DEMOLITION OF EXISTING SCHOOL BUILDINGS AND CONSTRUCTION OF THREE NEW DWELLINGS, FIVE CONVERSION DWELLINGS AND ONE CONVERSION OFFICE TOGETHER WITH CAR PARKING AT THE OLD SCHOOL, PARK LANE, RICHMOND, TW9 2RA





August 2014

THE HALEBOURNE GROUP LIMITED

Architect: The Halebourne Group Limited

Property:

Demolition of Existing School and Construction of Five Conversion Dwellings, One Conversion Office and Three New Dwellings together with Car Parking

The Old School, Park Lane, Richmond, TW9 2RA

2

Issue:

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1.0 BRIEF

Monitor Energy Consultancy were instructed by Maze Planning on behalf of The Halebourne Group Limited, the Clients, to undertake a Sustainability and Renewable Energy assessment, to appraise how the proposed development at The Old School, Park Lane, Richmond, TW9 2RA will respond to the London Borough of Richmond Upon Thames Sustainable Development Checklist. The purpose of the report is as follows:

To demonstrate how the development will reduce the carbon emissions through the provision of onsite renewable energy and how the development will meet conservation measures, sustainable drainage and water conservation requirements and the re-use of the existing materials of the demolished areas of the development to comply with the requirements of the London Borough of Richmond Upon Thames Supplementary Planning Document "Sustainable Construction Checklist Guidance Document" adopted August 2011 and the Mayor's London Plan 2011. These requirements are that a reduction of 20% carbon emissions is achievable from both regulated and unregulated emissions. This will also relate to the requirement to achieve Code for Sustainable Homes Level 4 for the Energy Ene1 category and Code for Sustainable Homes Level 3 for the remaining categories.

1.1 Approach

The clients approach, via the architects, to sustainable development is to first improve the energy efficiency of the building to the requirements of 25% better than the current Building Regulations. This follows the most recognised method of achieving sustainability through the energy hierarchy:

Use less energy (be lean).

Use renewable energy (be green).

Supply energy efficiently (be clean).

This appraisal demonstrates that by adopting the above approach, a 19% reduction in carbon emissions to the current Building Regulations will be achieved, including both regulated and unregulated emissions. This is also to the standards set by the Code for Sustainable Homes Level 4.

A detailed appraisal of all practical renewable technologies has been undertaken and the use of photovoltaic thermal panels has been adopted for the development. The primary advantages of these systems are as follows:

- Proven and well recognised technologies with limited requirements for future maintenance.
- A visible indication of the sustainability credentials of the development.
- Can be easily upgraded in the future to provide more hot water or electricity; particularly relevant with the implementation of Feed-in Tariffs and Renewable Heat Incentives.

This appraisal demonstrates that by the adoption of the strategy of incorporating energy efficient measures, the overall reduction in carbon emissions through the use of onsite renewable technology in the form of photovoltaic thermal panels is **7612.24 kgCO2/yr**

The extent of photovoltaic thermal panels will be drawn on to the elevations and when in use will provide a visible indication of the development's sustainable credentials.

Water efficient fittings to sanitary and kitchen fittings and water butts within the rear garden are proposed to achieve at least the minimum standards of compliance as required by the Code for Sustainable Homes Level 3/4 rating which clearly demonstrates a commitment to water conservation.

2.0 EXECUTIVE SUMMARY

2.1 Site Description

The demolition, careful removal of existing features for replacement and the erection of eight dwellings, one office, car parking facilities, landscaping and access drive on the site of The Old School, Park Lane, Richmond, TW9 2RA. The site is classified as a brownfield site as it is new dwellings built on the site of an existing school in a residential area which makes optimum use of the land available, in terms of site coverage and height and does not prevent other land coming forward for development in the future and helps to achieve a comprehensively planned development framework. The site is not in an open land area; is in an air quality management area (AQMA); is not in a District Heating Opportunity Area (DHOA); has no hazardous substances present; is not contaminated and is not in an area designated as on an archaeological site or monument.

This report basically demonstrates that the calculated minimum 20% carbon dioxide emissions (including both regulated and unregulated emissions,) to be off-set by on-site renewables for this development is **7612.24 kg CO2 /yr**.

2.2 Proposed Development

The proposed development comprises three new build houses, built as a terrace, and five dwellings and one office formed as a conversion of the existing school building, constructed with traditional brick cavity walls and slate tile roof areas. The proposed new driveway and paved areas will be constructed with permeable materials to reduce the surface water run-off potential. The waste materials from the demolition of the existing school will be re-used where possible and the remainder sent for recycling and not to landfill.

The energy performance of the proposed three new dwellings has been assessed for the base line requirement of compliance with Part L1A of the 2013 Building Regulations and the five conversion dwellings and one conversion office assessed with the minimum compliance standards set out in Part L1B of the 2010 Building Regulations. With the appropriate measures incorporated this report demonstrates that it will achieve minimum Building Regulations and therefore Code for Sustainable Homes Level 3 for energy.

To assess the 20% site wide carbon emissions to be off-set by on site renewable energy, the unregulated loads for each dwelling were calculated using the Code for Sustainable Homes Ene7 calculator and tabulated to the regulated HVAC loads calculated using SAP 2012.

The potential benefits of additional energy efficiency measures have been proportionally assessed across each group of dwellings together with the further improvements that can be achieved using low and zero carbon technologies in order to achieve the 20% carbon off-set required by the London Borough of Richmond Upon Thames and the 19% improvement over minimum Building Regulations 2013 standards to achieve a Code for Sustainable Homes Level 4 for the Energy Category.

The energy strategy comprises passive and low energy design measures including:

- Enhanced thermal performance to the floor, external walls and roof types.
- High performance double glazed windows and doors.
- High efficiency gas fired boiler with sophisticated controls.
- Low air permeability rate.
- Use of 100% low energy lighting.

In addition, the new dwellings (Units 7-9) will be provided with individual extract ventilation fans whilst the conversion dwellings (Units 2–6) and the conversion office (Unit 1) will be provided with individual extract fans. Photovoltaic thermal panels will be provided to the South facing roof slopes and concealed flat roof area.

Sufficient roof space is available on the development to accommodate photovoltaic panels and it is therefore proposed that sloping and horizontal PV arrays comprising of 109 photovoltaic panels be installed to generate **18.31** kWp of renewable energy. This would off-set **7612.24 kg CO2 per year** (7.61 tonnes CO2 per year) across the development, refer to Section 5.

The summary of carbon emission and energy results is provided in section 6 which includes the overall area weighted average CO2 savings expected as a result of incorporating all energy reduction measures.

All other matters are covered by comparison with the appropriate category as defined by the current version of the Code for Sustainable Homes which provides the latest Government advice to help deliver sustainable development with low carbon emissions in the housing sector. (Source – London Borough of Richmond upon Thames Council SPD Sustainable Construction Checklist Guidance Document adopted August 2011).

2.3 Relevant Policies, Strategies and Guidance

2.3.1 UK Government Strategy Documents

A series of Planning Policy Statements (PPS) and Planning Policy Guidance notes (PPG) are relevant to the sustainability and energy appraisal. These include the following:

- National Planning Policy Framework
- The Housing Green Paper
- PPS1 Delivering Sustainable Development
- Planning and Climate Change supplement to PPS1
- PPS7 Sustainable Development in Rural Areas
- PPS10 Planning for Sustainable Waste Management
- PPS22 Renewable Energy

Key aspects of these documents are shown in $\ensuremath{\textbf{Appendix}}\xspace \textbf{A}$

2.3.2 London Borough of Richmond upon Thames Planning Policies

The following documents set out the planning policies relevant for the Sustainable Construction Checklist SPD:

- Richmond Core Strategy (April 2009)
- Richmond Development Management Plan (DMP) (emerging, 2011)
- London Plan, Consolidated with Alterations since 2004 (February 2008)
- London Plan (emerging replacement plan, October 2009)

Minimum Policy Compliance

Environmental rating:

- Richmond Core Strategy CP1 Sustainable Development
- Richmond DMP Policy DM SD 1 Sustainable Construction
- Richmond DMP Policy DM SD 2 Renewable Energy and Decentralised Energy networks
- London Plan (LP) Policy 4A.3 Sustainable Design and Construction

Energy Assessment:

• London Plan Policy 4A.4 Energy assessment

Carbon Dioxide emissions reduction:

- Richmond Core Strategy CP2 Reducing Carbon Emissions
- Richmond DMP Policy DM SD 1 Sustainable Construction
- Richmond DMP Policy DM SD 2 Renewable Energy and Decentralised Energy Networks
- LP Policy 4A.3 Sustainable design and construction
- LP Policy 4A.5 Provision of heating and cooling networks
- LP Policy 4A.6 Decentralised Energy: Heating, Cooling and Power
- LP Policy 4A.7 Renewable Energy
- LP Policy 4A.8 Hydrogen Economy

Energy Use and Pollution/ Need for Cooling:

- Richmond Core Strategy CP1 Sustainable Development
- Richmond Core Strategy CP2 Reducing Carbon Emissions
- Richmond DMP Policy DM SD 4 Adapting to Higher Temperatures and Need for Cooling
- Richmond DMP Policy DM SD 5 Living Roofs
- LP Policy 4A.3 Sustainable design and construction

3.0 PLANNING REQUIREMENTS

3.1 Introduction

This section of the report identifies the design measures that will be implemented by the clients in order to meet the requirements of the London Borough of Richmond upon Thames' Sustainable Construction Checklist SPD adopted on 13 August 2011. This can best be demonstrated by referring to the relevant sections of the Code for Sustainable Homes (CSH) which provides the latest Government advice to delivering sustainable development with low carbon emissions in the housing

sector. It sets standards for achieving energy and water efficient buildings focusing on a high quality, highly insulated building shell with low air permeability taking advantage of passive solutions before the addition of active or renewable features:

- high levels of insulation
- low levels of air-permeability
- passive solar design strategies
- low energy lighting
- the use of environmentally benign materials
- low water use sanitary ware
- rainwater harvesting

3.2 Design Philosophy

The design intention for the new dwellings (units 7-9) is to maximise the potential of the South facing facade to harness useful solar gains in order to reduce the heating requirement. The thermal performance of the building fabric is to be enhanced by increasing insulation beyond the requirements of current Building Regulations, accredited details are to be adopted to reduce cold bridging and to achieve low design air permeability rates. For all units, energy efficient heating, ventilation and lighting systems are to be incorporated.

General design philosophy for Code Level 3 homes is to keep the same basic specification throughout the dwellings for simplicity. In this case, the new dwellings will all have the same basic specification throughout for each dwelling. Similarly, the conversion dwellings (Units 2-6) and the conversion office (Unit 1) will share the same specification. The intention is that every floor, wall, roof and window detail will be consistent for each part of the development. This specification employs U values as per the schedule described in Section 6.1 of the report which enables Building Regulations to be achieved under Part L1A or Part L1B as appropriate.

Water efficient fittings to sanitary and kitchen fittings and water butts within garden areas are proposed to achieve at least the minimum standards of compliance as required by the Code for Sustainable Homes Level 3 and 4 (105 litres/per person/day) rating which clearly demonstrates a commitment to water conservation.

3.3 Code Requirements

The main commentary on these design measures applicable to the requirements for planning are included below and are discussed in relation to each relevant section of the CSH.

3.3.1 Energy

The clients have adopted the most recognised sustainable strategy for achieving Code ratings which adopts the following principles as based on the current version of the Code:

- Improve building fabric and insulation levels.
- Carefully detail all building junctions to reduce heat loss and air leakage.

• Introduce energy efficient technologies.

ENE1 Dwelling Emission Rate

This element is mandatory and now mirrors Part L1A which changed in October 2013. The requirement of 19% improvement of the DER over the TER for Code Level 4 will be attained without a single credit in the new scoring system. This is because the latest version of Part L1A seeks to reduce CO2 emissions from new homes compared with pre October 2013 standards. Methods of reaching these standards are detailed within the energy efficiency section.

ENE2 Fabric Energy Efficiency

This element is mandatory, in the latest version of the Code the heat loss parameter has been dropped in favour of the term "FEES" measured in kWh/m2/yr. The methods of reaching this standard have been covered within the energy efficiency section.

ENE3 Energy Display Devices

This is not a mandatory element but is considered to be an important aspect of improving householders understanding of energy use.

ENE4 Drying Space

A secure drying space will be provided either within the rear garden areas or by the use of proprietary and appropriately sized indoor drying lines.

ENE5 Provision of A+ white goods

All white goods provided will be A+ rated wherever possible as part of the sustainability strategy.

ENE6 External Lighting

This is not a mandatory element but all external lighting will be energy efficient.

Where security light fittings are designed for energy efficiency, these will be adequately controlled, all burglar security lights will have a maximum wattage of 150W, movement detecting control devices (PIR) and daylight cut-off sensors. All other security lighting will have dedicated energy efficient fittings and will be fitted with daylight cut-off sensors or timers.

ENE7 Renewable Technologies

This is achieved where the site wide renewable strategy, in combination with the requirements to reduce energy demand for the dwelling, ensures that there is a 20% reduction in CO2 through renewable technology.

This technology must be covered by the Microgeneration Certification Scheme (MCS) and that it is installed by MCS accredited installers. Only systems approved by this scheme have been incorporated within the development.

ENE8 Cycle Storage

The clients are committed to providing an appropriate level of cycle storage. The architect is to ensure that all the cycle storage is provided and is Code compliant and is all accessible without having to take bikes through the property. Minimum storage space required for the Code is provided and is at least as per below:

1 cycle: 2m long x 0.75m wide. 2 cycles: 2m long x 1.5m wide. 4 cycles: 2m long x 2.5m wide.

ENE9 Home Office

This is not a mandatory element but the architect has incorporated a designated study as an appropriate space for a home office within the floor plans where the following criteria are met:

A minimum 1.8m wall length to allow a desk, chair and filing cabinet or bookshelf to be installed, with space to move around the front and side of the desk, use the chair appropriately and operate the filing cabinet safely.

Two double power sockets.

Two telephone points (or double telephone point) or one telephone point where the dwelling is connected to cable or broadband is available at the address.

Adequate daylighting from nearby windows. The detailed calculations will be undertaken at a later stage but typically the location of the home office space has been located close to available windows.

3.3.2 Water

WAT1 Internal Water Use

This element is mandatory and Part G of the Building Regulations, which came into force in April 2010, will generally allow compliance with Code Level 3 of the CSH. This limits the potable internal water use to less than 105 litres per person per day.

As the scheme progresses towards construction, the detailed specifications of sanitary fittings will be developed with the clients to ensure compliance with this element and will be calculated using the Water Efficiency Calculator for new dwellings. This is the Government's National calculation method for the assessment of water efficiency in new dwellings in support of Building Regulations Part G 2009 and the Code for Sustainable Homes April 2009 and subsequent versions. The calculator assesses the contribution that each internal water fitting (micro component) has on whole house water consumption, measured in litres per person per day based on research into typical water use.

WAT2 External Water Use

This is not a mandatory element but the clients are committed to providing water butts in the private garden areas. Minimum storage volume requirements for homes with individual gardens, patios and terraces are as below:

- Terraces and patios 100 litres minimum
- 1 2 bedroom home with private garden 150 litres minimum
- 3+ bedroom home with private garden 200 litres minimum

The specification of the rainwater collector provided by the clients will ensure compliance with the following criteria:

- No open access at the top of the collector (a childproof lid is allowed).
- Provision of a tap or other arrangement for drawing off water.
- Connection to the rainwater downpipes with an automatic overflow into the conventional rainwater drainage system.
- A means of detaching the rainwater downpipe and access provision to enable cleaning of the interior.
- Where the collection system is to be sited outside and not buried, it must be stable and adequately supported; the material used for the container shall be durable and opaque to sunlight.

3.3.3 Materials

MAT1 Environmental Impact of Materials

This is a mandatory element and the clients are committed to reducing the environmental impact of their building materials. The clients will achieve this through the sourcing of materials to achieve a Green Guide rating of between A+ and D, for the following five elements of the building envelope:

Roof External Walls Internal Walls Upper and Ground Floors Windows

As the scheme progresses to construction, a detailed specification list will be provided by the Client's technical team in conjunction with their buying team and drawings clearly marking the location and area of the elements and the details of the materials used within the elements will be prepared. This will allow the Code Mat 1 Calculator Tool to be utilised to demonstrate compliance.

MAT2 Responsible Sourcing of Basic Building Materials

This is not a mandatory element although the clients are committed to responsibly resourcing all building materials.

MAT3 Responsible Sourcing of Finishing Materials

This is not a mandatory element although the clients are committed to responsibly resourcing all building materials.

3.3.4 Surface Water Run-Off

SUR1 Surface Water Run-off

The client is committed to design the surface water drainage for this project 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. The criteria for this category will be followed.

The driveway, paths and paved areas will utilise permeable materials which will also minimise the site surface water run-off.

SUR2 Flood Risk

This element is achievable as the site is not in an area of flood risk.

3.3.5 Waste

A waste strategy for construction and in use will be prepared for this development and will demonstrate compliance with the following criteria:

WAS1 Storage of Household Waste

This element is mandatory and as the scheme progresses, the layouts will demonstrate how there is adequate space allocated for waste storage complying with the criteria. Internally, recyclable household waste is sorted before collection and at least three separate bins are provided with 30 litres total capacity. Every bin provided should have at least 7 litres capacity and be located in an adequate internal space which is not a free standing bin in the kitchen.

WAS2 Site Waste Management Plans

This element is not now mandatory and the client will prepare a detailed SWMP as the scheme progresses towards construction. This SWMP will take account of the materials arising from the demolition works etc. and also for disposal of site waste as it occurs and generally diverting from landfill.

WAS3 Composting

This element is not mandatory but will be achieved through the three bin collection system, which means that green/kitchen waste is collected by the Council. This means that this credit can be awarded by default as we are providing suitable internal storage.

3.3.6 Pollution

POL1 Global Warming Potential

This element is not mandatory but the clients will ensure that the insulation materials do not have a negative environmental impact during manufacture. All insulation products that arrive on site can be confirmed as having a GWP less than 5.

POL2 NOx Emissions

The clients will install gas boilers with low NOX emissions and Class 5.

3.3.7 Health and Wellbeing

HEA1 Daylighting

The daylighting calculations will be undertaken and it is likely that the dwellings will attain the requirements by ensuring adequate daylight factor in the kitchen, living room, dining room and study/home office.

HEA2 Sound Insulation

The dwellings will be designed and tested to achieve the sound insulation standards required by the current Building Regulations.

HEA3 Private Space

All of the dwellings incorporate a private space with the following criteria:

- A minimum size that allows all occupants to sit outside.
- Allows easy access to all occupants, including wheelchair users.
- Accessible only to occupants of the dwelling.

HEA4 Lifetime Homes –Lifetime Homes credits will not be sought.

3.3.8 Management

MAN1 Home User Guide

This element is not mandatory but the clients are committed to providing a Home User Guide, compiled using *Checklist Man 1 Part.* The Home User Guide will be provided in an appropriate format for users. This might include translation into foreign languages, braille, large print or audio CD. In summary the Home User Guide will contain information pertaining to:

Part 1

- a) Environmental strategy/ design and features.
- b) Energy Efficiency Information.
- c) Water Use.
- d) Waste and Recycling.
- e) Sustainable DIY
- f) Emergency Information.
- g) References/ Further information.
- h) Alternative formats.

Part 2

- a) Recycling.
- b) SUDs.
- c) Public Transport.
- d) Local Amenities.
- e) Responsible Purchasing.
- f) Emergency Information.

g) References/ Further Information.

MAN2 Considerate Constructors Scheme

The clients or their contractor will sign up to the Considerate Constructors Scheme and the site will be appropriately audited to achieve the Checklist Man 2 items and score.

MAN3 Construction Site Impacts

The clients or their contractor will maintain a record of on on-site water usage and diesel consumption for this section. Additionally monitoring CO2 emissions of all delivery staff and sub-contractors vehicles will be considered as the scheme progresses towards construction.

MAN4 Security

This credit is attained through the requirement of the LPA and the Design Guide to ensure that the requirements of Secured by Design are considered in the development of the scheme.

3.3.9 Ecology

ECO1 Ecological Value of Site – A report must be provided by a qualified ecologist

ECO2 Ecological Enhancement – A report must be provided by a qualified ecologist and recommendations followed.

ECO 3 Protection of Ecological Features

All existing features of ecological value on the development site potentially affected by the works will be maintained and adequately protected during site clearance, preparation and construction works.

ECO4 Change in Ecological Value of Site – A report must be provided by a qualified ecologist and recommendations followed.

ECO5 Building Footprint – Not applicable

Code Pre-Assessment

To demonstrate compliance with the CSH we have undertaken the pre-assessment sheets for the dwellings and these are included within **Appendix D**. As the scheme progresses to detailed design, the formal assessments will be undertaken using the appropriate version of CSH and SAP. To summarise the approach we have included the CSH assessments for these 8 number two and three bed terraced houses in **Appendix D** which all achieve a credit score of **>57%** which represent a PASS for Level 3. It will be noted that the Energy Category of the CSH must achieve Level 4.

4.0 WATER EFFICIENCY

To help reduce the burden on the local water resources, a series of water efficiency measures are being proposed on the development. A water use of 105 litres/person/day is targeted which is the equivalent required for Code for Sustainable Homes Level 3/4 housing.

The water efficiency measures being considered are as follows and as the scheme progresses to detailed design the clients will review the strategy in detail:

Low use aerated taps; Baths with a limited volume of 150 litres; Showers limited to 6 l/min; Dual flush low volume toilets with a 6/4 litre capacity; Water butts within rear gardens.

Through the use of the Water Efficiency Calculator for new dwellings, the above strategy will achieve at least Code for Sustainable Homes Level 3/4 with regards to water. With the implementation of the above strategy, the development will be seen to be actively promoting water efficiency.

5.0 ENERGY EFFICIENCY STATEMENT

5.1 Introduction

5.1.1 Purpose

The purpose of this section of the document is to explain the energy strategy proposed for the proposed development at The Old School, Park Lane, Richmond, TW9 2RA. The report provides details of the energy assessment for the eight residential dwellings and one office explaining the energy efficiency measures together with assessment of potential low and zero carbon technologies.

5.1.2 Proposed Development

The Client proposes to construct eight 2 storey residential dwellings of 2 and 3 bedroom types and one office together with car parking facilities.

5.1.3 Background Policy Documents

Refer to Sections 2.3.1 and 2.3.2.

5.1.4 Disclaimer

This report has been prepared solely for the use of the Client, and Monitor energy consultancy accept no responsibility for its use by any third parties.

5.2 Approach

The basic approach for the energy strategy is as follows:

- 1. Establish the baseline energy demand in line with statutory requirements in terms of Building Regulations compliance.
- 2. Adopt passive and low energy design techniques in order to reduce the energy demand for the development beyond the baseline energy demand requirements.
- 3. Assess the potential viability of low and zero carbon technologies to suit the development and establish potential energy and carbon dioxide reduction for viable solutions.

This approach is in line with the principles detailed within the London Borough of Richmond upon Thames Sustainable Construction Checklist.

5.3 Energy Demand Assessment

The energy strategy for the development is based on the energy performance of the residential units and office and their associated carbon emission rates. The dwellings have been modelled using SAP 2012 to ensure that the Standard Case dwelling carbon emission rates meet Building Regulations 2013 compliance, with the calculated DER/BER (Dwelling/Building Emission Rate) equalling or bettering the calculated TER (Target Emission Rate) individually and as a weighted aggregate.

To assess the 20% site wide carbon emissions to be off-set by on site renewable energy the unregulated loads for each dwelling were calculated using the Code for Sustainable Homes Ene7 calculator and tabulated to the regulated HVAC loads calculated using SAP 2012. To achieve Code for Sustainable Homes Level 4 the DER must better the TER by a minimum of 19% for the new dwellings (Units 7-9) and Building Regulation L1B pass criteria required for the conversion dwellings (Units 2-6) and the office (Unit 1).

The short fall in the attained DER values has been established and the additional renewable energy off-set requirements have been calculated and tabled in this report.

In accordance with Mayor of London's Energy Hierarchy (*summarised as 'be Lean, be Clean, be Green'*) this report outlines the predicted energy usage and carbon dioxide (CO2) emissions for the proposed development and considers the impact of energy efficiency measures in achieving significant reductions.

Following the 'Lean' principle, passive design and efficiency measures were considered first to optimise the reduction of energy use within the development. These are described in Section 6.1.

Localised and decentralised energy networks were considered to meet the 'Clean' requirement and this is described in Section 6.2.

Finally, six potential renewable energy technologies were considered for integration within the proposed development as part of the '*Be Green*' stage and the feasibility assessments are described in Section 7.

The energy demand assessment has been undertaken using the Standard Assessment Procedure (SAP) 2009 Version 9.9 and the results in the tables represent all nine dwellings in the development.

5.4 Adopted Technology

Photovoltaic (PV) Technology

Photovoltaic cells and photovoltaic sheet have been considered as a viable option for this scheme with appropriate roof space being available as:-

Photovoltaic cells generate electricity for use in the development. Excess electricity generated could be exported to the National Grid. PV panels are included within the current Feed in Tariff scheme and therefore can provide income to the site which should reduce pay back periods for the equipment along with reducing the energy used from the National grid.

The proposed development has a reasonable roof area and this has been evaluated to assess what percentage reduction from onsite renewable energy may be realistically achieved.

The assessment is based upon the annual solar radiation kWh/m2 as identified within SAP 2012 Table H2 this is shown in the extracts below.

Tilt of Collector		Orientation of Collector								
Concetor	South	SE/SW	E/W	NE/NW	North					
Horizontal			961							
30°	1073	1027	913	785	730					
45°	1054	997	854	686	640					
60°	989	927	776	597	500					
Vertical	746	705	582	440	371					

Table H2: Annual	solar	radiation.	kWh/m²
	30101	ruuluului,	

Table H3: Overshading Factor

Overshading	% of Sky blocked by obstacles	Overshading Factor
Неаvy	>80%	0.50
Significant	>60% - 80%	0.67
Modest	20% - 60%	0.83
None or very little	<20%	1.00

Note: Overshading must be assessed separately for solar panels, taking account of the tilt of the collector. Usually there is less overshading of a solar collector compared to overshading of windows for solar gain (Table 6d)

Notes

1. The overshading category of "very little" is not appropriate for new dwellings.

Tilt of Collector	Average kWh/m2	Over shading factor	kWp	Over shading factor (Table 6d)	Yield kWh/yr	Area of PV panels	Number of PV panels or sheet/ 1kWp	CO2 offset/ panel kg/yr
Horizontal	961.00	1.00	1	0.83	797.63	7.98	7.35	65.81
45°	1054.00	1.00	1	0.83	874.82	8.75	6	72.85

Table 5.4.1 - Horizontal and Sloping Panel Solar Yield

CO2 Offset by	one PV	CO2 kg per	annum	Number	Number	kWp
Panel kg/yr		Houses	20% Target	PV	of PV	
				Panels	Panels/ kWp	
Horizontal – Houses 7-9	65.81	12078.90	2415.78	37	7.35	6.31
Pitched 45° - Houses 2-6	72.85	17364.35	3472.87	48	6.00	8.00
Pitched 45° - Office 1	72.85	8617.97	1723.59	24	6.00	4.00
Totals		38061.22	7612.24			18.31

To comply with Planning policy the 20% minimum carbon emissions (including regulated HVAC loads and unregulated appliances and cooking loads) that is required to be off-set by on-site renewable energy is **7612.24** kg CO2 per annum.

To comply with Planning policy the dwelling DER must better the TER by 19% to achieve Code for Sustainable Homes Level 4. To achieve this target reduction in carbon dioxide emissions a polycrystalline array of photovoltaic (PV) solar modules is proposed to be installed to match the slope of the roof angle on each roof. The PV panels will have a Peak panel power output of 240 Wp. Sufficient roof space has been identified upon each block to off-set the relevant associated carbon emission off-set as identified in the table below:-

		PV Panels						
	Carbon Off-set Total Kg CO2	Area m2	Cpv kgCO2 /m2/yr	Epv KWh/ m2/yr	PV Area m2	Number of PV Panels	Electrical Yield generated kWh/yr	КШр
Houses 7 - 9	2415.78	399.59	6.05		60	37	5033.05	6.31
Houses 2 - 6	3472.87	388.99	8.93		77	48	6998.56	8.00
Office Unit 1	1723.59	145.50	11.85		39	24	3499.89	4.00
20% Renewable Target	7612.24	934.08	8.15	90.18	176	109	15531.5	18.31

 Table 5.4.1 : Details the Photo Voltaic array requirement to meet Planning policy.

An indicative PV array layout has been included for each block to illustrate how this would look from an aerial viewpoint, refer to the Appendices.

The 109No. Photo Voltaic panels are each 1650 mm long x 992 mm wide and have a total area of 176m2. Each panel provides 615Kwh per kWp approximately 90.18kWh/m2 of panel.

It is anticipated that the PV array will provide an **18.31** kWp and save **7612.24** kg CO2 per year (7.61 tonnes CO2 per year) across the development.

6.0 ESTABLISHING CO2 EMISSIONS

This section of the energy statement seeks to identify the carbon footprint of the development. The Base Case DER and Actual DER Carbon Emissions as calculated by SAP 2012 in accordance with Building Regulations ADL1A 2013 and ADL1B 2010 without renewables are detailed below for all dwellings.

Dwelling Ref	Area GIA	2010 CO2 k	(g/m2/yr	% improvement over Standard Case	Code Level
		Standard Case/TER	Actual Case		
			DER/ <mark>BER</mark>		
Office 1	145.50	*18.90	18.90	0	L3
House 2	79.20	*24.59	24.59	0	L3
House 3	60.01	*32.68	32.68	0	L3
House 4	83.76	*27.13	27.13	0	L3
House 5	89.29	*24.77	24.77	0	L3
House 6	76.73	*27.80	27.80	0	L3
House 7	131.29	16.03	15.88	0.94	L3
House 8	137.01	14.44	14.63	-1.17	L2
House 9	131.29	16.03	15.88	0.94	L3

* Assessed using criteria from Building Regulations Part L1B 2010/2014. Assumed DER/BER=TER

Table 6.0.1: Base case SAP results 2012 for all dwellings

Table 6.0.1 illustrates compliance with Building regulations ADL1A for all the new dwellings. Under Section 4.0 of the approved Building Regulations document ADL1A, the Dwelling Emission Rate (DER) must be lower or equal to the Target Emission Rate (TER). For the conversion units, the passive measures introduced must be in accordance with the standards set for ADL1B.

Table 6.0.2 illustrates the carbon dioxide loads for the regulated HVAC and unregulated loads associated with each dwelling type across the development. The unregulated loads are associated with electrical appliances and cooking, and calculated from the Code for Sustainable Homes Energy Ene7 calculator. These figures have been used to assess the total energy usage and CO2 emissions across the site and to set the 20% carbon off-set required to satisfy the LBRUT planning requirement.

Dwelling Ref	Area GIA	HVAC Regulated	CO2 Unregulated kg/m2/yr		Total CO2 kg/m2/γr	Total CO2 kg/yr	20% Renewable Target kg CO2/yr	CO2 off-set kg/m2/yr
Conversion		DER/ <mark>BER</mark>	Electrical	Cooking				
Dwellings		CO2	Appliances					
		kg/m2/yr						
Office 1	145.50	18.90	38.20	2.13	59.23	8617.97	1723.59	11.85
House 2	79.20	24.59	16.23	2.24	42.53	3368.38	673.68	8.51
House 3	60.01	32.68	17.01	2.78	50.61	3037.11	607.42	10.12
House 4	83.76	27.13	16.01	2.15	44.38	3717.27	743.45	8.88
House 5	89.29	24.77	15.72	2.04	41.16	3675.18	735.04	8.23
House 6	76.73	27.80	16.37 2.31		46.48	3566.41	713.28	9.29
Total	534.49		CO2 Emissions (Reg + Unreg		nreg)	25982.32	5196.46	9.72
Area								

New Dwelli	ngs	DER CO2 kg/m2/yr	Electrical Appliances	Cooking				
House 7	131.29	15.88	13.46	1.44	30.77	4039.79	807.96	6.15
House 8	137.01	14.63	13.18	1.38	29.19	3999.32	799.86	5.84
House 9	131.29	15.88	13.46	1.44	30.77	4039.79	807.96	6.15
Total	399.59		CO2 Emissions (Reg + Unreg)			12078.90	2415.78	6.05
Area								

Summary - H	Summary - Houses 2-9 and Office 1								
Total Area	934.08	CO2 Emissions (Reg + Unreg)	38061.22						
	Minimum 20% Renewable Target 7612.24 8.15								

Table 6.0.2: Site Wide Regulated and Unregulated Co2 Emissions Used To Derive The 20% Carbon Off-Set.

The total site wide carbon dioxide emissions for the development are **38061.22** kg CO2 per year. The calculated minimum 20% carbon dioxide emissions to be off-set by on-site renewables for this development are therefore **7612.24** kg CO2 per year.

To satisfy the planning requirement the DER for each dwelling would basically need to be 19% lower than the associated TER value.

The impact of the 20% carbon dioxide emission off-set upon each dwelling DER was therefore assessed on an area basis to establish what level of improvement has been achieved by the revised DER over their respective TER's. The shortfall in the DER/BER was then assessed to establish the additional carbon dioxide emissions to be off-set by renewable technologies to meet the Code for Sustainable Homes Level 4 (19% improvement to Building Regulations Part L1A 2013 or L1B requirements) and to satisfy the LBRUT planning policy.

The results are tabled below in Table 6.0.3. In this case there was no shortfall.

Dwelling	. ,		Kg/m2/yr	DER	Improvement	CSH Level	Additional
Ref	Area	TER	DER/ <mark>BER</mark>	including 20% renewables	over TER (%)	4 DER> TER min	CO2 Off-set Kg/yr
Conversion D	Dwellings	I			L		
Office 1	145.50	18.90	18.90	6.30	66.67	66.67	0
House 2	79.20	24.59	24.59	9.42	61.69	61.69	0
House 3	60.01	32.68	32.68	18.47	43.48	43.48	0
House 4	83.76	27.13	27.13	11.02	59.38	59.38	0
House 5	89.29	24.77	24.77	8.72	64.80	64.80	0
House 6	76.73	27.80	27.80	10.52	62.16	62.16	0

* Assessed using criteria from Building Regulations Part L1B 2010/2014. Assumed DER/BER=TER

New Dwellings								
House 7	131.29	16.03	15.88	7.71	40.74	40.74	0	
House 8	137.01	14.44	14.63	6.46	39.75	39.75	0	
House 9	131.29	16.03	15.88	7.71	40.74	40.74	0	

Table 6.0.3: Net Improvement To The Dwellings DER/BER Values From The 20% Renewable Off-
Set, And Any Additional CO2 Off-Set Required To Satisfy CSH Level 4.

It can be seen that the adjusted DER values all meet CSH Level 4.

These figures have been added to the 20% carbon emission off-set and taken into account within the PV calculations refer to section 5.

The anticipated energy use for the site is illustrated in the following tables for natural gas and grid electricity.

Dwelling Reference	GIA Area	2012 CO2 Kg/m2/yr		Natural Gas kWh/yr		Electricity kWh/yr		Natural Gas	Electricity
		TER	DER/BER	Heating Hot		Pumps controls	Lights	Total kWh/yr	Total kWh/yr
Conversion Dv	vellings		<u> </u>		Water	controls			KVVII/ yi
Office 1	145.50	18.90	18.90	9154.84	2592.19	175.00	538.11	11747.03	713.11
House 2	79.20	24.59	24.59	5146.17	2440.06	75.00	520.01	7586.23	595.01
House 3	60.01	32.68	32.68	5685.58	2226.39	75.00	410.61	7911.97	485.61
House 4	83.76	27.13	27.13	6749.73	2469.29	75.00	467.31	9219.02	542.31
House 5	89.29	24.77	24.77	6345.79	2510.32	75.00	501.40	8856.11	576.40
House 6	76.73	27.80	27.80	6273.83	2414.95	75.00	418.15	8688.78	493.15
Total Area	534.49							54009.14	3405.59

New Dwelling	gs								
House 7	131.29	16.03	15.88	5649.37	2631.82	75.00	495.67	8281.19	570.67
House 8	137.01	14.44	14.63	5226.35	2642.70	75.00	511.34	7869.05	586.34
House 9	131.29	16.03	15.88	5649.37	2631.82	75.00	495.67	8281.19	570.67
Total Area	399.59							24431.43	1727.68
Site Total	934.08							78440.57	5133.27

Table 6.0.4: Energy Use For All Dwellings

6.1 Energy Efficiency Measures

The passive and low energy design measures that will be incorporated into the development are as follows:

- Enhanced thermal performance to the building fabric by increasing insulation where possible.
- An assumed thermal bridging y value of 0.07W/m2K for the conversion dwellings (Units 2-6) and office (Unit 1) and a calculated value of between 0.068 and 0.069W/m2K for each of the new build dwellings (Units 7-9).
- High performing doors, windows and roof lights.
- Lower air permeability rate of 3m3/hr/m3 at 50 Pa pressure for the new dwellings (Units 7-9), N/A to the conversion dwellings (Units 2-6) and conversion office (Unit 1).
- High efficiency gas combination boilers with programmer, room thermostat and TRV controls (Units 7-9) and FGHRS (Flue gas heat recovery system) (Units 2-6).
- High efficiency WWHRS (Waste water heat recovery system (Units 2-6)
- Energy efficient individual mechanical fans for the new build dwellings (Units 7-9). Individual extract fans and passive vents for the conversion dwellings (Units 2-6) and the conversion office (Unit 1).

	Baseline scheme U Values, W/m2K	Energy efficient scheme U values, W/m2K
Ground floor	0.10	0.10
External cavity walls	0.20	0.20
Timber walls	0.20	0.20
Party walls	0.00	0.00
Pitched roof, flat ceilings	0.10	0.10
Pitched roof, sloping ceilings	0.12	0.12
Flat roof	0.15	0.15
Doors	1.20	1.20
Windows and Rooflights	1.40	1.40

U-Values

Heating and Ventilation

Air permeability rate	3 for new build dwellings (Units 7-9) and N/A for conversion
	dwellings (Units 2-6) and conversion office (Unit 1)
Ventilation	Individual extract fans and passive vents for the conversion
	dwellings (Units 2-6) and conversion office (Unit 1) and
	individual fans for the new build dwellings (units 7-9)
Gas combination boiler	89.5% 2009 SEDBUK seasonal efficiency with time and
	temperature zone control
Low energy lighting	100%

6.2 Energy Efficient Supply

There are no combined heat and power (CHP) or community/district heating schemes known to be within economically viable distance of this proposed scheme of nine dwellings.

6.3 Renewable Energy Target

The London Borough of Richmond upon Thames has set a target of complying with the Code for Sustainable Homes Level 4 in CO2 emission reduction from a development through the use of onsite energy systems. The estimated annual CO2 emissions for this development based on the SAP calculation after implementation of the passive and low energy measures are **7612.24** kg CO2/yr.

Within Section 7 the various potential renewable energy technologies have been reviewed and for this development the conclusion is that photovoltaic panels would be the most viable option.

7 RENEWABLE ENERGY TECHNOLOGIES ASSESSMENT

7.1 Photovoltaic cells

There is an opportunity to install photovoltaic cells due to the available area of South facing inclined roof and concealed flat roof. The total PV panels required to satisfy the constraints of the Code for Sustainable Homes Level 4 and the 20% carbon off-set required to comply with the Planning policy of the London Borough of Richmond Upon Thames is 18.31kWp. The installation of the roof panels would be inclined at the angle of the roof for optimum efficiency. The SAP calculation has been repeated again to include 18.31kWp of photovoltaic panels, which would in total off-set **7612.24** kgCO2/yr, therefore exceeding the target to achieve Code for Sustainable Homes Level 4.

7.2 Solar Water Heating

The development has the potential to use solar water heating with panels located on the sloping and flat roof areas. For maximum, efficiency these should ideally be South facing and would therefore be competing for the same space as the PV panels.

Solar water heating panels would not be able to achieve the required 20% carbon reduction as there is a finite requirement for hot water, therefore increasing the area of panels will not reduce the CO2 emissions proportionately.

The preferred heating and hot water strategy is for the use of high efficiency combination boilers which maximise living space and avoids the need for stored hot water within the dwelling, which can result in inefficient standing heat losses. Solar water heating would require storage for the heated water, so for these three reasons this option has discarded.

7.3 Ground Source Heat pump

Approximately 10m of trench for slinky pipes would be required to obtain 1kW output of heating. For a small to average heat pump of 6kW this would require 60m for each unit, therefore there would not be adequate space on the site for this option. The alternative method involving drilling a borehole would be extremely expensive and is not generally considered a feasible option for small scale domestic applications.

7.4 Combined Heat and Power (CHP)

CHP is on-site generation of electricity using waste heat from to provide useful heat for the development or adjacent schemes. No existing CHP system has been identified within viable vicinity of the site. For maximum efficiency, a CHP system needs to operate for at least 5000 hours/year and requires a heat sink, a consistent base heating load requirement throughout the year where the waste heat from the electrical generation may be used constantly and efficiently while simultaneously providing electricity for the site. It is therefore more appropriate for hospitals, hotels etc where demand is consistent. Domestic dwellings have variable occupation patterns with heating and electrical demand focussing on early mornings and evenings during the week, changing to a more even pattern at weekends. For a development of this size and scale, it would not be appropriate to provide a new CHP plant.

7.5 Wind

The London Renewable Toolkit recommends that wind turbines are only appropriate where the average wind velocity is in excess of 6m/s. The DECC wind speed database estimates the average wind speed is less than 3.27m/s at an average height of 20m above ground level in this location which would not create a viable supply of energy. In addition, a wind turbine would be both visually and audibly intrusive and not suitable for this small urban site where there is insufficient space to accommodate it. For these reasons, wind power has been discounted for this development

7.6 Biomass

Biomass boilers are less efficient than the high efficiency combination boilers proposed, they would require increased management, maintenance and space for both a central energy plant room and biomass store. In addition, there would be a requirement for biomass deliveries via heavy vehicles therefore it is considered that this site and its location are not suitable for fuel delivery, storage or local supply.

8.0 CONCLUSION

This report identifies how a minimum of 20% of the carbon emissions for which the development is responsible, including both regulated and unregulated emissions, are off-set by on-site renewable energy production methods.

The calculated minimum 20% carbon dioxide emissions to be off-set by on-site renewables for this development is **7612.24 kg CO2** per year. The introduction of the 20% renewable contribution when apportioned across the respective dwelling blocks generally satisfies the Planning policy. To satisfy these criteria it would appear that sufficient roof space exists to accommodate a horizontal PV array comprising of 109 No Photo Voltaic panels in total to provide **18.31 kWp** and save **7612.24 kg CO2 per year** (**7.61 tonnes** CO2 per year) across the development.

The scheme therefore demonstrates compliance with London Borough of Richmond upon Thames Planning Policies.

The energy strategy for the proposed development has adopted a hierarchical approach of using passive and low energy design to reduce the baseline energy demand and hence CO2 emissions followed by the application of low and zero carbon technologies as appropriate.

The analysis has shown that by incorporating passive and low energy design measures there is a reduction in the development CO2 emissions based on the SAP calculation method.

The potential on-site low and zero carbon technologies have been assessed taking into account the scale of this particular development and constraints such as location, visual impact, preventing additional vehicle movements and local pollution concerns.

