



**EAL CONSULT BUILDING SUSTAINABILITY SINCE 2008**

## **BDR PRE-ASSESSMENT**

### **PROPERTY ADDRESS**

123 STATION RD,  
HAMPTON,  
TW12 2AL

### **DATE**

October 2020

### **PREPARED BY**

EAL Consult

# Contents

EXECUTIVE SUMMARY .....3

BREEAM Domestic Refurbishment Overview .....5

BDR PRE- Assessment .....9

CONCLUSION..... 16

Appendix ..... 17

## EXECUTIVE SUMMARY

EAL Consult has conducted a Building Research Environmental Assessment Method (BREEAM) Domestic, Refurbishment & Fit Out 2014 pre-assessment for the proposed project. This assessment will support the planning application, for the conversion of existing commercial into one bedroom flat.

The pre-assessment is based on Domestic Refurbishment criteria and is representative of the development proposed for the site. The intent is to determine, whether the BREEAM 2014 rating is achievable for the proposed scheme.

The pre-assessment outlined in this report demonstrates that the proposed development could achieve a BREEAM '**Excellent**' rating with a score of **71.72%**. This is subject to a complete package of compliant evidence being submitted to the licensed BREEAM Assessor. Specifically:

**Table 1. Expected BREEAM Rating**

Building Type	Indicative Score	Minimum Mandatory standards for BREEAM "Excellent" achieved	BREEAM rating
Dwelling	71.72%	70%	<b>Excellent</b>

The development can meet BREEAM 'Excellent' because it meet the minimum requirement for Ene 02. According to the design SAP calculations (see Appendix), an efficient boiler is the cost effective solution for this development. The calculations showed an EER of 72.23 > 70 which is the minimum requirement for BREEAM Excellent).

**Table 2. EER calculated by energy measures**

	Existing	Boiler Only
<b>EER*</b>	37	72
<b>Ene 02</b>		<b><u>2.5</u></b>

\* Calculations based on Table 20 – BREEAM domestic refurb manual 2014.

Further credits may be achieved with significant cost implications that may not be financially beneficial for this development.

The relevant design team members should assess each of the credits that have been awarded to confirm and provide comments upon their validity.

As the scheme progresses and detailed designs are prepared, the pre-assessment may be subject to change and therefore, is for guidance only, at this stage.

*Table 3. Summary of Credits Targeted*

Credit Allocation	Weighting	Credits Available	Credits Awarded	%Achieved	%Score
Management	12%	11	9	81.82%	<b>9.82%</b>
Health and Wellbeing	17%	8	6	75.00%	<b>12.75%</b>
Energy	43%	27	19	70.37%	<b>30.26%</b>
Water	11%	5	3	60.00%	<b>6.60%</b>
Materials	8%	43	29	46.51%	<b>5.4%</b>
Waste	3%	5	4	80.00%	<b>2.40%</b>
Pollution	6%	8	6	75.00%	<b>4.5%</b>
Innovation	10%	10	0	0.00%	<b>0.00%</b>
<b>Total</b>	<b>100%</b>	<b>117</b>	<b>76</b>	-	<b>71.72%</b>

## BREEAM Domestic Refurbishment Overview

The BREEAM UK Refurbishment and Fit-out scheme is a performance based assessment method and certification scheme for existing building refurbishment and fit-out projects. The primary aim of BREEAMUK Refurbishment and Fit-out is to promote the delivery of sustainable refurbishment and fit-out, in order to mitigate the life cycle impacts of existing buildings on the environment in a robust and cost effective manner. This is achieved through integration and use of the scheme by clients and their project teams at key stages in the design and refurbishment/fit-out works process.

The BREEAM Domestic Refurbishment 2014 scheme can be used to assess the environmental life cycle impacts of refurbishment projects including, existing dwelling's, undergoing refurbishment, extensions, domestic conversions and change of use projects in the UK only. The following section sets out the project types for which the scheme should be used. For the purposes of this scheme, 'Domestic Refurbishment' is classified under two categories:

- Category 1: Alterations to existing dwellings and extensions
- Category 2: Domestic conversions and change of use projects

**The specific project falls under Category 2 – Domestic conversion and change of use projects.**

This is where a new dwelling is formed by change of use from a building which was not previously used for domestic purposes. This may also include change of use through the conversion of a single dwelling into multiple dwellings, or where several dwellings are converted into a single dwelling.

