PV - P.E.	-1667.2000 * 2.8000	-4668.1600	(110)
Primary energy kWh/year		1033.9715	(112)
Primary energy kWh/m2/year		16.8950	

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