The strategy is to utilise photovoltaic panels on the roofs of the dwellings. It is estimated that this will achieve a **7612.24 kg CO2** reduction in annual CO2 emissions when the passive and low energy measures are combined with the low and zero carbon technologies. This development achieves a better than 19% reduction in CO2 emissions compared to a Building Regulations Part L1A 2013 and L1B 2010 compliant scheme.

The SAP 2009 DER Worksheets are included in APPENDIX B

APPENDIX A

UK Government Strategy Documents

Planning for a Sustainable Future: White Paper:

This document sets out the Government's detailed proposals for reform of the Planning System. Many of the matters have been taken forward by the Planning Act 2008 or other amending legislation. However, the White Paper provides an overall context for the planning law and policy that has been produced since 2007.

The White Paper considered the long-term challenges for planning including:

Tackling climate change; Supporting sustainable economic development; Increasing housing supply; Protecting and enhancing the environment and natural resources; Improving local and national infrastructure; Maintaining security of energy supply.

Homes for the future: Housing Green Paper

The Housing Green Paper was published in July 2007 and sets out the Government's proposals to improve housing provision in terms of quality and quantity. Targets were set for carbon emissions, requiring all new homes to be zero carbon from 2016 as well as standards for water use, seeking to cut usage by 20% in new homes. Many of the matters discussed in the Green Paper are reflected in PPS3.

PPS1 – Delivering Sustainable Development

Published in 2005, PPS1 establishes the overall framework of planning policies on the delivery of sustainable development through the planning system. The statement reiterates the following four aims for sustainable development:

- 1. Social progress which recognises the needs of everyone
- 2. Effective protection of the environment
- 3. The prudent use of natural resources
- 4. The maintenance of high and stable levels of economic growth and employment.

PPS1 sets out six key principles which should be applied to ensure that development plans and decisions taken on planning applications contribute to the delivery of sustainable development:

- 1. Sustainable development should be pursued in an integrated manner
- 2. Global sustainability should be contributed toward by addressing the causes and potential impacts of climate change
- 3. A spatial planning approach should be at the heart of planning for sustainable development
- 4. High quality inclusive design should be promoted in the layout of new development and individual buildings, in terms of function and impact, over the life of the scheme
- 5. Polices should be set out to provide comprehensive and inclusive access, both in terms of location and external physical access

6. Community involvement is an essential element in delivering sustainable development and creating sustainable and safe communities.

The Planning and Climate Change supplement to PPS1, published in December 2007, sets out how planning should contribute to reducing emissions and stabilising climate change.

With regard to determining planning applications, paragraph 40 comments that an applicant should expect expeditious and sympathetic handling where a proposal would deliver the above key objectives. Planning Authorities should expect new development to:

- Comply with adopted DPD policies on local requirements for decentralised energy supply and for sustainable buildings, unless it can be demonstrated by the applicant, having regard to the type of development involved and its design, that this is not feasible or viable.
- Take account of landform, layout, building orientation, massing and landscaping to minimise energy consumption, including maximising cooling and avoiding solar gain in the summer and overall be planned so as to minimise carbon dioxide emissions through giving careful consideration to how all aspects of development form, together with the proposed density and mix of development, support opportunities for decentralised and renewable or lowcarbon energy supply
- Deliver a high quality local environment
- Provide public and private open space as appropriate so that it offers accessible choice of shade and shelter, recognising the opportunities for flood storage, wildlife and people provided by multifunctional green spaces
- Give priority to the use of sustainable drainage systems, paying attention to the potential contribution to be gained to water harvesting from impermeable surfaces and encourage layouts that accommodate waste water recycling
- Provide for sustainable waste management.

PPS22 – Renewable Energy

PPS22 promotes the use of renewable energy to meet the Government's sustainable development objectives and also to accord with the various international agreements to which it is party. Paragraph 18 states: "Local planning authorities and developers should consider the opportunity for incorporating renewable energy projects in all new developments. Small scale renewable energy schemes utilising technologies such as solar panels, biomass heating, small scale wind turbines, photovoltaic cells and combined heat and power schemes can be incorporated both into new developments and some existing buildings. Local Planning Authorities should specifically encourage such schemes through positive expressed polices in local development documents."

2.3.2 Local Government

Policy NE/3 - This policy follows the same intent as above and is positive towards promoting and encouraging developments with renewable energy sources.

2.3.4 Code for Sustainable Homes

The Code for Sustainable Homes (CSH) replaced the Government's Ecohomes strategy to improve the sustainable credentials of residential developments. The CSH introduces minimum environmental standards in the following areas:

Energy; Water; Materials; Surface Water Run-off; Waste; Pollution; Health and Wellbeing; Management; Ecology.

The CSH requirement for the proposed development at The Old School, Park Lane, Richmond, TW9 2RA are:

All dwellings are to achieve Code Level 4 in the Energy Ene1 category which corresponds to achieving 19% less CO2 emissions than a Building Regulations Part L1A 2010 compliant scheme.

All dwellings to achieve Code Level 3 in all other categories

2.3.5 Feed in Tariffs (FiTs)

Feed in Tariffs are payments to ordinary energy users for renewable electricity that they generate. The Government introduced these payments in April 2010, to enable the UK to increase the level of renewable energy used towards the target of 15% of the total energy used by 2020. It is hoped that the implementation of Feed in Tariffs, will in the long term increase the market value of properties with renewable technologies. At this stage, the use of Feed in Tariffs has not been assumed but the strategy allows for the simple addition of renewables should the resident wish to sign up. Prospective purchasers will be made aware of the benefits and the required commitments to Feed in Tariffs to encourage maximum usage of renewables.

2.3.6 Renewable Heat Incentives

The implementation of RHI has been delayed due to a European Commission challenge to the incentives proposed to large scale biomass production. Renewable Heat Incentives are the equivalent scheme to the Feed in Tariffs, but in relation to the production of heat from renewable technologies. This includes systems such as solar thermal panels and biomass boilers. As the use of heat incentives becomes more widespread, it is likely that over time the market value of properties will reflect the use of renewable technologies. At this stage, Renewable Heat Incentives will not have an impact on the strategy, but prospective purchasers will be made aware of the benefits and the required commitments to Feed in Tariffs to encourage maximum usage of renewable

APPENDIX B

SAP 2012 DER Worksheets

DER Worksheet Design - Draft



This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mrs Nicola Battis	ta .			Assessor r	umber	3998	
Assessor name								
Client	The Halebourne	Group			Last modif	fied	26/08/20)14
Address	2 The Old School	l Park Lane, Richn	nond, London, TWS	9				
1. Overall dwelling dime	ensions							
1. Overall uwening unite	:11510115		Area (m²)		Average sto	rev	Volu	me (m³)
			Area (iii)		height (m	•	Volu	ne (m)
Lowest occupied			39.00	(1a) x	2.31	(2a) =	9	0.09 (3a)
+1			40.20	(1b) x	3.05	(2b) =		2.61 (3b)
Total floor area	(1a) + (1b) +	+ (1c) + (1d)(1n)		(12) x	5.05			(50)
Dwelling volume	() * () *	(10) * (10)(1.)			(3a) + (3b) +	+ (3c) + (3d)(3	n) = 21	.2.70 (5)
					(==) (==)	() () (-		
2. Ventilation rate								
							m³ p	er hour
Number of chimneys					0	x 40 =		0 (6a)
Number of open flues					0	x 20 =		0 (6b)
Number of intermittent fa	ans				4	x 10 =		40 (7a)
Number of passive vents					0	x 10 =		0 (7b)
indificer of publice vents								
Number of flueless gas fir	es				0	x 40 =		0 (7c)
	es				0	x 40 =		0 (7c) inges per our
			(6a) + (6b) + (7a	a) + (7b) + (7		x 40 =	h	inges per
Number of flueless gas fir	ys, flues, fans, PSVs	is intended, proce			c) = 40		h	inges per our
Number of flueless gas fir Infiltration due to chimne	ys, flues, fans, PSVs s been carried out or	is intended, proce			c) = 40		h	inges per our
Number of flueless gas fir Infiltration due to chimne If a pressurisation test ha	ys, flues, fans, PSVs s been carried out or	is intended, proce			c) = 40 from (9) to (16)		h	unges per our 1.19 (8)
Number of flueless gas fir Infiltration due to chimne <i>If a pressurisation test ha</i> Number of storeys in the	ys, flues, fans, PSVs s been carried out or dwelling		eed to (17), otherw	vise continue	c) = 40 from (9) to (16)			(v) inges per our 1.19 (8) (9)
Number of flueless gas fir Infiltration due to chimne <i>If a pressurisation test ha</i> Number of storeys in the Additional infiltration	ys, flues, fans, PSVs s <i>been carried out or</i> dwelling 0.25 for steel or timb	per frame or 0.35	eed to (17), otherw for masonry const	vise continue	c) = 40 from (9) to (16)			(10) (10) (10) (10)
Number of flueless gas fir Infiltration due to chimne <i>If a pressurisation test ha</i> Number of storeys in the Additional infiltration Structural infiltration:	ys, flues, fans, PSVs s been carried out or dwelling 0.25 for steel or timk ground floor, enter 0	per frame or 0.35 0.2 (unsealed) or (eed to (17), otherw for masonry const	vise continue	c) = 40 from (9) to (16)			(14) (15) (15) (15) (10) (11) (11)
Number of flueless gas fir Infiltration due to chimne <i>If a pressurisation test has</i> Number of storeys in the Additional infiltration Structural infiltration: If suspended wooden	ys, flues, fans, PSVs s been carried out or dwelling 0.25 for steel or timb ground floor, enter 0 nter 0.05, else enter 0	ber frame or 0.35 0.2 (unsealed) or (0	eed to (17), otherw for masonry const	vise continue	c) = 40 from (9) to (16)			(v) (v) (v) (v) (v) (v) (v) (v)
Number of flueless gas fir Infiltration due to chimne <i>If a pressurisation test ha</i> Number of storeys in the Additional infiltration Structural infiltration: If suspended wooden If no draught lobby, er	ys, flues, fans, PSVs s been carried out or dwelling 0.25 for steel or timb ground floor, enter 0 nter 0.05, else enter 0	ber frame or 0.35 0.2 (unsealed) or (0	eed to (17), otherw for masonry const	vise continue	c) = 40 from (9) to (16) 2 100.00			(14) (17) (17) (17) (10) (10) (10) (12) (13)
Number of flueless gas fir Infiltration due to chimne <i>If a pressurisation test ha</i> Number of storeys in the Additional infiltration Structural infiltration: If suspended wooden If no draught lobby, er Percentage of windows an	ys, flues, fans, PSVs s been carried out or dwelling 0.25 for steel or timb ground floor, enter 0 nter 0.05, else enter 0	ber frame or 0.35 0.2 (unsealed) or (0	eed to (17), otherw for masonry const	vise continue ruction nter 0	c) = 40 from (9) to (16) 2 100.00	÷ (5) =	h 	(14) (14) (14) (10) (10) (11) (11) (12) (14) (14)
Number of flueless gas fir Infiltration due to chimne <i>If a pressurisation test has</i> Number of storeys in the Additional infiltration Structural infiltration: If suspended wooden If no draught lobby, er Percentage of windows an Window infiltration	ys, flues, fans, PSVs s been carried out or dwelling 0.25 for steel or timb ground floor, enter 0 nter 0.05, else enter (nd doors draught pro	ber frame or 0.35 0.2 (unsealed) or (0 bofed	eed to (17), otherw for masonry constr 0.1 (sealed), else er	vise continue ruction hter 0	c) = 40 from (9) to (16) 2 100.00 0.25 -	÷ (5) =	$ \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix} $	(14) (10) (10) (10) (10) (10) (10) (10) (10) (11) (10) (11) (11) (11) (12) (13) (14) (15)
Number of flueless gas fir Infiltration due to chimne <i>If a pressurisation test ha</i> Number of storeys in the Additional infiltration Structural infiltration: If suspended wooden If no draught lobby, er Percentage of windows an Window infiltration Infiltration rate	ys, flues, fans, PSVs s been carried out or dwelling 0.25 for steel or timk ground floor, enter 0 nter 0.05, else enter (nd doors draught pro ty value, then (18) =	oer frame or 0.35 0.2 (unsealed) or 0 0 oofed [(17) ÷ 20] + (8), 0	eed to (17), otherw for masonry constr 0.1 (sealed), else er	vise continue ruction hter 0	c) = 40 from (9) to (16) 2 100.00 0.25 -	÷ (5) =	$ \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix} $	(14) (14) (14) (10) (10) (11) (11) (12) (13) (14) (14) (16) (16)
Number of flueless gas fir Infiltration due to chimne <i>If a pressurisation test has</i> Number of storeys in the Additional infiltration Structural infiltration: If suspended wooden If no draught lobby, er Percentage of windows an Window infiltration Infiltration rate If based on air permeabili	ys, flues, fans, PSVs s been carried out or dwelling 0.25 for steel or timk ground floor, enter 0 nter 0.05, else enter (nd doors draught pro ty value, then (18) =	oer frame or 0.35 0.2 (unsealed) or 0 0 oofed [(17) ÷ 20] + (8), 0	eed to (17), otherw for masonry constr 0.1 (sealed), else er	vise continue ruction hter 0	c) = 40 from (9) to (16) 2 100.00 0.25 -	÷ (5) =	$ \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix} $	(14) (9) (10) (9) (10) (11) (10) (10) (11) (10) (11) (10) (11) (10) (11) (10) (11) (10) (11) (12) (12) (12) (12) (12) (12) (12) (13) (16) (18)
Number of flueless gas fir Infiltration due to chimne <i>If a pressurisation test ha</i> Number of storeys in the Additional infiltration Structural infiltration: If suspended wooden If no draught lobby, er Percentage of windows an Window infiltration Infiltration rate If based on air permeabili Number of sides on which	ys, flues, fans, PSVs s been carried out or dwelling 0.25 for steel or timk ground floor, enter 0 nter 0.05, else enter 0 nd doors draught pro ty value, then (18) = n the dwelling is shelf	oer frame or 0.35 0.2 (unsealed) or 0 0 oofed [(17) ÷ 20] + (8), 0	eed to (17), otherw for masonry constr 0.1 (sealed), else er	vise continue ruction hter 0	c) = 40 from (9) to (16) 2 100.00 0.25 -	÷ (5) =		(14) (9) (10) (10) (10) (10) (10) (11) (10) (12) (13) (14) (14) (14) (15) (16) (16) (16) (19) (19) (10) (10) (11) (10) (11) (11) (11) (11) (11) (12) (12) (12) (13) (14) (14) (16) (16) (16) (16) (17)
Number of flueless gas fir Infiltration due to chimne <i>If a pressurisation test has</i> Number of storeys in the Additional infiltration Structural infiltration: If suspended wooden If no draught lobby, er Percentage of windows an Window infiltration Infiltration rate If based on air permeabili Number of sides on which Shelter factor	ys, flues, fans, PSVs s been carried out or dwelling 0.25 for steel or timb ground floor, enter 0 hter 0.05, else enter 0 hd doors draught pro ty value, then (18) = h the dwelling is shelf ting shelter factor	ber frame or 0.35 0.2 (unsealed) or 0 0 bofed [(17) ÷ 20] + (8), 0 tered	eed to (17), otherw for masonry constr 0.1 (sealed), else er	vise continue ruction hter 0	c) = 40 from (9) to (16) 2 100.00 0.25 -	÷ (5) = ; (5) = ; (14) ÷ 10 ; (12) + (13) + (1 ; (12) + (13) + (1) ; (15) + (15		(14) (9) (9) (10) (11) (10) (10) (11) (10) (10) (11) (10) (1
Number of flueless gas fir Infiltration due to chimne <i>If a pressurisation test ha</i> Number of storeys in the Additional infiltration Structural infiltration: If suspended wooden If no draught lobby, er Percentage of windows an Window infiltration Infiltration rate If based on air permeabili Number of sides on which Shelter factor Infiltration rate incorpora	ys, flues, fans, PSVs s been carried out or dwelling 0.25 for steel or timb ground floor, enter 0 hter 0.05, else enter 0 hd doors draught pro ty value, then (18) = h the dwelling is shelf ting shelter factor	oer frame or 0.35 0.2 (unsealed) or 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	eed to (17), otherw for masonry constr 0.1 (sealed), else er	vise continue ruction hter 0	c) = 40 from (9) to (16) 2 100.00 0.25 -	÷ (5) = [0.2 x (14) ÷ 10 (12) + (13) + (1 1 - [0.075 x (19) (18) x (2)		(14) (9) (9) (10) (11) (10) (10) (11) (10) (10) (11) (10) (1
Number of flueless gas fir Infiltration due to chimne <i>If a pressurisation test has</i> Number of storeys in the Additional infiltration Structural infiltration: If suspended wooden If no draught lobby, er Percentage of windows ar Window infiltration Infiltration rate If based on air permeabili Number of sides on which Shelter factor Infiltration rate incorpora Infiltration rate modified	ys, flues, fans, PSVs s been carried out or dwelling 0.25 for steel or time ground floor, enter 0 nter 0.05, else enter 0 nd doors draught pro ty value, then (18) = n the dwelling is shelt ting shelter factor for monthly wind spe Feb Mar	ber frame or 0.35 0.2 (unsealed) or 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	eed to (17), otherw for masonry constr 0.1 (sealed), else er otherwise (18) = (10	ruction hter 0	c) = 40 from (9) to (16) 2 100.00 0.25 - (8) + (10) + (11) +	÷ (5) = [0.2 x (14) ÷ 10 (12) + (13) + (1 1 - [0.075 x (19) (18) x (2)	$ \mathbf{h} \mathbf{h} $	(14) (9) (9) (10) (11) (10) (10) (11) (10) (10) (11) (10) (10) (11) (10) (1
Number of flueless gas fir Infiltration due to chimne <i>If a pressurisation test has</i> Number of storeys in the Additional infiltration Structural infiltration: If suspended wooden If no draught lobby, er Percentage of windows an Window infiltration Infiltration rate If based on air permeabili Number of sides on which Shelter factor Infiltration rate incorpora Infiltration rate modified	ys, flues, fans, PSVs s been carried out or dwelling 0.25 for steel or time ground floor, enter 0 nter 0.05, else enter 0 nd doors draught pro ty value, then (18) = n the dwelling is shelt ting shelter factor for monthly wind spe Feb Mar	ber frame or 0.35 0.2 (unsealed) or 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	eed to (17), otherw for masonry constr 0.1 (sealed), else er otherwise (18) = (10	ruction hter 0	c) = 40 from (9) to (16) 2 100.00 0.25 - (8) + (10) + (11) +	÷ (5) = 	$ \mathbf{h} \mathbf{h} $	(14) (9) (9) (10) (11) (10) (10) (11) (10) (10) (11) (10) (10) (11) (10) (1
Number of flueless gas fir Infiltration due to chimne <i>If a pressurisation test ha</i> Number of storeys in the Additional infiltration Structural infiltration: If suspended wooden If no draught lobby, er Percentage of windows an Window infiltration Infiltration rate If based on air permeabili Number of sides on which Shelter factor Infiltration rate incorpora Infiltration rate modified Jan Monthly average wind spo	ys, flues, fans, PSVs s been carried out or dwelling 0.25 for steel or timb ground floor, enter 0 nter 0.05, else enter 0 nd doors draught pro ty value, then (18) = n the dwelling is shelt ting shelter factor for monthly wind spe Feb Mar eed from Table U2	ber frame or 0.35 0.2 (unsealed) or 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	eed to (17), otherw for masonry constr 0.1 (sealed), else er otherwise (18) = (10 May Jun	ruction nter 0 6)	c) = 40 from (9) to (16) 2 100.00 0.25 - (8) + (10) + (11) +	÷ (5) = 	$ \qquad \qquad \qquad \qquad \qquad \qquad \qquad \qquad \qquad \qquad$	(14) (9) (10) (11) (10) (10) (10) (11) (10) (10) (10) (11) (10) (10) (11) (10) (12) (10) (10) (12) (10) (12) (10) (12) (10) (12) (10) (12) (10) (



	0.61	0.60	0.59	0.53	0.52	0.46	0.46	0.45	0.48	0.52	0.54	0.57	(22b)
Calculate effecti	ve air chan	ge rate for t	he applica	ble case:									
If mechanica	l ventilatior	n: air change	e rate throu	ugh system								N/A	(23a)
If balanced w	vith heat re	covery: effic	iency in %	allowing fo	or in-use fa	ctor from Ta	able 4h					N/A	(23c)
d) natural ve	ntilation or	whole hous	e positive	input venti	lation from	n loft							
	0.69	0.68	0.67	0.64	0.63	0.60	0.60	0.60	0.62	0.63	0.65	0.66	(24d)
Effective air cha	nge rate - e	enter (24a) o	or (24b) or	(24c) or (24	ld) in (25)								
	0.69	0.68	0.67	0.64	0.63	0.60	0.60	0.60	0.62	0.63	0.65	0.66	(25)
										-			-
3. Heat losses a	and heat lo	ss paramete	er										
Element				Gross rea, m²	Opening m ²		area m²	U-value W/m ² K	AxUW		/alue, /m².K	Ахк, kJ/К	
Deer			u	icu, m					= 3.74		,	KJ/K	(2c)
Door Window							08 X	1.80					(26)
							16 x	1.50	= 9.26	_			(27)
Ground floor							.00 x	0.22	= 8.58	-			(28a)
Exposed floor							20 x	0.22	= 0.26	_			(28b
External wall						23		0.30	= 7.09				(29a)
External wall							84 X	0.28	= 0.80				(29a)
Party wall							.97 x	0.00	= 0.00				(32)
Roof						21		0.16	= 3.41				(30)
Roof							.70 x	0.18	= 6.43				(30)
Total area of ext		_				131	L.91						(31)
Fabric heat loss,	W/K = ∑(A	×U)								5)(30) + (3		39.57	(33)
Heat capacity Cr								(28)	(30) + (32) -	+ (32a)(3	2e) =	N/A	(34)
Thermal mass pa	arameter (T	「MP) in kJ/m	1²K									450.00	(35)
Thermal bridges	::Σ(L x Ψ) ca	alculated us	ing Appen	dix K								19.79	(36)
Total fabric heat	t loss									(33) + (3	36) =	59.35	(37)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ventilation heat	loss calcula	ated month	y 0.33 x (2	25)m x (5)								_	
	48.33	47.82	47.31	44.95	44.50	42.44	42.44	42.06	43.24	44.50	45.40	46.34	(38)
Heat transfer co	efficient, W	//K (37)m +	(38)m									- .	
	107.69	107.17	106.67	104.30	103.86	101.80	101.80	101.42	102.59	103.86	104.75	105.69	
									Average = S	<u>(</u> 39)112/	/12 =	104.30	(39)
Heat loss param	eter (HLP),	W/m²K (39)m ÷ (4)										
	1.36	1.35	1.35	1.32	1.31	1.29	1.29	1.28	1.30	1.31	1.32	1.33	
									Average = S	(40)112/	/12 =	1.32	(40)
Number of days	in month (⁻	Table 1a)											
	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00	(40)
A Motor boot				-									
4. Water heating		equirement										2.45	(12)
Assumed occupa					(25)							2.45	(42)
Annual average								_		•		92.33	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage				1.1									
	-			1	1	1	-	1 4 -		-			1
	e in litres pe 101.56	er day for ea 97.87	ch month 94.17	Vd,m = fact 90.48	or from Ta 86.79	83.10	83.10	86.79	90.48	94.17	97.87	101.56	
_	101.56	97.87	94.17	90.48	86.79	83.10	83.10		90.48	94.17 ∑(44)1	·	101.56 1107.94	(44)
Energy content	101.56	97.87 er used = 4.1	94.17 8 x Vd,m x	90.48 nm x Tm/3	86.79 8600 kWh/r	83.10 month (see	83.10 Tables 1b,	1c 1d)		∑(44)1	.12 =	1107.94	(44)
Energy content	101.56	97.87	94.17	90.48	86.79	83.10	83.10		90.48	∑(44)1 123.05	.12 =	1107.94	
Energy content	101.56	97.87 er used = 4.1	94.17 8 x Vd,m x	90.48 nm x Tm/3	86.79 8600 kWh/r	83.10 month (see	83.10 Tables 1b,	1c 1d)		∑(44)1	.12 =	1107.94	(44) (45)

Distribution loss 0.15 x (45)m											
22.59	19.76	20.39	17.78	17.06	14.72	13.64	15.65	15.84	18.46	20.15	21.88	(46)
Water storage loss calculat	ed for each	month (55	5) x (41)m									
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(56)
If the vessel contains dedic	ated solar s	torage or d	edicated V	WHRS (56)m x [(47) -	Vs] ÷ (47),	else (56)					
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(57)
Primary circuit loss for each	n month fro	m Table 3										
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(59)
Combi loss for each month	from Table	3a, 3b or 3	с								_	_
50.96	46.03	50.96	49.32	50.96	49.32	50.96	50.96	49.32	50.96	49.32	50.96	(61)
Total heat required for wat	er heating o	calculated f	or each mo	onth 0.85 x	(45)m + (4	6)m + (57)ı	m + (59)m -	+ (61)m		1		_
201.57	177.75	186.89	167.82	164.67	147.44	141.88	155.30	154.90	174.01	183.63	196.82	(62)
Solar DHW input calculated	using Appe			1	1						1	_
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(63)
Output from water heater			month) (62				T	r		1	r	-
201.57	177.75	186.89	167.82	164.67	147.44	141.88	155.30	154.90	174.01	183.63	196.82	
				() (•				∑(64)1	.12 = 2	2052.68	(64)
Heat gains from water heat			-	1	1		· · ·	1			1	٦
62.82	55.31	57.94	51.73	50.55	44.95	42.97	47.43	47.44	53.65	56.99	61.24	(65)
5. Internal gains												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5)												
122.38	122.38	122.38	122.38	122.38	122.38	122.38	122.38	122.38	122.38	122.38	122.38	(66)
Lighting gains (calculated ir	i Appendix I	L, equation	L9 or L9a),	, also see Ta	able 5				-		-	
29.45	26.15	21.27	16.10	12.04	10.16	10.98	14.27	19.16	24.32	28.39	30.26	(67)
Appliance gains (calculated	in Appendi	ix L, equatio	on L13 or L	13a), also s	ee Table 5							
217.76	220.02	214.33	202.20	186.90	172.52	162.91	160.65	166.35	178.47	193.77	208.15	(68)
Cooking gains (calculated ir) Appendix	L, equation	L15 or L15	ia), also see	e Table 5							
35.24	35.24	35.24	35.24	35.24	35.24	35.24	35.24	35.24	35.24	35.24	35.24	(69)
Pump and fan gains (Table	5a)											
3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	(70)
Losses e.g. evaporation (Ta	ble 5)											
-97.90	-97.90	-97.90	-97.90	-97.90	-97.90	-97.90	-97.90	-97.90	-97.90	-97.90	-97.90	(71)
Water heating gains (Table	5)											
84.43	82.30	77.87	71.85	67.94	62.44	57.76	63.75	65.88	72.11	79.15	82.31	(72)
Total internal gains (66)m	+ (67)m + (6	58)m + (69)ı	m + (70)m	+ (71)m + (72)m							
394.35	391.19	376.18	352.87	329.59	307.83	294.36	301.39	314.10	337.62	364.02	383.44	(73)
6. Solar gains												
		Access f	actor	Area	Sol	ar flux		g	FF		Gains	
		Table		m²		V/m²	•	ific data able 6b	specific o or Table		W	
South		0.7	7 X	6.16	x 4	6.75 x	0.9 x	0.72 x	0.70	=	100.59	(78)
Solar gains in watts ∑(74)m	ı(82)m		L									
100.59	164.74	209.85	237.17	247.15	237.85	232.39	225.68	219.21	177.68	119.23	86.92	(83)
	*				•	•	•			•		_ · ·
Total gains - internal and so	əlar (73)m +	· (83)m										
Total gains - internal and so 494.94	blar (73)m + 555.92	· (83)m 586.02	590.04	576.74	545.68	526.75	527.07	533.31	515.30	483.25	470.35	(84)

7. Mean intern	al tempera	ture (heati	ing season)										
Temperature du	iring heatin	g periods ir	n the living a	area from T	able 9, Th	L(°C)						21.00	(85)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor	r for gains f	or living ar	ea n1,m (se	e Table 9a)									
	1.00	1.00	1.00	1.00	0.99	0.94	0.80	0.82	0.97	1.00	1.00	1.00	(86)
Mean internal te	emp of livin	g area T1 (steps 3 to 7	in Table 9c)								
	20.07	20.17	20.32	20.52	20.72	20.90	20.98	20.98	20.86	20.60	20.31	20.07	(87)
Temperature du	iring heatin	g periods ir	n the rest of	f dwelling fi	om Table 9	9, Th2(°C)							
	19.79	19.80	19.80	19.83	19.83	19.85	19.85	19.86	19.84	19.83	19.82	19.81	(88)
Utilisation factor	r for gains f	or rest of d	welling n2,	m									
	1.00	1.00	1.00	1.00	0.98	0.87	0.62	0.65	0.92	1.00	1.00	1.00	(89)
Mean internal te	emperature	in the rest	of dwelling	g T2 (follow	steps 3 to	7 in Table 9	e)						_
	18.96	19.06	19.21	19.43	19.63	19.81	19.85	19.85	19.77	19.51	19.22	18.97	(90)
Living area fract	ion	•	•	•					Liv	ving area ÷	(4) =	0.44	(91)
Mean internal te	emperature	for the wh	nole dwellin	g fLA x T1 +	·(1 - fLA) x ⁻	Т2							_
	19.46	19.55	19.70	19.92	20.12	20.30	20.35	20.35	20.26	20.00	19.70	19.46	(92)
Apply adjustmer	nt to the me	ean interna	l temperati	ure from Ta	ble 4e whe	ere appropr	iate						
	19.46	19.55	19.70	19.92	20.12	20.30	20.35	20.35	20.26	20.00	19.70	19.46	(93)
		I									I	1	
8. Space heatir	ng requiren	nent											
	Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation facto	r for gains,	ηm											
	1.00	1.00	1.00	1.00	0.98	0.91	0.71	0.73	0.94	1.00	1.00	1.00	(94)
Useful gains, ηm	nGm, W (94	1)m x (84)n	ı										
	494.87	555.71	585.40	587.86	567.22	495.00	371.88	387.20	502.29	513.07	483.05	470.31	(95)
Monthly average	e external t	emperatur	e from Tabl	e U1									
	4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)
Heat loss rate fo	or mean inte	ernal temp	erature, Lm	, W [(39)m	x [(93)m -	(96)m]							
	1632.15	1570.42	1408.37	1149.09	874.04	579.88	382.03	400.81	631.79	975.77	1320.11	1613.05	(97)
Space heating re	equirement	, kWh/mor	nth 0.024 x	[(97)m - (9	5)m] x (41)	m							
	846.13	681.88	612.29	404.09	228.27	0.00	0.00	0.00	0.00	344.25	602.68	850.20	
									∑(98	3)15, 10	.12 = 4	569.80	(98)
Space heating re	equirement	kWh/m²/y	ear							(98)	÷ (4)	57.70	(99)
9a. Energy requ	uirements -	individual	heating sy	stems inclu	ding micro	O-CHP							
Space heating													-
Fraction of space	e heat from	secondary	/suppleme	ntary system	m (table 11	L)						0.00	(201)
Fraction of space	e heat from	main syste	em(s)							1 - (20	01) =	1.00	(202)
Fraction of space	e heat from	main syste	em 2									0.00	(202)
Fraction of total	space heat	from main	system 1						(20	02) x [1- (20	3)] =	1.00	(204)
Fraction of total	space heat	from main	system 2							(202) x (20	03) =	0.00	(205)
Efficiency of mai	in system 1	(%)										88.80	(206)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating fu	uel (main sy	stem 1), kV	Vh/month										
	952.85	767.89	689.52	455.05	257.06	0.00	0.00	0.00	0.00	387.67	678.70	957.43]
									∑(211	L)15, 10	.12 = 5	5146.17	(211)

Water heating

Efficiency of water heater

	0.05	06 70	06.44	05.05	04.65	70.50	70 50	70.50	70 50	05.44	06.44	00.00	(247)
Water heating f	86.85	86.70	86.44	85.85	84.65	79.50	79.50	79.50	79.50	85.44	86.44	86.89	(217)
water neating i		205.02	216.22	105 49	194.53	195.46	178.47	195.34	104.94	203.65	212.44	226 52	Г
	232.10	205.02	210.22	195.48	194.53	185.46	178.47	195.34	194.84	<u>Σ(219a)1</u>	·	226.52 2440.06	 (219)
Annual totals										2(2198)1	12 =	2440.00] (219)
Space heating f	ual main o	uctor 1										5146.17	7
Water heating f		ystem 1										2440.06	
Electricity for p		and electric	keen-hot (Tahle 4f)								2440.00	
central heat					ating unit				30.00	1			(230c)
boiler flue fa		i water puir			ating unit				45.00] T			(230e)
Total electricity		we kWh/ve	ar						43.00			75.00	(231)
Electricity for lig		-	ai									520.01	(232)
Total delivered		-						(211)(221) + (221) +	(222) (22	7h) –	8181.24	(232)
Total delivered	energy for a	an uses						(211)(221	.) ' (231) '	(232)(23)		0101.24	_ (230)
10a. Fuel costs	s - individua	I heating sy	stems incl	uding micr	o-CHP								
						Fuel		Fu	el price			Fuel	
					k\	Nh/year				,		ost £/year	-
Space heating -	main syster	m 1			5	5146.17) x		3.48	x 0.01		179.09	(240)
Water heating					2	2440.06) x		3.48	x 0.01	=	84.91	(247)
Pumps and fans	S					75.00) x		13.19	x 0.01	=	9.89	(249)
Electricity for lig	ghting					520.01) x		13.19	x 0.01	=	68.59	(250)
Additional stand	ding charge	S										120.00	(251)
Total energy co	st							(24	40)(242)	+ (245)(25	54) =	462.48	(255)
11a. SAP ratin	g - individu	al heating s	ystems inc	luding micr	ro-CHP								
Energy cost def	lator (Table	12)										0.42	(256)
Energy cost fact	tor (ECF)											1.56	(257)
SAP value												78.18	1
SAP rating (sect	tion 13)											78	(258)
SAP band												С]
			_										
12a. CO ₂ emiss	sions - indiv	vidual heatii	ng systems	including					-				
						Energy Nh/year			sion factor CO₂/kWh			missions CO₂/year	
Space heating -	main syster	m 1			5	5146.17] x		0.22] =		1111.57	(261)
Water heating					2	440.06] x		0.22] =		527.05	(264)
Space and wate	er heating							(26	1) + (262) -	+ (263) + (26	64) =	1638.63	(265)
Pumps and fans	5					75.00] x		0.52] =		38.93	(267)
Electricity for lig	ghting					520.01] x		0.52] =		269.88	(268)
Total CO₂, kg/ye	ear									(265)(27	71) =	1947.44	(272)
Dwelling CO ₂ er	mission rate									(272) ÷	(4) =	24.59	(273)
El value												78.99	
El rating (sectio	on 14)											79	(274)
EI band												С	
13a. Primary e	noray indi	ividual bost	ting cyctom	s including	micro-CH	D							
-13a. Primary e	energy - Indi	Moual neat	ing system	is including				D.J	and facto		P1		
						Energy		Prim	ary factor		Prin	nary Energy	/

	Energy kWh/year		Primary factor		Primary Energy kWh/year
Space heating - main system 1	5146.17] x	1.22	=	6278.33 (261)
Water heating	2440.06	x	1.22	=	2976.88 (264)

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Space and water heating			(261) + (262) +	- (263) + (264) =	9255.21	(265)
Pumps and fans	75.00	х	3.07	=	230.25	(267)
Electricity for lighting	520.01	х	3.07	=	1596.43	(268)
Primary energy kWh/year					11081.88	(272)
Dwelling primary energy rate kWh/m2/year					139.92	(273)

DER Worksheet Design - Draft



This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mrs Nico	la Battista					As	sessor num	ber	3998		
Client		bourne Gro						st modified			/2014	
							Ld	sembulieu		20/00	72014	
Address	3 The Old	t School Pai	rk Lane, Ric	hmond	, London, TV	/9						
1. Overall dwelling dimen	sions											
					Area (m²)			age storey ight (m)		Vo	olume (m³)	
Lowest occupied				Γ	29.81	(1a) x		3.45	(2a) =		102.84	(3a)
+1					30.20	(1b) x		2.22	(2b) =		67.04	(3b)
Total floor area	(1a)	+ (1b) + (1c	c) + (1d)(1	.n) = [60.01	(4)			_			
Dwelling volume							(3a)	+ (3b) + (3	c) + (3d)(3i	n) =	169.89	(5)
2. Ventilation rate								·				
										m	³ per hour	
Number of chimneys								0] x 40 =		0	(6a)
Number of open flues								0] x 20 =		0	(6b)
Number of intermittent far	15							4] x 10 =		40	(7a)
Number of passive vents								0] x 10 =		0	(7b)
Number of flueless gas fire	s							0] x 40 =		0	(7c)
										Air	changes per hour	
Infiltration due to chimney	s, flues, fans	s, PSVs		(6a) + (6b) + (7a) + (7b) + (7c) =	40	÷ (5) =		0.24	(8)
If a pressurisation test has	been carriec	d out or is ir	ntended, pr	oceed t	o (17), other	wise continu	e from (9) t	o (16)	-			
Air permeability value, q50	, expressed	in cubic me	etres per ho	our per	square metro	e of envelope	e area				5.00	(17)
If based on air permeability	value, then	ו (18) = [(17	7) ÷ 20] + (8), other	wise (18) = (16)					0.49	(18)
Number of sides on which	the dwelling	g is sheltere	d								4	(19)
Shelter factor								1 -	[0.075 x (19)] =	0.70	(20)
Infiltration rate incorporati	ng shelter fa	actor							(18) x (2	0) =	0.34	(21)
Infiltration rate modified for	or monthly v	vind speed:	:									
Jan	Feb	Mar	Apr	May	y Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Monthly average wind spec	ed from Tab	le U2										
5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70	
												(22)
Wind factor (22)m ÷ 4												(22)
Wind factor (22)m ÷ 4	1.25	1.23	1.10	1.08	0.95	0.95	0.93	1.00	1.08	1.13	1.18	(22) (22a)
						0.95	0.93	1.00	1.08	1.13	1.18	
1.28					x (22a)m	0.95	0.93	0.34	1.08 0.37	0.38	0.40	
1.28 Adjusted infiltration rate (a	Illowing for s	shelter and 0.42	wind facto	or) (21) :	x (22a)m							(22a)
1.28Adjusted infiltration rate (a0.43	Illowing for s 0.42 ge rate for t	shelter and 0.42 the applicat	wind facto 0.37 ble case:	or) (21) :	x (22a)m							(22a)
1.28Adjusted infiltration rate (a0.43Calculate effective air chan	Illowing for s 0.42 ge rate for t n: air change	shelter and 0.42 the applicat e rate throu	l wind facto 0.37 ble case: ugh system	or) (21) : 0.37	x (22a)m	0.32					0.40	(22a) (22b)
1.28Adjusted infiltration rate (a0.43Calculate effective air chanIf mechanical ventilation	0.42 ge rate for t n: air change covery: effic	shelter and 0.42 the applicat e rate throu ciency in %	l wind facto 0.37 ble case: ugh system allowing fo	or) (21) : 0.37 r in-use	x (22a)m 0.32	0.32					0.40 N/A	(22a) (22b) (23a)
1.28 Adjusted infiltration rate (a 0.43 Calculate effective air chan If mechanical ventilation If balanced with heat re	0.42 ge rate for t n: air change covery: effic	shelter and 0.42 the applicat e rate throu ciency in %	l wind facto 0.37 ble case: ugh system allowing fo	or) (21) : 0.37 r in-use	x (22a)m 0.32 factor from rom loft	0.32					0.40 N/A	(22a) (22b) (23a)



	0.59	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58	(25)
3. Heat losses	and heat lo	ss paramet	er										
Element		oo paramee		Gross	Openings	Net	area	U-value	A x U W	/К к-ч	value,	Ахκ,	
			а	rea, m²	m²		m²	W/m²K			/m².K	kJ/K	
Door						2.	71 x	1.80	= 4.88				(26)
Window						4.	82 x	1.50	= 7.25				(27)
Ground floor						29	.81 x	0.22	= 6.56				(28a)
External wall						55	.32 x	0.30	= 16.60				(29a)
Party wall						46	.96 x	0.00	= 0.00				(32)
External wall						19	.32 x	0.28	= 5.41				(29a)
Roof						14	.25 x	0.16	= 2.28				(30)
Roof						21	.86 x	0.18	= 3.93				(30)
Total area of e	xternal elem	ents ∑A, m²	:			148	3.09						(31)
Fabric heat loss	s, W/K = ∑(A	× U)							(26	5)(30) + (32) =	46.90	(33)
Heat capacity C	Cm = ∑(А x к))						(28)	.(30) + (32) +	- (32a)(3	2e) =	N/A	(34)
Thermal mass p	parameter (1	FMP) in kJ/n	n²K									450.00	(35)
Thermal bridge	es: Σ(L x Ψ) c	alculated us	sing Appen	dix K								22.21	(36)
Total fabric hea	at loss									(33) + (36) =	69.12	(37)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ventilation hea	at loss calcula	ated month	ly 0.33 x (2	25)m x (5)									
	33.29	33.09	32.89	31.95	31.77	30.95	30.95	30.80	31.27	31.77	32.13	32.50	(38)
Heat transfer c	oefficient, W	V/K (37)m +	+ (38)m										
	102.41	102.21	102.01	101.07	100.89	100.07	100.07	99.92	100.39	100.89	101.25	101.62	
									Average = ∑	(39)112	/12 =	101.06	(39)
Heat loss parar	meter (HLP),	W/m²K (39	9)m ÷ (4)										_
	1.71	1.70	1.70	1.68	1.68	1.67	1.67	1.67	1.67	1.68	1.69	1.69	
									Average = ∑	(40)112	/12 =	1.68	(40)
Number of day		Table 1a)						1					-
	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00	(40)
4. Water heat	ting energy r	equiremen	t										
Assumed occup												1.98	(42)
Annual average	•	usage in litro	es per day '	Vd,average	= (25 x N) +	36						81.27	(43)
0	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usag	ge in litres pe	er day for ea	ach month	Vd,m = fact	tor from Tab	ole 1c x (43)	-					
	89.40	86.15	82.90	79.65	76.39	73.14	73.14	76.39	79.65	82.90	86.15	89.40	7
								ł	_	∑(44)1	.12 =	975.25	(44)
Energy content	t of hot wate	er used = 4.1	L8 x Vd,m x	nm x Tm/3	3600 kWh/m	onth (see	Tables 1b	, 1c 1d)					_
	132.57	115.95	119.65	104.31	100.09	86.37	80.04	91.84	92.94	108.31	118.23	128.39	7
					•			•	•	∑(45)1	.12 =	1278.70	(45)
Distribution los	s 0.15 x (45)m											-
	19.89	17.39	17.95	15.65	15.01	12.96	12.01	13.78	13.94	16.25	17.73	19.26	(46)
Water storage	loss calculat	ed for each	month (55	5) x (41)m				•			•		-
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(56)
If the vessel co	ntains dedic	ated solar s	torage or d	ledicated W	/WHRS (56)	m x [(47) -	Vs] ÷ (47)	, else (56)					
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(57)
Primary circuit	loss for each	n month fro	m Table 3										
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(59)
												-	