Examples of a change of use projects include an office, school or hospital building being converted into flats, a large dwelling being converted into flats, or maisonettes being converted into a single dwelling. Changes of use is further defined by Regulation 5 (a), (b) and (g) of the Building Regulations 2000 for England and Wales or Regulation 4 – schedule 2 types 1 and 3 of Technical Handbook 2010 for Scotland.

The environmental issues which BREEAM examined are divided up into the following ten categories:

- |                         |                        |
|-------------------------|------------------------|
| • Management            | • Materials            |
| • Health and Well Being | • Waste                |
| • Energy                | • Land-use and Ecology |
| • Transport             | • Pollution            |
| • Water                 | • Innovation           |

### Aims of BREEAM

- To mitigate the impacts of buildings on the environment
- To enable buildings to be recognized according to their environmental benefits
- To provide a credible, environmental label for buildings
- To stimulate demand for sustainable buildings

### Objectives of BREEAM

- To provide market recognition to low environmental impact buildings
- To ensure best environmental practice is incorporated in buildings

- To set criteria and standards surpassing those required by regulations and challenge the market to provide innovative solutions that minimise the environmental impact of buildings
- To raise awareness of owners, occupants, designers and operators of the benefits of buildings with a reduced impact on the environment
- To allow organisations to demonstrate progress towards corporate environmental objectives

## **BREEAM Credibility**

### **Technical Credibility**

BREEAM is tried and tested, both in terms of its robust technical standards and its commercial delivery and expert advice (based on scientific evidence) continues to inform almost every issue in BREEAM.

### **Robust Technical Standards**

BREEAM has always used objective criteria's to recognise good environmental performance. Where specific targets cannot be set using hard science or research, sensible practical measures are recommended to minimise environmental impact or enhance the environment of the building and its users.

### **Commercial Credibility**

Assessments are undertaken by organisations and individuals trained and licensed by BRE Global Assessors. BRE Global has gained UKAS (United Kingdom Accreditation Service) accreditation for all its BREEAM schemes. This means that its management of BREEAM is monitored and overseen by UKAS.

### **Scoring and Rating**

This section of the report explains how an assessed building's certified BREEAM rating is calculated. There are a number of elements that determine the BREEAM rating; these are as follows:

- BREEAM rating benchmarks
- BREEAM environmental weightings
- Minimum BREEAM standards

### **BREEAM Rating Benchmarks**

Table 3 below summarises the overall percentage score that is required to classify within each rating.

**Table 4. BREEAM Ratings**

<b>BREEAM Rating</b>	<b>% Score</b>
Unclassified	<30
Pass	≥30
Good	≥45
Very good	≥55
Excellent	≥70
Outstanding	≥85

In this respect each BREEAM rating broadly represents performance equivalent to:

1. **Outstanding:** Less than top 1% of UK new non-domestic buildings (innovator)
2. **Excellent:** Top 10% of UK new non-domestic buildings (best practice)
3. **Very Good:** Top 25% of UK new non-domestic buildings (advanced good practice)
4. **Good:** Top 50% of UK new non-domestic buildings (intermediate good practice)
5. **Pass:** Top 75% of UK new non-domestic buildings (standard good practice)

### BREEAM Environmental Weightings

Table 4 below outlines the environmental weightings that are adopted in each section to convert the credits awarded into an overall percentage score.

Table 5. BREEAM Section Weighting

BREEAM Section	Weighting % 2014
Management	12%
Health & Wellbeing	17%
Energy	43%
Water	11%
Materials	8%
Waste	3%
Pollution	6%
Innovation (Additional)	10%

The BREEAM Refurbishment and Fit Out 2014 mandatory minimum standards for each rating are set out in Table 5, highlighting those required for a 'Excellent' rating.