Combi loss for e	ach month	from Table	3a, 3b or 3	с									
	50.96	46.03	50.96	49.32	50.96	49.32	50.96	50.96	49.32	50.96	49.32	50.96	(61)
Total heat requi	red for wat	er heating o	calculated f	or each mo	onth 0.85 x	(45)m + (4	6)m + (57)r	n + (59)m +	- (61)m				
	183.53	161.98	170.61	153.63	151.05	135.69	130.99	142.80	142.25	159.27	167.55	179.35	(62)
Solar DHW inpu	t calculated	using App	endix G or A	Appendix H									
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(63)
Output from wa	ter heater f	or each mo	onth (kWh/	month) (62	2)m + (63)n	า							
	183.53	161.98	170.61	153.63	151.05	135.69	130.99	142.80	142.25	159.27	167.55	179.35]
										∑(64)1	.12 = 1	.878.70	(64)
Heat gains from	water heat	ing (kWh/n	nonth) 0.2	5 × [0.85 ×	(45)m + (61	L)m] + 0.8 ×	[(46)m + (57)m + (59)	m]				
	56.82	50.06	52.52	47.01	46.02	41.05	39.35	43.28	43.23	48.75	51.64	55.43	(65)
5. Internal gair	IS								_				
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains	(Table 5)		•										-
	99.10	99.10	99.10	99.10	99.10	99.10	99.10	99.10	99.10	99.10	99.10	99.10	(66)
Lighting gains (c	alculated in	Appendix	L, equation	L9 or L9a),	also see Ta	able 5							
	23.25	20.65	16.79	12.71	9.50	8.02	8.67	11.27	15.13	19.21	22.42	23.90	(67)
Appliance gains	(calculated	in Appendi	ix L, equatio	on L13 or L1	L3a), also s	ee Table 5							
	172.97	174.77	170.24	160.61	148.46	137.04	129.40	127.61	132.13	141.76	153.92	165.34	(68)
Cooking gains (c	alculated in	Appendix	L, equation	L15 or L15	a), also see	e Table 5							
	32.91	32.91	32.91	32.91	32.91	32.91	32.91	32.91	32.91	32.91	32.91	32.91	(69)
Pump and fan g	ains (Table S	5a)											
	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	(70)
Losses e.g. evap	oration (Tal	ole 5)											
	-79.28	-79.28	-79.28	-79.28	-79.28	-79.28	-79.28	-79.28	-79.28	-79.28	-79.28	-79.28	(71)
Water heating g	ains (Table	5)											
	76.37	74.49	70.60	65.30	61.86	57.01	52.89	58.17	60.04	65.53	71.72	74.50	(72)
Total internal ga	ins (66)m +	- (67)m + (6	68)m + (69)	m + (70)m ·	+ (71)m + (72)m							
	328.32	325.64	313.36	294.35	275.55	257.80	246.69	252.78	263.03	282.22	303.78	319.47	(73)
													-
6. Solar gains													
			Access f Table		Area m²		ar flux //m²		g ific data able 6b	FF specific o or Table		Gains W	
							I			1			1 4

North			0.7	7 x	4.82	x 1	0.63 x	0.9 x 🚺).72 x	0.70	=	17.90	(74)
Solar gains in wa	tts ∑(74)m	(82)m											
	17.90	34.21	58.13	93.37	125.78	134.65	125.72	99.74	69.89	40.72	22.08	14.92	(83)
Total gains - inte	rnal and so	lar (73)m +	(83)m										
	346.22	359.85	371.49	387.73	401.33	392.45	372.41	352.52	332.92	322.95	325.87	334.39	(84)
7. Mean intern	al temperat	ture (heatir	ng season)										

													-
Temperature du	ring heating	g periods in	the living a	area from T	able 9, Thi	1(°C)						21.00	(85)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor	r for gains f	or living are	ea n1,m (se	e Table 9a)					_				_
	1.00	1.00	1.00	1.00	1.00	0.98	0.92	0.94	0.99	1.00	1.00	1.00	(86)
Mean internal te	emp of livin	g area T1 (s	steps 3 to 7	in Table 9c)								
	19.77	19.84	20.00	20.24	20.51	20.77	20.91	20.88	20.67	20.34	20.02	19.76	(87)

Temperature during heating periods in the rest of dwelling from Table 9, Th2(°C)

	19.54	10 54	10 54	19.55	10 55	19.56	10 56	10.57	10 56	10 55	19.55	10 55	(00)
1 1411 + f + -		19.54	19.54		19.55	19.56	19.56	19.57	19.56	19.55	19.55	19.55	(88)
Utilisation facto	_		-									1] ()
	1.00	1.00	1.00	1.00	0.99	0.94	0.74	0.81	0.98	1.00	1.00	1.00	(89)
Mean internal to	emperature	1	-		steps 3 to	7 in Table 9				I	1	1	-
	18.44	18.51	18.67	18.93	19.20	19.45	19.55	19.54	19.36	19.03	18.70	18.44	(90)
Living area fract	ion								Li	ving area ÷	(4) =	0.43	(91)
Mean internal to	emperature	for the wh	ole dwellin	g fLA x T1 +	-(1 - fLA) x ⊺	Γ2						_	_
	19.02	19.09	19.25	19.50	19.77	20.02	20.14	20.12	19.93	19.60	19.28	19.01	(92)
Apply adjustment	nt to the me	ean interna	l temperati	ure from Ta	ble 4e whe	re appropr	iate						
	19.02	19.09	19.25	19.50	19.77	20.02	20.14	20.12	19.93	19.60	19.28	19.01	(93)
8. Space heating	a requirem	ont											
o. space neath	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilization facto			IVIdI	Apr	Мау	Jun	Jui	Aug	Seb	001	NOV	Dec	
Utilisation facto	-	1			0.00					1 1 00		1.00] (0.0)
	1.00	1.00	1.00	1.00	0.99	0.96	0.83	0.88	0.98	1.00	1.00	1.00	(94)
Useful gains, ηπ				1	I			1				1	1
	346.18	359.78	371.33	387.14	398.29	375.06	310.79	309.88	327.90	322.51	325.78	334.36	(95)
Monthly average	e external t	emperature	e from Tabl	e U1									-
	4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)
Heat loss rate fo	or mean inte	ernal tempe	erature, Lm	, W [(39)m	x [(93)m -	(96)m]							_
	1507.07	1450.04	1300.47	1071.16	813.91	542.33	354.04	371.83	585.08	907.81	1232.71	1505.03	(97)
Space heating re	equirement,	, kWh/mon	th 0.024 x	[(97)m - (9	5)m] x (41)ı	m							
	863.71	732.66	691.28	492.49	309.22	0.00	0.00	0.00	0.00	435.46	652.99	870.99]
									Σ(9	8)15, 10	.12 =	5048.80	(98)
с I										(00)	(7
Space heating re	equirement	kWh/m²/y	ear							(98)	÷ (4)	84.13	(99)
		-				CUD				(98)	÷ (4)	84.13] (99)
9a. Energy req		-		stems inclu	ding micro	-CHP				(98)	÷ (4)	84.13	(99)
9a. Energy req Space heating	uirements -	individual	heating sys							(98)	÷ (4)		1
9a. Energy req Space heating Fraction of spac	uirements - e heat from	individual secondary	heating sys /suppleme									0.00] (201)
9a. Energy req Space heating Fraction of spac Fraction of spac	uirements - e heat from e heat from	individual secondary main syste	heating sys /suppleme em(s)							(98) 1 - (20		0.00] (201)] (202)
9a. Energy req Space heating Fraction of spac Fraction of spac Fraction of spac	uirements - e heat from e heat from e heat from	individual secondary main syste main syste	heating sys /suppleme em(s) em 2							1 - (20	01) =	0.00] (201)] (202)] (202)
9a. Energy req Space heating Fraction of spac Fraction of spac Fraction of spac Fraction of total	uirements - e heat from e heat from e heat from space heat	individual secondary main syste main syste from main	heating sys /supplemen em(s) em 2 system 1						(20	1 - (20)2) x [1- (20	D1) = 3)] =	0.00] (201)] (202)] (202)] (202)] (204)
9a. Energy req Space heating Fraction of spac Fraction of spac Fraction of spac	uirements - e heat from e heat from e heat from space heat	individual secondary main syste main syste from main	heating sys /supplemen em(s) em 2 system 1						(20	1 - (20	D1) = 3)] =	0.00 1.00 0.00] (201)] (202)] (202)
9a. Energy req Space heating Fraction of spac Fraction of spac Fraction of spac Fraction of total	uirements - e heat from e heat from e heat from space heat space heat	individual secondary main syste main syste from main from main	heating sys /supplemen em(s) em 2 system 1						(20	1 - (20)2) x [1- (20	D1) = 3)] =	0.00 1.00 0.00 1.00] (201)] (202)] (202)] (202)] (204)
9a. Energy req Space heating Fraction of spac Fraction of spac Fraction of spac Fraction of total Fraction of total	uirements - e heat from e heat from e heat from space heat space heat	individual secondary main syste main syste from main from main	heating sys /supplemen em(s) em 2 system 1				Jul	Aug	(20 Sep	1 - (20)2) x [1- (20	D1) = 3)] =	0.00 1.00 0.00 1.00 0.00] (201)] (202)] (202)] (202)] (204)] (205)
9a. Energy req Space heating Fraction of spac Fraction of spac Fraction of spac Fraction of total Fraction of total	e heat from e heat from e heat from space heat space heat in system 1 Jan	individual secondary main syste main syste from main from main (%) Feb	heating sys /supplement em(s) em 2 system 1 system 2 Mar	ntary system	m (table 11)	Jul	Aug	·	1 - (20)2) x [1- (20 (202) x (20	01) = 3)] = 03) =	0.00 1.00 0.00 1.00 0.00 88.80] (201)] (202)] (202)] (202)] (204)] (205)
9a. Energy req Space heating Fraction of spac Fraction of spac Fraction of spac Fraction of total Fraction of total Efficiency of ma	e heat from e heat from e heat from space heat space heat in system 1 Jan	individual secondary main syste main syste from main from main (%) Feb	heating sys /supplement em(s) em 2 system 1 system 2 Mar	ntary system	m (table 11)	Jul	Aug	·	1 - (20)2) x [1- (20 (202) x (20	01) = 3)] = 03) =	0.00 1.00 0.00 1.00 0.00 88.80] (201)] (202)] (202)] (202)] (204)] (205)
9a. Energy req Space heating Fraction of spac Fraction of spac Fraction of spac Fraction of total Fraction of total Efficiency of ma	e heat from e heat from e heat from space heat space heat in system 1 Jan uel (main sy	individual secondary main syste from main from main (%) Feb stem 1), kV	heating sys /supplemen em(s) em 2 system 1 system 2 Mar Vh/month	ntary system	m (table 11 May) Jun	1	-	Sep	1 - (20)2) x [1- (20 (202) x (20 Oct	01) = 3)] = 03) = Nov 735.35	0.00 1.00 0.00 1.00 0.00 88.80 Dec] (201)] (202)] (202)] (202)] (204)] (205)
9a. Energy req Space heating Fraction of spac Fraction of spac Fraction of spac Fraction of total Fraction of total Efficiency of ma	e heat from e heat from e heat from space heat space heat in system 1 Jan uel (main sy	individual secondary main syste from main from main (%) Feb stem 1), kV	heating sys /supplemen em(s) em 2 system 1 system 2 Mar Vh/month	ntary system	m (table 11 May) Jun	1	-	Sep	1 - (20)2) x [1- (20 (202) x (20 Oct 490.39	01) = 3)] = 03) = Nov 735.35	0.00 1.00 0.00 1.00 0.00 88.80 Dec 980.84] (201)] (202)] (202)] (204)] (205)] (206)
9a. Energy req Space heating Fraction of spac Fraction of spac Fraction of spac Fraction of total Fraction of total Efficiency of ma Space heating fu	e heat from e heat from e heat from e heat from space heat space heat in system 1 Jan Jan Jel (main sy 972.64	individual secondary main syste from main from main (%) Feb stem 1), kV	heating sys /supplemen em(s) em 2 system 1 system 2 Mar Vh/month	ntary system	m (table 11 May) Jun	1	-	Sep	1 - (20)2) x [1- (20 (202) x (20 Oct 490.39	01) = 3)] = 03) = Nov 735.35	0.00 1.00 0.00 1.00 0.00 88.80 Dec 980.84] (201)] (202)] (202)] (204)] (205)] (206)
9a. Energy req Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of ma Space heating for Water heating	e heat from e heat from e heat from e heat from space heat space heat in system 1 Jan Jan Jel (main sy 972.64	individual secondary main syste from main from main (%) Feb stem 1), kV	heating sys /supplemen em(s) em 2 system 1 system 2 Mar Vh/month	ntary system	m (table 11 May) Jun	1	-	Sep	1 - (20)2) x [1- (20 (202) x (20 Oct 490.39	01) = 3)] = 03) = Nov 735.35	0.00 1.00 0.00 1.00 0.00 88.80 Dec 980.84] (201)] (202)] (202)] (204)] (205)] (206)
9a. Energy req Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of ma Space heating for Water heating	e heat from e heat from e heat from e heat from space heat space heat in system 1 Jan uel (main sy 972.64 ter heater 87.02	individual secondary main syste from main from main (%) Feb stem 1), kV 825.07 86.96	heating sys /supplemenerm(s) em 2 system 1 system 2 Mar Vh/month 778.47	Apr 554.61	m (table 11 May 348.22) Jun 0.00	0.00	0.00	Sep 0.00 Σ(21)	1 - (20)2) x [1- (20 (202) x (20 Oct <u>490.39</u> 1)15, 10	01) = 3)] = 03) = Nov 735.35 12 =	0.00 1.00 0.00 1.00 0.00 88.80 Dec 980.84 5685.58] (201)] (202)] (202)] (204)] (205)] (206)] (206)] (211)
9a. Energy req Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of ma Space heating fu Water heating Efficiency of wat	e heat from e heat from e heat from e heat from space heat space heat in system 1 Jan uel (main sy 972.64 ter heater 87.02	individual secondary main syste from main from main (%) Feb stem 1), kV 825.07 86.96	heating sys /supplemenerm(s) em 2 system 1 system 2 Mar Vh/month 778.47	Apr 554.61	m (table 11 May 348.22) Jun 0.00	0.00	0.00	Sep 0.00 Σ(21)	1 - (20)2) x [1- (20 (202) x (20 Oct <u>490.39</u> 1)15, 10	01) = 3)] = 03) = Nov 735.35 12 =	0.00 1.00 0.00 1.00 0.00 88.80 Dec 980.84 5685.58] (201)] (202)] (202)] (204)] (205)] (206)] (206)] (211)
9a. Energy req Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of ma Space heating fu Water heating Efficiency of wat	e heat from e heat from e heat from space heat space heat in system 1 Jan uel (main sy 972.64 ter heater 87.02 uel, kWh/m	individual secondary main syste from main from main (%) Feb stem 1), kW 825.07 86.96 onth	heating sys /supplemenerm(s) em 2 system 1 system 2 Mar Vh/month 778.47 86.79	Apr 554.61 86.40	m (table 11 May 348.22 85.52) Jun 0.00 79.50	0.00	0.00	Sep 0.00 Σ(21) 79.50	1 - (20)2) x [1- (20 (202) x (20 Oct 1)15, 10 86.10	01) = 3)] = 03) = Nov 735.35 12 = 86.73 193.18	0.00 1.00 0.00 1.00 88.80 Dec 980.84 5685.58 87.06] (201)] (202)] (202)] (204)] (205)] (206)] (206)] (211)
9a. Energy req Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of ma Space heating fu Water heating Efficiency of wat	e heat from e heat from e heat from space heat space heat in system 1 Jan uel (main sy 972.64 ter heater 87.02 uel, kWh/m	individual secondary main syste from main from main (%) Feb stem 1), kW 825.07 86.96 onth	heating sys /supplemenerm(s) em 2 system 1 system 2 Mar Vh/month 778.47 86.79	Apr 554.61 86.40	m (table 11 May 348.22 85.52) Jun 0.00 79.50	0.00	0.00	Sep 0.00 Σ(21) 79.50	1 - (20)2) x [1- (20 (202) x (20 Oct 490.39 1)15, 10 866.10 184.98	01) = 3)] = 03) = Nov 735.35 12 = 86.73 193.18	0.00 1.00 0.00 1.00 0.00 88.80 Dec 980.84 5685.58 87.06 206.00] (201)] (202)] (202)] (204)] (205)] (206)] (206)] (211)] (217)
9a. Energy req Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of ma Space heating for Water heating Efficiency of wat	e heat from e heat from e heat from space heat space heat in system 1 Jan uel (main sy 972.64 ter heater 87.02 uel, kWh/m 210.92	individual secondary main syste from main from main (%) Feb stem 1), kV 825.07 86.96 onth 186.27	heating sys /supplemenerm(s) em 2 system 1 system 2 Mar Vh/month 778.47 86.79	Apr 554.61 86.40	m (table 11 May 348.22 85.52) Jun 0.00 79.50	0.00	0.00	Sep 0.00 Σ(21) 79.50	1 - (20)2) x [1- (20 (202) x (20 Oct 490.39 1)15, 10 866.10 184.98	01) = 3)] = 03) = Nov 735.35 12 = 86.73 193.18 12 =	0.00 1.00 0.00 1.00 0.00 88.80 Dec 980.84 5685.58 87.06 206.00] (201)] (202)] (202)] (204)] (205)] (206)] (206)] (211)] (217)
 9a. Energy req Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of ma Space heating fu Water heating Efficiency of wat Water heating fu Water heating fu Annual totals Space heating fu 	e heat from e heat from e heat from e heat from space heat space heat in system 1 Jan uel (main sy 972.64 ter heater 87.02 uel, kWh/m 210.92	individual secondary main syste from main from main (%) Feb stem 1), kV 825.07 86.96 onth 186.27	heating sys /supplemenerm(s) em 2 system 1 system 2 Mar Vh/month 778.47 86.79	Apr 554.61 86.40	m (table 11 May 348.22 85.52) Jun 0.00 79.50	0.00	0.00	Sep 0.00 Σ(21) 79.50	1 - (20)2) x [1- (20 (202) x (20 Oct 490.39 1)15, 10 866.10 184.98	D1) = 3)] = D3) = Nov 735.35 12 = 86.73 193.18 12 =	0.00 1.00 0.00 1.00 0.00 88.80 Dec 980.84 5685.58 87.06 206.00 2226.39 5685.58] (201)] (202)] (202)] (204)] (205)] (206)] (206)] (211)] (217)
 9a. Energy req Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of ma Space heating for Water heating for Water heating for Water heating for Annual totals 	e heat from e heat from e heat from space heat space heat in system 1 Jan uel (main sy 972.64 ter heater 87.02 uel, kWh/m 210.92 uel - main sy uel	individual secondary main syste from main from main (%) Feb stem 1), kV 825.07 86.96 onth 186.27	heating sys /supplemen em(s) em 2 system 1 system 2 Mar Vh/month 778.47 86.79 196.58	Apr 554.61 86.40 177.82	m (table 11 May 348.22 85.52) Jun 0.00 79.50	0.00	0.00	Sep 0.00 Σ(21) 79.50	1 - (20)2) x [1- (20 (202) x (20 Oct 490.39 1)15, 10 866.10 184.98	D1) = 3)] = D3) = Nov 735.35 12 = 86.73 193.18 12 =	0.00 1.00 0.00 1.00 0.00 88.80 Dec 980.84 5685.58 87.06 206.00 2226.39] (201)] (202)] (202)] (204)] (205)] (206)] (206)] (211)] (217)

central heating pump or water pump within warm air	heating unit	30.00	(230c)
boiler flue fan		45.00	(230e)
Total electricity for the above, kWh/year		7	5.00 (231)
Electricity for lighting (Appendix L)		4	10.61 (232)
Total delivered energy for all uses		(211)(221) + (231) + (232)(237b) = 83	97.58 <mark>(238)</mark>
10- Fuel and individual bacting sustains industrian			
10a. Fuel costs - individual heating systems including m		Fred radian	
	Fuel kWh/year		Fuel £/year
Space heating - main system 1	5685.58	x 3.48 x 0.01 = 19	97.86 (240)
Water heating	2226.39		7.48 (247)
Pumps and fans	75.00		9.89 (249)
Electricity for lighting	410.61	x 13.19 x 0.01 = 5	4.16 (250)
Additional standing charges			20.00 (251)
Total energy cost		(240)(242) + (245)(254) = 45	59.39 (255)
11a. SAP rating - individual heating systems including n	nicro-CHP		
Energy cost deflator (Table 12)			0.42 (256)
Energy cost factor (ECF)			1.84 (257)
SAP value		7	4.37
SAP rating (section 13)			74 (258)
SAP band			С
12a. CO ₂ emissions - individual heating systems includi	ng micro-CHP		
	Energy	Emission factor Em	issions
	kWh/year	kg CO₂/kWh kg C	O₂/year
Space heating - main system 1	5685.58	x 0.22 = 12	28.09 (261)
Water heating	2226.39	x 0.22 = 48	30.90 (<mark>264)</mark>
Space and water heating		(261) + (262) + (263) + (264) = 17	08.99 (265)
Pumps and fans	75.00	x 0.52 = 3	8.93 (267)
Electricity for lighting	410.61	x 0.52 = 22	13.11 (268)

Dwelling CO₂ emission rate El value

Total CO₂, kg/year

El rating (section 14)

EI band

13a. Primary energy - individual heating systems including micro-CHP

	Energy kWh/year		Primary factor		Primary Energy kWh/year	,
Space heating - main system 1	5685.58	x	1.22	=	6936.41	(261)
Water heating	2226.39	х	1.22	=	2716.20	(264)
Space and water heating			(261) + (262) +	(263) + (264) =	9652.61	(265)
Pumps and fans	75.00	x	3.07	=	230.25	(267)
Electricity for lighting	410.61	x	3.07	=	1260.57	(268)
Primary energy kWh/year					11143.43	(272)
Dwelling primary energy rate kWh/m2/year					185.69	(273)

(265)...(271) =

(272) ÷ (4) =

1961.02

32.68

74.98

75

С

(272)

(273)

(274)



This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

	Mrs Nicola Battista				Ass	sessor num	ber	3998		
Client	The Halebourne Gr	oup			Las	t modified		26/08	8/2014	
Address	4 The Old School Pa	ark Lane, Richm	iond, London, T	W9						
1. Overall dwelling dimen	sions									
			Area (m²)		age storey ight (m)		Vo	olume (m³)	
Lowest occupied			41.45	(1a) x		2.31	(2a) =		95.75	(3a)
+1			42.31	(1b) x		3.05	(2b) =		129.05	(3b)
Total floor area	(1a) + (1b) + (1	lc) + (1d)(1n)	= 83.76	(4)						
Dwelling volume					(3a)	+ (3b) + (3c	:) + (3d)(3	n) =	224.80	(5)
2. Ventilation rate										
								m	³ per hour	
Number of chimneys						0	x 40 =		0	(6a)
Number of open flues						0	x 20 =		0	(6b)
Number of intermittent fan	S					4	x 10 =		40	(7a)
Number of passive vents						0	x 10 =		0	(7b
						0	x 40 =		0	(7c)
Number of flueless gas fires	i					0	x 40 –		-	
Number of flueless gas fires						0	x 40 –	L	changes pe hour	
			(6a) + (6b) +	- (7a) + (7b) + (7c) =	40	÷ (5) =	Air		
nfiltration due to chimneys	s, flues, fans, PSVs	intended, proce				40		Air	hour	· · ?r
nfiltration due to chimneys f a pressurisation test has b	s, flues, fans, PSVs Deen carried out or is	intended, proce				40		Air	hour	· · ?r
nfiltration due to chimneys f a pressurisation test has b	s, flues, fans, PSVs Deen carried out or is	intended, proce				40 (16)		Air	hour	er (8) (9)
nfiltration due to chimneys f a pressurisation test has b Number of storeys in the dy	s, flues, fans, PSVs been carried out or is welling		eed to (17), oth	erwise continue		40 (16)		Air	hour 0.18	er (8) (9) (10)
nfiltration due to chimneys If a pressurisation test has b Number of storeys in the dy Additional infiltration	, flues, fans, PSVs been carried out or is welling 25 for steel or timber	frame or 0.35	eed to (17), othe	erwise continue		40 (16)		Air	hour 0.18 0.10	(9) (10) (11)
nfiltration due to chimneys If a pressurisation test has b Number of storeys in the dy Additional infiltration Structural infiltration: 0.	s, flues, fans, PSVs been carried out or is welling 25 for steel or timber ound floor, enter 0.2	frame or 0.35	eed to (17), othe	erwise continue		40 (16)		Air	hour 0.18 0.10 0.35	(8) (9) (10) (11) (11)
nfiltration due to chimneys If a pressurisation test has b Number of storeys in the dy Additional infiltration Structural infiltration: 0. If suspended wooden gr	s, flues, fans, PSVs been carried out or is welling 25 for steel or timber ound floor, enter 0.2 er 0.05, else enter 0	frame or 0.35 f (unsealed) or 0	eed to (17), othe	erwise continue	e from (9) to	40 (16)		Air	hour 0.18 0.10 0.35 0.00	(9) (10) (11) (12) (13)
nfiltration due to chimneys f a pressurisation test has b Number of storeys in the du Additional infiltration Structural infiltration: 0. If suspended wooden gr If no draught lobby, ente	s, flues, fans, PSVs been carried out or is welling 25 for steel or timber ound floor, enter 0.2 er 0.05, else enter 0	frame or 0.35 f (unsealed) or 0	eed to (17), othe	erwise continue	e from (9) to	40 (16) 2 00.00		Air	hour 0.18 0.10 0.35 0.00	(9) (10) (11) (12) (13) (14)
nfiltration due to chimneys If a pressurisation test has b Number of storeys in the dy Additional infiltration Structural infiltration: 0. If suspended wooden gr If no draught lobby, enter Percentage of windows and	s, flues, fans, PSVs been carried out or is welling 25 for steel or timber ound floor, enter 0.2 er 0.05, else enter 0	frame or 0.35 f (unsealed) or 0	eed to (17), othe	erwise continue	e from (9) to	40 (16) 2 00.00 0.25 - [0.2	÷ (5) =	Air	hour 0.18 0.10 0.35 0.00 0.00	(9) (10) (11) (12) (13) (14) (15)
nfiltration due to chimneys of a pressurisation test has be Number of storeys in the du Additional infiltration Structural infiltration: 0. If suspended wooden gr If no draught lobby, enter Percentage of windows and Window infiltration Infiltration rate	5, flues, fans, PSVs been carried out or is welling 25 for steel or timber ound floor, enter 0.2 er 0.05, else enter 0 I doors draught proof	frame or 0.35 f (unsealed) or 0 ed	eed to (17), othe for masonry co 0.1 (sealed), else	erwise continue	e from (9) to	40 (16) 2 00.00 0.25 - [0.2	÷ (5) = * x (14) ÷ 10	Air	hour 0.18 0.10 0.35 0.00 0.00 0.05	(9) (10) (11) (12) (13) (14) (15) (16)
nfiltration due to chimneys of a pressurisation test has be Number of storeys in the dw Additional infiltration Structural infiltration: 0. If suspended wooden gr If no draught lobby, enter Percentage of windows and Window infiltration Infiltration rate f based on air permeability	s, flues, fans, PSVs been carried out or is welling 25 for steel or timber ound floor, enter 0.2 er 0.05, else enter 0 I doors draught proof value, then (18) = [(1	frame or 0.35 f (unsealed) or 0 ed .7) ÷ 20] + (8), o	eed to (17), othe for masonry co 0.1 (sealed), else	erwise continue	e from (9) to	40 (16) 2 00.00 0.25 - [0.2	÷ (5) = * x (14) ÷ 10	Air	hour 0.18 0.10 0.35 0.00 0.00 0.05 0.68	(9) (10) (11) (12) (12) (13) (14) (15) (16) (18)
nfiltration due to chimneys of a pressurisation test has be Number of storeys in the dw Additional infiltration Structural infiltration: 0. If suspended wooden gr If no draught lobby, enter Percentage of windows and Window infiltration	s, flues, fans, PSVs been carried out or is welling 25 for steel or timber ound floor, enter 0.2 er 0.05, else enter 0 I doors draught proof value, then (18) = [(1	frame or 0.35 f (unsealed) or 0 ed .7) ÷ 20] + (8), o	eed to (17), othe for masonry co 0.1 (sealed), else	erwise continue	e from (9) to	40 2 00.00 0.25 - [0.2 + (11) + (12)	÷ (5) = * x (14) ÷ 10	Air	hour 0.18 0.10 0.35 0.00 0.00 0.05 0.68 0.68	(9) (10) (11) (12) (12) (13) (14) (15) (16) (16) (18) (19)
nfiltration due to chimneys If a pressurisation test has b Number of storeys in the dy Additional infiltration Structural infiltration: 0. If suspended wooden gr If no draught lobby, enter Percentage of windows and Window infiltration Infiltration rate f based on air permeability Number of sides on which t	s, flues, fans, PSVs been carried out or is welling 25 for steel or timber ound floor, enter 0.2 er 0.05, else enter 0 I doors draught proof value, then (18) = [(1 he dwelling is shelter	frame or 0.35 f (unsealed) or 0 ed .7) ÷ 20] + (8), o	eed to (17), othe for masonry co 0.1 (sealed), else	erwise continue	e from (9) to	40 2 00.00 0.25 - [0.2 + (11) + (12)	÷ (5) = - x (14) ÷ 10) + (13) + (1	Air	hour 0.18 0.10 0.35 0.00 0.00 0.00 0.00 0.05 0.68 0.68 4	er (8)
nfiltration due to chimneys If a pressurisation test has b Number of storeys in the du Additional infiltration Structural infiltration: 0. If suspended wooden gr If no draught lobby, enter Percentage of windows and Window infiltration Infiltration rate If based on air permeability Number of sides on which t	5, flues, fans, PSVs been carried out or is welling 25 for steel or timber ound floor, enter 0.2 er 0.05, else enter 0 I doors draught proof Value, then (18) = [(1 he dwelling is shelter	frame or 0.35 f (unsealed) or 0 ed .7) ÷ 20] + (8), o ed	eed to (17), othe for masonry co 0.1 (sealed), else	erwise continue	e from (9) to	40 2 00.00 0.25 - [0.2 + (11) + (12)	÷ (5) =	Air	hour 0.18 0.10 0.35 0.00 0.00 0.05 0.68 0.68 4 0.70	(9) (10) (11) (12) (12) (13) (14) (15) (16) (18) (19) (20)
nfiltration due to chimneys of a pressurisation test has be Number of storeys in the dy Additional infiltration Structural infiltration: 0. If suspended wooden gr If no draught lobby, enter Percentage of windows and Window infiltration Infiltration rate f based on air permeability Number of sides on which t Shelter factor Infiltration rate incorporation	5, flues, fans, PSVs been carried out or is welling 25 for steel or timber ound floor, enter 0.2 er 0.05, else enter 0 I doors draught proof Value, then (18) = [(1 he dwelling is shelter	frame or 0.35 f (unsealed) or 0 ed .7) ÷ 20] + (8), o ed	eed to (17), othe for masonry co 0.1 (sealed), else	erwise continue nstruction e enter 0	e from (9) to	40 2 00.00 0.25 - [0.2 + (11) + (12)	÷ (5) =	Air	hour 0.18 0.10 0.35 0.00 0.00 0.05 0.68 0.68 4 0.70	(9) (10) (11) (12) (12) (13) (14) (15) (16) (18) (19) (20)
nfiltration due to chimneys If a pressurisation test has be Number of storeys in the du Additional infiltration Structural infiltration: 0. If suspended wooden gr If no draught lobby, enter Percentage of windows and Window infiltration Infiltration rate f based on air permeability Number of sides on which t Shelter factor nfiltration rate incorporation	5, flues, fans, PSVs been carried out or is welling 25 for steel or timber ound floor, enter 0.2 er 0.05, else enter 0 I doors draught proof Value, then (18) = [(1 he dwelling is shelter ng shelter factor r monthly wind speec Feb Mar	frame or 0.35 f (unsealed) or 0 ed .7) ÷ 20] + (8), o ed	eed to (17), oth for masonry co 0.1 (sealed), else otherwise (18) =	erwise continue nstruction e enter 0	(8) + (10) -	40 (16) 2 00.00 0.25 - [0.2 + (11) + (12 1 -	÷ (5) =	Air	hour 0.18 0.10 0.35 0.00 0.00 0.00 0.00 0.05 0.68 0.68 4 0.70 0.47	(9) (10) (11) (12) (12) (13) (14) (15) (16) (18) (19) (20)
nfiltration due to chimneys f a pressurisation test has b Number of storeys in the du Additional infiltration Structural infiltration: 0. If suspended wooden gr If no draught lobby, enter Percentage of windows and Window infiltration Infiltration rate f based on air permeability Number of sides on which t Shelter factor Infiltration rate incorporation Infiltration rate modified fo	5, flues, fans, PSVs been carried out or is welling 25 for steel or timber ound floor, enter 0.2 er 0.05, else enter 0 I doors draught proof Value, then (18) = [(1 he dwelling is shelter ng shelter factor r monthly wind speec Feb Mar	frame or 0.35 f (unsealed) or 0 ed .7) ÷ 20] + (8), o ed d: Apr	eed to (17), oth for masonry co 0.1 (sealed), else otherwise (18) =	erwise continue nstruction e enter 0 = (16) Jul	(8) + (10) -	40 (16) 2 00.00 0.25 - [0.2 + (11) + (12 1 -	÷ (5) =	Air	hour 0.18 0.10 0.35 0.00 0.00 0.00 0.00 0.05 0.68 0.68 4 0.70 0.47	(9) (10) (11) (12) (13) (14) (15) (16) (16) (18) (19) (20) (21)
nfiltration due to chimneys of a pressurisation test has be Number of storeys in the due Additional infiltration Structural infiltration: 0. If suspended wooden gr If no draught lobby, enter Percentage of windows and Window infiltration Infiltration rate f based on air permeability Number of sides on which t Shelter factor nfiltration rate incorporation nfiltration rate modified for Jan Monthly average wind spee	5, flues, fans, PSVs been carried out or is welling 25 for steel or timber ound floor, enter 0.2 er 0.05, else enter 0 doors draught proof value, then (18) = [(1 he dwelling is shelter ng shelter factor r monthly wind speed Feb Mar ed from Table U2	frame or 0.35 f (unsealed) or 0 ed .7) ÷ 20] + (8), o ed d: Apr	eed to (17), othe for masonry co 0.1 (sealed), else otherwise (18) = May Jun	erwise continue nstruction e enter 0 = (16) Jul	e from (9) to	40 2 0 (16) 2 00.00 0.25 - [0.2 + (11) + (12 1 - Sep	÷ (5) = × (14) ÷ 10) + (13) + (1 [0.075 x (19 (18) x (2 Oct	Air	hour 0.18 0.10 0.35 0.00 0.00 0.05 0.68 0.68 4 0.70 0.47 Dec	(9) (10) (11) (12) (12) (13) (14) (15) (16) (18) (19) (20)

0.61	0.59 0.	.58 0.5	2 0.51	0.45	0.45	0.44	0.47	0.51	0.53	0.56	(22b)
Calculate effective air change	e rate for the a	pplicable cas	e:								
If mechanical ventilation:	air change rate	e through sys	tem							N/A	(23a)
If balanced with heat reco	overy: efficienc	y in % allowii	ng for in-use fa	ctor from T	able 4h					N/A	(23c)
d) natural ventilation or v	whole house po	sitive input v	entilation from	n loft							_
0.68	0.68 0.	.67 0.6	4 0.63	0.60	0.60	0.60	0.61	0.63	0.64	0.66	(24d)
Effective air change rate - en	iter (24a) or (24	b) or (24c) o	r (24d) in (25)		-	•	•		•		
0.68	0.68 0.	.67 0.6	4 0.63	0.60	0.60	0.60	0.61	0.63	0.64	0.66	(25)
			•	•	•	•			•	•	
3. Heat losses and heat loss	s parameter										
Element		Gross	Opening ² m ²		area	U-value W/m²K	AxUW		value, / m² K	Ахк,	
_		area, m ^a	- m-	-	m²	-		к),	/m².K	kJ/K	
Door					08 X	1.80	= 3.74				(26)
Window					.26 x	1.50	= 19.94				(27)
Ground floor					.45 ×	0.22	= 9.12	_			(28a)
Exposed floor				1.	12 ×	0.22	= 0.25	_			(28b
External wall				61	.52 x	0.30	= 18.46				(29a)
External wall				2.	89 ×	0.28	= 0.81				(29a)
Party wall				55	.58 x	0.00	= 0.00				(32)
Roof				22	.27 x	0.16	= 3.56				(30)
Roof				37	.87 x	0.18	= 6.82				(30)
Total area of external element	nts ∑A, m²			182	2.46						(31)
Fabric heat loss, W/K = ∑(A ×	: U)						(26	5)(30) + (3	32) =	62.70	(33)
Heat capacity Cm = ∑(A x κ)						(28)	.(30) + (32) +	+ (32a)(32	2e) =	N/A	(34)
Thermal mass parameter (TN	۷P) in kJ/m²K									450.00	(35)
Thermal bridges: $\Sigma(L \times \Psi)$ cal	lculated using A	ppendix K								27.37	(36)
Total fabric heat loss								(33) + (3	36) =	90.06	(37)
Jan	Feb N	lar Ap	r May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ventilation heat loss calculat	ed monthly 0.3	33 x (25)m x	(5)								
50.67	50.14 49	.63 47.2	46.74	44.63	44.63	44.24	45.44	46.74	47.66	48.62	(38)
Heat transfer coefficient, W/	′K (37)m + (38)	m									
140.73	140.21 139	9.69 137.	26 136.81	134.69	134.69	134.30	135.51	136.81	137.73	138.69	
							Average = ∑	(39)112/	/12 =	137.26	(39)
Heat loss parameter (HLP), V	V/m²K (39)m÷	(4)									
1.68	1.67 1.	.67 1.6	4 1.63	1.61	1.61	1.60	1.62	1.63	1.64	1.66	1
						•	Average = ∑	(40)112/	/12 =	1.64	(40)
Number of days in month (Ta	able 1a)								<u> </u>		
31.00	28.00 31	.00 30.0	0 31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00	(40)
					1	1				1	
4. Water heating energy re	quirement										
Assumed occupancy, N										2.53	(42)
Annual average hot water us	age in litres pe	r day Vd,avei	rage = (25 x N)	+ 36						94.30	(43)
Jan	Feb N	lar Ap	r May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per	day for each m	ionth Vd,m =	factor from Ta	ble 1c x (43	3)						
103.73	99.95 96	6.18 92.4	1 88.64	84.87	84.87	88.64	92.41	96.18	99.95	103.73	
								∑(44)1	.12 =	1131.55	(44)
Energy content of hot water	used = 4.18 x V	/d,m x nm x 1	m/3600 kWh/r	month (see	Tables 1b	, 1c 1d)					
153.82	134.53 138	8.83 121.	03 116.13	100.21	92.86	106.56	107.83	125.67	137.18	148.97	
i								∑(45)1	.12 =	1483.64	(45)