Table 6-Minimum BREEAM Standards

Minimum standards by BREEAM rating level					
BREEAM Issue	Pass	Good	Very Good	Excellent	Outstanding
<b>Ene 02 : Energy efficiency rating post refurbishment</b>	0.5 credits	1 credits	2.5 credits	2.5 credits	3.5 credits
<b>Wat 01 : Internal Water Use</b>	-	-	1 credits	2 credits	3 credits
<b>Hea 05: Ventilation</b>	1 credits	1 credits	1 credits	1 credits	1 credits
<b>Hea 06 : Safety</b>	1 credits	1 credits	1 credits	1 credits	1 credits
<b>Pol 03: Flooding</b>	-	-	-	2 credits	2 credits
<b>Mat 01: Environmental Impact of Materials</b>	Criterion 1 only	Criterion 1 only	Criterion 1 only	Criterion 1 only	Criterion 1 only

To achieve a BREEAM 'Excellent' Rating, a minimum score of 70% and a few minimum standards must be achieved. The minimum standards will ensure that the building addresses certain issues which are considered fundamental to its environmental performance. In order to achieve a high BREEAM rating it is essential that a low carbon energy strategy is assessed at an early stage. Further credits are available for carrying out a low carbon energy study and most importantly, implementing the results.

### **BREEAM Credits for Innovation**

Innovation credits provide additional recognition for a building that innovates in the field of sustainable performance, above and beyond the level that is currently recognized and rewarded within standard BREEAM issues.



## BDR PRE- Assessment

A BREEAM Assessor has conducted a preliminary assessment of the environmental performance of the proposal in order to guide the conversion of an existing ground floor office space to provide a 1 bedroom flat. The proposal includes associated alterations including some fenestration changes.

The BREEAM Refurbishment and Fit Out 2014 – Domestic criteria has been used as a basis to assess the preliminary design and to highlight key sustainability opportunities for the scheme.

### Score

The following section highlights the BREEAM credits that have been awarded for the proposed change of use, which is deemed likely to achieve a BREEAM rating of 'Excellent'.

We understand the pre-assessment will be submitted as part of the planning application and we recommend that the client is satisfied with the assumptions made and the approach taken at this stage are reasonable.

### **BREEAM Domestic Refurbishment Scheme 2014 Pre Assessment: Credit Summary**

The following table sets out the likely BREEAM score based on the drawings and specifications provided to date.

Table 7. BREEAM Domestic Refurbishment 2014 Pre- Assessment Summary

BDR 2014 Credit Reference		Credits Available	Credits Awarded	Responsibility	Evidence Required
<b>Management</b>					
<b>Man 01</b>	Home user guide	3	3	Developer	Written confirmation from the developer or in the specification that a home user guide will be:  Supplied to all dwellings and will as a minimum include a list of contents showing that the guide will cover all of the issues required in the 'user guide contents list'
<b>Man 02</b>	Responsible construction practiced	2	1	Developer	Written confirmation: that registration with the Considerate Constructor scheme OR completion of the checklists took place no later than the commencement of the refurbishment works
<b>Man 03</b>	Construction site impacts	1	1	Developer	Checklist A-5: Small-scale refurbishments- Construction site impacts should be completed.  Confirmation that site timber will be sourced from suppliers capable of providing certification to the level required for the particular tier claimed in Mat 02 Responsible sourcing of materials AND A copy of the policy for sourcing site timber for the project
<b>Man 04</b>	Security	2	1	Developer	-Confirmation that retained external windows and doors meet the minimum security requirements in CN6  -Confirmation that windows and either new external or entrance door sets, or both, present meet CN1 in the form of: Written confirmation from the developer OR Relevant drawings clearly showing location of the windows, external and entrance door sets and locks OR A building and site inspection report and photographic evidence OR Where evidence 1 cannot be produced compliant design stage commitment from the developer outlining the design specification

					that will be implemented if the above detailed documentary evidence cannot be produced at this stage
<b>Man 05</b>	Protection and enhancement of ecological features	1	1	Developer	One credit can be awarded where the refurbishment site is defined as 'land of low ecological value' and where the surrounding site contains no features of ecological value
<b>Man 06</b>	Project management	2	2	Developer	Written confirmation of a commitment or contract to provide compliant aftercare support and training or a compliant design stage commitment to provide aftercare
<b>Health and Wellbeing</b>					
<b>Hea 01</b>	Daylighting	2	2	Daylight Assessor	<ul style="list-style-type: none"> <li>• A completed signed and dated copy of Checklist A-7: Daylight Factor, parts 1 and 2, or parts 3 and 4 as relevant</li> <li>• Where relevant, calculations to demonstrate: Average daylight factor using the Hea01 calculator</li> <li>• Position of the no-sky line and percentage of area of the working plane that receives direct light from the sky</li> </ul>
<b>Hea 02</b>	Sound Insulation	-	-	-	Credits have not been targeted for this issue
<b>Hea 03</b>	Volatile Organic compounds	1	1	Developer	Compliant design stage commitment that the VOC content of the relevant specified product types will comply with the standards specified within the criteria
<b>Hea 04</b>	Inclusive Design	2	1	Developer	A copy of the Access Statement completed by the inclusive design champion, NRAC auditors or NRAC consultant to address the requirements of Sections 6— 9 of Part M. In all cases the access statement is signed by the developer and, when completed by an inclusive design champion or NRAC auditor, the appointed assessor

<b>Hea 05</b>	Ventilation	2	1	Developer	Written confirmation from the developer confirming the level of background, extract and purge ventilation  OR Compliant design stage commitment confirming the level of background, extract and purge ventilation that will be implemented
<b>Hea 06</b>	Safety	1	1	Developer	Detailed documentary evidence demonstrating that the fire detection and fire alarm system and carbon monoxide detectors are certified to the relevant standards OR Where evidence 1 cannot be produced, compliant design stage commitment outlining the design specification that will be implemented

Energy					
<b>Ene 01</b>	Improvement in Energy efficiency Rating	6	4	Energy Assessor	SAP Calculations
<b>Ene 02</b>	Energy Efficiency Rating Post refurbishment	4	2.5	Energy Assessor	A copy of the design stage energy performance certificate report or SAP 2012 worksheets post refurbishment to confirm the dwellings energy efficiency rating.  A copy of the output from the BREEAM Domestic Refurbishment energy calculator
<b>Ene 03</b>	Primary energy Demand	7	5.5	Energy Assessor	A copy of the design stage energy performance certificate report, SAP 2012 or RdSAP April 2012 worksheets (or EPC report) post-refurbishment to confirm the dwelling's primary energy demand.  A copy of the output from the BREEAM Domestic Refurbishment energy calculator
<b>Ene 04</b>	Renewable Technologies	1		Developer	Credits have not been targeted for this issue.

<b>Ene 05</b>	Energy Labelled White Goods	2	2	Developer	Detailed documentary evidence for existing white goods confirming the performance of the appliances OR Compliant design stage evidence outlining the appliances to be provided with their applicable ratings under the EU energy efficiency labelling scheme
<b>Ene 06</b>	Drying Space	1	0	-	Credits have not been targeted for this issue.
<b>Ene 07</b>	Lighting	2	1	Developer	Detailed documentary evidence confirming: <ul style="list-style-type: none"> <li>• The types of light fitting for all external lamps</li> <li>• The control systems applicable to each light fitting or group of fittings</li> </ul> Detailed documentary evidence confirming: <ul style="list-style-type: none"> <li>• The average Watts/m2 for all internal lights</li> </ul>
<b>Ene 08</b>	Display Energy Devices	2	1	Developer	Detailed documentary evidence confirming: That the energy display device is dedicated to each individual dwelling The consumption data displayed by the energy display device Whether the energy display device can record consumption data OR Where the above cannot be produced at this stage, a compliant design stage commitment outlining the design specification that will be implemented
<b>Ene 09</b>	Cycle storage	2	1	Developer/Architect	Detailed documentary evidence showing: a. The number of bedrooms and the corresponding number of cycle storage spaces per dwelling b. Location, type and size of storage c. Convenient access to cycle storage d. Any security measures e. Details of the proprietary system (if applicable) OR a compliant design stage commitment outlining the design specification that will be implemented
<b>Ene 10</b>	Home Office	1	1	Developer/Architect	Detailed documentary evidence showing: <ul style="list-style-type: none"> <li>• Location of and sufficient space for the home office</li> <li>• Location and number of sockets</li> </ul>