Distribution loss 0.15 x (45)m									
23.07 20.18	20.82 18.15	17.42 15.	03 13.93	15.98	16.18	18.85	20.58	22.35	(46)
Water storage loss calculated for each	n month (55) x (41)m								
0.00 0.00	0.00 0.00	0.00 0.0	0.00	0.00	0.00	0.00	0.00	0.00	(56)
If the vessel contains dedicated solar	storage or dedicated V	VWHRS (56)m x [(47) - Vs] ÷ (47),	else (56)					
0.00 0.00	0.00 0.00	0.00 0.0	0.00	0.00	0.00	0.00	0.00	0.00	(57)
Primary circuit loss for each month fr	om Table 3								
0.00 0.00	0.00 0.00	0.00 0.0	0.00	0.00	0.00	0.00	0.00	0.00	(59)
Combi loss for each month from Tabl	e 3a, 3b or 3c								
50.96 46.03	50.96 49.32	50.96 49.	32 50.96	50.96	49.32	50.96	49.32	50.96	(61)
Total heat required for water heating	calculated for each m	onth 0.85 x (45)m	ı + (46)m + (57)ı	m + (59)m +	(61)m				
204.78 180.56	189.79 170.35	167.09 149	.53 143.82	157.52	157.15	176.63	186.49	199.93	(62)
Solar DHW input calculated using App	endix G or Appendix H	ł							
0.00 0.00	0.00 0.00	0.00 0.0	00.00	0.00	0.00	0.00	0.00	0.00	(63)
Output from water heater for each m	onth (kWh/month)(6	2)m + (63)m							
204.78 180.56	189.79 170.35	167.09 149	.53 143.82	157.52	157.15	176.63	186.49	199.93	
						∑(64)11	2 = 2	083.64	(64)
Heat gains from water heating (kWh/	month) 0.25 × [0.85 ×	(45)m + (61)m] +	0.8 × [(46)m + (57)m + (59)r	m]				
63.89 56.24	58.90 52.57	51.35 45.	65 43.62	48.17	48.18	54.53	57.94	62.27	(65)
T to the second sectors									
5. Internal gains	Maria Array	No.			6	0.1	N	Dee	
Jan Feb	Mar Apr	May Ju	n Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5)				1 100 50		100 -0	100 -0	100 -0	7 (60)
126.52 126.52	126.52 126.52	126.52 126	.52 126.52	126.52	126.52	126.52	126.52	126.52	66)
Lighting gains (calculated in Appendix		, also see Table 5							_
	40.44		0.07	12.02	47.04	24.00	25 54	27.20	1071
26.46 23.50	19.11 14.47	10.82 9.1		12.83	17.21	21.86	25.51	27.20	(67)
Appliance gains (calculated in Append	lix L, equation L13 or L	13a), also see Tab	le 5					1	- · ·
Appliance gains (calculated in Append 227.12 229.48	lix L, equation L13 or L 223.54 210.89	13a), also see Tab 194.93 179	le 5 .93 169.91	12.83 167.56	17.21 173.49	21.86 186.14	25.51 202.10	27.20 217.10	(67) (68)
Appliance gains (calculated in Appendix 227.12 229.48 Cooking gains (calculated in Appendix	lix L, equation L13 or L 223.54 210.89 (L, equation L15 or L1)	13a), also see Tab 194.93 179 5a), also see Table	le 5 .93 169.91 5	167.56	173.49	186.14	202.10	217.10] (68)
Appliance gains (calculated in Append 227.12 229.48 Cooking gains (calculated in Appendix 35.65 35.65	lix L, equation L13 or L 223.54 210.89	13a), also see Tab 194.93 179	le 5 .93 169.91 5					1	- · ·
Appliance gains (calculated in Appendi 227.12 229.48 Cooking gains (calculated in Appendia 35.65 35.65 Pump and fan gains (Table 5a)	lix L, equation L13 or L 223.54 210.89 (L, equation L15 or L1) 35.65 35.65	13a), also see Tab 194.93 179 5a), also see Table 35.65 35.	le 5 .93 169.91 5 65 35.65	167.56 35.65	173.49 35.65	186.14 35.65	202.10 35.65	217.10 35.65] (68)] (69)
Appliance gains (calculated in Appendia 227.12 229.48 Cooking gains (calculated in Appendia 35.65 35.65 Pump and fan gains (Table 5a) 3.00 3.00	lix L, equation L13 or L 223.54 210.89 (L, equation L15 or L1)	13a), also see Tab 194.93 179 5a), also see Table	le 5 .93 169.91 5 65 35.65	167.56	173.49	186.14	202.10	217.10] (68)
Appliance gains (calculated in Appendia 227.12 229.48 Cooking gains (calculated in Appendia 35.65 35.65 Pump and fan gains (Table 5a) 3.00 3.00 Losses e.g. evaporation (Table 5)	Jix L, equation L13 or L 223.54 210.89 4 L, equation L15 or L15 35.65 35.65 3.00 3.00	13a), also see Tab 194.93 179 5a), also see Table 35.65 35. 3.00 3.0	le 5 .93 169.91 5 65 35.65 00 3.00	167.56 35.65 3.00	173.49 35.65 3.00	186.14 35.65 3.00	202.10 35.65 3.00	217.10 35.65 3.00] (68)] (69)] (70)
Appliance gains (calculated in Appendia 227.12 229.48 Cooking gains (calculated in Appendia 35.65 35.65 Pump and fan gains (Table 5a) 3.00 3.00 Losses e.g. evaporation (Table 5) -101.21 -101.21	lix L, equation L13 or L 223.54 210.89 (L, equation L15 or L1) 35.65 35.65	13a), also see Tab 194.93 179 5a), also see Table 35.65 35.	le 5 .93 169.91 5 65 35.65 00 3.00	167.56 35.65	173.49 35.65	186.14 35.65	202.10 35.65	217.10 35.65] (68)] (69)
Appliance gains (calculated in Appendia 227.12 229.48 Cooking gains (calculated in Appendia 35.65 35.65 Pump and fan gains (Table 5a) 3.00 3.00 Losses e.g. evaporation (Table 5) -101.21 -101.21 Water heating gains (Table 5)	Jix L, equation L13 or L 223.54 210.89 4 L, equation L15 or L15 35.65 35.65 3.00 3.00 -101.21 -101.21	13a), also see Tab 194.93 179 5a), also see Table 35.65 35. 3.00 3.0 -101.21 -101	le 5 .93 169.91 5 65 35.65 00 3.00 .21 -101.21	167.56 35.65 3.00 -101.21	173.49 35.65 3.00 -101.21	186.14 35.65 3.00 -101.21	202.10 35.65 3.00 -101.21	217.10 35.65 3.00 -101.21] (68)] (69)] (70)] (71)
Appliance gains (calculated in Appendiate)227.12229.48Cooking gains (calculated in Appendiate)35.6535.6535.65Pump and fan gains (Table 5a)3.003.003.00Losses e.g. evaporation (Table 5)-101.21-101.21Water heating gains (Table 5)85.8783.69	ix L, equation L13 or L 223.54 210.89 x L, equation L15 or L13 35.65 35.65 3.00 3.00 -101.21 -101.21 79.17 73.02	13a), also see Table 194.93 179 5a), also see Table 35.65 35. 3.00 3.0 -101.21 -101 69.02 63.	le 5 .93 169.91 5 65 35.65 00 3.00 .21 -101.21	167.56 35.65 3.00	173.49 35.65 3.00	186.14 35.65 3.00	202.10 35.65 3.00	217.10 35.65 3.00] (68)] (69)] (70)
Appliance gains (calculated in Appendia 227.12 229.48 Cooking gains (calculated in Appendia 35.65 35.65 Pump and fan gains (Table 5a) 3.00 3.00 Losses e.g. evaporation (Table 5) -101.21 -101.21 Water heating gains (Table 5) 85.87 83.69 Total internal gains (66)m + (67)m + 1	dix L, equation L13 or L 223.54 210.89 x L, equation L15 or L15 35.65 35.65 3.00 3.00 -101.21 -101.21 79.17 73.02 68)m + (69)m + (70)m	13a), also see Tab 194.93 179 5a), also see Table 35.65 35. 3.00 3.0 -101.21 -101 69.02 63. + (71)m + (72)m	le 5 .93 169.91 5 65 35.65 00 3.00 .21 -101.21 40 58.62	167.56 35.65 3.00 -101.21 64.75	173.49 35.65 3.00 -101.21 66.92	186.14 35.65 3.00 -101.21 73.29	202.10 35.65 3.00 -101.21 80.47	217.10 35.65 3.00 -101.21 83.70] (68)] (69)] (70)] (71)] (72)
Appliance gains (calculated in Appendiate)227.12229.48Cooking gains (calculated in Appendiate)35.6535.6535.65Pump and fan gains (Table 5a)3.003.003.00Losses e.g. evaporation (Table 5)-101.21-101.21Water heating gains (Table 5)85.8783.69	ix L, equation L13 or L 223.54 210.89 x L, equation L15 or L13 35.65 35.65 3.00 3.00 -101.21 -101.21 79.17 73.02	13a), also see Table 194.93 179 5a), also see Table 35.65 35. 3.00 3.0 -101.21 -101 69.02 63.	le 5 .93 169.91 5 65 35.65 00 3.00 .21 -101.21 40 58.62	167.56 35.65 3.00 -101.21	173.49 35.65 3.00 -101.21	186.14 35.65 3.00 -101.21	202.10 35.65 3.00 -101.21	217.10 35.65 3.00 -101.21] (68)] (69)] (70)] (71)
Appliance gains (calculated in Appendia 227.12 229.48 Cooking gains (calculated in Appendia 35.65 35.65 Pump and fan gains (Table 5a) 3.00 3.00 Losses e.g. evaporation (Table 5) -101.21 -101.21 Water heating gains (Table 5) 85.87 83.69 Total internal gains (66)m + (67)m + 1	dix L, equation L13 or L 223.54 210.89 x L, equation L15 or L15 35.65 35.65 3.00 3.00 -101.21 -101.21 79.17 73.02 68)m + (69)m + (70)m	13a), also see Tab 194.93 179 5a), also see Table 35.65 35. 3.00 3.0 -101.21 -101 69.02 63. + (71)m + (72)m	le 5 .93 169.91 5 65 35.65 00 3.00 .21 -101.21 40 58.62	167.56 35.65 3.00 -101.21 64.75	173.49 35.65 3.00 -101.21 66.92	186.14 35.65 3.00 -101.21 73.29	202.10 35.65 3.00 -101.21 80.47	217.10 35.65 3.00 -101.21 83.70] (68)] (69)] (70)] (71)] (72)
Appliance gains (calculated in Appendia 227.12 229.48 Cooking gains (calculated in Appendia 35.65 35.65 Pump and fan gains (Table 5a) 3.00 3.00 Losses e.g. evaporation (Table 5) -101.21 -101.21 Water heating gains (Table 5) 85.87 83.69 Total internal gains (66)m + (67)m + (67)m + (67)m + (67)m + (67)m + (70) + (7	dix L, equation L13 or L 223.54 210.89 x L, equation L15 or L15 35.65 35.65 3.00 3.00 -101.21 -101.21 79.17 73.02 68)m + (69)m + (70)m	13a), also see Tab 194.93 179 5a), also see Table 35.65 35. 3.00 3.0 -101.21 -101 69.02 63. + (71)m + (72)m	le 5 .93 169.91 5 65 35.65 00 3.00 .21 -101.21 40 58.62	167.56 35.65 3.00 -101.21 64.75 309.08	173.49 35.65 3.00 -101.21 66.92	186.14 35.65 3.00 -101.21 73.29	202.10 35.65 3.00 -101.21 80.47	217.10 35.65 3.00 -101.21 83.70] (68)] (69)] (70)] (71)] (72)
Appliance gains (calculated in Appendia 227.12 229.48 Cooking gains (calculated in Appendia 35.65 35.65 Pump and fan gains (Table 5a) 3.00 3.00 Losses e.g. evaporation (Table 5) -101.21 -101.21 Water heating gains (Table 5) 85.87 83.69 Total internal gains (66)m + (67)m + (67)m + (67)m + (67)m + (67)m + (70) + (7	dix L, equation L13 or L 223.54 210.89 2.23.54 210.89 3.00 1.5 or L15 35.65 35.65 3.00 3.00 -101.21 -101.21 79.17 73.02 68)m + (69)m + (70)m 385.77 385.77 362.34	13a), also see Tab 194.93 179 5a), also see Table 35.65 35. 3.00 3.0 -101.21 -101 69.02 63. + (71)m + (72)m 338.73 316	le 5 .93 169.91 5 65 35.65 00 3.00 .21 -101.21 40 58.62 .42 302.36	167.56 35.65 3.00 -101.21 64.75 309.08	173.49 35.65 3.00 -101.21 66.92 321.59 g fic data	186.14 35.65 3.00 -101.21 73.29 345.24 FF specific da	202.10 35.65 3.00 -101.21 80.47 372.04	217.10 35.65 3.00 -101.21 83.70 391.95] (68)] (69)] (70)] (71)] (72)
Appliance gains (calculated in Appendia 227.12 229.48 Cooking gains (calculated in Appendia 35.65 35.65 Pump and fan gains (Table 5a) 3.00 3.00 Losses e.g. evaporation (Table 5) -101.21 -101.21 Water heating gains (Table 5) 85.87 83.69 Total internal gains (66)m + (67)m + 1 403.40 400.62 6. Solar gains	dix L, equation L13 or L 223.54 210.89 2.23.54 210.89 3.00 1.5 or L15 35.65 35.65 3.00 3.00 -101.21 -101.21 79.17 73.02 68)m + (69)m + (70)m 385.77 385.77 362.34	13a), also see Tab 194.93 179 5a), also see Table 35.65 35. 3.00 3.0 -101.21 -101 69.02 63. + (71)m + (72)m 338.73 316 Area m ²	le 5 .93 169.91 5 65 35.65 00 3.00 .21 -101.21 40 58.62 .42 302.36 Solar flux W/m ²	167.56 35.65 3.00 -101.21 64.75 309.08 specif or Ta	173.49 35.65 3.00 -101.21 66.92 321.59 g fic data able 6b	186.14 35.65 3.00 -101.21 73.29 345.24 FF specific da or Table	202.10 35.65 3.00 -101.21 80.47 372.04	217.10 35.65 3.00 -101.21 83.70 391.95 Gains W] (68)] (69)] (70)] (71)] (72)] (73)
Appliance gains (calculated in Appendia 227.12 229.48 Cooking gains (calculated in Appendia 35.65 35.65 Pump and fan gains (Table 5a) 3.00 3.00 Losses e.g. evaporation (Table 5) -101.21 -101.21 Water heating gains (Table 5) 85.87 83.69 Total internal gains (66)m + (67)m + (403.40 400.62 6. Solar gains South	iix L, equation L13 or L 223.54 210.89 x L, equation L15 or L13 35.65 35.65 3.00 3.00 -101.21 -101.21 79.17 73.02 68)m + (69)m + (70)m 385.77 385.77 362.34 Access factor Table 6d 0.77 x	13a), also see Table 194.93 179 5a), also see Table 35.65 35. 3.00 3.0 -101.21 -101 69.02 63. + (71)m + (72)m 338.73 316 Area m² 5.16 x	le 5 .93 169.91 5 65 35.65 00 3.00 .21 -101.21 40 58.62 .42 302.36 Solar flux W/m ² 46.75 x	167.56 35.65 3.00 -101.21 64.75 309.08 \$pecif or Ta 0.9 x 0	173.49 35.65 3.00 -101.21 66.92 321.59 g fic data able 6b .72 x	186.14 35.65 3.00 -101.21 73.29 345.24 FF specific da or Table 0.70	202.10 35.65 3.00 -101.21 80.47 372.04	217.10 35.65 3.00 -101.21 83.70 391.95 Gains W 100.59] (68)] (69)] (70)] (71)] (72)] (73)] (78)
Appliance gains (calculated in Appendia 227.12 229.48 Cooking gains (calculated in Appendia 35.65 35.65 Pump and fan gains (Table 5a) 3.00 3.00 Losses e.g. evaporation (Table 5) -101.21 -101.21 Water heating gains (Table 5) 85.87 83.69 Total internal gains (66)m + (67)m + 0 403.40 400.62 6. Solar gains South West	dix L, equation L13 or L 223.54 210.89 2.23.54 210.89 3.00 1.5 or L15 35.65 35.65 3.00 3.00 -101.21 -101.21 79.17 73.02 68)m + (69)m + (70)m 385.77 385.77 362.34	13a), also see Tab 194.93 179 5a), also see Table 35.65 35. 3.00 3.0 -101.21 -101 69.02 63. + (71)m + (72)m 338.73 316 Area m ²	le 5 .93 169.91 5 65 35.65 00 3.00 .21 -101.21 40 58.62 .42 302.36 Solar flux W/m ² 46.75 x	167.56 35.65 3.00 -101.21 64.75 309.08 \$pecif or Ta 0.9 x 0	173.49 35.65 3.00 -101.21 66.92 321.59 g fic data able 6b	186.14 35.65 3.00 -101.21 73.29 345.24 FF specific da or Table 0.70	202.10 35.65 3.00 -101.21 80.47 372.04	217.10 35.65 3.00 -101.21 83.70 391.95 Gains W] (68)] (69)] (70)] (71)] (72)] (73)
Appliance gains (calculated in Appendiate cooking gains (Table 5a) 35.65 35.65 Pump and fan gains (Table 5a) 3.00 3.00 Losses e.g. evaporation (Table 5) -101.21 -101.21 Water heating gains (Table 5) 85.87 83.69 Total internal gains (66)m + (67)m	ix L, equation L13 or L ix L, equation L13 or L13 223.54 210.89 x L, equation L15 or L13 35.65 35.65 3.00 3.00 -101.21 -101.21 79.17 73.02 68)m + (69)m + (70)m 385.77 362.34 Access factor Table 6d 0.77 x 0.77 x	13a), also see Table 194.93 179 5a), also see Table 35.65 35. 3.00 3.0 -101.21 -101 69.02 63. + (71)m + (72)m 338.73 316 Area m² 6.16 x x 7.10 x x	le 5 .93 169.91 5 65 35.65 00 3.00 .21 -101.21 40 58.62 .42 302.36 Solar flux W/m ² 46.75 x 19.64 x	167.56 35.65 3.00 -101.21 64.75 309.08 specifion 0.9 x 0 0.9 x 0 0.9 x 0	173.49 35.65 3.00 -101.21 66.92 321.59 g fic data able 6b .72 x .72 x	186.14 35.65 3.00 -101.21 73.29 345.24 FF specific da or Table 0.70 0.70	202.10 35.65 3.00 -101.21 80.47 372.04 ata 6c = [] = []	217.10 35.65 3.00 -101.21 83.70 391.95 Gains W 100.59 48.70] (68)] (69)] (70)] (71)] (72)] (73)] (78)] (80)
Appliance gains (calculated in Appendia 227.12 229.48 Cooking gains (calculated in Appendia 35.65 35.65 Pump and fan gains (Table 5a) 3.00 3.00 Losses e.g. evaporation (Table 5) -101.21 -101.21 Water heating gains (Table 5) 85.87 83.69 Total internal gains (66)m + (67)m + 0 403.40 400.62 6. Solar gains South West Solar gains in watts Σ (74)m(82)m 149.29 260.01	Jix L, equation L13 or L13 223.54 210.89 223.54 210.89 35.65 35.65 35.65 35.65 3.00 3.00 -101.21 -101.21 79.17 73.02 68)m + (69)m + (70)m 385.77 362.34 Access factor Table 6d 0.77 x 0.77 x 366.75 466.01	13a), also see Table 194.93 179 5a), also see Table 35.65 35. 3.00 3.0 -101.21 -101 69.02 63. + (71)m + (72)m 338.73 316 Area m² 5.16 x	le 5 .93 169.91 5 65 35.65 00 3.00 .21 -101.21 40 58.62 .42 302.36 Solar flux W/m ² 46.75 x 19.64 x	167.56 35.65 3.00 -101.21 64.75 309.08 \$pecif or Ta 0.9 x 0	173.49 35.65 3.00 -101.21 66.92 321.59 g fic data able 6b .72 x	186.14 35.65 3.00 -101.21 73.29 345.24 FF specific da or Table 0.70	202.10 35.65 3.00 -101.21 80.47 372.04	217.10 35.65 3.00 -101.21 83.70 391.95 Gains W 100.59] (68)] (69)] (70)] (71)] (72)] (73)] (78)
Appliance gains (calculated in Appendiate cooking gains (calculated in Appendiate coo	Jix L, equation L13 or L13 223.54 210.89 223.54 210.89 35.65 35.65 35.65 35.65 3.00 3.00 -101.21 -101.21 79.17 73.02 68)m + (69)m + (70)m 385.77 362.34 Access factor Table 6d 0.77 x 0.77 x 366.75 466.01	13a), also see Table 194.93 179 5a), also see Table 35.65 35. 3.00 3.0 -101.21 -101 69.02 63. + (71)m + (72)m 338.73 316 Area m² 6.16 x x 7.10 x x	le 5 .93 169.91 5 65 35.65 00 3.00 .21 -101.21 40 58.62 .42 302.36 Solar flux W/m ² 46.75 x 19.64 x .94 505.71	167.56 35.65 3.00 -101.21 64.75 309.08 specifion 0.9 x 0 0.9 x 0 0.9 x 0	173.49 35.65 3.00 -101.21 66.92 321.59 g fic data able 6b .72 x .72 x	186.14 35.65 3.00 -101.21 73.29 345.24 FF specific da or Table 0.70 0.70	202.10 35.65 3.00 -101.21 80.47 372.04 ata 6c = [] = []	217.10 35.65 3.00 -101.21 83.70 391.95 Gains W 100.59 48.70] (68)] (69)] (70)] (71)] (72)] (73)] (78)] (80)

7. Mean inter	nal tempera	iture (heati	ng season)										
Temperature d	uring heatin	g periods ir	the living	area from T	Table 9, Th1	.(°C)						21.00	(85)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation fact	or for gains f	for living are	ea n1,m (se	e Table 9a)	1								
	1.00	1.00	1.00	0.99	0.97	0.87	0.70	0.75	0.94	1.00	1.00	1.00	(86)
Mean internal	temp of livir	ng area T1 (s	steps 3 to 7	in Table 90	c)								
	19.83	19.96	20.17	20.45	20.72	20.92	20.98	20.97	20.84	20.49	20.11	19.82	(87)
Temperature d	uring heatin	g periods ir	n the rest of	f dwelling f	rom Table 9	∋ <i>,</i> Th2(°C)							
	19.56	19.56	19.56	19.59	19.59	19.61	19.61	19.61	19.60	19.59	19.58	19.57	(88)
Utilisation fact	or for gains f	for rest of d	welling n2,	m									
	1.00	1.00	1.00	0.99	0.93	0.75	0.50	0.55	0.87	0.99	1.00	1.00	(89)
Mean internal	temperature	e in the rest	of dwelling	g T2 (follow	steps 3 to	7 in Table 9	9c)						
	18.52	18.65	18.87	19.16	19.41	19.58	19.61	19.61	19.53	19.20	18.82	18.52	(90)
Living area frac	tion								Li	ving area ÷	(4) =	0.45	(91)
Mean internal	temperature	e for the wh	ole dwellin	g fLA x T1 +	+(1 - fLA) x T	Т2							
	19.11	19.24	19.46	19.74	20.00	20.18	20.23	20.22	20.12	19.78	19.40	19.11	(92)
Apply adjustme	ent to the m	ean interna	l temperat	ure from Ta	able 4e whe	ere appropi	riate						
	19.11	19.24	19.46	19.74	20.00	20.18	20.23	20.22	20.12	19.78	19.40	19.11	(93)
							_						
8. Space heat										_			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation fact	_	1	1	1	_			_		T	1	1	.
	1.00	1.00	1.00	0.99	0.95	0.81	0.59	0.65	0.91	0.99	1.00	1.00	(94)
Useful gains, η			1							1	1	1	т
	552.55	660.06	750.24	817.80	820.19	679.82	479.61	498.77	655.33	630.99	551.59	518.82	(95)
Monthly avera	-		1					1		1	1		7
	4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)
Heat loss rate f								1		1	1	1	т
		2011.18					488.45	513.50	815.24	1255.70	1694.51	2067.72	(97)
Space heating	-	1						1		1	1	1	Т
	1139.92	907.95	788.23	482.90	234.69	0.00	0.00	0.00	0.00	464.78	822.91	1152.38]
									∑(9)	8)15, 10		5993.76	_ (98) □
Space heating	requirement	: kWh/m²/y	ear							(98)	÷ (4)	71.56	(99)
9a. Energy ree	quirements	- individual	heating sy	stems inclu	iding micro	-CHP							
Space heating													
Fraction of spa	ce heat from	n secondary	/suppleme	ntary syste	m (table 11	.)						0.00	(201)
Fraction of spa	ce heat from	n main syste	em(s)							1 - (20	01) =	1.00	(202)
Fraction of spa	ce heat from	n main syste	em 2									0.00	(202)
Fraction of tota	al space heat	t from main	system 1						(20	02) x [1- (20	3)] =	1.00	(204)
Fraction of tota	al space heat	t from main	system 2							(202) x (20	03) =	0.00	(205)
Efficiency of m												88.80	(206)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	_ `
Space heating	fuel (main sy	vstem 1), kV	Vh/month										
	1283.69	1022.47	887.65	543.81	264.29	0.00	0.00	0.00	0.00	523.40	926.70	1297.73]
									∑(21	1)15, 10	.12 = 6	5749.73	_] (211)

Water heating

Efficiency of water heater

	07.05	07.11	06.00	06 17	04.00	70.50	70 50	70.50	70.50	86.02	00.00	07.20	(217)
Water heating f	87.25	87.11	86.83	86.17	84.68	79.50	79.50	79.50	79.50	86.03	86.92	87.29	(217)
water neating i	234.72	207.28	218.57	197.68	197.32	188.09	180.91	198.14	197.67	205.31	214.56	229.04	7
	254.72	207.28	216.57	197.08	197.52	100.09	160.91	196.14	197.07	<u>Σ(219a)1</u>	·	2469.29	(219)
Annual totals										2(2198)1	.12	2409.29	_ (219)
Space heating fu	uel - main sv	vstem 1										6749.73	7
Water heating f		Stell I										2469.29	
Electricity for pu		nd electric	keep-hot (Table 4f)								2105.25	
central heati					iting unit				30.00	1			(230c)
boiler flue fa					U				45.00]			(230e)
Total electricity	for the abo	ve, kWh/ye	ar							_		75.00	(231)
Electricity for lig	ghting (Appe	endix L)										467.31	(232)
Total delivered	energy for a	ll uses						(211)(221	l) + (231) +	(232)(23	7b) =	9761.33	(238)
									_				_
10a. Fuel costs	s - individua	I heating sy	stems inclu	uding micro	o-CHP								
					k	Fuel Wh/year		Fu	iel price		co	Fuel ost £/year	
Space heating -	main systen	n 1				6749.73	x		3.48	x 0.01		234.89	(240)
Water heating						2469.29	x		3.48	x 0.01		85.93	(247)
Pumps and fans	;					75.00	x		13.19	x 0.01	=	9.89	(249)
Electricity for lig						467.31	x		13.19	x 0.01	=	61.64	(250)
Additional stand	ding charges	;								-		120.00	(251)
Total energy cos	st							(24	40)(242)	+ (245)(2	54) =	512.35	(255)
11a. SAP rating	-		ystems incl	uding micr	о-СНР								
Energy cost defl		12)										0.42	(256)
Energy cost fact	or (ECF)											1.67	_ (257) _
SAP value SAP rating (sect	ion 12)											76.69	(258)
SAP band	1011 13)											 С	_ (256) _
SAF Danu												C	
12a. CO ₂ emiss	sions - indiv	idual heatir	ng systems	including r	nicro-CHP								
						Energy Wh/year			sion factor CO₂/kWh			missions ; CO₂/year	
Space heating -	main systen	n 1				6749.73] x		0.22] =		1457.94	(261)
Water heating						2469.29] x		0.22] =		533.37	(264)
Space and wate	r heating							(26	1) + (262) -	+ (263) + (2	64) =	1991.31	(265)
Pumps and fans	;					75.00] x		0.52] =		38.93	(267)
Electricity for lig	ghting					467.31] x		0.52] =		242.53	(268)
Total CO₂, kg/ye	ear									(265)(2 ⁻	71) =	2272.77	(272)
Dwelling CO ₂ en	nission rate									(272) ÷	(4) =	27.13	(273)
EI value												76.35	
El rating (section	n 14)											76	(274)
EI band												С	
13a. Primary e	noray indi	vidual boat	ing system	s including	micro CH	D							
13a. Finnary e	incry - inui	Hada neat	mg system	3-meruumg	micro-cn								

	Energy kWh/year		Primary factor		Primary Energy kWh/year		
Space heating - main system 1	6749.73) x	1.22	=	8234.67 (261)		
Water heating	2469.29	x	1.22	=	3012.53 (264)		

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Space and water heating			(261) + (262) +	(263) + (264) =	11247.20	(265)
Pumps and fans	75.00	х	3.07	=	230.25	(267)
Electricity for lighting	467.31	х	3.07	=	1434.64	(268)
Primary energy kWh/year					12912.09	(272)
Dwelling primary energy rate kWh/m2/year					154.16	(273)



This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mrs Nicola Battista				As	sessor num	ber	3998		
Client	The Halebourne Gr	oup			Las	t modified		26/08	3/2014	
Address	5 The Old School Pa	ark Lane, Richm	ond, London,	TW9						
1. Overall dwelling dimen	sions									
			Area (m	2)		age storey ight (m)		Vo	olume (m³)	
Lowest occupied			52.75	(1a) x		2.31	(2a) =		121.85	(3a)
+1			36.54	(1b) x		2.11	(2b) =		77.10	(3b)
Total floor area	(1a) + (1b) + (1	Lc) + (1d)(1n)	= 89.29	(4)						
Dwelling volume					(3a)	+ (3b) + (3c) + (3d)(3	8n) =	198.95	(5)
2. Ventilation rate						/				
								m	³ per hour	
Number of chimneys						0	x 40 =		0	(6a)
Number of open flues						0	x 20 =		0	(6b
Number of intermittent fan	S					4	x 10 =		40	(7a)
Number of passive vents						0	x 10 =		0	(7 b
									-	
Number of flueless gas fires	5					0	x 40 =		0	(7c)
Number of flueless gas fires	5					0	x 40 =		0 changes pe hour	
-			(6a) + (6b)	+ (7a) + (7b) + (7c) =	0	x 40 = ÷ (5) =	Air	changes pe	
nfiltration due to chimney	s, flues, fans, PSVs	intended, proce				40		Air	changes pe hour	er
nfiltration due to chimneys f a pressurisation test has i	s, flues, fans, PSVs been carried out or is	intended, proce				40		Air	changes pe hour	er
nfiltration due to chimneys f a pressurisation test has i	s, flues, fans, PSVs been carried out or is	intended, proce				40 (16)		Air	changes pe hour	er (8) (9)
nfiltration due to chimneys f a pressurisation test has a Number of storeys in the de	s, flues, fans, PSVs been carried out or is welling		eed to (17), oti	nerwise continu		40 (16)		Air	changes pe hour 0.20	er (8) (9) (10)
nfiltration due to chimneys of a pressurisation test has Number of storeys in the de Additional infiltration	s, flues, fans, PSVs been carried out or is welling 25 for steel or timber	frame or 0.35	eed to (17), oth	nerwise continu		40 (16)		Air	changes pe hour 0.20 0.10	er (8) (9) (10) (11)
nfiltration due to chimneys If a pressurisation test has a Number of storeys in the de Additional infiltration Structural infiltration: 0.	s, flues, fans, PSVs been carried out or is welling 25 for steel or timber ound floor, enter 0.2	frame or 0.35	eed to (17), oth	nerwise continu		40 (16)		Air	changes per hour 0.20 0.10 0.35	(8) (9) (10) (11) (11)
nfiltration due to chimneys If a pressurisation test has a Number of storeys in the de Additional infiltration Structural infiltration: 0. If suspended wooden gr If no draught lobby, ent	s, flues, fans, PSVs been carried out or is welling 25 for steel or timber ound floor, enter 0.2 er 0.05, else enter 0	frame or 0.35 f (unsealed) or 0	eed to (17), oth	nerwise continu	e from (9) to	40 (16)		Air	changes per hour 0.20 0.10 0.35 0.00	(9) (10) (11) (12) (13)
nfiltration due to chimneys If a pressurisation test has a Number of storeys in the de Additional infiltration Structural infiltration: 0. If suspended wooden gr If no draught lobby, ent	s, flues, fans, PSVs been carried out or is welling 25 for steel or timber ound floor, enter 0.2 er 0.05, else enter 0	frame or 0.35 f (unsealed) or 0	eed to (17), oth	nerwise continu	e from (9) to	40 (16) 2	÷ (5) =	Air	changes per hour 0.20 0.10 0.35 0.00	(9) (10) (11) (12) (13) (14)
nfiltration due to chimneys If a pressurisation test has a Number of storeys in the de Additional infiltration Structural infiltration: 0. If suspended wooden gr If no draught lobby, ente Percentage of windows and	s, flues, fans, PSVs been carried out or is welling 25 for steel or timber ound floor, enter 0.2 er 0.05, else enter 0	frame or 0.35 f (unsealed) or 0	eed to (17), oth	nerwise continu	e from (9) to	40 (16) 2 .00.00	÷ (5) = x (14) ÷ 10	Air	changes per hour 0.20 0.10 0.35 0.00 0.05	(9) (10) (11) (12) (13) (14) (15)
nfiltration due to chimneys of a pressurisation test has Number of storeys in the de Additional infiltration Structural infiltration: 0. If suspended wooden gr If no draught lobby, ente Percentage of windows and Window infiltration Infiltration rate	s, flues, fans, PSVs been carried out or is welling 25 for steel or timber ound floor, enter 0.2 er 0.05, else enter 0 I doors draught proof	frame or 0.35 f (unsealed) or 0 ed	eed to (17), oth	onstruction	e from (9) to	40 (16) 2 00.00 0.25 - [0.2	÷ (5) = x (14) ÷ 10	Air	changes per hour 0.20 0.10 0.35 0.00 0.05	(9) (10) (11) (12) (13) (14) (15) (16)
nfiltration due to chimneys of a pressurisation test has a Number of storeys in the de Additional infiltration Structural infiltration: 0. If suspended wooden gr If no draught lobby, ent Percentage of windows and Window infiltration Infiltration rate f based on air permeability	s, flues, fans, PSVs been carried out or is welling 25 for steel or timber ound floor, enter 0.2 er 0.05, else enter 0 I doors draught proof	frame or 0.35 f (unsealed) or 0 ed .7) ÷ 20] + (8), o	eed to (17), oth	onstruction	e from (9) to	40 (16) 2 00.00 0.25 - [0.2	÷ (5) = x (14) ÷ 10	Air	changes per hour 0.20 0.10 0.35 0.00 0.05 0.05 0.75	(9) (10) (11) (12) (13) (14) (15) (16) (18)
Structural infiltration: 0. If suspended wooden gr If no draught lobby, ent Percentage of windows and Window infiltration	s, flues, fans, PSVs been carried out or is welling 25 for steel or timber ound floor, enter 0.2 er 0.05, else enter 0 I doors draught proof	frame or 0.35 f (unsealed) or 0 ed .7) ÷ 20] + (8), o	eed to (17), oth	onstruction	e from (9) to	40 (16) 2 0.00.00 0.25 - [0.2 + (11) + (12)	÷ (5) = x (14) ÷ 10	Air	changes per hour 0.20 0.10 0.35 0.00 0.05 0.75 0.75	(9) (10) (11) (12) (12) (13) (14) (15) (16) (16) (18) (19)
nfiltration due to chimneys If a pressurisation test has a Number of storeys in the de Additional infiltration Structural infiltration: 0. If suspended wooden gr If no draught lobby, ent Percentage of windows and Window infiltration Infiltration rate f based on air permeability Number of sides on which t	s, flues, fans, PSVs been carried out or is welling 25 for steel or timber ound floor, enter 0.2 er 0.05, else enter 0 I doors draught proof	frame or 0.35 f (unsealed) or 0 ed .7) ÷ 20] + (8), o	eed to (17), oth	onstruction	e from (9) to	40 (16) 2 0.00.00 0.25 - [0.2 + (11) + (12)	÷ (5) = x (14) ÷ 10) + (13) + (1	Air	changes per hour 0.20 0.10 0.35 0.00 0.05 0.75 0.75 4	(8)
Infiltration due to chimneys of a pressurisation test has a Number of storeys in the de Additional infiltration Structural infiltration: 0. If suspended wooden gr If no draught lobby, ente Percentage of windows and Window infiltration Infiltration rate f based on air permeability Number of sides on which to Shelter factor	s, flues, fans, PSVs been carried out or is welling 25 for steel or timber ound floor, enter 0.2 er 0.05, else enter 0 doors draught proof	frame or 0.35 f (unsealed) or 0 ed .7) ÷ 20] + (8), o ed	eed to (17), oth	onstruction	e from (9) to	40 (16) 2 0.00.00 0.25 - [0.2 + (11) + (12)	÷ (5) = x (14) ÷ 10) + (13) + (1 [0.075 x (19	Air	changes per hour 0.20 0.10 0.35 0.00 0.05 0.75 0.75 4 0.70	(9) (10) (11) (12) (12) (13) (14) (15) (16) (18) (18) (19) (20)
nfiltration due to chimneys of a pressurisation test has a Number of storeys in the de Additional infiltration Structural infiltration: 0. If suspended wooden gr If no draught lobby, ente Percentage of windows and Window infiltration Infiltration rate f based on air permeability Number of sides on which to Shelter factor Infiltration rate incorporati	s, flues, fans, PSVs been carried out or is welling 25 for steel or timber ound floor, enter 0.2 er 0.05, else enter 0 doors draught proof	frame or 0.35 f (unsealed) or 0 ed .7) ÷ 20] + (8), o ed	eed to (17), oth	perwise continue onstruction se enter 0 = (16)	e from (9) to	40 (16) 2 0.00.00 0.25 - [0.2 + (11) + (12)	÷ (5) = x (14) ÷ 10) + (13) + (1 [0.075 x (19	Air	changes per hour 0.20 0.10 0.35 0.00 0.05 0.75 0.75 4 0.70	(9) (10) (11) (12) (12) (13) (14) (15) (16) (18) (18) (19) (20)
nfiltration due to chimneys If a pressurisation test has a Number of storeys in the de Additional infiltration Structural infiltration: 0. If suspended wooden gr If no draught lobby, ente Percentage of windows and Window infiltration Infiltration rate f based on air permeability Number of sides on which to Shelter factor Infiltration rate incorporation	s, flues, fans, PSVs been carried out or is welling 25 for steel or timber round floor, enter 0.2 er 0.05, else enter 0 doors draught proof value, then (18) = [(1 the dwelling is shelter ing shelter factor r monthly wind speed Feb Mar	frame or 0.35 f (unsealed) or 0 ed .7) ÷ 20] + (8), o ed	eed to (17), oth	perwise continue onstruction se enter 0 = (16)	(8) + (10)	40 (16) 2 .00.00 0.25 - [0.2 + (11) + (12) 1 -	÷ (5) = x (14) ÷ 10) + (13) + (1 [0.075 x (19 (18) x (2	Air 	changes per hour 0.20 0.10 0.35 0.00 0.05 0.75 0.75 4 0.70 0.53	(9) (10) (11) (12) (12) (13) (14) (15) (16) (18) (18) (19) (20)
nfiltration due to chimneys of a pressurisation test has a Number of storeys in the de Additional infiltration Structural infiltration: 0. If suspended wooden gr If no draught lobby, enter Percentage of windows and Window infiltration Infiltration rate f based on air permeability Number of sides on which to Shelter factor Infiltration rate incorporati Infiltration rate modified for Jan	s, flues, fans, PSVs been carried out or is welling 25 for steel or timber round floor, enter 0.2 er 0.05, else enter 0 doors draught proof value, then (18) = [(1 the dwelling is shelter ing shelter factor r monthly wind speed Feb Mar	frame or 0.35 f (unsealed) or 0 ed .7) ÷ 20] + (8), o ed d: Apr	eed to (17), oth	nerwise continue onstruction se enter 0 = (16) n Jul	(8) + (10)	40 (16) 2 .00.00 0.25 - [0.2 + (11) + (12) 1 -	÷ (5) = x (14) ÷ 10) + (13) + (1 [0.075 x (19 (18) x (2	Air 	changes per hour 0.20 0.10 0.35 0.00 0.05 0.75 0.75 4 0.70 0.53	(9) (10) (11) (12) (13) (14) (15) (16) (16) (18) (19) (20) (21)
nfiltration due to chimneys of a pressurisation test has a Number of storeys in the de Additional infiltration Structural infiltration: 0. If suspended wooden gr If no draught lobby, enter Percentage of windows and Window infiltration Infiltration rate f based on air permeability Number of sides on which the Shelter factor nfiltration rate incorporation filtration rate modified for Jan Monthly average wind speed	s, flues, fans, PSVs been carried out or is welling 25 for steel or timber ound floor, enter 0.2 er 0.05, else enter 0 d doors draught proof value, then (18) = [(1 the dwelling is shelter ing shelter factor r monthly wind speed Feb Mar ed from Table U2	frame or 0.35 f (unsealed) or 0 ed .7) ÷ 20] + (8), o ed d: Apr	eed to (17), oth for masonry c 0.1 (sealed), els otherwise (18) May Ju	nerwise continue onstruction se enter 0 = (16) n Jul	e from (9) to (8) + (10) Aug	40 (16) 2 .00.00 0.25 - [0.2 + (11) + (12) 1 - Sep	÷ (5) = x (14) ÷ 10) + (13) + (1 [0.075 x (19 (18) x (2 Oct	Air 	changes per hour 0.20 0.10 0.35 0.00 0.05 0.75 0.75 4 0.70 0.53 0.75	(9) (10) (11) (12) (12) (13) (14) (15) (16) (16) (18) (19) (20)



0.67	0.66	0.64	0.58	0.57	0.50	0.50	0.49	0.53	0.57	0.59	0.62	(22b)
Calculate effective air char	nge rate for	the applica	ble case:									
If mechanical ventilatio	n: air chang	e rate thro	ugh system								N/A	(23a)
If balanced with heat re	covery: effi	ciency in %	allowing fo	or in-use fac	tor from Ta	able 4h					N/A	(23c)
d) natural ventilation o	r whole hou	se positive	input venti	lation from	loft							
0.72	0.72	0.71	0.67	0.66	0.62	0.62	0.62	0.64	0.66	0.67	0.69	(24d)
Effective air change rate -	enter (24a) o	or (24b) or	(24c) or (24	ld) in (25)								
0.72	0.72	0.71	0.67	0.66	0.62	0.62	0.62	0.64	0.66	0.67	0.69	(25)
_						-				·		_
3. Heat losses and heat lo	oss paramet							_				
Element			Gross rea, m ²	Openings m ²		area m²	U-value W/m ² K	AxUW		/alue, /m².K	Ахк, kJ/K	
Door		-	,			96 x	1.80	= 7.13		,	,	(26)
Window						.57 x	1.50	= 18.90				(20)
Ground floor						.75 x	0.22	= 11.61				(28a)
External wall					45		0.22	= 13.74	\leq			(29a)
Party wall						.01 × [0.00	= 0.00				(32)
Roof					23		0.16	= 0.00	\exists			(32)
Roof						.01 × [0.10	= 3.33				(30)
Total area of external elem	$rants \sum \Lambda m^2$	2				7.19	0.18	- 3.33				(31)
Fabric heat loss, W/K = Σ (A	_				157	.15		(26	5)(30) + (1	32) =	58.48	(33)
Heat capacity Cm = $\Sigma(A \times K)$							(28)	.(30) + (32) +			N/A	(34)
Thermal mass parameter (m²K					(20)	.(50) * (52) *	(320)(3		450.00	(35)
Thermal bridges: $\Sigma(L \times \Psi)$			div K								23.58	(36)
Total fabric heat loss		ыпа Арреп							(33) + (36) =	82.06	(37)
	Feb	Mar	Apr	May	lun	Iul	Aug	Sen] (37)
Jan	Feb	Mar	Apr 25)m x (5)	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec] (37)
Jan Ventilation heat loss calcu	ated month	ly 0.33 x (2	25)m x (5)				-		Oct	Nov	Dec	1
Jan Ventilation heat loss calcu 47.58	ated month 47.00	ly 0.33 x (2 46.44		May 43.31	Jun 41.02	Jul 41.02	Aug 40.59	Sep] (38)
Jan Ventilation heat loss calcu 47.58 Heat transfer coefficient, V	ated month 47.00 V/K (37)m +	ly 0.33 x (2 46.44 ⊦ (38)m	25)m x (5) 43.81	43.31	41.02	41.02	40.59	41.90	Oct 43.31	Nov 44.31	Dec 45.35	1
Jan Ventilation heat loss calcu 47.58	ated month 47.00	ly 0.33 x (2 46.44	25)m x (5)				-	41.90	Oct 43.31 125.37	Nov 44.31 126.37	Dec 45.35] (38)
Jan Ventilation heat loss calcu 47.58 Heat transfer coefficient, V 129.64	ated month 47.00 V/K (37)m + 129.07	ly 0.33 x (2 46.44 ⊦ (38)m 128.50	25)m x (5) 43.81	43.31	41.02	41.02	40.59	41.90	Oct 43.31 125.37	Nov 44.31 126.37	Dec 45.35	1
Jan Ventilation heat loss calcu 47.58 Heat transfer coefficient, V 129.64 Heat loss parameter (HLP)	ated month 47.00 V/K (37)m + 129.07 W/m ² K (39	ly 0.33 x (2 46.44 ⊦ (38)m 128.50 9)m ÷ (4)	25)m x (5) 43.81 125.87	43.31	41.02	41.02	40.59	41.90 123.96 Average = Σ	Oct 43.31 125.37 :(39)112,	Nov 44.31 126.37 /12 =	Dec 45.35 127.42 125.86] (38)
Jan Ventilation heat loss calcu 47.58 Heat transfer coefficient, V 129.64	ated month 47.00 V/K (37)m + 129.07	ly 0.33 x (2 46.44 ⊦ (38)m 128.50	25)m x (5) 43.81	43.31	41.02	41.02	40.59	41.90 123.96 Average = Σ 1.39	Oct 43.31 125.37 5(39)112, 1.40	Nov 44.31 126.37 /12 = 1.42	Dec 45.35 127.42 125.86 1.43] (38)]] (39)
Jan Ventilation heat loss calcu 47.58 Heat transfer coefficient, V 129.64 Heat loss parameter (HLP) 1.45	ated month 47.00 V/K (37)m + 129.07 W/m ² K (39 1.45	ly 0.33 x (2 46.44 ⊦ (38)m 128.50 9)m ÷ (4)	25)m x (5) 43.81 125.87	43.31	41.02	41.02	40.59	41.90 123.96 Average = Σ	Oct 43.31 125.37 5(39)112, 1.40	Nov 44.31 126.37 /12 = 1.42	Dec 45.35 127.42 125.86] (38)
Jan Ventilation heat loss calcu 47.58 Heat transfer coefficient, V 129.64 Heat loss parameter (HLP) 1.45 Number of days in month	ated month 47.00 V/K (37)m + 129.07 W/m ² K (39 1.45 (Table 1a)	ly 0.33 x (2 46.44 + (38)m 128.50 9)m ÷ (4) 1.44	25)m x (5) 43.81 125.87 1.41	43.31 125.37 1.40	41.02 123.08 1.38	41.02 123.08 1.38	40.59	41.90 123.96 Average = Σ 1.39 Average = Σ	Oct 43.31 125.37 (39)112, 1.40 (40)112,	Nov 44.31 126.37 /12 = 1.42 /12 =	Dec 45.35 127.42 125.86 1.43 1.41] (38)]] (39)] (40)
Jan Ventilation heat loss calcu 47.58 Heat transfer coefficient, V 129.64 Heat loss parameter (HLP) 1.45	ated month 47.00 V/K (37)m + 129.07 W/m ² K (39 1.45	ly 0.33 x (2 46.44 ⊦ (38)m 128.50 9)m ÷ (4)	25)m x (5) 43.81 125.87	43.31	41.02	41.02	40.59	41.90 123.96 Average = Σ 1.39	Oct 43.31 125.37 5(39)112, 1.40	Nov 44.31 126.37 /12 = 1.42	Dec 45.35 127.42 125.86 1.43] (38)]] (39)
Jan Ventilation heat loss calcu 47.58 Heat transfer coefficient, V 129.64 Heat loss parameter (HLP) 1.45 Number of days in month	ated month 47.00 V/K (37)m + 129.07 W/m ² K (39 1.45 (Table 1a) 28.00	ly 0.33 x (2 46.44 ← (38)m 128.50 9)m ÷ (4) 1.44 31.00	25)m x (5) 43.81 125.87 1.41	43.31 125.37 1.40	41.02 123.08 1.38	41.02 123.08 1.38	40.59	41.90 123.96 Average = Σ 1.39 Average = Σ	Oct 43.31 125.37 (39)112, 1.40 (40)112,	Nov 44.31 126.37 /12 = 1.42 /12 =	Dec 45.35 127.42 125.86 1.43 1.41] (38)]] (39)] (40)
Jan Ventilation heat loss calcu 47.58 Heat transfer coefficient, V 129.64 Heat loss parameter (HLP) 1.45 Number of days in month 31.00	ated month 47.00 V/K (37)m + 129.07 W/m ² K (39 1.45 (Table 1a) 28.00	ly 0.33 x (2 46.44 ← (38)m 128.50 9)m ÷ (4) 1.44 31.00	25)m x (5) 43.81 125.87 1.41	43.31 125.37 1.40	41.02 123.08 1.38	41.02 123.08 1.38	40.59	41.90 123.96 Average = Σ 1.39 Average = Σ	Oct 43.31 125.37 (39)112, 1.40 (40)112,	Nov 44.31 126.37 /12 = 1.42 /12 =	Dec 45.35 127.42 125.86 1.43 1.41] (38)]] (39)] (40)
Jan Ventilation heat loss calcu 47.58 Heat transfer coefficient, V 129.64 Heat loss parameter (HLP) 1.45 Number of days in month 31.00 4. Water heating energy	ated month 47.00 V/K (37)m 4 129.07 W/m ² K (39 1.45 (Table 1a) 28.00 requiremen	ly 0.33 x (2 46.44 + (38)m 128.50 9)m ÷ (4) 1.44 31.00 t	25)m x (5) 43.81 125.87 1.41 30.00	43.31 125.37 1.40 31.00	41.02 123.08 1.38 30.00	41.02 123.08 1.38	40.59	41.90 123.96 Average = Σ 1.39 Average = Σ	Oct 43.31 125.37 (39)112, 1.40 (40)112,	Nov 44.31 126.37 /12 = 1.42 /12 =	Dec 45.35 127.42 125.86 1.43 1.41 31.00] (38)] (39)] (40)] (40)
Jan Ventilation heat loss calcu 47.58 Heat transfer coefficient, V 129.64 Heat loss parameter (HLP) 1.45 Number of days in month 31.00 4. Water heating energy Assumed occupancy, N	ated month 47.00 V/K (37)m 4 129.07 W/m ² K (39 1.45 (Table 1a) 28.00 requiremen	ly 0.33 x (2 46.44 + (38)m 128.50 9)m ÷ (4) 1.44 31.00 t	25)m x (5) 43.81 125.87 1.41 30.00	43.31 125.37 1.40 31.00	41.02 123.08 1.38 30.00	41.02 123.08 1.38	40.59	41.90 123.96 Average = Σ 1.39 Average = Σ	Oct 43.31 125.37 (39)112, 1.40 (40)112,	Nov 44.31 126.37 /12 = 1.42 /12 =	Dec 45.35 127.42 125.86 1.43 1.41 31.00 2.62] (38)] (39)] (40)] (40)
Jan Ventilation heat loss calcu 47.58 Heat transfer coefficient, V 129.64 Heat loss parameter (HLP) 1.45 Number of days in month 31.00 4. Water heating energy Assumed occupancy, N Annual average hot water	ated month 47.00 V/K (37)m 4 129.07 W/m ² K (39 1.45 (Table 1a) 28.00 requiremen usage in litra Feb	ly 0.33 x (2 46.44 + (38)m 128.50 9)m ÷ (4) 1.44 31.00 t t mar	25)m x (5) 43.81 125.87 1.41 30.00 Vd,average Apr	43.31 125.37 1.40 31.00 = (25 x N) + May	41.02 123.08 1.38 30.00 36 Jun	41.02 123.08 1.38 31.00	40.59 122.65 1.37 31.00	41.90 123.96 Average = Σ 1.39 Average = Σ 30.00	Oct 43.31 125.37 (39)112, 1.40 (40)112, 31.00	Nov 44.31 126.37 /12 = 1.42 /12 = 30.00	Dec 45.35 127.42 125.86 1.43 1.41 31.00 2.62 96.33] (38)] (39)] (40)] (40)
Jan Ventilation heat loss calcu 47.58 Heat transfer coefficient, V 129.64 Heat loss parameter (HLP) 1.45 Number of days in month 31.00 4. Water heating energy Assumed occupancy, N Annual average hot water Jan	ated month 47.00 V/K (37)m 4 129.07 W/m ² K (39 1.45 (Table 1a) 28.00 requiremen usage in litra Feb	ly 0.33 x (2 46.44 + (38)m 128.50 9)m ÷ (4) 1.44 31.00 t t mar	25)m x (5) 43.81 125.87 1.41 30.00 Vd,average Apr	43.31 125.37 1.40 31.00 = (25 x N) + May	41.02 123.08 1.38 30.00 36 Jun	41.02 123.08 1.38 31.00	40.59 122.65 1.37 31.00	41.90 123.96 Average = Σ 1.39 Average = Σ 30.00	Oct 43.31 125.37 (39)112, 1.40 (40)112, 31.00	Nov 44.31 126.37 /12 = 1.42 /12 = 30.00	Dec 45.35 127.42 125.86 1.43 1.41 31.00 2.62 96.33] (38)] (39)] (40)] (40)
Jan Ventilation heat loss calcu 47.58 Heat transfer coefficient, V 129.64 Heat loss parameter (HLP) 1.45 Number of days in month 31.00 4. Water heating energy Assumed occupancy, N Annual average hot water Jan Hot water usage in litres p	ated month 47.00 V/K (37)m + 129.07 W/m ² K (39 1.45 (Table 1a) 28.00 requiremen usage in litre Feb er day for ea	ly 0.33 x (2 46.44 ← (38)m 128.50 9)m ÷ (4) 1.44 31.00 t ses per day ¹ Mar ach month	25)m x (5) 43.81 125.87 1.41 30.00 Vd,average Apr Vd,m = fact	43.31 125.37 1.40 31.00 = (25 x N) + May cor from Tab	41.02 123.08 1.38 30.00 30.00	41.02 123.08 1.38 31.00 Jul	40.59 122.65 1.37 31.00 Aug	41.90 123.96 Average = Σ 1.39 Average = Σ 30.00 Sep	Oct 43.31 125.37 (39)112, 1.40 (40)112, 31.00 Oct	Nov 44.31 126.37 /12 = 1.42 /12 = 30.00 Nov 102.11	Dec 45.35 127.42 125.86 1.41 1.41 31.00 2.62 96.33 Dec] (38)] (39)] (40)] (40)
Jan Ventilation heat loss calcu 47.58 Heat transfer coefficient, V 129.64 Heat loss parameter (HLP) 1.45 Number of days in month 31.00 4. Water heating energy Assumed occupancy, N Annual average hot water Jan Hot water usage in litres p	ated month 47.00 V/K (37)m + 129.07 W/m ² K (39 1.45 (Table 1a) 28.00 requirement usage in litro Feb er day for ea 102.11	ly 0.33 x (2 46.44 (38)m 128.50 9)m ÷ (4) 1.44 31.00 t ses per day ¹ Mar ach month 98.25	25)m x (5) 43.81 125.87 1.41 30.00 Vd,average Apr Vd,m = fact 94.40	43.31 125.37 1.40 31.00 = (25 x N) + May for from Tab 90.55	41.02 123.08 1.38 30.00 36 Jun ole 1c x (43 86.69	41.02 123.08 1.38 31.00 Jul) 86.69	40.59 122.65 1.37 31.00 Aug 90.55	41.90 123.96 Average = Σ 1.39 Average = Σ 30.00 Sep	Oct 43.31 125.37 (39)112, 1.40 (40)112, 31.00 Oct 98.25	Nov 44.31 126.37 /12 = 1.42 /12 = 30.00 Nov 102.11	Dec 45.35 127.42 125.86 1.41 1.41 31.00 2.62 96.33 Dec 105.96] (38)] (39)] (39)] (40)] (40)] (42)] (43)
Jan Ventilation heat loss calcu 47.58 Heat transfer coefficient, V 129.64 Heat loss parameter (HLP) 1.45 Number of days in month 31.00 4. Water heating energy Assumed occupancy, N Annual average hot water Jan Hot water usage in litres p 105.96	ated month 47.00 V/K (37)m + 129.07 W/m ² K (39 1.45 (Table 1a) 28.00 requirement usage in litro Feb er day for ea 102.11	ly 0.33 x (2 46.44 (38)m 128.50 9)m ÷ (4) 1.44 31.00 t ses per day ¹ Mar ach month 98.25	25)m x (5) 43.81 125.87 1.41 30.00 Vd,average Apr Vd,m = fact 94.40	43.31 125.37 1.40 31.00 = (25 x N) + May for from Tab 90.55	41.02 123.08 1.38 30.00 36 Jun ole 1c x (43 86.69	41.02 123.08 1.38 31.00 Jul) 86.69	40.59 122.65 1.37 31.00 Aug 90.55	41.90 123.96 Average = Σ 1.39 Average = Σ 30.00 Sep	Oct 43.31 125.37 (39)112, 1.40 (40)112, 31.00 Oct 98.25	Nov 44.31 126.37 /12 = 1.42 /12 = 30.00 Nov 102.11	Dec 45.35 127.42 125.86 1.41 1.41 31.00 2.62 96.33 Dec 105.96] (38)] (39)] (39)] (40)] (40)] (42)] (43)
Jan Ventilation heat loss calcu 47.58 Heat transfer coefficient, V 129.64 Heat loss parameter (HLP) 1.45 Number of days in month 31.00 4. Water heating energy Assumed occupancy, N Annual average hot water Jan Hot water usage in litres p 105.96	ated month 47.00 V/K (37)m + 129.07 W/m ² K (39 1.45 (Table 1a) 28.00 requirement usage in litro Feb er day for ea 102.11 er used = 4.2	ly 0.33 x (2 46.44 (38)m 128.50 9)m ÷ (4) 1.44 31.00 t sper day ' Mar ach month 98.25 18 x Vd,m x	25)m x (5) 43.81 125.87 1.41 30.00 Vd,average Apr Vd,m = fact 94.40 nm x Tm/3	43.31 125.37 1.40 31.00 = (25 x N) + May for from Tab 90.55 3600 kWh/m	41.02 123.08 1.38 30.00 36 Jun ole 1c x (43 86.69 honth (see	41.02 123.08 1.38 31.00 Jul) 86.69 Tables 1b,	40.59 122.65 1.37 31.00 Aug 90.55 1c 1d)	41.90 123.96 Average = Σ 1.39 Average = Σ 30.00 Sep 94.40	Oct 43.31 125.37 (39)112, (40)112, 31.00 Oct 98.25 Σ(44)1	Nov 44.31 126.37 /12 = 1.42 /12 = 30.00 102.11 .12 = 102.11 .12 =	Dec 45.35 127.42 125.86 1.41 31.00 2.62 96.33 Dec 105.96 1155.92] (38)] (39)] (39)] (40)] (40)] (42)] (43)
Jan Ventilation heat loss calcu 47.58 Heat transfer coefficient, V 129.64 Heat loss parameter (HLP) 1.45 Number of days in month 31.00 4. Water heating energy Assumed occupancy, N Annual average hot water Jan Hot water usage in litres p 105.96	ated month 47.00 V/K (37)m + 129.07 W/m ² K (39 1.45 (Table 1a) 28.00 requirement usage in litro Feb er day for ea 102.11 er used = 4.2 137.43	ly 0.33 x (2 46.44 (38)m 128.50 9)m ÷ (4) 1.44 31.00 t sper day ' Mar ach month 98.25 18 x Vd,m x	25)m x (5) 43.81 125.87 1.41 30.00 Vd,average Apr Vd,m = fact 94.40 nm x Tm/3	43.31 125.37 1.40 31.00 = (25 x N) + May for from Tab 90.55 3600 kWh/m	41.02 123.08 1.38 30.00 36 Jun ole 1c x (43 86.69 honth (see	41.02 123.08 1.38 31.00 Jul) 86.69 Tables 1b,	40.59 122.65 1.37 31.00 Aug 90.55 1c 1d)	41.90 123.96 Average = Σ 1.39 Average = Σ 30.00 Sep 94.40	Oct 43.31 125.37 (39)112, 1.40 (40)112, 31.00 Oct 98.25 Σ(44)1 128.38	Nov 44.31 126.37 /12 = 1.42 /12 = 30.00 0 0 0 0 0 0 0 0 0 0 0 0	Dec 45.35 127.42 125.86 1.41 1.41 31.00 2.62 96.33 Dec 96.33 Dec 105.96 105.96] (38)] (39)] (40)] (40)] (42)] (43)] (44)
Jan Ventilation heat loss calcu 47.58 Heat transfer coefficient, V 129.64 Heat loss parameter (HLP) 1.45 Number of days in month 31.00 4. Water heating energy Assumed occupancy, N Annual average hot water Jan Hot water usage in litres p 105.96 Energy content of hot wat	ated month 47.00 V/K (37)m + 129.07 W/m ² K (39 1.45 (Table 1a) 28.00 requirement usage in litro Feb er day for ea 102.11 er used = 4.2 137.43	ly 0.33 x (2 46.44 (38)m 128.50 9)m ÷ (4) 1.44 31.00 t sper day ' Mar ach month 98.25 18 x Vd,m x	25)m x (5) 43.81 125.87 1.41 30.00 Vd,average Apr Vd,m = fact 94.40 nm x Tm/3	43.31 125.37 1.40 31.00 = (25 x N) + May for from Tab 90.55 3600 kWh/m	41.02 123.08 1.38 30.00 36 Jun ole 1c x (43 86.69 honth (see	41.02 123.08 1.38 31.00 Jul) 86.69 Tables 1b,	40.59 122.65 1.37 31.00 Aug 90.55 1c 1d)	41.90 123.96 Average = Σ 1.39 Average = Σ 30.00 Sep 94.40	Oct 43.31 125.37 (39)112, 1.40 (40)112, 31.00 Oct 98.25 Σ(44)1 128.38	Nov 44.31 126.37 /12 = 1.42 /12 = 30.00 0 0 0 0 0 0 0 0 0 0 0 0	Dec 45.35 127.42 125.86 1.41 1.41 31.00 2.62 96.33 Dec 96.33 Dec 105.96 105.96] (38)] (39)] (40)] (40)] (42)] (43)] (44)

Water storage los	s calculate	d for each	month (55) x (41)m									
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(56)
If the vessel conta	ains dedica	ted solar s	torage or de	edicated W	/WHRS (56)	m x [(47) -	Vs] ÷ (47),	else (56)					
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(57)
Primary circuit los	ss for each	month fro	m Table 3										
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(59)
Combi loss for each	ch month f	rom Table	3a, 3b or 3o	C									
	50.96	46.03	50.96	49.32	50.96	49.32	50.96	50.96	49.32	50.96	49.32	50.96	(61)
Total heat require	ed for wate	er heating o	alculated fo	or each mo	onth 0.85 x	(45)m + (4	6)m + (57)	m + (59)m +	(61)m				
	208.09	183.46	192.78	172.95	169.59	151.69	145.82	159.82	159.47	179.34	189.45	203.14	(62)
Solar DHW input	calculated	using Appe	endix G or A	ppendix H									
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(63)
Output from wate	er heater fo	or each mo	onth (kWh/n	nonth) (62	2)m + (63)m	ı							
	208.09	183.46	192.78	172.95	169.59	151.69	145.82	159.82	159.47	179.34	189.45	203.14	
										∑(64)1	.12 = 2	115.60	(64)
Heat gains from w	vater heati	ng (kWh/n	nonth) 0.25	5 × [0.85 ×	(45)m + (61)m] + 0.8 ×	: [(46)m + (57)m + (59)	m]				
	64.99	57.20	59.89	53.44	52.19	46.37	44.28	48.93	48.96	55.43	58.92	63.34	(65)
5. Internal gains									/				
5. Internal gains	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (100	wiai	Αþi	ividy	Jun	501	Aug	Sch	000	NOV	Det	
The case is gains (130.79	130.79	130.79	130.79	130.79	130.79	130.79	130.79	130.79	130.79	130.79	130.79	(66)
L Lighting gains (cal							130.75	130.75	150.75	150.75	150.75	150.75	_ (00)
	28.39	25.22	20.51	15.53	11.61	9.80	10.59	13.76	18.47	23.45	27.37	29.18	(67)
Appliance gains (c			I I I I I I I I I I I I I I I I I I I				10.55	15.70	10.47	23.43	27.57	25.10	
Г. тррициона (ч	237.77	240.23	234.02	220.78	204.07	188.37	177.88	175.41	181.63	194.86	211.57	227.27	(68)
L Cooking gains (cal							177.00	175.11	101.05	13 1.00	211.57		
рон (л.	36.08	36.08	36.08	36.08	36.08	36.08	36.08	36.08	36.08	36.08	36.08	36.08	(69)
∟ Pump and fan gai								1					_ (/
· · ·	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	(70)
Losses e.g. evapor													
 Г	-104.64	-104.64	-104.64	-104.64	-104.64	-104.64	-104.64	-104.64	-104.64	-104.64	-104.64	-104.64	(71)
Water heating gai	ins (Table !	5)						1					
Γ	87.35	85.12	80.50	74.22	70.14	64.40	59.52	65.77	67.99	74.50	81.84	85.13	(72)
Total internal gair	ns (66)m +	(67)m + (6	8)m + (69)r	n + (70)m ·	+ (71)m + (7	72)m					1		
Γ	418.74	415.81	400.26	375.76	351.06	327.80	313.22	320.18	333.33	358.05	386.02	406.83	(73)
	•		· · · ·					•			,		
6. Solar gains				-									
			Access fa Table		Area m²		ar flux V/m²	sneci	g ific data	FF specific c	lata	Gains W	
			Tuble	04		•	,	•	able 6b	or Table		••	
West			0.77	7 x	12.03	x 1	9.64 x	0.9 x 0).72 x	0.70	=	82.52	(80)
East			0.77	7 x	0.54	x 1	9.64 x	0.9 x 0).72 x	0.70	=	3.70	(76)
Solar gains in wat	ts ∑(74)m	(82)m											
Γ	86.23	168.68	277.79	405.14	496.52	508.27	483.90	415.66	323.08	200.15	107.52	70.91	(83)
Total gains - inter	nal and so	lar (73)m +	(83)m										
Γ	504.97	584.49	678.05	780.91	847.57	836.08	797.12	735.84	656.41	558.20	493.54	477.74	(84)
L	1				•			•		•	•		_

7. Mean internal temperature (heating season)

Temperature du	ring heating	g periods in	the living a	rea from T	able 9, Th1	(°C)						21.00	(85)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation facto	r for gains fo	or living are	a n1,m (se	e Table 9a)									
	1.00	1.00	1.00	1.00	0.97	0.85	0.66	0.74	0.96	1.00	1.00	1.00	(86)
Mean internal to	emp of living	g area T1 (s	teps 3 to 7	in Table 9c)								
	19.97	20.07	20.26	20.53	20.78	20.95	20.99	20.99	20.86	20.53	20.21	19.96	(87)
Temperature du			the rest of	dwelling fr									
	19.72	19.73	19.73	19.76	19.76	19.78	19.78	19.78	19.77	19.76	19.75	19.74	(88)
Utilisation facto		I			15.70	15.70	15.70	15.70	15.77	15.70	15.75	15.74	(00)
otilisation facto	-				0.04	0.70	0.40	0.50	0.00	1.00	1.00	1.00	(00)
	1.00	1.00	1.00	0.99	0.94	0.73	0.49	0.56	0.90	1.00	1.00	1.00	(89)
Mean internal to					-								
	18.79	18.90	19.09	19.38	19.62	19.76	19.78	19.78	19.70	19.39	19.06	18.80	(90)
Living area fract	ion								Liv	ving area ÷	(4) =	0.45	(91)
Mean internal to	emperature	for the who	ole dwellin	g fLA x T1 +	(1 - fLA) x T	2							
	19.32	19.43	19.62	19.91	20.15	20.30	20.33	20.33	20.23	19.91	19.58	19.33	(92)
Apply adjustme	nt to the me	an internal	temperatu	ire from Ta	ble 4e whe	re appropri	iate						
	19.32	19.43	19.62	19.91	20.15	20.30	20.33	20.33	20.23	19.91	19.58	19.33	(93)
											×		
8. Space heating	ng requirem	ent											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation facto	r for gains, r	յՠ											
	1.00	1.00	1.00	0.99	0.95	0.79	0.57	0.64	0.93	1.00	1.00	1.00	(94)
Useful gains, ηπ	nGm, W (94)m x (84)m											
	504.93	584.34	677.22	774.35	804.10	658.38	455.01	473.15	609.85	556.45	493.42	477.71	(95)
Monthly average	e external te	emperature	from Table	e U1									
	4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)
Heat loss rate fo	or mean inte	rnal tempe	rature, Lm,	W [(39)m	x [(93)m - ((96)m]						,	
	1947.76	1875.31	1686.42	1385.28	1059.45	701.85	459.05	481.78	759.54	1166.97	1577.33	1927.63	(97)
Space heating re							100100	102170	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	1100107	1077100	101/100	(01)
Space nearing re	1073.46	867.53	750.85	439.87	189.98	0.00	0.00	0.00	0.00	454.23	780.41	1078.74	
	1075.40	807.55	750.85	459.67	169.96	0.00	0.00	0.00					(00)
									∑(98	3)15, 10		635.06	(98)
Space heating re	equirement	kWh/m²/ye	ear							(98) -	÷ (4)	63.11	(99)
9a. Energy req	uirements -	individual	heating sys	tems inclu	ding micro	-CHP							
Space heating													
Fraction of space	e heat from	secondary	/sunnlemer	ntary system	n (table 11)						0.00	(201)
Fraction of space				itary syster		1				1 - (20)1) _ [1.00	
										1 - (20			(202)
Fraction of spac		-							(2.2			0.00	(202)
Fraction of total									(20	2) x [1- (20		1.00	(204)
Fraction of total			system 2							(202) x (20)3) =	0.00	(205)
Efficiency of ma	in system 1	(%)										88.80	(206)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating fu	iel (main sy	stem 1), kW	/h/month										
	1208.86	976.95	845.55	495.35	213.94	0.00	0.00	0.00	0.00	511.52	878.84	1214.79	
									∑(211	.)15, 10	12 = 6	345.79	(211)
Water heating													
Efficiency of wat	ter heater												
	87.14	87.02	86.73	85.96	84.16	79.50	79.50	79.50	79.50	85.95	86.82	87.18	(217)

Water heating fuel, kWh/month						
238.79 210.82 222.28 201.20 20	1.52 190.80 18	83.42	201.03 200.59	208.64 218	3.22 233.00]
			Σ	<u>(219a)112 =</u>	2510.32	(219)
Annual totals						-
Space heating fuel - main system 1					6345.79	
Water heating fuel					2510.32	
Electricity for pumps, fans and electric keep-hot (Table 4f)						
central heating pump or water pump within warm air heating	unit		30.00			(230c)
boiler flue fan			45.00			(230e)
Total electricity for the above, kWh/year					75.00	(231)
Electricity for lighting (Appendix L)					501.40	(232)
Total delivered energy for all uses		(2	11)(221) + (231) + (2	232)(237b) =	9432.51	(238)
10a. Fuel costs - individual heating systems including micro-CH	Р					
	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating - main system 1	6345.79	x	3.48	x 0.01 =	220.83	(240)
Water heating	2510.32	x	3.48	x 0.01 =	87.36	(240)
Pumps and fans	75.00	x	13.19	x 0.01 =	9.89	(249)
Electricity for lighting	501.40	x	13.19	x 0.01 =	66.13	(250)
Additional standing charges	501.40	^	15.15	x 0.01 -	120.00	(251)
Total energy cost			(240) (242) +	(245)(254) =	504.22	(255)
			(240)(242)	(243)(234) -	504.22	_ (233)
11a. SAP rating - individual heating systems including micro-CH	IP					
Energy cost deflator (Table 12)					0.42	(256)
Energy cost factor (ECF)					1.58	(257)
SAP value					78.00]
SAP rating (section 13)					78	(258)
SAP band					С]
12a. CO ₂ emissions - individual heating systems including micro	o-CHP					
	Energy		Emission factor		Emissions	
	kWh/year		kg CO₂/kWh		kg CO₂/year	-
Space heating - main system 1	6345.79	х	0.22	=	1370.69	(261)
Water heating	2510.32	х	0.22	=	542.23	(264)
Space and water heating			(261) + (262) +	(263) + (264) =	1912.92	(265)
Pumps and fans	75.00	х	0.52	=	38.93	(267)
Electricity for lighting	501.40	х	0.52	=	260.23	(268)
Total CO ₂ , kg/year				(265)(271) =	2212.07	(272)
Dwelling CO ₂ emission rate				(272) ÷ (4) =	24.77	(273)
El value					77.93]
El rating (section 14)					78	(274)
El band					C	
13a. Primary energy - individual heating systems including micr	ro-CHP					
	Energy kWh/year		Primary factor		Primary Energy kWh/year	,
Space heating - main system 1	6345.79	x	1.22	=	7741.87	(261)

3062.59

10804.45

(264)

(265)

х

1.22

=

(261) + (262) + (263) + (264) =

2510.32

Pumps and fans	75.00] x	3.07] =	230.25	(267)
Electricity for lighting	501.40] x	3.07] =	1539.30	(268)
Primary energy kWh/year					12574.00	(272)
Dwelling primary energy rate kWh/m2/year					140.82	(273)



This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mrs Nicola Battist	а			Ass	essor numb	er	3998		
Client	The Halebourne G	iroup			Las	t modified		26/08	/2014	
Address	6 The Old School I	Park Lane, Richmon	d, London, TW9							
1. Overall dwelling dimen	isions					_				
			Area (m²)			age storey ght (m)		Vo	lume (m³)	
Lowest occupied		[39.96	(1a) x		2.31	(2a) =		92.31	(3a)
+1		[36.77	(1b) x		2.11	(2b) =		77.58	(3b)
Total floor area	(1a) + (1b) + ((1c) + (1d)(1n) = [76.73	(4)						
Dwelling volume					(3a) ·	+ (3b) + (3c)	+ (3d)(3r	n) =	169.89	(5)
2. Ventilation rate										
								m	³ per hour	
Number of chimneys						0	x 40 =		0	(6a)
Number of open flues						0	x 20 =		0	(6b)
Number of intermittent fai	ns					4	x 10 =		40	(7a)
Number of passive vents						0	x 10 =		0	(7b)
Number of flueless gas fire	!S					0	x 40 =		0	(7c)
								Air o	changes per hour	-
Infiltration due to chimney	s, flues, fans, PSVs		(6a) + (6b) + (7a) + (7b) + (7	7c) =	40	÷ (5) =		0.24	(8)
If a pressurisation test has	been carried out or is	s intended, proceed	to (17), otherwi	se continue	e from (9) to	o (16)				
Number of storeys in the d	welling					2				(9)
Additional infiltration									0.10	(10)
Structural infiltration: 0	.25 for steel or timbe	er frame or 0.35 for	masonry constru	uction					0.35	(11)
If suspended wooden g	round floor, enter 0.2	2 (unsealed) or 0.1 (sealed), else ent	ter 0					0.00	(12)
If no draught lobby, ent	er 0.05, else enter 0] (12)
									0.05	(12)
Percentage of windows an	d doors draught proc	ofed			1	00.00			0.05	_ · ·
Percentage of windows an Window infiltration	d doors draught proc	ofed			1	00.00	x (14) ÷ 100	D] =	0.05] (13)
-	d doors draught proc	ofed] (13) (14)
Window infiltration			erwise (18) = (16)		0.25 - [0.2			0.05] (13) (14)] (15)
Window infiltration	y value, then (18) = [(17) ÷ 20] + (8), othe	erwise (18) = (16)		0.25 - [0.2			0.05 0.79] (13) (14)] (15)] (16)
Window infiltration Infiltration rate If based on air permeabilit	y value, then (18) = [(17) ÷ 20] + (8), othe	erwise (18) = (16)		0.25 - [0.2 - (11) + (12)		5) = [0.05 0.79 0.79] (13) (14)] (15)] (16)] (18)
Window infiltration Infiltration rate If based on air permeabilit Number of sides on which	y value, then (18) = [(the dwelling is shelte	17) ÷ 20] + (8), othe	erwise (18) = (16)		0.25 - [0.2 - (11) + (12)	+ (13) + (15	5) = [[]]] = [0.05 0.79 0.79 3	(13) (14) (15) (16) (18) (19)
Window infiltration Infiltration rate If based on air permeabilit Number of sides on which Shelter factor	y value, then (18) = [(the dwelling is shelte ing shelter factor	17) ÷ 20] + (8), othe ered	erwise (18) = (16)		0.25 - [0.2 - (11) + (12)	+ (13) + (15 0.075 x (19	5) = [[]]] = [0.05 0.79 0.79 3 0.78	(13) (14) (15) (16) (18) (19) (20)
Window infiltration Infiltration rate If based on air permeabilit Number of sides on which Shelter factor Infiltration rate incorporat	y value, then (18) = [(the dwelling is shelte ing shelter factor	17) ÷ 20] + (8), othe ered) Jul		0.25 - [0.2 - (11) + (12)	+ (13) + (15 0.075 x (19	5) = [[]]] = [0.05 0.79 0.79 3 0.78	(13) (14) (15) (16) (18) (19) (20)
Window infiltration Infiltration rate If based on air permeabilit Number of sides on which Shelter factor Infiltration rate incorporat Infiltration rate modified for	y value, then (18) = [(the dwelling is shelte ing shelter factor or monthly wind spee Feb Mar	17) ÷ 20] + (8), othe ered			(8) + (10) +	0.25 - [0.2 - (11) + (12) 1 - [+ (13) + (15 0.075 x (19 (18) x (20	5) = [0.05 0.79 0.79 3 0.78 0.61	(13) (14) (15) (16) (18) (19) (20)
Window infiltration Infiltration rate If based on air permeabilit Number of sides on which Shelter factor Infiltration rate incorporat Infiltration rate modified for Jan	y value, then (18) = [(the dwelling is shelte ing shelter factor or monthly wind spee Feb Mar	17) ÷ 20] + (8), othe ered	y Jun		(8) + (10) +	0.25 - [0.2 - (11) + (12) 1 - [+ (13) + (15 0.075 x (19 (18) x (20	5) = [0.05 0.79 0.79 3 0.78 0.61	(13) (14) (15) (16) (18) (19) (20)
Window infiltration Infiltration rate If based on air permeabilit Number of sides on which Shelter factor Infiltration rate incorporat Infiltration rate modified fo Jan Monthly average wind spe	y value, then (18) = [(the dwelling is shelte ing shelter factor or monthly wind spee Feb Mar ed from Table U2	17) ÷ 20] + (8), othe ered ed: Apr Ma	y Jun	lut	(8) + (10) + Aug	0.25 - [0.2 - (11) + (12) 1 - [Sep	+ (13) + (15 0.075 x (19 (18) x (20 Oct	5) =]] =)] = Nov	0.05 0.79 0.79 3 0.78 0.61 Dec	(13) (14) (15) (16) (18) (19) (20) (21)



	0.78	0.76	0.75	0.67	0.65	0.58	0.58	0.56	0.61	0.65	0.68	0.72	(22b)
Calculate effective ai	ir chang	e rate for t	he applica	ble case:									
If mechanical ven	tilation:	air change	e rate thro	ugh system								N/A	(23a)
If balanced with h	neat reco	overy: effic	ciency in %	allowing fo	or in-use fac	tor from Ta	able 4h					N/A	(23c)
d) natural ventila	tion or v	whole hous	se positive	input venti	lation from	loft							
	0.80	0.79	0.78	0.72	0.71	0.67	0.67	0.66	0.69	0.71	0.73	0.76	(24d)
Effective air change	rate - en	nter (24a) c	or (24b) or	(24c) or (24	ld) in (25)								
(0.80	0.79	0.78	0.72	0.71	0.67	0.67	0.66	0.69	0.71	0.73	0.76	(25)
3. Heat losses and l	heat los	s paramete		-		.						-	
Element				Gross rea, m ²	Opening m ²		area m²	U-value W/m ² K	AxUW		/alue, /m².K	Ахк, kJ/K	
Door						-	98 x	1.80	= 3.56				(26)
Window						17		1.68	= 28.95				(27)
Roof window						0.		1.33	= 1.10				(27a)
Ground floor						39		0.22	= 8.79	=			(28a)
External wall							.88 x	0.30	= 14.36				(29a)
Party wall						25	.71 x	0.00	= 0.00	Ę			(32)
Roof						38	.04 x	0.16	= 6.09				(30)
Roof						24	.01 x	0.18	= 4.32				(30)
Total area of externa	l eleme	nts ∑A, m²				169	9.94						(31)
Fabric heat loss, W/k	< = Σ(A ×	< U)							(26	5)(30) + (32) =	67.18	(33)
Heat capacity Cm = 2	<u>(</u> Ахк)							(28)	(30) + (32) -	+ (32a)(3	2e) =	N/A	(34)
Thermal mass param	neter (TN	MP) in kJ/m	۱²K									450.00	(35)
Thermal bridges: ∑(L	xΨ) cal	lculated us	ing Appen	dix K								25.49	(36)
Total fabric heat loss										(33) + (36) =	92.67	
	•									(33) · (50) =	92.07	(37)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	_ (37)
Ventilation heat loss	Jan				May	Jun	Jul	Aug	Sep		-		_ (37)
Ventilation heat loss	Jan			25)m x (5)	May 40.04	Jun 37.41	Jul 37.41	Aug 36.92	Sep 38.42		-		_ (37) _ (38)
Ventilation heat loss	Jan calculat 4.92	ted monthl 44.26	ly 0.33 x (2 43.62	25)m x (5)				-		Oct	Nov	Dec	_ ` `
Ventilation heat loss 4 Heat transfer coeffic	Jan calculat 4.92	ted monthl 44.26	ly 0.33 x (2 43.62	25)m x (5)				-		Oct	Nov	Dec	_ ` `
Ventilation heat loss 4 Heat transfer coeffic	Jan calculat 4.92 ient, W/	ted monthl 44.26 /K (37)m +	ly 0.33 x (2 43.62 (38)m	25)m x (5) 40.60	40.04	37.41	37.41	36.92	38.42	Oct 40.04 132.70	Nov 41.18 133.85	Dec 42.37	_ ` `
Ventilation heat loss 4 Heat transfer coeffic	Jan calculat 4.92 ient, W/ 37.59	ted monthl 44.26 /K (37)m + 136.93	y 0.33 x (2 43.62 (38)m 136.29	25)m x (5) 40.60	40.04	37.41	37.41	36.92	38.42	Oct 40.04 132.70	Nov 41.18 133.85	Dec 42.37 135.04] (38)
Ventilation heat loss 4 Heat transfer coeffic 1 Heat loss parameter	Jan calculat 4.92 ient, W/ 37.59	ted monthl 44.26 /K (37)m + 136.93	y 0.33 x (2 43.62 (38)m 136.29	25)m x (5) 40.60	40.04	37.41	37.41	36.92 129.59 1.69	38.42 131.09 Average = ∑ 1.71	Oct 40.04 132.70 5(39)112, 1.73	Nov 41.18 133.85 /12 = 1.74	Dec 42.37 135.04 133.27 1.76] (38)] (39)
Ventilation heat loss 4 Heat transfer coeffic 1 Heat loss parameter	Jan calculat 4.92 ient, W/ 37.59 (HLP), V 1.79	ted month 44.26 /K (37)m + 136.93 N/m ² K (39 1.78	ly 0.33 x (2 43.62 (38)m 136.29 I)m ÷ (4)	25)m x (5) 40.60 133.27	40.04	37.41	37.41	36.92 129.59 1.69	38.42 131.09 Average = ∑	Oct 40.04 132.70 5(39)112, 1.73	Nov 41.18 133.85 /12 = 1.74	Dec 42.37 135.04 133.27] (38)
Ventilation heat loss 4 Heat transfer coeffic 1 Heat loss parameter Number of days in m	Jan calculat 4.92 ient, W/ 37.59 (HLP), V 1.79 nonth (Ti	ted monthi 44.26 /K (37)m + 136.93 //m ² K (39 1.78 able 1a)	ly 0.33 x (2 43.62 (38)m 136.29 I)m ÷ (4) 1.78	25)m x (5) 40.60 133.27 1.74	40.04 132.70 1.73	37.41 130.07 1.70	37.41 130.07 1.70	36.92 129.59 1.69	38.42 131.09 Average = ∑ 1.71 Average = ∑	Oct 40.04 132.70 5(39)112, 1.73 5(40)112,	Nov 41.18 133.85 /12 = 1.74 /12 =	Dec 42.37 135.04 133.27 1.76 1.74] (38)] (39)] (40)
Ventilation heat loss 4 Heat transfer coeffic 1 Heat loss parameter Number of days in m	Jan calculat 4.92 ient, W/ 37.59 (HLP), V 1.79	ted month 44.26 /K (37)m + 136.93 N/m ² K (39 1.78	ly 0.33 x (2 43.62 (38)m 136.29 I)m ÷ (4)	25)m x (5) 40.60 133.27	40.04	37.41	37.41	36.92 129.59 1.69	38.42 131.09 Average = ∑ 1.71	Oct 40.04 132.70 5(39)112, 1.73	Nov 41.18 133.85 /12 = 1.74	Dec 42.37 135.04 133.27 1.76] (38)] (39)
Ventilation heat loss 4 Heat transfer coeffic 1 Heat loss parameter Number of days in m	Jan calculat 4.92 ient, W/ 37.59 (HLP), V 1.79 1.00	ted monthi 44.26 /K (37)m + 136.93 //m ² K (39 1.78 able 1a) 28.00	ly 0.33 x (2 43.62 (38)m 136.29 h)m ÷ (4) 1.78 31.00	25)m x (5) 40.60 133.27 1.74	40.04 132.70 1.73	37.41 130.07 1.70	37.41 130.07 1.70	36.92 129.59 1.69	38.42 131.09 Average = ∑ 1.71 Average = ∑	Oct 40.04 132.70 5(39)112, 1.73 5(40)112,	Nov 41.18 133.85 /12 = 1.74 /12 =	Dec 42.37 135.04 133.27 1.76 1.74] (38)] (39)] (40)
Ventilation heat loss 4 Heat transfer coeffic 1 Heat loss parameter Number of days in m 3	Jan calculat 4.92 ient, W/ 37.59 (HLP), V 1.79 1.79 nonth (Tr 1.00	ted monthi 44.26 /K (37)m + 136.93 //m ² K (39 1.78 able 1a) 28.00	ly 0.33 x (2 43.62 (38)m 136.29 h)m ÷ (4) 1.78 31.00	25)m x (5) 40.60 133.27 1.74	40.04 132.70 1.73	37.41 130.07 1.70	37.41 130.07 1.70	36.92 129.59 1.69	38.42 131.09 Average = ∑ 1.71 Average = ∑	Oct 40.04 132.70 5(39)112, 1.73 5(40)112,	Nov 41.18 133.85 /12 = 1.74 /12 =	Dec 42.37 135.04 133.27 1.76 1.74] (38)] (39)] (40)
Ventilation heat loss 4 Heat transfer coeffic 1 Heat loss parameter Number of days in m 3 4. Water heating er	Jan calculat 4.92 ient, W/ 37.59 (HLP), V 1.79 nonth (Ti 1.00 nergy re	ted monthi 44.26 /K (37)m + 136.93 ///m ² K (39 1.78 able 1a) 28.00	ly 0.33 x (2 43.62 (38)m 136.29))m ÷ (4) 1.78 31.00	25)m x (5) 40.60 133.27 1.74 30.00	40.04 132.70 1.73 31.00	37.41 130.07 1.70 30.00	37.41 130.07 1.70	36.92 129.59 1.69	38.42 131.09 Average = ∑ 1.71 Average = ∑	Oct 40.04 132.70 5(39)112, 1.73 5(40)112,	Nov 41.18 133.85 /12 = 1.74 /12 =	Dec 42.37 135.04 133.27 1.76 1.74 31.00] (38)] (39)] (40)] (40)
Ventilation heat loss 4 Heat transfer coeffic 1 Heat loss parameter 3 Number of days in m 3 4. Water heating er Assumed occupancy, Annual average hot v	Jan calculat 4.92 ient, W/ 37.59 (HLP), V 1.79 nonth (Ti 1.00 nergy re	ted monthi 44.26 /K (37)m + 136.93 ///m ² K (39 1.78 able 1a) 28.00	ly 0.33 x (2 43.62 (38)m 136.29))m ÷ (4) 1.78 31.00	25)m x (5) 40.60 133.27 1.74 30.00	40.04 132.70 1.73 31.00	37.41 130.07 1.70 30.00	37.41 130.07 1.70	36.92 129.59 1.69	38.42 131.09 Average = ∑ 1.71 Average = ∑	Oct 40.04 132.70 5(39)112, 1.73 5(40)112,	Nov 41.18 133.85 /12 = 1.74 /12 =	Dec 42.37 135.04 133.27 1.76 1.74 31.00 2.40] (38)] (39)] (40)] (40)] (42)
Ventilation heat loss 4 Heat transfer coeffic 1 Heat loss parameter 3 Number of days in m 3 4. Water heating er Assumed occupancy, Annual average hot v	Jan calculat 4.92 ient, W/ 37.59 (HLP), V 1.79 toonth (Tr 1.00 nergy re , N water us Jan	ted monthi 44.26 /K (37)m + 136.93 ///m ² K (39 1.78 able 1a) 28.00 equirement sage in litre Feb	ly 0.33 x (2 43.62 (38)m 136.29))m ÷ (4) 1.78 31.00 t es per day Mar	25)m x (5) 40.60 133.27 1.74 30.00 Vd,average Apr	40.04 132.70 1.73 31.00 = (25 x N) + May	37.41 130.07 1.70 30.00 + 36 Jun	37.41 130.07 1.70 31.00	36.92 129.59 1.69 31.00	38.42 131.09 Average = ∑ 1.71 Average = ∑ 30.00	Oct 40.04 132.70 5(39)112, 1.73 5(40)112, 31.00	Nov 41.18 133.85 /12 = 1.74 /12 = 30.00	Dec 42.37 135.04 133.27 1.76 1.74 31.00 2.40 91.15] (38)] (39)] (40)] (40)] (42)
Ventilation heat loss 4 Heat transfer coeffic 1 Heat loss parameter 4 Heat loss parameter 5 Number of days in m 3 4. Water heating er Assumed occupancy, Annual average hot w Hot water usage in li	Jan calculat 4.92 ient, W/ 37.59 (HLP), V 1.79 toonth (Tr 1.00 nergy re , N water us Jan	ted monthi 44.26 /K (37)m + 136.93 ///m ² K (39 1.78 able 1a) 28.00 equirement sage in litre Feb	ly 0.33 x (2 43.62 (38)m 136.29))m ÷ (4) 1.78 31.00 t es per day Mar	25)m x (5) 40.60 133.27 1.74 30.00 Vd,average Apr	40.04 132.70 1.73 31.00 = (25 x N) + May	37.41 130.07 1.70 30.00 + 36 Jun	37.41 130.07 1.70 31.00	36.92 129.59 1.69 31.00	38.42 131.09 Average = ∑ 1.71 Average = ∑ 30.00	Oct 40.04 132.70 5(39)112, 1.73 5(40)112, 31.00	Nov 41.18 133.85 /12 = 1.74 /12 = 30.00	Dec 42.37 135.04 133.27 1.76 1.74 31.00 2.40 91.15] (38)] (39)] (40)] (40)] (42)
Ventilation heat loss 4 Heat transfer coeffic 1 Heat loss parameter 4 Heat loss parameter 5 Number of days in m 3 4. Water heating er Assumed occupancy, Annual average hot w Hot water usage in li	Jan calculat 4.92 ient, W/ 37.59 (HLP), V 1.79 t.79 honth (Tr 1.00 hergy re , N water us Jan tres per	ted monthi 44.26 /K (37)m + 136.93 //m ² K (39 1.78 able 1a) 28.00 equirement sage in litre Feb r day for ea	ly 0.33 x (2 43.62 (38)m 136.29)m ÷ (4) 1.78 31.00 t as per day Mar cch month	25)m x (5) 40.60 133.27 1.74 30.00 Vd,average Apr Vd,m = fact	40.04 132.70 1.73 31.00 = (25 x N) + May for from Tal	37.41 130.07 1.70 30.00 → 36 Jun ble 1c x (43	37.41 130.07 1.70 31.00 Jul	36.92 129.59 1.69 31.00	38.42 131.09 Average = ∑ 1.71 Average = ∑ 30.00 Sep	Oct 40.04 132.70 (39)112, (40)112, 31.00 Oct	Nov 41.18 133.85 /12 = 1.74 /12 = 30.00 Nov 96.62	Dec 42.37 135.04 133.27 1.76 1.74 31.00 2.40 91.15 Dec] (38)] (39)] (40)] (40)] (42)
Ventilation heat loss 4 Heat transfer coeffic 1 Heat loss parameter 4 Heat loss parameter 5 Number of days in m 3 4. Water heating er Assumed occupancy, Annual average hot w Hot water usage in li	Jan calculat 4.92 ient, W/ 37.59 (HLP), V 1.79 t.79 nonth (Tr 1.00 nergy re , N water us Jan tres per 00.26	ted monthi 44.26 /K (37)m + 136.93 //m ² K (39 1.78 able 1a) 28.00 equirement sage in litre Feb day for ea 96.62	ly 0.33 x (2 43.62 (38)m 136.29)m ÷ (4) 1.78 31.00 t as per day Mar ch month 92.97	25)m x (5) 40.60 133.27 1.74 30.00 Vd,average Apr Vd,m = fact 89.33	40.04 132.70 1.73 31.00 = (25 x N) + May for from Tal 85.68	37.41 130.07 1.70 30.00 → 36 Jun ble 1c x (43 82.03	37.41 130.07 1.70 31.00 Jul) 82.03	36.92 129.59 1.69 31.00 31.00 Aug 85.68	38.42 131.09 Average = ∑ 1.71 Average = ∑ 30.00 Sep	Oct 40.04 132.70 5(39)112, 1.73 5(40)112, 31.00 Oct 92.97	Nov 41.18 133.85 /12 = 1.74 /12 = 30.00 Nov 96.62	Dec 42.37 135.04 133.27 1.76 1.74 31.00 2.40 91.15 Dec 100.26] (38)] (39)] (40)] (40)] (42)] (43)
Ventilation heat loss 4 Heat transfer coeffic 1 Heat loss parameter 4 Heat loss parameter 5 Number of days in m 3 4. Water heating er Assumed occupancy, Annual average hot w Hot water usage in li 10 Energy content of hoc	Jan calculat 4.92 ient, W/ 37.59 (HLP), V 1.79 t.79 nonth (Tr 1.00 nergy re , N water us Jan tres per 00.26	ted monthi 44.26 /K (37)m + 136.93 //m ² K (39 1.78 able 1a) 28.00 equirement sage in litre Feb day for ea 96.62	ly 0.33 x (2 43.62 (38)m 136.29)m ÷ (4) 1.78 31.00 t as per day Mar ch month 92.97	25)m x (5) 40.60 133.27 1.74 30.00 Vd,average Apr Vd,m = fact 89.33	40.04 132.70 1.73 31.00 = (25 x N) + May for from Tal 85.68	37.41 130.07 1.70 30.00 → 36 Jun ble 1c x (43 82.03	37.41 130.07 1.70 31.00 Jul) 82.03	36.92 129.59 1.69 31.00 31.00 Aug 85.68	38.42 131.09 Average = ∑ 1.71 Average = ∑ 30.00 Sep	Oct 40.04 132.70 5(39)112, 1.73 5(40)112, 31.00 Oct 92.97	Nov 41.18 133.85 /12 = 1.74 /12 = 30.00 Nov 96.62	Dec 42.37 135.04 133.27 1.76 1.74 31.00 2.40 91.15 Dec 100.26] (38)] (39)] (40)] (40)] (42)] (43)
Ventilation heat loss 4 Heat transfer coeffic 1 Heat loss parameter 4 Heat loss parameter 5 Number of days in m 3 4. Water heating er Assumed occupancy, Annual average hot w Hot water usage in li 10 Energy content of hoc	Jan calculat 4.92 ient, W/ 37.59 (HLP), V 1.79 honth (Tr 1.00 hergy re , N water us Jan tres per 00.26 bt water	ted monthi 44.26 /K (37)m + 136.93 //m ² K (39 1.78 able 1a) 28.00 equirement sage in litre Feb day for ea 96.62 used = 4.1	ly 0.33 x (2 43.62 (38)m 136.29)m ÷ (4) 1.78 31.00 t ss per day Mar ch month 92.97 8 x Vd,m ×	25)m x (5) 40.60 133.27 1.74 30.00 Vd,average Apr Vd,m = fact 89.33 nm x Tm/3	40.04 132.70 1.73 31.00 = (25 x N) + May for from Tal 85.68 3600 kWh/r	37.41 130.07 1.70 30.00 30.00 30.00 1.70 30.00 1.70 30.00 1.70 30.00 1.70 30.00 1.70 30.00 1.70 30.00 1.70 30.00 1.70 1.70 30.00 1.70 30.00 1.70 30.00 1.70 1.	37.41 130.07 1.70 31.00 Jul) 82.03 Tables 1b,	36.92 129.59 1.69 31.00 Aug 85.68 1c 1d)	38.42 131.09 Average = ∑ 1.71 Average = ∑ 30.00 Sep 89.33	Oct 40.04 132.70 (39)112, (40)112, 31.00 Oct 92.97 Σ(44)1	Nov 41.18 133.85 /12 = 1.74 /12 = 30.00 0 0 0 0 0 0 0 0 0 0 0 0	Dec 42.37 135.04 133.27 1.76 1.76 1.74 31.00 2.40 91.15 Dec 100.26 1093.80] (38)] (39)] (40)] (40)] (40)] (42)] (43)