					<ul style="list-style-type: none"> <li>• Location of telephone points</li> <li>• That adequate ventilation will be provided</li> <li>• Window (either of the width and height of no less than 450mm)</li> </ul>
<b>Water</b>					
<b>Wat 01</b>	Internal Water Use	3	2	Developer	Drawings describing the location, details and type of appliances or fittings that use water in the dwelling or dwellings, including any specific water reduction equipment
<b>Wat 02</b>	External Water Use	1	0	-	Credits have not been targeted for this issue.
<b>Wat 03</b>	Water Meter	1	1	Developer	<p>Detailed documentary evidence confirming:</p> <ul style="list-style-type: none"> <li>• The water meter make and model</li> <li>• The consumption data displayed by the water meter</li> <li>• The location of the water meter</li> </ul>
<b>Materials</b>					
<b>Mat 01</b>	Environmental Impact of Materials	20	15	Developer/Architect	<ul style="list-style-type: none"> <li>• Specification providing a detailed description of each applicable element and its constituent materials</li> <li>• Design drawings or specification detailing the location and area (m2) of each applicable element</li> </ul>
<b>Mat 02</b>	Responsible sourcing of Materials	15	10	Developer	<ul style="list-style-type: none"> <li>• Written confirmation that: All timber will/has come from a 'legal source'.</li> <li>• Detailed documentary evidence outlining the commitment to responsible sourcing which should take the form of: A sustainable procurement plan</li> <li>• Design drawings and/or specification confirming:</li> <li>• The location of elements and materials specified</li> <li>• Details of the materials specified for each element.</li> </ul>

<b>Mat 03</b>	Insulation	8	4	Developer	Use of Insulation that has a low embodied impact
<b>Waste</b>					
<b>Was 01</b>	Household Waste	2	1	Developer	Evidence of the recycling facilities
<b>Was 02</b>	Refurbishment site Waste Management	3	3	Developer	<ul style="list-style-type: none"> <li>• A copy of the compliant site waste management plan/Checklist A-10: Refurbishment Site Waste Management – up to £100k value containing the appropriate benchmarks, commitments and procedures</li> <li>• Where appropriate, a copy of the pre-refurbishment audit</li> </ul>
<b>Pollution</b>					
<b>Pol 01</b>	Nitrogen Oxide Emissions	3	2	Developer	NOx emissions of space heating and hot water systems are ≤ 70 mg/kWh
<b>Pol 02</b>	Surface Water Run Off	3	2	Developer & Hydrologist	<ul style="list-style-type: none"> <li>• Compliant design stage commitment outlining the design specification that will be implemented</li> <li>• Written confirmation of the appointment of an appropriately qualified professional to carry out the calculations and provide design criteria for all relevant elements</li> </ul>
<b>Pol 03</b>	Flooding	2	2	Flood risk assessor	<ul style="list-style-type: none"> <li>• Flood risk assessment</li> </ul>
<b>Innovation</b>					
<b>Inn 01</b>		0	0		

## CONCLUSION

The overall score is indicative of what could be achieved, providing all the information has been received and is compliant with the BREEAM requirements.

The pre-assessment should be read in conjunction with the BREEAM Domestic Refurbishment 2014 Manual for a fuller understanding of the actual requirements and commitments.

A preliminary score of 71.72% can be achieved for the proposed change of use. This equates to a 'Excellent' rating and it is assumed that the mandatory minimum standards for this rating will be met.

Credit Allocation	Weighting	Credits Available	Credits Awarded	%Achieved	%Score
<b>Management</b>	12%	11	9	81.82%	<b>9.82%</b>
<b>Health and Wellbeing</b>	17%	8	6	75.00%	<b>12.75%</b>
<b>Energy</b>	43%	27	19	70.37%	<b>30.26%</b>
<b>Water</b>	11%	5	3	60.00%	<b>6.60%</b>
<b>Materials</b>	8%	43	29	67.44%	<b>5.40%</b>
<b>Waste</b>	3%	5	4	80.00%	<b>2.40%</b>
<b>Pollution</b>	6%	8	6	75.00%	<b>4.50%</b>
<b>Innovation</b>	10%	10	0	0.00%	<b>0.00%</b>
<b>Total</b>	<b>100%</b>	<b>117</b>	<b>76</b>	-	<b>71.72%</b>



## Appendix

- SAP Calculations Notional
- SAP Calculations Proposed

**Project Information**

Building type Ground-floor flat

Reference

Date 28 October 2020

Email: none Project 123 Station Road  
LONDON  
TW12 2AL**SAP 2012 worksheet for Existing dwelling - calculation of energy ratings****1. Overall dwelling dimensions**

	<b>Area (m<sup>2</sup>)</b>	<b>Av. Storey height (m)</b>	<b>Volume (m<sup>3</sup>)</b>	
Ground floor (1)	46.01	3.06	140.79	(3a)
Total floor area	46.01			(4)
Dwelling volume (m <sup>3</sup> )			140.79	(5)

**SAP 2012 worksheet for Existing dwelling - calculation of energy ratings**

**2. Ventilation rate**

	<b>main + secondary + other heating</b>		<b>m<sup>3</sup> per hour</b>									
Number of chimneys	0 + 0 + 0	x 40	0.00 (6a)									
Number of open flues	0 + 0 + 0	x 20	0.00 (6b)									
Number of intermittent fans	3	x 10	30.00 (7a)									
Number of passive vents	0	x 10	0.00 (7b)									
Number of flueless gas fires	0	x 40	0.00 (7c)									
			<b>Air changes per hour</b>									
Infiltration due to chimneys, fans and flues			0.21 (8)									
Pressure test, result q50	15.00		(17)									
Air permeability			0.96 (18)									
Number of sides on which sheltered			2.00 (19)									
Shelter factor			0.85 (20)									
Infiltration rate incorporating shelter factor			0.82 (21)									
Infiltration rate modified for monthly wind speed												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70	
												52.50 (22)
Wind Factor												
1.27	1.25	1.23	1.10	1.08	0.95	0.95	0.93	1.00	1.08	1.13	1.18	
												13.13 (22a)
Adjusted infiltration rate (allowing for shelter and wind speed)												
1.04	1.02	1.00	0.90	0.88	0.78	0.78	0.76	0.82	0.88	0.92	0.96	
												10.74 (22b)
Ventilation : natural ventilation, intermittent extract fans												
Effective air change rate												
1.04	1.02	1.00	0.91	0.89	0.80	0.80	0.79	0.84	0.89	0.92	0.96	(25)

**SAP 2012 worksheet for Existing dwelling - calculation of energy ratings**

**3. Heat losses and heat loss parameter**

Element	Gross area, m <sup>2</sup>	Openings m <sup>2</sup>	Net area A, m <sup>2</sup>	U-value W/m <sup>2</sup> K	A x U W/K	kappa-value kJ/m <sup>2</sup> K	A x K kJ/K						
Window - Single-glazed (North) FRONT			<b>8.310</b>	<b>4.84 (6.00)</b>	40.21			(27)					
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (West) SIDE			<b>3.740</b>	<b>1.50 (1.60)</b>	5.62			(27)					
Full glazed door - Single-glazed (North) FRONT			<b>2.020</b>	<b>5.70</b>	11.51			(26)					
Full glazed door - Double-glazed, argon filled, low-E, En=0.1, soft coat (South) REAR			<b>2.810</b>	<b>1.80</b>	5.06			(26)					
Walls HALLWAY/LOBBY			29.22	0.70 (Ru=0.78)	20.50	135.00	3944.70	(29)					
Walls FRONT ENTRANCE			1.57	2.10	3.30	135.00	212.41	(29)					
Walls UPGRADED, EXTERNAL #WINDOWS DOORS			49.69	1.55	77.02	70.00	3478.30	(29)					
Ground floors UNDERGROUND			46.01	0.63	28.99	110.00	5061.10	(28)					
Party wall SOLID			33.54	0.00	0.00	180.00	6037.20						
Party ceiling ANOTHER DWELLING ABOVE			46.01	0.00	0.00	30.00	1380.30						
Total area of external elements Sigma A, m <sup>2</sup>							143.37	(31)					
Fabric heat loss, W/K							192.22	(33)					
Heat capacity							20114.01	(34)					
Thermal mass parameter, kJ/m <sup>2</sup> K							437.17	(35)					
Effect of thermal bridges							21.51	(36)					
Total fabric heat loss							213.72	(37)					
Ventilation heat loss calculated monthly													
	48.49	47.54	46.59	42.07	41.22	37.28	37.28	36.55	38.80	41.22	42.93	44.72	(38)
Heat transfer coefficient, W/K													
	262.22	261.27	260.32	255.79	254.95	251.00	251.00	250.28	252.52	254.95	256.66	258.45	255.78 (39)
Heat loss parameter (HLP), W/m <sup>2</sup> K													
	5.70	5.68	5.66	5.56	5.54	5.46	5.46	5.44	5.49	5.54	5.58	5.62	5.56 (40)
HLP (average)													5.56 (40)
Number of days in month (Table 1a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	31	28	31	30	31	30	31	31	30	31	30	31	