22.30 19.51	20.13 17.55	16.84 14.5	3 13.46	15.45 15.64	18.22 19.89	21.60 (46)
Water storage loss calculated for each		10.04 14.5	15.40	15.45 15.04	18.22 19.89	21.00 (40)
0.00 0.00	0.00 0.00	0.00 0.0	0 0.00	0.00 0.00	0.00 0.00	0.00 (56)
If the vessel contains dedicated solar s					0.00	
0.00 0.00	0.00 0.00	0.00 0.0		0.00 0.00	0.00 0.00	0.00 (57)
Primary circuit loss for each month fro		0.00 0.0	0.00	0.00 0.00	0.00	0.00 (07)
0.00 0.00	0.00 0.00	0.00 0.0	0 0.00	0.00 0.00	0.00 0.00	0.00 (59)
Combi loss for each month from Table		0.00 0.0	0.00	0.00 0.00	0.00 0.00	0.00 (00)
50.96 46.03	50.96 49.32	50.96 49.3	2 50.96	50.96 49.32	50.96 49.32	50.96 (61)
Total heat required for water heating of	I				00000 10002	
199.65 176.07	185.15 166.31	163.22 146.		153.97 153.55	172.44 181.92	194.96 (62)
Solar DHW input calculated using Appe						(
0.00 0.00	0.00 0.00	0.00 0.0	0 0.00	0.00 0.00	0.00 0.00	0.00 (63)
Output from water heater for each mo						
199.65 176.07	185.15 166.31	163.22 146.	19 140.72	153.97 153.55	172.44 181.92	194.96
						2034.14 (64)
Heat gains from water heating (kWh/n	nonth) 0.25 × [0.85 × (4	15)m + (61)m] + ().8 × [(46)m + (57)m + (59)m]	2(0),	
62.18 54.75	57.36 51.23	50.07 44.5		46.99 46.99	53.13 56.42	60.62 (65)
5. Internal gains						
Jan Feb	Mar Apr	May Jur	lut r	Aug Sep	Oct Nov	Dec
Metabolic gains (Table 5)						
119.89 119.89	119.89 119.89	119.89 119.	89 119.89	119.89 119.89	119.89 119.89	119.89 <mark>(66)</mark>
Lighting gains (calculated in Appendix I	., equation L9 or L9a), a	also see Table 5				
23.68 21.03	17.10 12.95	9.68 8.1	7 8.83	11.48 15.40	19.56 22.83	24.34 (67)
Appliance gains (calculated in Appendi	x L, equation L13 or L13	3a), also see Tabl	e 5			
212.47 214.68	209.12 197.29	182.36 168.	33 158.95	156.75 162.30	174.13 189.06	203.10 (68)
Cooking going (coloulated in Annondiv				150.75 102.50		
	L, equation L15 or L15a), also see Table	5	100.75 102.00		
34.99 34.99	L, equation L15 or L15a 34.99 34.99), also see Table 34.99 34.9		34.99 34.99	34.99 34.99	34.99 (69)
						34.99 (69)
34.99 34.99			9 34.99			34.99 (69) 3.00 (70)
34.9934.99Pump and fan gains (Table 5a)	34.99 34.99	34.99 34.9	9 34.99	34.99 34.99	34.99 34.99	`` ` `
34.99 34.99 Pump and fan gains (Table 5a) 3.00	34.99 34.99	34.99 34.9	99 34.99 0 3.00	34.99 34.99	34.99 34.99	`` ` `
34.9934.99Pump and fan gains (Table 5a)3.003.00Losses e.g. evaporation (Table 5)	34.99 34.99 3.00 3.00	34.99 34.9 3.00 3.0	99 34.99 0 3.00	34.99 34.99 3.00 3.00	34.99 34.99 3.00 3.00	3.00 (70)
34.99 34.99 Pump and fan gains (Table 5a) 3.00 3.00 3.00 Losses e.g. evaporation (Table 5) -95.92	34.99 34.99 3.00 3.00	34.99 34.9 3.00 3.0	99 34.99 0 3.00 92 -95.92	34.99 34.99 3.00 3.00	34.99 34.99 3.00 3.00	3.00 (70)
34.9934.99Pump and fan gains (Table 5a)3.003.00Losses e.g. evaporation (Table 5)-95.92-95.92Vater heating gains (Table 5)	34.99 34.99 3.00 3.00 -95.92 -95.92 77.10 71.15	34.99 34.9 3.00 3.0 -95.92 -95.9 67.29 61.8	99 34.99 0 3.00 92 -95.92	34.99 34.99 3.00 3.00 -95.92 -95.92	34.99 34.99 3.00 3.00 -95.92 -95.92	3.00 (70) -95.92 (71)
34.99 34.99 Pump and fan gains (Table 5a) 3.00 3.00 3.00 Losses e.g. evaporation (Table 5) -95.92 -95.92 -95.92 Water heating gains (Table 5) 83.57 83.57 81.47	34.99 34.99 3.00 3.00 -95.92 -95.92 77.10 71.15	34.99 34.9 3.00 3.0 -95.92 -95.9 67.29 61.8	99 34.99 0 3.00 92 -95.92 36 57.24	34.99 34.99 3.00 3.00 -95.92 -95.92	34.99 34.99 3.00 3.00 -95.92 -95.92	3.00 (70) -95.92 (71)
34.99 34.99 Pump and fan gains (Table 5a) 3.00 3.00 3.00 Losses e.g. evaporation (Table 5) -95.92 -95.92 -95.92 Water heating gains (Table 5) 83.57 83.57 81.47 Total internal gains (66)m + (67)m + (6 381.69 379.14	34.99 34.99 3.00 3.00 -95.92 -95.92 77.10 71.15 8)m + (69)m + (70)m +	34.99 34.9 3.00 3.0 -95.92 -95.9 67.29 61.8 (71)m + (72)m	99 34.99 0 3.00 92 -95.92 36 57.24	34.99 34.99 3.00 3.00 -95.92 -95.92 63.16 65.26	34.99 34.99 3.00 3.00 -95.92 -95.92 71.41 78.36	3.00 (70) -95.92 (71) 81.48 (72)
34.99 34.99 Pump and fan gains (Table 5a) 3.00 3.00 3.00 Losses e.g. evaporation (Table 5) -95.92 -95.92 -95.92 Water heating gains (Table 5) 83.57 83.57 81.47 Total internal gains (66)m + (67)m + (67	34.99 34.99 3.00 3.00 -95.92 -95.92 77.10 71.15 8)m + (69)m + (70)m + 365.29 343.36	34.99 34.9 3.00 3.0 -95.92 -95.9 67.29 61.8 (71)m + (72)m 321.30 300.	99 34.99 0 3.00 92 -95.92 36 57.24 33 286.99	34.99 34.99 3.00 3.00 -95.92 -95.92 63.16 65.26 293.35 304.94	34.99 34.99 3.00 3.00 -95.92 -95.92 71.41 78.36 327.07 352.22	3.00 (70) -95.92 (71) 81.48 (72) 370.88 (73)
34.99 34.99 Pump and fan gains (Table 5a) 3.00 3.00 3.00 Losses e.g. evaporation (Table 5) -95.92 -95.92 -95.92 Water heating gains (Table 5) 83.57 83.57 81.47 Total internal gains (66)m + (67)m + (6 381.69 379.14	34.99 34.99 3.00 3.00 -95.92 -95.92 77.10 71.15 8)m + (69)m + (70)m +	34.99 34.9 3.00 3.0 -95.92 -95.9 67.29 61.8 (71)m + (72)m	99 34.99 0 3.00 92 -95.92 36 57.24	34.99 34.99 3.00 3.00 -95.92 -95.92 63.16 65.26 293.35 304.94 g specific data	34.99 34.99 3.00 3.00 -95.92 -95.92 71.41 78.36 327.07 352.22 FF specific data	3.00 (70) -95.92 (71) 81.48 (72)
34.99 34.99 Pump and fan gains (Table 5a) 3.00 3.00 3.00 Losses e.g. evaporation (Table 5) -95.92 -95.92 -95.92 Water heating gains (Table 5) 83.57 83.57 81.47 Total internal gains (66)m + (67)m + (6 381.69 379.14	34.99 34.99 3.00 3.00 -95.92 -95.92 77.10 71.15 8)m + (69)m + (70)m + 365.29 343.36	34.99 34.9 3.00 3.0 -95.92 -95.9 67.29 61.8 (71)m + (72)m 321.30 300. Area	99 34.99 0 3.00 92 -95.92 36 57.24 33 286.99 Solar flux	34.99 34.99 3.00 3.00 -95.92 -95.92 63.16 65.26 293.35 304.94 g specific data or Table 6b	34.99 34.99 3.00 3.00 -95.92 -95.92 71.41 78.36 327.07 352.22 FFF specific data or Table 6c	3.00 (70) -95.92 (71) 81.48 (72) 370.88 (73) Gains
34.99 34.99 Pump and fan gains (Table 5a) 3.00 3.00 3.00 Losses e.g. evaporation (Table 5) -95.92 -95.92 -95.92 Water heating gains (Table 5) 83.57 83.57 81.47 Total internal gains (66)m + (67)m + (6 381.69 379.14	34.99 34.99 3.00 3.00 -95.92 -95.92 77.10 71.15 8)m + (69)m + (70)m + 365.29 343.36	34.99 34.9 3.00 3.0 -95.92 -95.9 67.29 61.8 (71)m + (72)m 321.30 300. Area	99 34.99 0 3.00 92 -95.92 36 57.24 33 286.99 Solar flux W/m ²	34.99 34.99 3.00 3.00 -95.92 -95.92 63.16 65.26 293.35 304.94 g specific data or Table 6b 0.9 x 0.72 x	34.99 34.99 3.00 3.00 -95.92 -95.92 71.41 78.36 327.07 352.22 FF specific data or Table 6c	3.00 (70) -95.92 (71) 81.48 (72) 370.88 (73) Gains W 33.82 (80)
34.99 34.99 Pump and fan gains (Table 5a) 3.00 3.00 3.00 Losses e.g. evaporation (Table 5) -95.92 -95.92 -95.92 Water heating gains (Table 5) 83.57 83.57 81.47 Total internal gains (66)m + (67)m + (6) 381.69 379.14	34.99 34.99 3.00 3.00 -95.92 -95.92 77.10 71.15 8)m + (69)m + (70)m + 365.29 343.36 Access factor Table 6d 0.77 x 0.77 x	34.99 34.9 3.00 3.0 3.00 3.0 -95.92 -95.9 67.29 61.8 (71)m + (72)m 321.30 300. Area m² 300. 4.93 x 7.99 x	99 34.99 00 3.00 92 -95.92 36 57.24 33 286.99 Solar flux W/m² 19.64 x 19.64 x	34.99 34.99 3.00 3.00 -95.92 -95.92 63.16 65.26 293.35 304.94 g specific data or Table 6b 0.9 x 0.72 x 0.9 x 0.72 x	34.99 34.99 3.00 3.00 -95.92 -95.92 71.41 78.36 327.07 352.22 FF specific data or Table 6c 0.70 = 0.70 =	3.00 (70) -95.92 (71) 81.48 (72) 370.88 (73) Gains W 33.82 (80) 54.81 (76)
34.99 34.99 Pump and fan gains (Table 5a) 3.00 3.00 3.00 Losses e.g. evaporation (Table 5) -95.92 -95.92 -95.92 Water heating gains (Table 5) 83.57 83.57 81.47 Total internal gains (66)m + (67)m + (6 381.69 379.14	34.99 34.99 3.00 3.00 -95.92 -95.92 77.10 71.15 8)m + (69)m + (70)m + 365.29 343.36 Access factor Table 6d 0.77 x	34.99 34.9 3.00 3.0 -95.92 -95.9 67.29 61.8 (71)m + (72)m 321.30 300. Area m²	99 34.99 0 3.00 92 -95.92 36 57.24 33 286.99 Solar flux W/m² 19.64 x 19.64 x 19.64 x 10.63 x	34.99 34.99 3.00 3.00 -95.92 -95.92 63.16 65.26 293.35 304.94 g specific data or Table 6b 0.9 x 0.72 x 0.9 x 0.72 x 0.9 x 0.72 x 0.9 x 0.72 x	34.99 34.99 3.00 3.00 -95.92 -95.92 71.41 78.36 327.07 352.22 FF specific data or Table 6c 0.70 = 0.70 = 0.70 = 0.70 =	3.00 (70) -95.92 (71) 81.48 (72) 370.88 (73) Gains (73) 54.81 (76) 16.04 (74)
34.99 34.99 Pump and fan gains (Table 5a) 3.00 3.00 3.00 Losses e.g. evaporation (Table 5) -95.92 -95.92 Water heating gains (Table 5) 83.57 81.47 Total internal gains (66)m + (67)m + (6) 381.69 379.14 6. Solar gainsWestEastNorthEast	34.99 34.99 3.00 3.00 -95.92 -95.92 77.10 71.15 8)m + (69)m + (70)m + 365.29 343.36 Access factor Table 6d 0.77 x 0.77 x	34.99 34.9 3.00 3.0 3.00 3.0 -95.92 -95.9 67.29 61.8 (71)m + (72)m 321.30 300. Area m² 300. 4.93 x 7.99 x	99 34.99 0 3.00 92 -95.92 36 57.24 33 286.99 Solar flux W/m² 19.64 x 19.64 x 19.64 x 10.63 x	34.99 34.99 3.00 3.00 -95.92 -95.92 63.16 65.26 293.35 304.94 g specific data or Table 6b 0.9 x 0.72 x 0.9 x 0.72 x	34.99 34.99 3.00 3.00 -95.92 -95.92 71.41 78.36 327.07 352.22 FF specific data or Table 6c 0.70 = 0.70 = 0.70 = 0.70 =	3.00 (70) -95.92 (71) 81.48 (72) 370.88 (73) Gains W 33.82 (80) 54.81 (76)
34.99 34.99 Pump and fan gains (Table 5a) 3.00 3.00 3.00 Losses e.g. evaporation (Table 5) -95.92 -95.92 -95.92 Water heating gains (Table 5) 83.57 83.57 81.47 Total internal gains (66)m + (67)m + (6 381.69 379.14 6. Solar gains West East North	34.99 34.99 3.00 3.00 -95.92 -95.92 77.10 71.15 8)m + (69)m + (70)m + 365.29 343.36 Access factor Table 6d 0.77 x 0.77 x 0.77 x 0.77 x	34.99 34.9 3.00 3.0 -95.92 -95.9 67.29 61.8 (71)m + (72)m 321.30 300. Area m²	99 34.99 00 3.00 92 -95.92 36 57.24 33 286.99 Solar flux W/m² 19.64 x 19.64 x 10.63 x 26.24 x	34.99 34.99 3.00 3.00 -95.92 -95.92 63.16 65.26 293.35 304.94 g specific data or Table 6b 0.9 x 0.72 x 0.9 x 0.72 x 0.9 x 0.72 x 0.9 x 0.72 x	34.99 34.99 3.00 3.00 -95.92 -95.92 71.41 78.36 327.07 352.22 FF specific data or Table 6c 0.70 = 0.70 = 0.70 = 0.70 =	3.00 (70) -95.92 (71) 81.48 (72) 370.88 (73) Gains (73) 54.81 (76) 16.04 (74)

Total gains - internal and solar (73)m + (83)m

	496.24	603.01	736.85	895.02	1009.42	1010.85	960.87	863.56	739.79	593.16	494.93	465.20	(84)
7. Mean interr	al tempera	iture (heatii	ng season)										
Temperature du				area from T	able 9. Th1	(°C)						21.00	(85)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec] ()
Utilisation facto	r for gains f	or living are	ea n1,m (se	•	•			Ū	•				
	1.00	1.00	1.00	0.99	0.92	0.76	0.58	0.66	0.93	1.00	1.00	1.00	(86)
Mean internal t	emp of livin	g area T1 (s	teps 3 to 7	' in Table 90	:)			•			•		_
	19.74	19.88	20.13	20.49	20.79	20.96	20.99	20.98	20.84	20.44	20.04	19.73	(87)
Temperature du	Iring heatin	g periods in	the rest o	f dwelling f	rom Table 9	9, Th2(°C)					·		_
	19.47	19.48	19.49	19.51	19.52	19.54	19.54	19.55	19.53	19.52	19.51	19.50	(88)
Utilisation facto	r for gains f	or rest of d	welling n2,	m									
	1.00	1.00	1.00	0.97	0.86	0.62	0.40	0.47	0.84	0.99	1.00	1.00	(89)
Mean internal t	emperature	e in the rest	of dwellin	g T2 (follow	steps 3 to	7 in Table 9	əc)						
	18.36	18.50	18.76	19.13	19.40	19.53	19.54	19.55	19.47	19.10	18.69	18.37	(90)
Living area fract	ion								Li	ving area ÷	(4) =	0.24	(91)
Mean internal t	emperature	e for the wh	ole dwellir	ng fLA x T1 -	+(1 - fLA) x⊺	г2							
	18.69	18.83	19.09	19.46	19.74	19.87	19.89	19.89	19.80	19.42	19.01	18.70	(92)
Apply adjustme	nt to the me	ean internal	l temperat	ure from Ta	able 4e whe	re appropr	iate						
	18.69	18.83	19.09	19.46	19.74	19.87	19.89	19.89	19.80	19.42	19.01	18.70	(93)
8. Space heati	ag roquiror	aant											
o. Space fleath	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation facto			IVIAI	Арі	Ividy	Jun	101	Aug	Jep	000	NOV	Dec	
othisution facto	1.00	1.00	1.00	0.97	0.88	0.65	0.44	0.52	0.86	0.99	1.00	1.00	(94)
Useful gains, ŋn				0.57	0.00	0.05	0.44	0.52	0.00	0.55	1.00	1.00] (34)
, (, -	496.09	602.41	733.42	870.22	883.94	662.08	426.07	447.78	635.32	587.50	494.53	465.11	(95)
Monthly averag	L		1			001.00		1	000102	007.00	1.5.1.00] (55)
, .	4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)
Heat loss rate fo] ()
	1980.11	1908.00	1715.73	1406.85	1066.37	685.96	428.07	452.48	747.11	1170.76	1594.51	1958.15	(97)
Space heating r	equirement	, kWh/mon		[(97)m - (9	5)m] x (41)	m							
	1104.11	877.36	730.84	386.37	135.73	0.00	0.00	0.00	0.00	433.94	791.98	1110.82]
							•		∑(9)	8)15 <i>,</i> 10	.12 =	5571.16	(98)
Space heating r	equirement	kWh/m²/ye	ear							(98)	÷ (4)	72.61	(99)
													_
9a. Energy req	uirements -	- individual	heating sy	stems inclu	iding micro	-СНР							
Space heating													1
Fraction of space				ntary syste	m (table 11)						0.00] (201)
Fraction of space										1 - (2	01) = [1.00] (202)] (202)
Fraction of space		-							(2)			0.00] (202)
Fraction of tota			-						(20	02) x [1- (20		1.00] (204)
Fraction of tota			system 2							(202) x (2	U3) = [0.00] (205)] (205)
Efficiency of ma	-		Mar	A	Mari	l 	11	۸~	500	0.0	Nevi	88.80	(206)
Space heating f	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
space neating n				125 10	152.04	0.00	0.00	0.00	0.00	100 00	001 07	1250.02	1
	1243.37	988.01	823.02	435.10	152.84	0.00	0.00	0.00		488.68	891.87	1250.93]
Water heating									2(21	1)15, 10	.12 - []	6273.83] (211)
Water heating													

Efficiency of water	r heater												
	87.24	87.10	86.75	85.78	83.47	79.50	79.50	79.50	79.50	85.94	86.90	87.28	(217)
Water heating fue	el, kWh/me	onth											
	228.86	202.16	213.44	193.88	195.54	183.88	177.01	193.67	193.15	200.65	209.34	223.38]
										∑(219a)1	.12 =	2414.95	(219)
Annual totals													-
Space heating fuel	l - main sy	stem 1										6273.83	1
Water heating fue	el .											2414.95	1
Electricity for pum	nps, fans a	nd electric	keep-hot (Table 4f)									
central heating	g pump or	water pun	np within w	arm air hea	ating unit				30.00]			(230c)
boiler flue fan									45.00	ĺ			(230e)
Total electricity fo	r the abov	/e, kWh/ye	ar					1		75.00	(231)		
Electricity for light	ing (Appe	ndix L)								418.15	(232)		
Total delivered en								(211)(221	L) + (231) +	(232)(237	7b) =	9181.92	(238)
	0,								·				
10a. Fuel costs -	individual	heating sy	ystems inclu	uding micro	o-CHP								
						Fuel		Fu	uel price			Fuel	
						Wh/year				1		ost £/year	7
Space heating - ma	ain system	n 1				5273.83	x		3.48	x 0.01		218.33	(240)
Water heating						2414.95	х		3.48	x 0.01		84.04	(247)
Pumps and fans						75.00	x		13.19	x 0.01		9.89	(249)
Electricity for light	-					418.15	×		13.19	x 0.01	=	55.15] (250)
Additional standin	ig charges											120.00] (251) _
Total energy cost								(2	40)(242) -	+ (245)(25	54) =	487.42	(255)
11a. SAP rating -	individua	I heating s	vstems incl	luding micr	о-СНР								
Energy cost deflat		-										0.42	(256)
Energy cost factor		,										1.68	(257)
SAP value	(-)											76.54]
SAP rating (section	n 13)											77	(258)
SAP band	- 1											С]
													_
12a. CO ₂ emissio	ns - indivi	idual heati	ng systems	including	micro-CHP								
						Energy Wh/year			sion factor CO₂/kWh			Emissions g CO₂/year	
Space heating - ma	ain system	n 1			E	5273.83	x	_	0.22] =		1355.15	(261)
Water heating						2414.95	x		0.22] =		521.63	(264)
Space and water h	neating							(26	51) + (262) +	1	54) =	1876.77	(265)
Pumps and fans						75.00	x	(0.52] =	- · · ,	38.93	(267)
Electricity for light	ing					418.15	x		0.52] =		217.02	(268)
Total CO ₂ , kg/year	-									(265)(2	71) =	2132.72	(272)
Dwelling CO ₂ emis										(272) ÷		27.80	(273)
El value										(_/_/		76.52]
El rating (section 1	14)											77	(274)
El band	- · /											C]
												-	_
13a. Primary ene	ergy - indiv	vidual heat	ting system	s including									
						Energy Wh/year		Prim	nary factor			mary Energy Wh/year	1
Space heating - ma	ain system	n 1				5273.83	x	[1.22] =		7654.07	(261)
Space nearing - Ille	uni systell					5.05	l X	L	1.22] –	Ĺ	1054.07] (201)

Water heating	2414.95	x	1.22	=	2946.23	(264)
Space and water heating			(261) + (262) +	(263) + (264) =	10600.30	(265)
Pumps and fans	75.00	х	3.07	=	230.25	(267)
Electricity for lighting	418.15	x	3.07	=	1283.72	(268)
Primary energy kWh/year					12114.27	(272)
Dwelling primary energy rate kWh/m2/year					157.88	(273)



This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mrs Nicola I	Battista					Ass	essor num	ber	3998		
Client	The Halebo	urne Groเ	qu				Las	t modified		26/08	/2014	
Address	Plot 7 The C	Old Schoo	l Park Lane	, Richmon	d <i>,</i> TW9							
1. Overall dwelling dime	nsions			_	4 20							
				A	rea (m²)			age storey ight (m)		Vo	lume (m³)	
owest occupied					54.80	(1a) x		2.35	(2a) =		128.78	(3a)
1					48.78	(1b) x		2.70	(2b) =		131.71	(3b)
2					27.71	(1c) x		2.70	(2c) =		74.82] (3c)
otal floor area	(1a) + ((1b) + (1c)) + (1d)(1	n) =	131.29	(4)						_
welling volume							(3a)	+ (3b) + (3d	c) + (3d)(3	n) =	335.30	(5)
2. Ventilation rate												_
z. ventilation rate										m	³ per hour	
lumber of chimneys								0	x 40 =		0	(6a)
lumber of open flues								0	x 40 =		0] (6b)
lumber of intermittent fa	anc							4	x 10 =		40] (00)] (7a)
lumber of passive vents	115							0	x 10 =		0] (7a)
lumber of flueless gas fir	0 5							0	x 40 =		0] (75)
fumber of fueless gas in	23							0	x 40 -	Airo	hanges pe	
											hour	
nfiltration due to chimne	ys, flues, fans, P	۶Vs		(6a)	+ (6b) + (7a	a) + (7b) + (7	7c) =	40	÷ (5) =		0.12	(8)
f a pressurisation test has	s been carried o	ut or is in	tended, pro	oceed to (1	17), otherw	ise continue	e from (9) to	o (16)				
ir permeability value, q5	0, expressed in	cubic me	tres per ho	ur per squ	are metre o	of envelope	area				3.00	(17)
based on air permeabili	ty value, then (1	L8) = [(17)	÷ 20] + (8), otherwis	se (18) = (16	5)					0.27	(18)
lumber of sides on which	the dwelling is	sheltered	ł								2	(19)
helter factor								1 -	[0.075 x (19	9)] =	0.85	
												(20)
nfiltration rate incorpora	ting shelter fact	or							(18) x (2	0) =	0.23] (20)] (21)
•									(18) x (2	0) =	0.23	-
			Apr	May	Jun	Jul	Aug	Sep	(18) x (2 Oct	0) = Nov	0.23 Dec	-
nfiltration rate modified f	for monthly win Feb	nd speed: Mar	Apr	May	Jun	Jul		Sep			Dec] (21)
nfiltration rate modified f Jan Nonthly average wind spo 5.10	for monthly win Feb	nd speed: Mar	Apr 4.40	May 4.30	Jun 3.80	Jul 3.80	Aug 3.70	Sep				-
Nonthly average wind spe	for monthly win Feb eed from Table	nd speed: Mar U2			1			_	Oct	Nov	Dec] (21)
nfiltration rate modified f Jan Nonthly average wind spo 5.10	for monthly win Feb eed from Table	nd speed: Mar U2			1			_	Oct	Nov	Dec] (21)
filtration rate modified f Jan Ionthly average wind spo 5.10 Vind factor (22)m ÷ 4	for monthly win Feb eed from Table 5.00 1.25	1.23	4.40	4.30	3.80 0.95	3.80	3.70	4.00	Oct 4.30	Nov 4.50	Dec] (21)] (22)
nfiltration rate modified f Jan Nonthly average wind spo 5.10 Vind factor (22)m ÷ 4	for monthly win Feb eed from Table 5.00 1.25	1.23	4.40	4.30	3.80 0.95	3.80	3.70	4.00	Oct 4.30	Nov 4.50	Dec] (21)] (22)
filtration rate modified f Jan Ionthly average wind spo 5.10 Vind factor (22)m ÷ 4 1.28 djusted infiltration rate (0.29	for monthly win Feb eed from Table 5.00 1.25 (allowing for she 0.29	Mar U2 4.90 1.23 elter and volume 0.28	4.40 1.10 wind facto 0.25	4.30 1.08 r) (21) x (2	3.80 0.95 2a)m	3.80 0.95	3.70 0.93	4.00	Oct 4.30 1.08	Nov 4.50	Dec 4.70] (21)] (22)] (22)
nfiltration rate modified f Jan Monthly average wind spo 5.10 Vind factor (22)m ÷ 4 1.28 djusted infiltration rate (for monthly win Feb eed from Table 5.00 1.25 (allowing for she 0.29 nge rate for the	Mar U2 4.90 1.23 elter and 0.28 e applicab	4.40 1.10 wind facto 0.25 le case:	4.30 1.08 r) (21) x (2	3.80 0.95 2a)m	3.80 0.95	3.70 0.93	4.00	Oct 4.30 1.08	Nov 4.50	Dec 4.70] (21)] (22)] (22)] (22)
nfiltration rate modified f Jan Monthly average wind spa 5.10 Vind factor (22)m ÷ 4 1.28 djusted infiltration rate (0.29 falculate effective air cha	for monthly win Feb eed from Table 5.00 1.25 (allowing for she 0.29 nge rate for the on: air change rate	Mar U2 4.90 1.23 elter and 0.28 e applicab ate throug	4.40 1.10 wind facto 0.25 le case: gh system	4.30 1.08 r) (21) x (2 0.25	3.80 0.95 2a)m 0.22	3.80 0.95 0.22	3.70 0.93	4.00	Oct 4.30 1.08	Nov 4.50	Dec 4.70 1.18 0.27] (21)] (22)] (22)
filtration rate modified f Jan Ionthly average wind spo 5.10 /ind factor (22)m ÷ 4 1.28 djusted infiltration rate (0.29 alculate effective air cha If mechanical ventilatio	for monthly win Feb eed from Table 5.00 1.25 (allowing for she 0.29 nge rate for the on: air change rate recovery: efficient	Mar U2 4.90 1.23 elter and 0.28 e applicab ate throug ncy in % a	4.40 1.10 wind facto 0.25 le case: gh system sllowing fo	4.30 1.08 r) (21) x (2 0.25	3.80 0.95 2a)m 0.22	3.80 0.95 0.22	3.70 0.93	4.00	Oct 4.30 1.08	Nov 4.50	Dec 4.70 1.18 0.27] (21] (22] (22] (22] (22



	0.54	0.54	0.54	0.53	0.53	0.52	0.52	0.52	0.53	0.53	0.53	0.54	(25
					· · ·							·	_
3. Heat losses a	nd heat lo	ss paramet		6	0	N 1 - 4			A			•	
Element				Gross rea, m ²	Openings m ²		area m²	U-value W/m²K	A x U W		value, /m².K	Ахк, kJ/K	
Door						3.	72 x	1.20	= 4.46				(26
Window						12	.46 x	1.33	= 16.52	2			(27
Roof window						6.	39 x	1.33	= 8.47				(27
Basement floor						54	.80 x	0.10	= 5.48				(28
External wall						110	D.66 x	0.20	= 22.13	3			(29
Basement wall						51	.47 x	0.18	= 9.26				(29
Party wall						61	.28 x	0.00	= 0.00				(32
Roof						38	.64 x	0.10	= 3.86				(30
Roof						10	.03 x	0.12	= 1.20				(30
Roof						1.	11 x	0.15	= 0.17				(30
Total area of exte	ernal elem	ents ∑A, m²				28	9.28						(31
abric heat loss,	W/K = ∑(A	× U)							(2	6)(30) + (32) =	71.57	(33
Heat capacity Cm	n = ∑(А x к)	1						(28)	(30) + (32)	+ (32a)(3	2e) =	N/A	(34
Thermal mass pa	rameter (T	MP) in kJ/n	∩²K									250.00	(35
Thermal bridges:	Σ(L x Ψ) ca	alculated us	ing Append	dix K								19.77	(36
Total fabric heat	loss									(33) + (36) =	91.33	(37
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ventilation heat	loss calcula	ated month	ly 0.33 x (2	25)m x (5)									_
	60.04	59.85	59.67	58.83	58.67	57.94	57.94	57.81	58.22	58.67	58.99	59.33	(38
Heat transfer coe	efficient, W	//K (37)m +	· (38)m					_					_
	151.37	151.19	151.01	150.17	150.01	149.27	149.27	149.14	149.56	150.01	150.33		
									Average = 2	∑(39)112,	/12 =	150.17	(39
Heat loss parame								1			1		-
	1.15	1.15	1.15	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.15	
Number of doub		Tabla 1a)							Average = 2	∑(40)112,	/12 =	1.14	(40
Number of days i	•		24.00	20.00	21.00	20.00	21.00	21.00	20.00	24.00	20.00	21.00	
	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00	(40
4. Water heatin	ig energy r	equiremen	t										
Assumed occupa	ncy, N											2.90	(42
	not water u	usage in litre	es per day ۱	√d,average	= (25 x N) +	36						103.03	(43
Annual average h		Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	Jan					le 1c x (43	3)						
Annual average h			ch month v	Vd,m = fact	tor from Tab		•						
Annual average h			ach month 105.09	Vd,m = fact 100.97	tor from Tab 96.85	92.73	92.73	96.85	100.97	105.09	109.22	113.34	
Annual average h	in litres pe	er day for ea			r – – – – – – – – – – – – – – – – – – –			96.85	100.97	105.09 Σ(44)1	·	113.34 1236.40	(44
Annual average h Hot water usage	in litres pe 113.34	er day for ea	105.09	100.97	96.85	92.73	92.73	-	100.97		·	1	(44
	in litres pe 113.34	er day for ea	105.09	100.97	96.85	92.73	92.73	-	100.97		·	1236.40]] (44

	25.21	22.05	22.75	19.84	19.03	16.43	15.22	17.47	17.67	20.60	22.48	24.42	(46)	
Water storage loss calculated for each month (55) x (41)m														
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(56)	
If the vessel cont	If the vessel contains dedicated solar storage or dedicated WWHRS (56)m x [(47) - Vs] ÷ (47), else (56)													

	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(57)
Primary circuit lo	oss for each	n month fro	m Table 3										
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(59)
Combi loss for e	ach month	from Table	3a, 3b or 3	с									
	50.96	46.03	50.96	49.32	49.35	45.73	47.25	49.35	49.32	50.96	49.32	50.96	(61)
Total heat requi	red for wat	er heating o	calculated f	or each mo	onth 0.85 x	(45)m + (4	46)m + (57)r	n + (59)m	+ (61)m				
	219.03	193.03	202.65	181.56	176.25	155.23	148.72	165.79	167.14	188.27	199.21	213.73	(62)
Solar DHW input	t calculated	l using Appe	endix G or A	Appendix H									
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(63)
Output from wa	ter heater f	for each mo	onth (kWh/	month) (62	2)m + (63)m	ı							
	219.03	193.03	202.65	181.56	176.25	155.23	148.72	165.79	167.14	188.27	199.21	213.73]
										∑(64)1	.12 =	2210.62	(64)
Heat gains from	water heat	ing (kWh/m	nonth) 0.2	5 × [0.85 ×	(45)m + (61	.)m] + 0.8 :	× [(46)m + (57)m + (5	9)m]				
	68.62	60.38	63.18	56.30	54.53	47.84	45.55	51.05	51.51	58.40	62.17	66.86	(65)
		•	•	•	•	•						.	_
5. Internal gain	IS												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains	(Table 5)												_
	144.91	144.91	144.91	144.91	144.91	144.91	144.91	144.91	144.91	144.91	144.91	144.91	(66)
Lighting gains (c	alculated in	Appendix I	L, equation	L9 or L9a),	also see Ta	ble 5							_
	28.07	24.93	20.27	15.35	11.47	9.69	10.47	13.60	18.26	23.18	27.06	28.85	(67)
Appliance gains	(calculated	in Appendi	x L, equatio	on L13 or L	13a), also se	ee Table 5							_
	299.27	302.37	294.55	277.89	256.86	237.09	223.89	220.78	228.61	245.27	266.30	286.06	(68)
Cooking gains (c	alculated ir	n Appendix	L, equation	L15 or L15	a), also see	Table 5							_
	37.49	37.49	37.49	37.49	37.49	37.49	37.49	37.49	37.49	37.49	37.49	37.49	(69)
Pump and fan ga	ains (Table	5a)											
	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	(70)
Losses e.g. evap	oration (Ta	ble 5)											
	-115.93	-115.93	-115.93	-115.93	-115.93	-115.93	-115.93	-115.93	-115.93	-115.93	-115.93	3 -115.93	(71)
Water heating g	ains (Table	5)											
	92.24	89.86	84.92	78.20	73.29	66.45	61.23	68.62	71.54	78.49	86.34	89.87	(72)
Total internal ga	ins (66)m -	+ (67)m + (6	58)m + (69)	m + (70)m	+ (71)m + (7	72)m							
	489.05	486.63	469.21	440.91	411.10	382.70	365.05	372.48	387.88	416.42	449.18	474.25	(73)
6 Solar gains													
6. Solar gains					A	6.	las flux		_			Caina	
			Access f Table		Area m²		lar flux N/m²	spe	g cific data	FF specific c	lata	Gains W	
								or	Table 6b	or Table			
South			0.7	7 X	10.58	x	46.75 x	0.9 x	0.72 x	0.70	=	172.76	(78)
Horizontal			1.0	0 x [4.50	x 2	26.00 x	0.9 x	0.72 x	0.70	=	53.07]
West			0.7	7 ×	0.94	x	19.64 x	0.9 x	0.72 x	0.70	=	6.45	(80)
East			0.7	7 X	0.94	x []	19.64 x	0.9 x	0.72 x	0.70	=	6.45	(76)
West			1.0	0 x [1.89	x 2	26.61 x	0.9 x	0.72 x	0.70	=	22.81	(80)
Solar gains in wa	atts ∑(74)m	n(82)m											-
	261.54	464.51	677.60	896.24	1045.58	1053.70	1009.55	897.50	754.15	525.53	316.93	221.34	(83)
Total gains - inte					•			•			•		

7. Mean internal temperature (heating season)

695.59 **(84)**

766.11

750.59 951.14 1146.81 1337.14 1456.68 1436.40 1374.60 1269.98 1142.03 941.95

Temperature during heating periods in the living area from Table 9, Th1(°C) 21.00 (85) Ian Feb Mar Apr Jun Jul Aug Sep Oct Nov Dec													(85)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation facto	r for gains f	or living are	a n1,m (se	e Table 9a)									
	1.00	0.99	0.98	0.93	0.82	0.63	0.47	0.53	0.79	0.97	1.00	1.00	(86)
Mean internal t							-						()
Weathinternalt	-	- · ·	-			20.07	20.00	20.00	20.01	20 54	20.05	10.00	(07)
	19.73	19.94	20.24	20.59	20.85	20.97	20.99	20.99	20.91	20.54	20.05	19.69	(87)
Temperature du	iring heatin	g periods in	the rest of	dwelling fr	om Table 9), Th2("C)							
	19.96	19.96	19.96	19.97	19.97	19.97	19.97	19.97	19.97	19.97	19.96	19.96	(88)
Utilisation facto	r for gains f	or rest of d	welling n2,	m									
	1.00	0.99	0.97	0.91	0.76	0.54	0.36	0.42	0.71	0.95	0.99	1.00	(89)
Mean internal t	emperature	in the rest	of dwelling	g T2 (follow	steps 3 to 3	7 in Table 9	c)						
	18.80	19.01	19.31	19.65	19.87	19.96	19.97	19.97	19.92	19.60	19.13	18.76	(90)
Living area fract										/ing area ÷		0.14	(91)
-		for the wh	ala duyallia	~ fl A v T1 i	/1 f(A) v T	· 1					(4) -	0.14	(91)
Mean internal t	-			-									
	18.93	19.14	19.44	19.78	20.01	20.10	20.11	20.11	20.06	19.73	19.25	18.89	(92)
Apply adjustme	nt to the me	ean internal	temperatu	ure from Ta	ble 4e whe	re appropr	iate						
	18.93	19.14	19.44	19.78	20.01	20.10	20.11	20.11	20.06	19.73	19.25	18.89	(93)
											×		
8. Space heating	ng requirem	ient											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation facto	r for gains,	ηm											
	1.00	0.99	0.97	0.91	0.76	0.56	0.38	0.43	0.72	0.95	0.99	1.00	(94)
Useful gains, ηn	nGm, W (94)m x (84)m											
0 / 1	748.40	942.28	1112.85	1211.39	1112.38	799.46	521.85	548.86	819.47	892.47	760.53	694.19	(95)
Monthly average		II			1112.50	755.40	521.05	540.00	015.47	052.47	700.55	054.15	(55)
Monthly averag		-											(
	4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)
Heat loss rate fo	or mean inte	ernal tempe		, W [(39)m	x [(93)m - ([96)m]							
	2214.33	2152.27	1953.42	1633.70	1246.41	820.75	524.30	553.50	891.13	1369.93	1827.10	2213.05	(97)
Space heating re	equirement	, kWh/mont	th 0.024 x	[(97)m - (95	5)m] x (41)r	n							
	1090.65	813.11	625.38	304.06	99.72	0.00	0.00	0.00	0.00	355.23	767.93	1130.04	
									∑(98	3)15, 10	12 = 5	186.12	(98)
Space heating re	equirement	kWh/m²/ve	ar							(98) -	÷ (4)	39.50	(99)
opuce nearing r	equilence in enterine									(50)			(55)
9a. Energy req	uirements -	individual	heating sys	stems inclu	ding micro	-CHP							
Space heating													
Fraction of space	e heat from	secondary	/suppleme	ntarv syster	n (table 11)						0.00	(201)
Fraction of space										1 - (20)1) –	1.00	(202)
										1 - (20			
Fraction of space												0.00	(202)
Fraction of tota	l space heat	from main	system 1						(20	2) x [1- (20	3)] =	1.00	(204)
Fraction of tota	l space heat	from main	system 2							(202) x (20)3) =	0.00	(205)
Efficiency of ma	in system 1	(%)										91.80	(206)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating fu	uel (main sy	stem 1), kW	/h/month										
	1188.07	885.74	681.24	331.22	108.62	0.00	0.00	0.00	0.00	386.96	836.53	1230.98	
		000174		551.22	100.02	0.00	0.00	0.00)15, 10		649.37	(211)
Makes 1									2(211	.,1, 10	12 - 5	J-13.37	(211)
Water heating													
Efficiency of wa	ter heater												
	87.10	86.85	86.33	85.08	82.63	79.50	79.50	79.50	79.50	85.34	86.71	87.18	(217)

Water heating fuel, kWh/month						
251.49 222.25 234.74 213.40 213	3.31 195.26 187	7.07 2	08.54 210.24	220.61 229	9.74 245.17]
				∑(219a)112 =	2631.82	(219)
Annual totals						
Space heating fuel - main system 1					5649.37]
Water heating fuel					2631.82]
Electricity for pumps, fans and electric keep-hot (Table 4f)						
central heating pump or water pump within warm air heating	unit		30.00			(230c)
boiler flue fan			45.00			(230e)
Total electricity for the above, kWh/year					75.00	(231)
Electricity for lighting (Appendix L)					495.67	(232)
Total delivered energy for all uses		(211	l)(221) + (231) + (232)(237b) =	8851.86	(238)
10a. Fuel costs - individual heating systems including micro-CHF	•					
	Fuel		Fuel price		Fuel	
	kWh/year				cost £/year	_
Space heating - main system 1	5649.37	x	3.48	x 0.01 =	196.60	(240)
Water heating	2631.82	x	3.48	x 0.01 =	91.59	(247)
Pumps and fans	75.00	x	13.19	x 0.01 =	9.89	(249)
Electricity for lighting	495.67	x	13.19	x 0.01 =	65.38	(250)
Additional standing charges					120.00	(251)
Total energy cost			(240)(242) +	(245)(254) =	483.46	(255)
11a. SAP rating - individual heating systems including micro-CH	P					
Energy cost deflator (Table 12)					0.42	(256)
Energy cost factor (ECF)					1.15	(257)
SAP value					83.93]
SAP rating (section 13)					84	(258)
SAP band					В]
12a. CO ₂ emissions - individual heating systems including micro	-СНР					
	Energy		Emission factor		Emissions	
	kWh/year		kg CO₂/kWh		kg CO₂/year	
Space heating - main system 1	5649.37	х	0.22	=	1220.26	(261)
Water heating	2631.82	х	0.22	=	568.47	(264)
Space and water heating			(261) + (262) +	(263) + (264) =	1788.74	(265)
Pumps and fans	75.00	х	0.52	=	38.93	(267)
Electricity for lighting	495.67	х	0.52	=	257.25	(268)
Total CO ₂ , kg/year				(265)(271) =	2084.92	(272)
Dwelling CO ₂ emission rate				(272) ÷ (4) =	15.88	(273)
El value					84.15	
El rating (section 14)					84	(274)
El band					В	
13a. Primary energy - individual heating systems including micro	o-CHP					
	Energy kWh/year		Primary factor		Primary Energy kWh/year	
Space heating - main system 1	5649.37	x	1.22	=	6892.23	(261)
· ····································					2240.00	

3210.82

10103.05

(264)

(265)

2631.82

х

1.22

=

(261) + (262) + (263) + (264) =

Water heating

Space and water heating

Pumps and fans	75.00] x	3.07] =	230.25	(267)
Electricity for lighting	495.67] x	3.07] =	1521.71	(268)
Primary energy kWh/year					11855.01	(272)
Dwelling primary energy rate kWh/m2/year					90.30	(273)



This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

	Mrs Nicola	a Battista					Ass	sessor num	ber	3998		
Client	The Haleb	ourne Gro	up				Las	t modified		26/08	/2014	
Address	Plot 8 The	Old Schoo	ol Park Lane	e, Richmon	d, TW9							
1. Overall dwelling dimer	isions			Δ.	rea (m²)		Aver	age storey		Ve	olume (m³)	
				A	iea (iii)			ight (m)		vc	June (m)	
owest occupied					50.54	(1a) x		2.35	(2a) =		118.77	(3a)
+1					44.62	(1b) x		2.70	(2b) =		120.47] (3b)
-2					41.85	(1c) x		2.70	(2c) =		113.00	 (3c)
Total floor area	(1a) +	+ (1b) + (1c	:) + (1d)(1	Ln) = 🗌 🗄	137.01	(4)						
Owelling volume							(3a)	+ (3b) + (3	c) + (3d)(3	n) =	352.24	(5)
2. Ventilation rate										m	³ per hour	
Number of chimneys								0	x 40 =		0	(6a)
Number of open flues								0	x 40 =		0	(0a)
Number of intermittent far	20							4	x 10 =		40	_ (00) _ (7a)
Number of passive vents	15							0	x 10 =		0	(78)
Number of flueless gas fire	s							0	x 40 =		0] (70)
							L			L	changes pe	
											hour	
					+ (6b) + (7a		-	40	÷ (5) =		0.11	(8)
			ntended, pr				-	-	÷ (5) =		0.11	(8)
f a pressurisation test has	been carried	out or is ir		roceed to (1	17), otherwi	ise continue	e from (9) to	-	÷ (5) =		0.11 3.00	
f a pressurisation test has Air permeability value, q50	been carried , expressed i	<i>out or is ir</i> n cubic me	etres per ho	roceed to (1 our per squ	17), otherwi	<i>ise continue</i> of envelope	e from (9) to	-	÷ (5) =			_ (8) _ (17) _ (18)
f a pressurisation test has Air permeability value, q50 f based on air permeability	<i>been carried</i> , expressed i y value, then	<i>out or is ir</i> n cubic me (18) = [(17	etres per ho) ÷ 20] + (8	roceed to (1 our per squ	17), otherwi	<i>ise continue</i> of envelope	e from (9) to	-	÷ (5) =		3.00	(17)
f a pressurisation test has Air permeability value, q50 f based on air permeability Number of sides on which Shelter factor	<i>been carried</i>), expressed i y value, then the dwelling	out or is ir n cubic me (18) = [(17 is sheltere	etres per ho) ÷ 20] + (8	roceed to (1 our per squ	17), otherwi	<i>ise continue</i> of envelope	e from (9) to	o (16)	[0.075 x (19	9)] = [3.00 0.26] (17)] (18)] (19)] (20)
nfiltration due to chimney If a pressurisation test has Air permeability value, q50 f based on air permeability Number of sides on which Shelter factor nfiltration rate incorporati	been carried), expressed i y value, then the dwelling ng shelter fa	out or is ir n cubic me (18) = [(17 is sheltere ctor	etres per ho) ÷ 20] + (8 d	roceed to (1 our per squ	17), otherwi	<i>ise continue</i> of envelope	e from (9) to	o (16)		9)] = [3.00 0.26 3] (17)] (18)] (19)
f a pressurisation test has Air permeability value, q50 f based on air permeability Number of sides on which Shelter factor nfiltration rate incorporation	been carried), expressed i y value, then the dwelling ing shelter fac or monthly w	out or is in n cubic me (18) = [(17 is sheltere ctor ind speed:	etres per ho) ÷ 20] + (8 d	roceed to (1 our per squ 3), otherwis	17), otherwi lare metre c se (18) = (16	ise continue of envelope	area	1 -	[0.075 x (19 (18) x (2	())] = [()) = [3.00 0.26 3 0.78 0.20] (17)] (18)] (19)] (20)
f a pressurisation test has Air permeability value, q50 f based on air permeability Number of sides on which Shelter factor nfiltration rate incorporation nfiltration rate modified for Jan	been carried), expressed i y value, then the dwelling ng shelter fa or monthly w Feb	out or is ir n cubic me (18) = [(17 is sheltere ctor ind speed: Mar	etres per ho) ÷ 20] + (8 d	roceed to (1 our per squ	17), otherwi	<i>ise continue</i> of envelope	e from (9) to	o (16)	[0.075 x (19	9)] = [3.00 0.26 3 0.78] (17)] (18)] (19)] (20)
f a pressurisation test has Air permeability value, q50 f based on air permeability Number of sides on which Shelter factor nfiltration rate incorporati nfiltration rate modified fo Jan Monthly average wind spe	been carried , expressed i y value, then the dwelling ing shelter fa- or monthly w Feb ed from Table	out or is ir n cubic me (18) = [(17 is sheltere ctor ind speed: Mar e U2	etres per ho) ÷ 20] + (8 d Apr	roceed to (1 our per squ)), otherwis May	17), otherwi lare metre o se (18) = (16 Jun	ise continue of envelope 5) Jul	area Aug	р (16) 1 - Sep	[0.075 x (19 (18) x (2 Oct	()] = (0) = Nov	3.00 0.26 3 0.78 0.20 Dec] (17)] (18)] (19)] (20)] (21)
If a pressurisation test has Air permeability value, q50 f based on air permeability Number of sides on which Shelter factor nfiltration rate incorporati nfiltration rate modified fo Jan Monthly average wind spe 5.10	been carried), expressed i y value, then the dwelling ng shelter fa or monthly w Feb	out or is ir n cubic me (18) = [(17 is sheltere ctor ind speed: Mar	etres per ho) ÷ 20] + (8 d	roceed to (1 our per squ 3), otherwis	17), otherwi lare metre c se (18) = (16	ise continue of envelope	area	1 -	[0.075 x (19 (18) x (2	())] = [()) = [3.00 0.26 3 0.78 0.20] (17)] (18)] (19)] (20)
f a pressurisation test has Air permeability value, q50 f based on air permeability Number of sides on which Shelter factor nfiltration rate incorporati nfiltration rate modified fo Jan Monthly average wind spect 5.10 Wind factor (22)m ÷ 4	been carried , expressed i y value, then the dwelling ng shelter fa- or monthly w Feb ed from Table 5.00	out or is ir n cubic me (18) = [(17 is sheltere ctor ind speed: Mar e U2 4.90	etres per ho) ÷ 20] + (8 d Apr <u>4.40</u>	May	17), otherwi iare metre o se (18) = (16 Jun 3.80	ise continue of envelope 5) Jul 3.80	Aug	2 (16) 1 - Sep 4.00	[0.075 x (19 (18) x (2 Oct 4.30	()] = (0) = Nov 4.50	3.00 0.26 3 0.78 0.20 Dec 4.70] (17)] (18)] (19)] (20)] (21)] (22)
f a pressurisation test has Air permeability value, q50 f based on air permeability Number of sides on which shelter factor nfiltration rate incorporation filtration rate modified for Jan Monthly average wind spectrum 5.10 Vind factor (22)m ÷ 4	been carried), expressed i y value, then the dwelling ng shelter fa- or monthly w Feb ed from Table 5.00	out or is ir n cubic me (18) = [(17 is sheltere ctor ind speed: Mar e U2 4.90	etres per ho) ÷ 20] + (8 d Apr <u>4.40</u> 1.10	May 1.08	17), otherwi are metre o se (18) = (16 Jun 3.80	ise continue of envelope 5) Jul	area Aug	р (16) 1 - Sep	[0.075 x (19 (18) x (2 Oct	()] = (0) = Nov	3.00 0.26 3 0.78 0.20 Dec] (17)] (18)] (19)] (20)] (21)
f a pressurisation test has Air permeability value, q50 f based on air permeability Number of sides on which Shelter factor Infiltration rate incorporation filtration rate modified for Jan Monthly average wind spection 5.10 Nind factor (22)m ÷ 4	been carried), expressed i y value, then the dwelling ng shelter fa- or monthly w Feb ed from Table 5.00	out or is ir n cubic me (18) = [(17 is sheltere ctor ind speed: Mar e U2 4.90	etres per ho) ÷ 20] + (8 d Apr <u>4.40</u> 1.10	May 1.08	17), otherwi are metre o se (18) = (16 Jun 3.80	ise continue of envelope 5) Jul 3.80	Aug	2 (16) 1 - Sep 4.00	[0.075 x (19 (18) x (2 Oct 4.30	()] = (0) = Nov 4.50	3.00 0.26 3 0.78 0.20 Dec 4.70] (17)] (18)] (19)] (20)] (21)] (22)
f a pressurisation test has Air permeability value, q50 f based on air permeability Number of sides on which Shelter factor Infiltration rate incorporation filtration rate modified for Jan Monthly average wind spect 5.10 Wind factor (22)m ÷ 4 1.28 Adjusted infiltration rate (a 0.26	been carried), expressed i y value, then the dwelling ng shelter fac- or monthly w Feb ed from Table 5.00 1.25 sllowing for s 0.26	out or is ir n cubic me (18) = [(17 is sheltere ctor ind speed: Mar e U2 4.90 1.23 helter and 0.25	etres per ho) ÷ 20] + (8 d Apr 4.40 1.10 wind facto 0.22	May 4.30 (21) x (2	17), otherwi iare metre o se (18) = (16 Jun 3.80 0.95 2a)m	ise continue of envelope 5) Jul 3.80	Aug 3.70	2 (16) 1 - Sep 4.00 1.00	[0.075 x (19 (18) x (2 Oct 4.30	()] = (0) = Nov 4.50 1.13	3.00 0.26 3 0.78 0.20 Dec 4.70] (17)] (18)] (19)] (20)] (21)] (22)] (22a
f a pressurisation test has Air permeability value, q50 f based on air permeability Number of sides on which Shelter factor Infiltration rate incorporation filtration rate modified for Jan Monthly average wind spect 5.10 Wind factor (22)m ÷ 4 1.28 Adjusted infiltration rate (a 0.26	been carried , expressed i y value, then the dwelling ng shelter fa- or monthly w Feb ed from Table 5.00 1.25 allowing for s 0.26 ge rate for th	out or is ir n cubic me (18) = [(17 is sheltere ctor ind speed: Mar e U2 4.90 1.23 helter and 0.25 ne applicat	etres per ho) ÷ 20] + (8 d Apr 4.40 1.10 wind facto 0.22 ole case:	May 4.30 (21) x (2 (21) x (2 (22)	17), otherwi iare metre o se (18) = (16 Jun 3.80 0.95 2a)m	ise continue of envelope 5) Jul 3.80	Aug 3.70	2 (16) 1 - Sep 4.00 1.00	[0.075 x (19 (18) x (2 Oct 4.30	()] = (0) = Nov 4.50 1.13	3.00 0.26 3 0.78 0.20 Dec 4.70] (17)] (18)] (19)] (20)] (21)] (22)] (22a
f a pressurisation test has Air permeability value, q50 f based on air permeability Number of sides on which Shelter factor nfiltration rate incorporati nfiltration rate modified fo Jan Monthly average wind spe 5.10 Wind factor (22)m ÷ 4 1.28 Adjusted infiltration rate (a 0.26 Calculate effective air chan	been carried b, expressed i y value, then the dwelling ing shelter fa- or monthly w Feb ed from Table 5.00 1.25 allowing for s 0.26 ge rate for th n: air change	out or is ir n cubic me (18) = [(17 is sheltere ctor ind speed: Mar e U2 4.90 1.23 helter and 0.25 ne application	etres per ho) ÷ 20] + (8 d Apr 4.40 1.10 wind factor 0.22 ole case: ugh system	May 4.30 1.08 0.22	17), otherwi lare metre o se (18) = (16 Jun 3.80 0.95 2a)m 0.19	<i>ise continue</i> of envelope 5) <i>Jul</i> 3.80 0.95 0.19	Aug 3.70	2 (16) 1 - Sep 4.00 1.00	[0.075 x (19 (18) x (2 Oct 4.30	()] = (0) = Nov 4.50 1.13	3.00 0.26 3 0.78 0.20 Dec 4.70 1.18] (17)] (18)] (19)] (20)] (21)] (22)] (22a] (22a
f a pressurisation test has ir permeability value, q50 based on air permeability lumber of sides on which helter factor hfiltration rate incorporation filtration rate modified for Jan Monthly average wind spect 5.10 Vind factor (22)m ÷ 4 1.28 djusted infiltration rate (a 0.26 alculate effective air chant If mechanical ventilatio	been carried , expressed i y value, then the dwelling ng shelter fa- or monthly w Feb ed from Table 5.00 1.25 allowing for s 0.26 ng e rate for the n: air change ecovery: effici	out or is ir n cubic me (18) = [(17 is sheltere ctor ind speed: Mar e U2 4.90 1.23 helter and 0.25 ne applicat rate throu	Apr 4.40 1.10 wind facto 0.22 ble case: allowing fo	May 1.08 (1), 21) x (2 (2), 21) x (2 (2), 22 (2), 21) x (2 (2), 22 (2), 22 (3), 21) x (2 (3), 22 (4), 20 (4),	17), otherwin nare metre of se (18) = (16) Jun 3.80 0.95 2a)m 0.19	<i>ise continue</i> of envelope 5) <i>Jul</i> 3.80 0.95 0.19	Aug 3.70	2 (16) 1 - Sep 4.00 1.00	[0.075 x (19 (18) x (2 Oct 4.30	()] = (0) = Nov 4.50 1.13	3.00 0.26 3 0.78 0.20 Dec 4.70 1.18 0.24] (17)] (18)] (19)] (20)] (21)] (22)] (22a] (22a] (22a



Γ	0.53	0.53	0.53	r (24c) or (24 0.53	0.52	0.52	0.52	0.52	0.52	0.52	0.53	0.53	(25)
L	0.55	0.55	0.00	0.55	0.52	0.02	0.52	0.52	0.52	0.52	0.55	0.55	(23)
3. Heat losses an	id heat los	s paramete	er										
Element			i	Gross area, m²	Openings m ²	Net are A, m ²		U-value W/m²K	A x U W		/alue, /m².K	Ахк, kJ/K	
Door						3.72	x	1.20	= 4.46				(26)
Window						12.46	x	1.33	= 16.52	2			(27)
Roof window						6.39	x	1.33	= 8.47				(27a
Basement floor						50.54	x	0.10	= 5.05				(28)
External wall						97.25	x [0.20	= 19.45	5			(2 9a
Basement wall						34.76	x	0.18	= 6.26				(29)
Party wall						69.11	x	0.00	= 0.00				(32)
Roof						27.09	x	0.10	= 2.71				(30)
Roof						18.49	_ x [0.12	= 2.22				(30)
Roof						1.11	_ x [0.15	= 0.17				(30)
Total area of exte	rnal eleme	ents ∑A, m²				251.81							(31)
Fabric heat loss, W	V/K = ∑(A >	× U)							(2	6)(30) + (32) =	65.31	(33)
Heat capacity Cm	= ∑(А х к)							(28)	(30) + (32)	+ (32a)(3	2e) =	N/A	(34)
Thermal mass par	ameter (T	MP) in kJ/m	۱²K									250.00	(35)
Thermal bridges: S	∑(L x Ѱ) са	lculated us	ing Apper	ndix K								17.35	(36)
Total fabric heat lo	oss									(33) + (36) =	82.66	(37)
	Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ventilation heat lo	oss calcula	ted monthl	y 0.33 x ((25)m x (5)									
	62.06	61.91	61.76	61.05	60.92	60.31 6	50.31	60.19	60.54	60.92	61.19	61.47	(38)
Heat transfer coef	fficient, W	/K (37)m +	(38)m										
L	144.72	144.57	144.42	143.71	143.58	142.96 1	42.96	142.85	143.20	143.58	143.85	144.12	
Heat loss paramet	ter (HLP), \	W/m²K (39)m ÷ (4)						Average = 2	∑(39)112,	/12 =	143.71	(39)
	1.06	1.06	1.05	1.05	1.05	1.04	1.04	1.04	1.05	1.05	1.05	1.05	
									Average = 2	<u>Σ</u> (40)112,	/12 =	1.05	(40)
Number of days ir	n month (T	able 1a)											
	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00	(40)
4. Water heating	g energy re	equirement											
Assumed occupan	icy, N											2.91	(42)
Annual average ho	ot water u	sage in litre	es per day	Vd,average	e = (25 x N) + 3	36						103.34	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage ii	n litres pei	r day for ea	ch month	Vd,m = fact	tor from Tabl	e 1c x (43)							
Γ	113.67	109.54	105.41	101.27	97.14	93.01 9	93.01	97.14	101.27	105.41	109.54	113.67	
										∑(44)1	.12 =	1240.08	(44)
Energy content of	hot water	r used = 4.1	.8 x Vd,m	x nm x Tm/3	3600 kWh/m	onth (see Tak	oles 1b,	1c 1d)					
07													_
Г	168.58	147.44	152.14	132.64	127.27	109.83 1	.01.77	116.78	118.18	137.72	150.34	163.26	
Distribution loss (ł		152.14	132.64	127.27	109.83 1	.01.77	116.78	118.18	137.72 ∑(45)1	·	163.26 1625.94	(45)

	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(57)
Primary circuit lo	oss for each	month fro	m Table 3										
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(59)
Combi loss for e	ach month	from Table	3a, 3b or 3	с		•		•	•		<u> </u>		-
	50.96	46.03	50.96	49.32	49.50	45.87	47.39	49.50	49.32	50.96	49.32	50.96	(61)
Total heat requi				1	1		1	1] ()
	219.53	193.46	203.10	181.96	176.77	155.69	149.17	166.28	167.49	188.68	199.65	214.22	(62)
Solar DHW input						155.05	149.17	100.28	107.49	188.08	199.05	214.22] (02)
			1		i	0.00	0.00	0.00	0.00				
a f	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(63)
Output from wa	r	1			1	1	1				, 		-
	219.53	193.46	203.10	181.96	176.77	155.69	149.17	166.28	167.49	188.68	199.65	214.22	_
										∑(64)1	.12 = 2	216.02	(64)
Heat gains from	water heat	ing (kWh/n	nonth) 0.2	5 × [0.85 ×	(45)m + (61	.)m] + 0.8 ×	< [(46)m + (57)m + (59)	m]				
	68.79	60.53	63.33	56.43	54.69	47.98	45.69	51.21	51.62	58.53	62.32	67.02	(65)
5. Internal gain	S									-			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains	(Table 5)												_
	145.56	145.56	145.56	145.56	145.56	145.56	145.56	145.56	145.56	145.56	145.56	145.56	(66)
Lighting gains (ca	alculated in	Appendix	L, equation	L9 or L9a),	also see Ta	able 5							
	28.95	25.72	20.91	15.83	11.84	9.99	10.80	14.03	18.84	23.92	27.92	29.76	(67)
Appliance gains	(calculated	in Appendi	ix L, equatio	on L13 or L	13a), also se	ee Table 5							
	305.99	309.16	301.16	284.13	262.62	242.41	228.91	225.74	233.74	250.77	272.28	292.49	(68)
Cooking gains (c	alculated in	Appendix	L, equation	L15 or L15	a), also see	Table 5					•		-
	37.56	37.56	37.56	37.56	37.56	37.56	37.56	37.56	37.56	37.56	37.56	37.56	(69)
Pump and fan ga	ains (Table !	5a)	1								1		_ · · /
	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	(70)
Losses e.g. evap			5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00		5.00] (/0)
203323 C.g. CVap	```	,	110 45	110 45	110 45	110 45	110 45	110 45	110 45	110 45	110 45	110 45	7 (74)
	-116.45	-116.45	-116.45	-116.45	-116.45	-116.45	-116.45	-116.45	-116.45	-116.45	-116.45	-116.45	(71)
Water heating g	``	,					I .	1				1	٦
	92.46	90.07	85.12	78.38	73.51	66.64	61.41	68.82	71.70	78.67	86.55	90.08	(72)
Total internal ga	ins (66)m +	+ (67)m + (6	58)m + (69)	m + (70)m	+ (71)m + (7	72)m							_
	497.07	494.62	476.86	448.00	417.64	388.72	370.79	378.26	393.94	423.03	456.41	482.00	(73)
6. Solar gains													
0. Solar gains					A	Cal	a		-			Caina	
			Access f Table		Area m²		lar flux V/m²	spec	g ific data	FF specific o	data	Gains W	
								•	able 6b	or Table			
South			0.7	7 X	10.58	x 4	6.75 x	0.9 x 0).72 x	0.70	=	172.76	(78)
Horizontal			1.0		4.50				0.72 x			53.07	ייי ר
West			0.7		0.94				0.72 x			6.45	_] (80)
										Г			
East			0.7		0.94				0.72 x			6.45	(76)
West		(02)	1.0	0 X	1.89	X 2	.6.61 x	0.9 x (0.72 x	0.70	=	22.81	(80)
Solar gains in wa	_ , ,	. ,			1		T	1	1				-
	261.54	464.51	677.60	896.24	1045.58	1053.70	1009.55	897.50	754.15	525.53	316.93	221.34	(83)

otal gains - internal and solar (73)m + (83)m	

758.61 959.13 1154.46 1344.24 1463.22 1442.42 1380.34 1275.77 1148.09 948.57

7. Mean internal temperature (heating season)

703.34 (84)

773.34

Temperature du	ring heating	g periods in	the living a	area from T	able 9, Th1	.(°C)						21.00	(85)
	Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation facto	r for gains f	or living are	ea n1,m (se	e Table 9a)									
	1.00	1.00	0.98	0.93	0.80	0.61	0.45	0.51	0.77	0.97	1.00	1.00	(86)
Mean internal te	emp of livin	g area T1 (s	teps 3 to 7	in Table 9c	:)								
	19.84	20.04	20.33	20.66	20.89	20.98	21.00	20.99	20.93	20.60	20.14	19.80	(87)
Temperature du	L] ()
	20.04	20.04	20.04	20.04	20.04	20.05	20.05	20.05	20.05	20.04	20.04	20.04	(88)
Utilisation facto	L				20.04	20.05	20.05	20.05	20.05	20.04	20.04	20.04] (00)
Othisation facto	-		_			0.50			0.70				
	1.00	0.99	0.98	0.91	0.75	0.53	0.36	0.41	0.70	0.95	0.99	1.00	(89)
Mean internal te	-		_				1					T	7
	18.98	19.18	19.46	19.78	19.97	20.04	20.05	20.05	20.01	19.73	19.28	18.94	(90)
Living area fract	ion								Li	ving area ÷ (4) =	0.12	(91)
Mean internal te	emperature	for the wh	ole dwellin	g fLA x T1 +	-(1 - fLA) x 1	Г2							
	19.08	19.28	19.56	19.88	20.08	20.15	20.16	20.16	20.12	19.83	19.38	19.04	(92)
Apply adjustme	nt to the me	ean internal	temperatu	ure from Ta	ble 4e whe	re approp	riate						
	19.08	19.28	19.56	19.88	20.08	20.15	20.16	20.16	20.12	19.83	19.38	19.04	(93)
					•						×		
8. Space heatir	ng requirem	ient											
	Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation facto	r for gains,	ηm											
	1.00	0.99	0.97	0.90	0.75	0.54	0.37	0.42	0.70	0.95	0.99	1.00	(94)
Useful gains, ηm	nGm, W (94	l)m x (84)m											-
	756.76	951.06	1121.29	1214.05	1099.49	778.96	507.06	533.76	807.91	898.64	768.33	702.17	(95)
Monthly average	e external t	emperature			1					1 1			
,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)
Heat loss rate fo							10.00	10.40	14.10	10.00	7.10	4.20] (50)
							500.47	5 26 5 7	861.65	4224.05	4766.00	2138.41	
Constanting of	2138.50	2078.30	1886.17	1577.78	1203.00	793.08	508.47	536.57	801.05	1324.95	1766.33	2138.41] (97)
Space heating re	· ·	,			, , , ,			I		TT		T	г
	1028.02	757.50	569.07	261.88	77.01	0.00	0.00	0.00	0.00	317.17	718.56	1068.56	
									∑(9)	8)15, 10:		1797.79	(98)
Space heating re	equirement	kWh/m²/ye	ear							(98) ÷	÷ (4)	35.02	(99)
9a. Energy req	uiromonte	individual	hosting sy	stoms inclu	ding micro	СНР							
	unements -	muividuai	neating sys	stems inclu		-спр							
Space heating													Т
Fraction of space				ntary syste	m (table 11	.)						0.00	(201)
Fraction of space	e heat from	main syste	m(s)							1 - (20	1) =	1.00	(202)
Fraction of space	e heat from	main syste	m 2									0.00	(202)
Fraction of total	space heat	from main	system 1						(20	02) x [1- (203	3)] =	1.00	(204)
Fraction of total	space heat	from main	system 2							(202) x (20	3) =	0.00	(205)
Efficiency of ma	in system 1	(%)										91.80	(206)
	Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec	_
Space heating fu	iel (main sv	stem 1), kW	/h/month		-			-	~				
	1119.85	825.17	619.91	285.28	83.89	0.00	0.00	0.00	0.00	345.50	782.75	1164.01	1
		020.17	515.51	200.20	05.05	0.00	0.00	0.00		1)15, 10:		5226.35	」] (211)
Water basting									2(21)	±/±), ±0		,220.33] (211)
Water heating	or basta												
Efficiency of wat												L -	٦.,
	87.01	86.74	86.15	84.74	82.11	79.50	79.50	79.50	79.50	85.09	86.60	87.10	(217)

Water heating fuel, kWh/month						
-	5.29 195.84 187	.63 2	209.16 210.68	221.75 230).55 245.95]
				<u>Σ</u> (219a)112 =	2642.70	(219)
Annual totals				_()] (,
Space heating fuel - main system 1					5226.35	1
Water heating fuel					2642.70]
Electricity for pumps, fans and electric keep-hot (Table 4f)						1
central heating pump or water pump within warm air heating	unit		30.00			(230c)
boiler flue fan			45.00			(230e)
Total electricity for the above, kWh/year					75.00	(231)
Electricity for lighting (Appendix L)					511.34	(232)
Total delivered energy for all uses		(21	1)(221) + (231) + (232)(237b) =	8455.39	(238)
10a. Fuel costs - individual heating systems including micro-CHF	D					
Toa. Tuer costs - mulvidual heating systems including micro-chr	Fuel		Fuel price		Fuel	
	kWh/year		r del price		cost £/year	
Space heating - main system 1	5226.35	x	3.48	x 0.01 =	181.88	(240)
Water heating	2642.70	x	3.48	x 0.01 =	91.97	(247)
Pumps and fans	75.00	x	13.19	x 0.01 =	9.89	(249)
Electricity for lighting	511.34	x	13.19	x 0.01 =	67.45	(250)
Additional standing charges					120.00	(251)
Total energy cost			(240)(242) +	(245)(254) =	471.18	(255)
11a. SAP rating - individual heating systems including micro-CH	P					
Energy cost deflator (Table 12)					0.42	(256)
Energy cost factor (ECF)					1.09] (257)]
SAP value					84.83	
SAP rating (section 13)					85] (258)]
SAP band					В	
12a. CO_2 emissions - individual heating systems including micro	-СНР					
	Energy kWh/year		Emission factor kg CO₂/kWh		Emissions kg CO₂/year	
Space heating - main system 1	5226.35	x	0.22	=	1128.89	(261)
Water heating	2642.70	x	0.22	=	570.82	(264)
Space and water heating			(261) + (262) +	(263) + (264) =	1699.72	(265)
Pumps and fans	75.00	x	0.52	=	38.93	(267)
Electricity for lighting	511.34	x	0.52	=	265.38	(268)
Total CO ₂ , kg/year				(265)(271) =	2004.02	(272)
Dwelling CO ₂ emission rate				(272) ÷ (4) =	14.63	(273)
El value					85.25]
El rating (section 14)					85	(274)
El band					В]
13a. Primary energy - individual heating systems including micr	O-CHP					
	Energy		Primary factor		Primary Energy	
	kWh/year		,		kWh/year	
Space heating - main system 1	5226.35	x	1.22	=	6376.14	(261)
Water heating	2642 70	v	1 22	_	2224 10	(264)

Space and water heating

3224.10

9600.24

(264)

(265)

2642.70

х

1.22

=

(261) + (262) + (263) + (264) =

Pumps and fans	75.00] x	3.07	=	230.25	(267)
Electricity for lighting	511.34) x	3.07	=	1569.80	(268)
Primary energy kWh/year					11400.30	(272)
Dwelling primary energy rate kWh/m2/year					83.21	(273)



This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

	Mrs Nicola B	attista					Ass	sessor num	iber	3998		
Client	The Halebou	irne Grou	qu				Las	t modified		26/08	/2014	
Address	Plot 9 The Ol	ld School	l Park Lane	e, Richmon	d, TW9							
1. Overall dwelling dime	nsions											
				A	rea (m²)			age storey ight (m)		Vo	olume (m³)	
owest occupied					54.80] <mark>(1a)</mark> x		2.35] (2a) =		128.78	(3a)
+1					48.78] (1b) x		2.70	(2b) =		131.71	(3b)
-2					27.71] (1c) x		2.70	(2c) =		74.82	(3c)
otal floor area	(1a) + (1	1b) + (1c)) + (1d)(1	Ln) =	131.29	(4)						
Owelling volume							(3a)	+ (3b) + (3	c) + (3d)(3	sn) =	335.30	(5)
2. Ventilation rate												
										m	³ per hour	
Number of chimneys								0] x 40 =		0	(6a)
Number of open flues								0] x 20 =		0	(6b)
Number of intermittent fa	ins							4] x 10 =		40	(7a)
lumber of passive vents								0] x 10 =		0] (7b)
Number of flueless gas fire	es							0] x 40 =		0	(7c)
										Air	changes pe hour	r
nfiltration due to chimne	ys, flues, fans, PS	SVs		(6a)	+ (6b) + (7a	a) + (7b) + (7	7c) =	40) ÷ (5) =			r (8)
			tended, pr					-] ÷ (5) =		hour	_
f a pressurisation test has	s been carried ou	it or is in	·	oceed to (17), otherw	ise continue	e from (9) to	-] ÷ (5) =		hour	_
f a pressurisation test has Air permeability value, q50	s been carried ou 0, expressed in c	<i>it or is in</i> cubic met	tres per ho	oceed to (our per squ	17), otherw are metre o	<i>ise continue</i> of envelope	e from (9) to	-] ÷ (5) =		hour 0.12] (8)] (17)
f a pressurisation test has Air permeability value, q50 f based on air permeabilit	s <i>been carried ou</i> 0, expressed in c ty value, then (18	<i>it or is in:</i> cubic met 8) = [(17)	tres per ho) ÷ 20] + (8	oceed to (our per squ	17), otherw are metre o	<i>ise continue</i> of envelope	e from (9) to	-] ÷ (5) =		hour 0.12 3.00] (8)] (17)] (18)
f a pressurisation test has Air permeability value, q5 f based on air permeabilit Number of sides on which	s <i>been carried ou</i> 0, expressed in c ty value, then (18	<i>it or is in:</i> cubic met 8) = [(17)	tres per ho) ÷ 20] + (8	oceed to (our per squ	17), otherw are metre o	<i>ise continue</i> of envelope	e from (9) to	o (16)			hour 0.12 3.00 0.27 2) (8)) (17)) (18)) (19)
f a pressurisation test has Air permeability value, q50 f based on air permeabilit Number of sides on which Shelter factor	s been carried ou 0, expressed in c ty value, then (18 the dwelling is s	ut or is in: cubic met 8) = [(17) shelterec	tres per ho) ÷ 20] + (8	oceed to (our per squ	17), otherw are metre o	<i>ise continue</i> of envelope	e from (9) to	o (16)	[0.075 x (19	9)] = [hour 0.12 3.00 0.27 2 0.85) (8)) (17)) (18)) (19)) (20)
f a pressurisation test has air permeability value, q50 f based on air permeabilit Jumber of sides on which helter factor nfiltration rate incorporat	s been carried ou 0, expressed in c ty value, then (18 the dwelling is s ting shelter facto	ut or is int cubic met 8) = [(17) shelterec	tres per ho) ÷ 20] + (8	oceed to (our per squ	17), otherw are metre o	<i>ise continue</i> of envelope	e from (9) to	o (16)		9)] = [hour 0.12 3.00 0.27 2) (8)) (17)) (18)) (19)
f a pressurisation test has air permeability value, q50 f based on air permeabilit Jumber of sides on which helter factor nfiltration rate incorporat	s been carried ou 0, expressed in c ty value, then (18 the dwelling is s ting shelter facto for monthly wind	ut or is int cubic met 8) = [(17) shelterec	tres per ho) ÷ 20] + (8	oceed to (our per squ	17), otherw are metre o	<i>ise continue</i> of envelope	e from (9) to	o (16)	[0.075 x (19	9)] = [hour 0.12 3.00 0.27 2 0.85) (8)) (17)) (18)) (19)) (20)
f a pressurisation test has Air permeability value, q50 f based on air permeabilit Number of sides on which Shelter factor nfiltration rate incorporat nfiltration rate modified f	s been carried ou 0, expressed in c ty value, then (18 the dwelling is s ting shelter facto for monthly wind Feb	ut or is int cubic met 8) = [(17) shelterec or d speed: Mar	tres per hc) ÷ 20] + (8	roceed to (our per squ), otherwis	17), otherw lare metre (se (18) = (16	ise continue of envelope 5)	e from (9) to	D (16) 1 -	[0.075 x (19 (18) x (2	9)] = 20) =	hour 0.12 3.00 0.27 2 0.85 0.23) (8)) (17)) (18)) (19)) (20)
f a pressurisation test has air permeability value, q50 f based on air permeabilit Jumber of sides on which helter factor nfiltration rate incorporat nfiltration rate modified f Jan	s been carried ou 0, expressed in c ty value, then (18 the dwelling is s ting shelter facto for monthly wind Feb Leed from Table U	ut or is int cubic met 8) = [(17) shelterec or d speed: Mar	tres per hc) ÷ 20] + (8	roceed to (our per squ), otherwis	17), otherw lare metre (se (18) = (16	ise continue of envelope 5)	e from (9) to	D (16) 1 -	[0.075 x (19 (18) x (2	9)] = 20) =	hour 0.12 3.00 0.27 2 0.85 0.23) (8)) (17)) (18)) (19)) (20)
f a pressurisation test has sir permeability value, q50 f based on air permeabilit Jumber of sides on which helter factor nfiltration rate incorporat nfiltration rate modified f Jan Monthly average wind spe	s been carried ou 0, expressed in c ty value, then (18 the dwelling is s ting shelter facto for monthly wind Feb Leed from Table U	ut or is int cubic met 8) = [(17) shelterec or d speed: Mar J2	tres per ho) ÷ 20] + (8 d Apr	oceed to (our per squ), otherwis May	17), otherw lare metre (se (18) = (16 Jun	ise continue of envelope 5) Jul	e from (9) to area Aug	р (16) 1 - Sep	[0.075 x (19 (18) x (2 Oct	9)] = Nov	hour 0.12 3.00 0.27 2 0.85 0.23 Dec) (8)) (17)) (18)) (19)) (20)] (21)
f a pressurisation test has ir permeability value, q50 based on air permeabilit lumber of sides on which helter factor nfiltration rate incorporat nfiltration rate modified f Jan Monthly average wind spe	s been carried ou 0, expressed in c ty value, then (18 the dwelling is s ting shelter facto for monthly wind Feb 1 eed from Table U 5.00 4	ut or is int cubic met 8) = [(17) shelterec or d speed: Mar J2	tres per ho) ÷ 20] + (8 d Apr	oceed to (our per squ), otherwis May	17), otherw lare metre (se (18) = (16 Jun	ise continue of envelope 5) Jul	e from (9) to area Aug	р (16) 1 - Sep	[0.075 x (19 (18) x (2 Oct	9)] = Nov	hour 0.12 3.00 0.27 2 0.85 0.23 Dec) (8)) (17)) (18)) (19)) (20)] (21)
f a pressurisation test has ir permeability value, q50 i based on air permeabilit lumber of sides on which helter factor nfiltration rate incorporat nfiltration rate modified f Jan Monthly average wind spec 5.10 Vind factor (22)m ÷ 4 1.28	s been carried ou 0, expressed in c ty value, then (18 the dwelling is s ting shelter facto for monthly wind Feb I eed from Table U 5.00 4	It or is interest cubic met 8) = [(17) shelterest or d speed: Mar J2 4.90	tres per ho ; 20] + (8 4 Apr 4.40 1.10	May 1.08	17), otherw are metre of se (18) = (16 Jun 3.80	ise continue of envelope 5) Jul 3.80	Aug	2 (16) 1 - Sep 4.00	[0.075 x (19 (18) x (2 Oct 4.30	9)] = 20) = Nov 4.50	hour 0.12 3.00 0.27 2 0.85 0.23 Dec 4.70) (8)) (17)) (18)) (19)) (20)) (21)) (22)
f a pressurisation test has ir permeability value, q50 i based on air permeabilit lumber of sides on which helter factor nfiltration rate incorporat nfiltration rate modified f Jan Monthly average wind spec 5.10 Vind factor (22)m ÷ 4 1.28	s been carried ou 0, expressed in c ty value, then (18 the dwelling is s ting shelter facto for monthly wind Feb 1 eed from Table U 5.00 4 1.25 5 allowing for shel	It or is interest cubic met 8) = [(17) shelterest or d speed: Mar J2 4.90	tres per ho ; 20] + (8 4 Apr 4.40 1.10	May 1.08	17), otherw are metre of se (18) = (16 Jun 3.80	ise continue of envelope 5) Jul 3.80	Aug	2 (16) 1 - Sep 4.00	[0.075 x (19 (18) x (2 Oct 4.30	9)] = 20) = Nov 4.50	hour 0.12 3.00 0.27 2 0.85 0.23 Dec 4.70) (8)) (17)) (18)) (19)) (20)) (21)) (22)
f a pressurisation test has sir permeability value, q50 f based on air permeability lumber of sides on which helter factor nfiltration rate incorporat nfiltration rate modified f Jan Monthly average wind spect 5.10 Vind factor (22)m ÷ 4 1.28 solution rate (0.29	s been carried ou 0, expressed in c ty value, then (18 the dwelling is s ting shelter factor for monthly wind Feb 1 eed from Table U 5.00 4 1.25 5 allowing for shell 0.29 0	at or is interpretent cubic met cubic met sheltered or d speed: Mar J2 4.90 1.23 Iter and work 0.28	tres per ho ÷ 20] + (8 Apr 4.40 1.10 wind factor 0.25	May 4.30 1.08 (21) x (2	17), otherw hare metre of se (18) = (16 Jun 3.80 0.95 22a)m	ise continue of envelope 5) Jul 3.80	Aug 3.70	2 (16) 1 - Sep 4.00 1.00	[0.075 x (19 (18) x (2 Oct 4.30	 ())] = ()) = ()) = Nov 4.50 1.13 	hour 0.12 3.00 0.27 2 0.85 0.23 Dec 4.70 1.18) (8)) (17)) (18)) (19)) (20)] (21)) (22)] (22a
f a pressurisation test has ir permeability value, q50 f based on air permeability Jumber of sides on which helter factor nfiltration rate incorporat nfiltration rate modified f Jan Monthly average wind spe 5.10 Vind factor (22)m ÷ 4 1.28 vdjusted infiltration rate (s been carried ou 0, expressed in c ty value, then (18 the dwelling is s ting shelter factor for monthly wind Feb I eed from Table U 5.00 4 1.25 5 allowing for shell 0.29 0 nge rate for the a	at or is in: cubic met cubic met 8) = [(17) shelterec or d speed: Mar J2 4.90 1.23 Iter and v 0.28 applicable	tres per ho ÷ 20] + (8 4 Apr 4.40 1.10 wind facto 0.25 le case:	May 4.30 1.08 (21) x (2	17), otherw hare metre of se (18) = (16 Jun 3.80 0.95 22a)m	ise continue of envelope 5) Jul 3.80	Aug 3.70	2 (16) 1 - Sep 4.00 1.00	[0.075 x (19 (18) x (2 Oct 4.30	 ())] = ()) = ()) = Nov 4.50 1.13 	hour 0.12 3.00 0.27 2 0.85 0.23 Dec 4.70 1.18) (8)) (17)) (18)) (19)) (20)] (21)) (22)] (22a
f a pressurisation test has ir permeability value, q50 i based on air permeabilit lumber of sides on which helter factor nfiltration rate incorporat nfiltration rate modified f Jan Monthly average wind spe 5.10 Vind factor (22)m ÷ 4 1.28 djusted infiltration rate (0.29 falculate effective air char	s been carried ou 0, expressed in c ty value, then (18 the dwelling is s ting shelter factor for monthly wind Feb 1 eed from Table U 5.00 4 1.25 5 allowing for shel 0.29 0 inge rate for the a pon: air change rate	at or is interval in the second seco	tres per ho ÷ 20] + (8 Apr 4.40 1.10 wind factor 0.25 le case: gh system	May 4.30 1.08 0.25	17), otherw lare metre (se (18) = (16 Jun 3.80 0.95 (2a)m 0.22	<i>ise continue</i> of envelope 5) Jul 3.80 0.95 0.22	Aug 3.70	2 (16) 1 - Sep 4.00 1.00	[0.075 x (19 (18) x (2 Oct 4.30	 ())] = ()) = ()) = Nov 4.50 1.13 	hour 0.12 3.00 0.27 2 0.85 0.23 Dec 4.70 1.18 0.27] (8)] (17)] (18)] (19)] (20)] (21)] (22)] (22a] (22a
a pressurisation test has ir permeability value, q50 based on air permeabilit umber of sides on which helter factor filtration rate incorporat filtration rate modified f Jan lonthly average wind spe 5.10 /ind factor (22)m ÷ 4 1.28 djusted infiltration rate (0.29 alculate effective air char If mechanical ventilatio	s been carried ou 0, expressed in c ty value, then (18 the dwelling is s ting shelter factor for monthly wind Feb 1 eed from Table U 5.00 4 1.25 5 allowing for shell 0.29 0 nge rate for the a on: air change rate ecovery: efficien	at or is interest ability of the second shelterest or dispeed: Mar J2 4.90 1.23 1ter and so 0.28 applicable te through acy in % a	tres per ho ÷ 20] + (8 4 Apr 4.40 1.10 wind facto 0.25 le case: gh system allowing fo	May 4.30 1.08 0.25 nr in-use fa	17), otherware metre of are metre of se (18) = (16) Jun 3.80 0.95 22a)m 0.22 ctor from Ta	<i>ise continue</i> of envelope 5) Jul 3.80 0.95 0.22	Aug 3.70	2 (16) 1 - Sep 4.00 1.00	[0.075 x (19 (18) x (2 Oct 4.30	 ())] = ()) = ()) = Nov 4.50 1.13 	hour 0.12 3.00 0.27 2 0.85 0.23 Dec 4.70 1.18 0.27 0.27] (8)] (17)] (18)] (19)] (20)] (21)] (22)] (22)] (22i] (22i



	0.54	0.54	0.54	0.53	0.53	0.52	0.52	0.52	0.53	0.53	0.53	0.54	(25)
				•	· ·		1	-1		•	1	- 1	
3. Heat losses a	nd heat lo	ss paramet											
Element				Gross rea, m²	Openings m ²		area m²	U-value W/m²K	A x U W		value, /m².K	Ахк, kJ/К	
Door							72 x	1.20	= 4.46				(26)
Window							.46 x	1.33	= 16.52				(27)
Roof window							39 x	1.33	= 8.47				(27a)
Basement floor						54	.80 x	0.10	= 5.48				(28)
External wall						110).66 x	0.20	= 22.13	3			(29a)
Basement wall						51	.47 x	0.18	= 9.26				(29)
Party wall						61	.28 x	0.00	= 0.00				(32)
, Roof							.64 x	0.10	= 3.86	=			(30)
Roof							.03 x	0.12	= 1.20				(30)
Roof						1.	11 x	0.15	= 0.17				(30)
Total area of exte	ernal elem	ents ∑A, m²				289	9.28			_			(31)
Fabric heat loss,	W/K = ∑(A	× U)							(2	6)(30) + (32) =	71.57	(33)
Heat capacity Cm	п = ∑(Ахк)	1						(28)	(30) + (32)	+ (32a)(3	2e) =	N/A	(34)
Thermal mass pa	rameter (1	「MP) in kJ/n	n²K									250.00	(35)
Thermal bridges:	Σ(L x Ψ) c	alculated us	sing Appen	dix K								19.77	(36)
Total fabric heat	loss									(33) + (36) =	91.33	(37)
	Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ventilation heat	loss calcula	ated month	ly 0.33 x (2	25)m x (5)									
	60.04	59.85	59.67	58.83	58.67	57.94	57.94	57.81	58.22	58.67	58.99	59.33	(38)
Heat transfer coe	efficient, W	//K (37)m +	- (38)m										
	151.37	151.19	151.01	150.17	150.01	149.27	149.27	149.14	149.56	150.01	150.33	150.66	
									Average = 2	∑(39)112	/12 =	150.17	(39)
Heat loss parame	eter (HLP),	W/m²K (39	9)m ÷ (4)										
[1.15	1.15	1.15	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.15	
									Average = 2	∑(40)112	/12 =	1.14	(40)
Number of days i	in month (Table 1a)											
	24.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00	(40)
i	31.00												
4. Water heatin													
4. Water heatin	ıg energy r											2 90	(42)
Assumed occupa	ng energy r ncy, N	requirement	t	Vd average	= (25 x N) +	36						2.90	(42)
Assumed occupa	ng energy r ncy, N not water u	requirement usage in litre	t es per day '				Jul	Aug	Sep	Oct		103.03	(42) (43)
Assumed occupa Annual average h	ng energy r ncy, N not water u Jan	requirement usage in litre Feb	t es per day v Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov		_
	g energy r ncy, N not water u Jan in litres pe	requirement usage in litre Feb er day for ea	t es per day ' Mar ich month '	Apr Vd,m = fact	May or from Tabl	Jun e 1c x (43	5)	_				103.03 Dec	_
Assumed occupa Annual average h	ng energy r ncy, N not water u Jan	requirement usage in litre Feb	t es per day v Mar	Apr	May	Jun		Aug 96.85	Sep	105.09	109.22	103.03 Dec 113.34] (43)
Assumed occupa Annual average h Hot water usage [ncy, N ncy, N not water u Jan in litres pe 113.34	requirement usage in litre Feb er day for ea 109.22	t es per day V Mar ach month V 105.09	Apr Vd,m = fact 100.97	May or from Tabl	Jun le 1c x (43 92.73	92.73	96.85			109.22	103.03 Dec	_
Assumed occupa Annual average h	ng energy r ncy, N not water u Jan in litres pe 113.34	requirement usage in litre Feb er day for ea 109.22 er used = 4.1	t Mar Mar 105.09 .8 x Vd,m x	Apr Vd,m = fact 100.97 nm x Tm/3	May or from Tabl 96.85	Jun e 1c x (43 92.73 onth (see	5) 92.73 Tables 1b	96.85	100.97	105.09 ∑(44)1	109.22	103.03 Dec 113.34 1236.40] (43)
Assumed occupa Annual average h Hot water usage [ncy, N ncy, N not water u Jan in litres pe 113.34	requirement usage in litre Feb er day for ea 109.22	t es per day V Mar ach month V 105.09	Apr Vd,m = fact 100.97	May or from Tabl	Jun le 1c x (43 92.73	92.73	96.85		105.09	109.22 12 = 149.89	103.03 Dec 113.34 1236.40] (43)

	25.21	22.05	22.75	19.84	19.03	16.43	15.22	17.47	17.67	20.60	22.48	24.42	(46)
Water storage lo	ss calculate	ed for each	month (55	5) x (41)m									
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(56)
If the vessel cont	ains dedica	ated solar s	torage or d	edicated W	WHRS (56))m x [(47) -	Vs] ÷ (47),	else (56)					

	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(57)
Primary circuit lo	oss for each	n month fro	m Table 3										
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(59)
Combi loss for e	ach month	from Table	3a, 3b or 3	с									
	50.96	46.03	50.96	49.32	49.35	45.73	47.25	49.35	49.32	50.96	49.32	50.96	(61)
Total heat requi	red for wat	er heating o	calculated f	or each mo	onth 0.85 x	(45)m + (4	46)m + (57)r	n + (59)m	+ (61)m				
	219.03	193.03	202.65	181.56	176.25	155.23	148.72	165.79	167.14	188.27	199.21	213.73	(62)
Solar DHW input	t calculated	l using Appe	endix G or A	Appendix H									
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(63)
Output from wa	ter heater f	for each mo	onth (kWh/	month) (62	2)m + (63)m	ı							
	219.03	193.03	202.65	181.56	176.25	155.23	148.72	165.79	167.14	188.27	199.21	213.73]
										∑(64)1	.12 =	2210.62	(64)
Heat gains from	water heat	ing (kWh/m	nonth) 0.2	5 × [0.85 ×	(45)m + (61	.)m] + 0.8 :	× [(46)m + (57)m + (5	9)m]				
	68.62	60.38	63.18	56.30	54.53	47.84	45.55	51.05	51.51	58.40	62.17	66.86	(65)
		•	•	•	•	•							_
5. Internal gain	IS												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains	(Table 5)												_
	144.91	144.91	144.91	144.91	144.91	144.91	144.91	144.91	144.91	144.91	144.91	144.91	(66)
Lighting gains (c	alculated in	Appendix I	L, equation	L9 or L9a),	also see Ta	ble 5							_
	28.07	24.93	20.27	15.35	11.47	9.69	10.47	13.60	18.26	23.18	27.06	28.85	(67)
Appliance gains	(calculated	in Appendi	x L, equatio	on L13 or L	13a), also se	ee Table 5							_
	299.27	302.37	294.55	277.89	256.86	237.09	223.89	220.78	228.61	245.27	266.30	286.06	(68)
Cooking gains (c	alculated ir	n Appendix	L, equation	L15 or L15	a), also see	Table 5							_
	37.49	37.49	37.49	37.49	37.49	37.49	37.49	37.49	37.49	37.49	37.49	37.49	(69)
Pump and fan ga	ains (Table	5a)											
	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	(70)
Losses e.g. evap	oration (Ta	ble 5)											
	-115.93	-115.93	-115.93	-115.93	-115.93	-115.93	-115.93	-115.93	-115.93	-115.93	-115.93	3 -115.93	(71)
Water heating g	ains (Table	5)											
	92.24	89.86	84.92	78.20	73.29	66.45	61.23	68.62	71.54	78.49	86.34	89.87	(72)
Total internal ga	ins (66)m -	+ (67)m + (6	58)m + (69)	m + (70)m	+ (71)m + (7	72)m							
	489.05	486.63	469.21	440.91	411.10	382.70	365.05	372.48	387.88	416.42	449.18	474.25	(73)
6 Solar gains													
6. Solar gains					A	6.	las flux		_			Caina	
			Access f Table		Area m²		lar flux N/m²	spe	g cific data	FF specific c	lata	Gains W	
								or	Table 6b	or Table			
South			0.7	7 X	10.58	x	46.75 x	0.9 x	0.72 x	0.70	=	172.76	(78)
Horizontal			1.0	0 x [4.50	x 2	26.00 x	0.9 x	0.72 x	0.70	=	53.07]
West			0.7	7 ×	0.94	x	19.64 x	0.9 x	0.72 x	0.70	=	6.45	(80)
East			0.7	7 X	0.94	x []	19.64 x	0.9 x	0.72 x	0.70	=	6.45	(76)
West			1.0	0 x [1.89	x 2	26.61 x	0.9 x	0.72 x	0.70	=	22.81	(80)
Solar gains in wa	atts ∑(74)m	n(82)m											-
	261.54	464.51	677.60	896.24	1045.58	1053.70	1009.55	897.50	754.15	525.53	316.93	221.34	(83)
Total gains - inte								•			•		

7. Mean internal temperature (heating season)

695.59 **(84)**

766.11

750.59 951.14 1146.81 1337.14 1456.68 1436.40 1374.60 1269.98 1142.03 941.95

Temperature du	ring heating	g periods in	the living a	area from T	able 9, Th1	(°C)						21.00	(85)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor	for gains f	or living are	a n1,m (se	e Table 9a)									
	1.00	0.99	0.98	0.93	0.82	0.63	0.47	0.53	0.79	0.97	1.00	1.00	(86)
Mean internal te							-						()
Wedninternarte	-		-			20.07	20.00	20.00	20.01	20 5 4	20.05	10.00	(07)
	19.73	19.94	20.24	20.59	20.85	20.97	20.99	20.99	20.91	20.54	20.05	19.69	(87)
Temperature du	ring heating	g periods in	the rest of	dwelling fr	om Table 9), Th2("C)							
	19.96	19.96	19.96	19.97	19.97	19.97	19.97	19.97	19.97	19.97	19.96	19.96	(88)
Utilisation factor	r for gains f	or rest of d	welling n2,r	n									
	1.00	0.99	0.97	0.91	0.76	0.54	0.36	0.42	0.71	0.95	0.99	1.00	(89)
Mean internal te	emperature	in the rest	of dwelling	T2 (follow	steps 3 to 3	7 in Table 9	c)						
	18.80	19.01	19.31	19.65	19.87	19.96	19.97	19.97	19.92	19.60	19.13	18.76	(90)
Living area fracti										ving area ÷		0.14	(91)
-		for the wh	ala durallin	~ fl A v T1 i	/1 f(A) v T	- - -					(4) -	0.14	(91)
Mean internal te	-			-									
	18.93	19.14	19.44	19.78	20.01	20.10	20.11	20.11	20.06	19.73	19.25	18.89	(92)
Apply adjustmer	nt to the me	an internal	temperatu	ire from Ta	ble 4e whe	re appropr	iate						
	18.93	19.14	19.44	19.78	20.01	20.10	20.11	20.11	20.06	19.73	19.25	18.89	(93)
8. Space heatin	ig requirem	ent											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor	for gains,	յՠ											
	1.00	0.99	0.97	0.91	0.76	0.56	0.38	0.43	0.72	0.95	0.99	1.00	(94)
Useful gains, ηm	Gm, W (94)m x (84)m											
	748.40	942.28	1112.85	1211.39	1112.38	799.46	521.85	548.86	819.47	892.47	760.53	694.19	(95)
Monthly average	e external t	emperature	e from Table	e U1									
, c	4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)
Heat loss rate fo							10.00	10.40	14.10	10.00	7.10	4.20	(30)
							524.20		004.42	4262.02	4007.40	2242.05	(07)
	2214.33	2152.27	1953.42	1633.70	1246.41	820.75	524.30	553.50	891.13	1369.93	1827.10	2213.05	(97)
Space heating re			th 0.024 x	[(97)m - (95	5)m] x (41)r								
	1090.65	813.11	625.38	304.06	99.72	0.00	0.00	0.00	0.00	355.23	767.93	1130.04	
									∑(98	3)15, 10	12 = 5	186.12	(98)
Space heating re	quirement	kWh/m²/ye	ear							(98)	÷ (4)	39.50	(99)
9a. Energy requ	uirements -	individual	heating sys	stems inclu	ding micro	-СНР							
Space heating													
Fraction of space	e heat from	secondary	/supplemer	ntary syster	m (table 11)						0.00	(201)
Fraction of space	e heat from	main syste	m(s)							1 - (20)1) =	1.00	(202)
Fraction of space	e heat from	main syste	m 2									0.00	(202)
Fraction of total									(20	2) x [1- (20	3)] =	1.00	(204)
Fraction of total									((202) x (20		0.00	(205)
			System 2							(202) × (20			
Efficiency of mai										• •		91.80	(206)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating fu	el (main sy	stem 1), kW	/h/month										
	1188.07	885.74	681.24	331.22	108.62	0.00	0.00	0.00	0.00	386.96	836.53	1230.98	
									∑(211	.)15, 10	12 = 5	649.37	(211)
Water heating													
Efficiency of wat	er heater												
	87.10	86.85	86.33	85.08	82.63	79.50	79.50	79.50	79.50	85.34	86.71	87.18	(217)
												-	. /

Water heating fuel, kWh/month						_
251.49 222.25 234.74 213.40 21	13.31 195.26 2	187.07	208.54 210.24	220.61 229	9.74 245.17	
Annual totals			Σ	(219a)112 =	2631.82	(219)
Space heating fuel - main system 1					5649.37	1
					2631.82] T
Water heating fuel Electricity for pumps, fans and electric keep-hot (Table 4f)					2031.82	
			20.00			(220-)
central heating pump or water pump within warm air heating	gunit		30.00			(230c)
boiler flue fan			45.00		75.00	(230e)
Total electricity for the above, kWh/year					75.00	(231)
Electricity for lighting (Appendix L)		1-		22) (2271)	495.67] (232)
Total delivered energy for all uses		(2	211)(221) + (231) + (2	32)(237b) =	8851.86	(238)
10a. Fuel costs - individual heating systems including micro-CH						
	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating - main system 1	5649.37	х	3.48	x 0.01 =	196.60	(240)
Water heating	2631.82	x	3.48	x 0.01 =	91.59	(247)
Pumps and fans	75.00	x	13.19	x 0.01 =	9.89	(249)
Electricity for lighting	495.67	x	13.19	x 0.01 =	65.38	(250)
Additional standing charges					120.00	(251)
Total energy cost			(240)(242) + (245)(254) =	483.46	(255)
11a. SAP rating - individual heating systems including micro-CH	НР					
Energy cost deflator (Table 12)					0.42	(256)
Energy cost factor (ECF)					1.15	(257)
SAP value					83.93]
SAP rating (section 13)					84	(258)
SAP band					B]
					_	_
12a. CO ₂ emissions - individual heating systems including micr	o-CHP Energy	V.	Emission factor		Emissions	
	kWh/year		kg CO₂/kWh		kg CO₂/year	
Space heating - main system 1	5649.37	х	0.22	=	1220.26	(261)
Water heating	2631.82	х	0.22	=	568.47	(264)
Space and water heating			(261) + (262) + (263) + (264) =	1788.74	(265)
Pumps and fans	75.00	х	0.52	=	38.93	(267)
Electricity for lighting	495.67	х	0.52	=	257.25	(268)
Total CO ₂ , kg/year			(265)(271) =	2084.92	(272)
Dwelling CO ₂ emission rate				(272) ÷ (4) =	15.88	(273)
El value					84.15]
El rating (section 14)					84	(274)
El band					В]
13a. Primary energy - individual heating systems including mic	cro-CHP					
	Energy kWh/year		Primary factor		Primary Energy kWh/year	,
Space heating - main system 1	5649.37	x	1.22	=	6892.23	(261)

Space and water heating

3210.82

10103.05

(264)

(265)

х

1.22

=

(261) + (262) + (263) + (264) =

2631.82

Pumps and fans	75.00] x	3.07] =	230.25	(267)
Electricity for lighting	495.67] x	3.07] =	1521.71	(268)
Primary energy kWh/year					11855.01	(272)
Dwelling primary energy rate kWh/m2/year					90.30	(273)

APPENDIX C

Code for Sustainable Homes Ene7 Worksheet



Energy averaging for the Code for Sustainable Homes Ene 1 and Ene 2 is permitted where a building contains multiple dwellings. For Ene 1 the area weighted average DER and TER must be calculated in accordance with the block averaging methodology defined in clauses 4.6 and 4.14 of the ADL1A. For apartment blocks it is acceptable to assess Ene 2 based on area weighted average FEE. The area weighted FEE must be calculated in accordance with the methodology defined in clauses 4.6 of ADL1A. The use of energy averaging to assess performance against Ene 2 is at the discretion of the developer and Assessor.

Assessor name		Mr Victor Battista			Assesso	or numb	er	3472	
					Created	ł		26/08/201	4
Energy Averaging									
URN	Vrs	Address	Built Form	DER	TER	FEE	Floor Area (m²)	DER x Floor Area	TER x Floor Area
0912006	2	6 The Old School Park Lane	Semi-detached	10.52	18.02	-1.0	76.73	807.20	1382.67
0912005	2	5 The Old School Park Lane	Enclosed mid	8.72	16.40	-1.0	89.29	778.61	1464.36
0912004	2	4 The Old School Park Lane	Enclosed end	11.02	18.00	-1.0	83.76	923.04	1507.68
0912003	2	3 The Old School Park Lane	Enclosed end	18.47	22.01	-1.0	60.01	1108.38	1320.82
0912002	2	2 The Old School Park Lane	Enclosed mid	9.42	16.83	-1.0	79.20	746.06	1332.94
						Total	388.99	4363.29	7008.47

Multiple dwelling DER = 11.22

Multiple dwelling TER = 18.02

Multiple dwelling FEE = -1.0

Ene 1 Results

Ene 1 using energy averaging = 37.7 % improvement*

4.1 credits

*100 x (1 - (DER/TER))

Ene 2 Results

Mid terrace and apartment blocks

Number of dwellings of this type = 2

FEE using energy averaging = -1 credits = 9

End terrace, semi-detached and detached

Number of dwellings of this type = 3

FEE using energy averaging = -1

credits = 9

Ene 2 credits using energy averaging for all dwelling types = 9 (Flats-MidTerrace-TFA x Flats-MidTerrace-Credits) + (Detached-Semi-TFA x Detached-Semi-Credits) / (TFA-All-Dwellings) (168.49 x 9) + (220.5 x 9) / (388.99)



Energy averaging for the Code for Sustainable Homes Ene 1 and Ene 2 is permitted where a building contains multiple dwellings. For Ene 1 the area weighted average DER and TER must be calculated in accordance with the block averaging methodology defined in clauses 4.6 and 4.14 of the ADL1A. For apartment blocks it is acceptable to assess Ene 2 based on area weighted average FEE. The area weighted FEE must be calculated in accordance with the methodology defined in clauses 4.6 of ADL1A. The use of energy averaging to assess performance against Ene 2 is at the discretion of the developer and Assessor.

Assessor name		Mr Victor Battista		Assesso	or numb	er	3472			
		c c				ł		26/08/2014		
Energy Averaging										
URN	Vrs	Address	Built Form	DER	TER	FEE	Floor Area (m²)	DER x Floor Area	TER x Floor Area	
0614009	2	Plot 9 The Old School Park Lane	End-terrace	7.71	16.03	-1.0	131.29	1012.25	2104.58	
0614008	2	Plot 8 The Old School Park Lane	Mid-terrace	6.46	14.44	-1.0	137.01	885.08	1978.42	
0614007	2	Plot 7 The Old School Park Lane	End-terrace	7.71	16.03	-1.0	131.29	1012.25	2104.58	
						Total	399.59	2909.58	6187.58	

Multiple dwelling DER = 7.28

Multiple dwelling TER = 15.48

Multiple dwelling FEE = -1.0

Ene 1 Results

Ene 1 using energy averaging = 53.0 % improvement*

5.4 credits

*100 x (1 - (DER/TER))

Ene 2 Results

Mid terrace and apartment blocks Number of dwellings of this type = 1

FEE using energy averaging = -1

credits = 9

End terrace, semi-detached and detached

Number of dwellings of this type = 2

FEE using energy averaging = -1

credits = 9

Ene 2 credits using energy averaging for all dwelling types = 9

(Flats-MidTerrace-TFA x Flats-MidTerrace-Credits) + (Detached-Semi-TFA x Detached-Semi-Credits) / (TFA-All-Dwellings)

(137.01 x 9) + (262.58 x 9) / (399.59)

CSH Ene 7 Assessment Tool

Code Addendum 2014 - Revision 00 (England Only)

Job no:	The Old School, Park Lane, Richmond
Assessment date:	July 2014
Assessor name:	Victor Battista
Registration no:	200
Development name:	The Old School, Park Lane, Richmond

Ene 7 Dwelling Assessme			Energ	у Туре								
				1	2	3	4	5	6	7	8	9
			Description	Plot 7	Plot 8	Plot 9	Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Plot 6
Standard case DER	SAP Worksheet Version 9.92	kgCO ₂ /m²/yr	SAP box [273] or [384]	15.88	14.63	15.88	0.00	24.59	32.68	27.13	24.77	27.80
Floor area	SAP Worksheet Version 9.92	m²	SAP box [4]	131.29	137.01	131.29		79.20	60.01	83.76	89.29	76.23
CO ₂ emission	s from electrical appliances	kgCO ₂ /m ² /yr		13.46	13.18	13.46		16.23	17.01	16.01	15.72	16.37
С	CO_2 emissions from Cooking kgCO ₂ /m ² /yr			1.44	1.38	1.44		2.24	2.78	2.15	2.04	2.31
Sta	Standard case CO ₂ emissions			30.77	29.19	30.77		43.06	52.47	45.28	42.52	46.48

Actual case DER	SAP Worksheet Version 9.92	kgCO ₂ /m ² /yr	SAP box [273] or [384]	9.50	8.70	9.50	16.25	15.20	20.25	17.00	14.80	17.20
Are SAP Sect	Are SAP Section 16 allowances sought?		n drop down menus	No								
Residual CO ₂ emissions offset from biomass CHP	SAP Worksheet Version 9.92	kgCO _{2/} m²/yr	SAP Section 16 SAP box [ZC5]									
CO ₂ reduction from additional allowable electricity	SAP Worksheet Version 9.92	kgCO ₂ /m ² /yr	SAP Section 16 SAP box [ZC7]									
	Actual case CO ₂ emissions	kgCO ₂ /m ² /yr	Equivalent to SAP box [ZC8]	24.39	23.26	24.39		33.67	40.04	35.15	32.55	35.88

Ene 7 Results		Energy Type								
		1	2	3	4	5	6	7	8	9
	Des	Plot 7	Plot 8	Plot 9	Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Plot 6
	criptio									
	lion									
% improvement in actual / standard case CO ₂ emissions	%	20	20	20		21	23	22	23	22
Ene 7 Credits		2	2	2		2	2	2	2	2

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All values to be taken from box numbers described within the worksheets set out within The Government's Standard Assessment Procedure for the Energy Ratings of SAP Worksheet Version 9.92, October 2013.

APPENDIX D

Code for Sustainable Homes Pre-Assessments

	-							
AM	ONI	TOR		The Old Sc	hool, Park I	ane	, Richmond, TW9 2AR	
11 ene	rgy cor	nsultancy		22 August 2014				
				1				
louse Type	1	Dwellings 2 - 6 - Ene	rgy averaging used fo	or Ene1 and 2 and t	o achieve CSH Lev Dwellings 2 - 6	Code	other Categories to achieve CSH Level 3.	Approved
					Weighted Score	Level		onfirmed
Category	Section	Description	Credits Available	Credits			Comment	
inergy	Ene1	Dwelling Emissions energy averaged ≥ 32%	10	4.10	4.80	4	Ground Floor U-Value=0.10	
	Ene2	Building Fabric energy averaged	9	9.00	10.53	4	External Wall U-Value=0.25; Timber Walls U-Values =0.25 and 0.23	
							Party Wall U-Value=0.00 - fully filled and sealed	
							Roof Pitched=0.11; Roof Other=0.14 Windows U-Value=1.2; Rooflights U-value=1.40	
							Doors U-Value=1.2	
							Y-Value=0.07 Units 1-6; 0.069 for Units 7 and 9; 0.074 for Unit 8.	
							Air Permeability Rate=4 Mechanical Ventilation with heat recovery 94% efficient and with a	
							SFP of 0.45 to Units 7 - 9 and extract fans to Units 1-6.	
							Condensing Combination Boiler=Sedbuk - Efficiency 89.5% Heating Controls=Zone control and weather compensator and	
						-	waste flue gas recovery system	
	Ene3	Energy Display Devices	2	2	2.34	3	100% Low energy light fittings That the correctly specified energy display device is dedicated to	
							the dwelling and the consumption data displayed by the correctly specified energy display device	
	Ene4	Drying Space	1	1	1.17	3	Drying= 6m+ of Drying Line	
	Ene5 Ene6	White Goods A+ Rated plus Leaflet External Lighting	2	1	1.17 1.17	3	A= Rated White Goods Energy Efficient External Lighting	-
	Ene7	LZCT	2	2	2.34	3	PV Panels=1KwPeak (approx. 8m2 per roof)	
	Ene8	Cycle Storage	2	1	1.17	3	Safe, secure and weather-proof storage for 1 cycle, 2m long x 1.5m wide.	
	Ene9	Home Office	1	1	1.17	3	Provision in 2nd or 3rd Bedroom for 1.8m long desk and chair and also 2 double electric sockets and a telephone point.	
		Total	31	22.1	25.86			1
/ater	Wat1	Internal Potable Water	5	3	4.50	3	To achieve 105 litres/person/day. Waste water recovery system.	
	Wat2	External Water Use	1	1	1.50	3	Water butts - 200 litre for each property	
laterials	Mat1	Total Environmental Impact of Materials	6 15	4 10	6.00 3.00	3	10 of 15 Credits taken	
	Mat2 Mat3	Responsible Sourcing Basic Building Materials Responsible Sourcing Internal Elements	6	3	0.90	3	3 Credits taken 1 Credits taken	
	IVIAL3	Total	24	14	4.20	3		1
urface Water	Sur1 Sur2	Reduction of Surface Water Run-Off Flood Risk	2	2	1.10 1.10		Site is in an area of low flood risk Site is in an area of low flood risk	
		Total	4	4	2.20	1		1
Vaste	Was1	Recycling and Storage	4	4	3.20	3	Local Authority collection, pre-collection sorting, 30 litre total capacity. Internal storage of 3 bins all with 7 litre minimum capacity	
	Was2	SWMP	3	1	0.80	3	1 Credit taken	
	Was3	Composting Total	1 8	1 6	0.80 4.80	3	Green waste bin provide by LBRUT	
ollution	Pol1	Global Warming Potential	8	1	4.80	3	All insulation to have GWP of less than 5	1
	Pol2	N0x Emissions Total	3	3	2.10 2.80	3	Dry N0x levels for boiler to be less than 40mg/kWh.	
ealth & Wellbeing	Hea1	Daylighting	3	0	0.00	0	0 Credit not taken at this stage. Potential to gain credits on issue of	
							detailed layouts and elevations. NB Home Office window has to achieve	
	Hea2	Sound Insulation	4	3	3.51	3	5dB Higher/lower taken. Lower value to account for the	
							requirement for Party Walls to be insulated under Building Regulations 2010	
	Hea3	Private Space	1 4	1 0	1.17 0.00		Private outdoor space of 4.5m2 provided 30% Lifetime Homes compliant	
	Hea4	Lifetime Homes Total	12	4	4.68	0	30% Litetime nomes compliant	1
lanagement	Man1	Home User Guide	3	3	3.33	3	To be provided and compiled using Checklist Man1 and in an appropriate format for users	
	Man2	Considerate Constructor's Scheme	2	1	1.11	3	The site will be signed up to the Considerate Constructor's Scheme and will be appropriately audited to achieve minimum credit	
	Man3	Site Impacts	2	1	1.11	3	A record to be maintained for on-site water usage and diesel	
	Man4	Secured By Design	2	1	1.11	3	consumption This credit is attained through the requirement of the LPA and the	
							Design Guide to ensure that the requirements of Secured by Design are considered.	
cology	Eco1	Total Environmental Value of The Site	9	6 1	6.66 1.33	3	Compliance has been assumed for Eco1 - Eco4. A qualified	
-07			-	_			Ecologist should be appointed prior to works commencing on site	
	Eco2	Ecological Enhancement	1	1	1.33	3		
	Eco3 Eco4	Protection of Ecological Features Change of Ecological Value of the Site	1 4	1 2	1.33 2.66	3		
	Eco5	Building Footprint	2	0	0.00	0		
		Total	9	5	6.65			
		Grand Total	107	69.1	63.85			
	-	Pre-Assessment Score (rounded down) Code for Sustainable Homes Level	+		63 3			
	1	PASS/FAIL			PASS			1

AM	ON	ITOR nsultancy		The Old Scl	nool, Park L	ane,	, Richmond, TW9 2AR	
17 ene	rgy co	nsultancy		22 August 2014				
louse Type		Dwellings 7 - 9 - En	argy averaging used fo	1			other Categories to achieve CSH Level 3.	
		Swellings 7 - 5 - Eli			Dwellings 7 - 9 Weighted Score	Code Level		Approved, onfirmed
				-				
ategory nergy	Section Ene1	Description Dwelling Emissions energy averaged ≥ 32%	Credits Available	Credits 5.40	6.32	4	Comment Ground Floor U-Value=0.10	
neigy								
	Ene2	Building Fabric energy averaged	9	9.00	10.53	4	External Wall U-Value=0.25; Timber Walls U-Values =0.25 and 0.23 Party Wall U-Value=0.00 - fully filled and sealed Roof Pitched=0.11; Roof Other=0.14 Windows U-Value=1.2; Rooflights U-value=1.40	3
							Doors U-Value=1.2	
							Y-Value=0.07 Units 1-6; 0.069 for Units 7 and 9; 0.074 for Unit 8. Air Permeability Rate=4 Mechanical Ventilation with heat recovery 94% efficient and with a	a
							SFP of 0.45 to Units 7 - 9 and extract fans to Units 1-6. Condensing Combination Boiler=Sedbuk - Efficiency 89.5% Heating Controls=Zone control and weather compensator and waste flue gas recovery system	
							100% Low energy light fittings	
	Ene3	Energy Display Devices	2	2	2.34	3	That the correctly specified energy display device is dedicated to the dwelling and the consumption data displayed by the correctly specified energy display device	
	Ene4	Drying Space	1	1	1.17 1.17	3	Drying= 6m+ of Drying Line	
	Ene5 Ene6	White Goods A+ Rated plus Leaflet External Lighting	2	1	1.17	3	A= Rated White Goods Energy Efficient External Lighting	
	Ene7	LZCT	2	2	2.34	3	PV Panels=1KwPeak (approx. 8m2 per roof)	
	Ene8	Cycle Storage	2	1	1.17	3	Safe, secure and weather-proof storage for 1 cycle, 2m long x 1.5n wide.	
	Ene9	Home Office	1	1	1.17	3	Provision in 2nd or 3rd Bedroom for 1.8m long desk and chair and also 2 double electric sockets and a telephone point.	
		Total	31	23.4	27.38	1		1
ater	Wat1	Internal Potable Water	5	3	4.50		To achieve 105 litres/person/day. Waste water recovery system.	
	Wat2	External Water Use Total	1 6	1 4	1.50 6.00	3	Water butts - 200 litre for each property	
aterials	Mat1	Environmental Impact of Materials	15	10	3.00	3	10 of 15 Credits taken	1
	Mat2	Responsible Sourcing Basic Building Materials	6	3	0.90		3 Credits taken	
	Mat3	Responsible Sourcing Internal Elements Total	3	1 14	0.30 4.20	3	1 Credits taken	
urface Water	Sur1	Reduction of Surface Water Run-Off	2	2	1.10	3	Site is in an area of low flood risk	1
	Sur2	Flood Risk	2	2	1.10	3	Site is in an area of low flood risk	
/aste	Was1	Total Recycling and Storage	4	4	2.20 3.20	3	Local Authority collection, pre-collection sorting, 30 litre total capacity. Internal storage of 3 bins all with 7 litre minimum capacity	
	Was2	SWMP	3	1	0.80	3	1 Credit taken	
	Was3	Composting	1	1	0.80	3	Green waste bin provide by LBRUT	
- U. Alta a	D-14	Total	8	6	4.80		All insulation to have CWD of loss than 5	1
ollution	Pol1 Pol2	Global Warming Potential N0x Emissions	1 3	1	0.70 2.10		All insulation to have GWP of less than 5 Dry N0x levels for boiler to be less than 40mg/kWh.	
	-	Total	4	4	2.80		,	1
ealth & Wellbeing	Hea1	Daylighting	3	0	0.00	0	0 Credit not taken at this stage. Potential to gain credits on issue o detailed layouts and elevations. NB Home Office window has to achieve	f
	Hea2	Sound Insulation	4	3	3.51	3	5dB Higher/lower taken. Lower value to account for the requirement for Party Walls to be insulated under Building Regulations 2010	
	Hea3	Private Space	1	1	1.17	3	Private outdoor space of 4.5m2 provided	
	Hea4	Lifetime Homes Total	4	0	0.00 4.68	0	30% Lifetime Homes compliant	
lanagement	Man1	Home User Guide	3	3	3.33	3	To be provided and compiled using Checklist Man1 and in an	
-	Man2	Considerate Constructor's Scheme	2	1	1.11	3	appropriate format for users The site will be signed up to the Considerate Constructor's Scheme and will be appropriately audited to achieve minimum credit	2
	Man3	Site Impacts	2	1	1.11	3	A record to be maintained for on-site water usage and diesel	
	Man4	Secured By Design	2	1	1.11	3	consumption This credit is attained through the requirement of the LPA and the	
	IVIAI14					5	Design Guide to ensure that the requirements of Secured by Design are considered.	
cology	Eco1	Total Environmental Value of The Site	9	6	6.66 1.33	3	Compliance has been assumed for Eco1 - Eco4. A qualified Ecologist should be appointed prior to works commencing on site	
	Eco2	Ecological Enhancement	1	1	1.33	3		
	Eco3 Eco4	Protection of Ecological Features Change of Ecological Value of the Site	1 4	1 2	1.33 2.66	3		
	Eco4 Eco5	Building Footprint	2	0	0.00	3		
		Total	9	5	6.65			1
		Grand Total	107	70.4	65.37	-		
		Pre-Assessment Score (rounded down) Code for Sustainable Homes Level			65 3	-		
	+	PASS/FAIL	1		PASS			1