**SAP 2012 worksheet for Existing dwelling - calculation of energy ratings**

**4. Water heating energy requirements**

												<b>kWh/year</b>	
Assumed occupancy, N												1.57	(42)
Annual average hot water usage in litres per day Vd,average												75.34	(43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage in litres per day for each month													
82.87	79.86	76.85	73.83	70.82	67.81	67.81	70.82	73.83	76.85	79.86	82.87	(44)	
Energy content of hot water used													
122.90	107.49	110.92	96.70	92.79	80.07	74.20	85.14	86.16	100.41	109.60	119.02		
Energy content (annual)												1185.40	(45)
Distribution loss													
18.44	16.12	16.64	14.51	13.92	12.01	11.13	12.77	12.92	15.06	16.44	17.85	(46)	
Hot water storage volume (litres)												0.00	(50)
Hot water cylinder loss factor (kWh/day)												0.0000	(51)
Volume factor												0.0000	(52)
Temperature factor												0.0000	(53)
Energy lost from store (kWh/day)												0.00	(55)
Total storage loss													
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)	
Net storage loss													
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 loss													
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 calculated for each month													
42.23	36.76	39.16	36.41	36.09	33.44	34.55	36.09	36.41	39.16	39.38	42.23	(61)	
Total heat required for water heating calculated for each month													
165.13	144.25	150.08	133.11	128.88	113.51	108.75	121.23	122.57	139.57	148.99	161.26	(62)	
Output from water heater for each month, kWh/month													
165.13	144.25	150.08	133.11	128.88	113.51	108.75	121.23	122.57	139.57	148.99	161.26	(64)	
												1637.33	(64)
Heat gains from water heating, kWh/month													
51.42	44.93	46.67	41.26	39.87	34.98	33.31	37.33	37.75	43.18	46.29	50.13	(65)	

**SAP 2012 worksheet for Existing dwelling - calculation of energy ratings**

**5. Internal gains**

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains, Watts												
94.42	94.42	94.42	94.42	94.42	94.42	94.42	94.42	94.42	94.42	94.42	94.42	(66)
Lighting gains												
61.02	54.20	44.07	33.37	24.94	21.06	22.75	29.58	39.70	50.40	58.83	62.71	(67)
Appliances gains												
204.31	206.43	201.09	189.71	175.36	161.86	152.85	150.73	156.07	167.44	181.80	195.30	(68)
Cooking gains												
46.02	46.02	46.02	46.02	46.02	46.02	46.02	46.02	46.02	46.02	46.02	46.02	(69)
Pumps and fans gains												
10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	(70)
Losses e.g. evaporation (negative values)												
-62.95	-62.95	-62.95	-62.95	-62.95	-62.95	-62.95	-62.95	-62.95	-62.95	-62.95	-62.95	(71)
Water heating gains												
69.12	66.86	62.73	57.30	53.59	48.59	44.77	50.18	52.43	58.03	64.29	67.38	(72)
Total internal gains												
421.93	414.97	395.38	367.87	341.38	319.00	307.86	317.97	335.69	363.37	392.41	412.88	(73)

**6. Solar gains (calculation for January)**

	Area & Flux	g & FF	Shading	Gains								
Window - Single-glazed (North) FRONT	0.9 x 8.310	10.63 0.85 x 0.80	0.77	41.6404								
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (West) SIDE	0.9 x 3.740	19.64 0.63 x 0.70	0.77	22.4487								
Full glazed door - Single-glazed (North) FRONT	0.9 x 2.020	10.63 0.85 x 0.80	0.77	10.1220								
Full glazed door - Double-glazed, argon filled, low-E, En=0.1, soft coat (South) REAR	0.9 x 2.810	46.75 0.63 x 0.70	0.77	40.1494								
Total solar gains, January				114.36	(83-1)							
Solar gains												
114.36	208.59	324.17	470.14	591.62	616.62	582.26	486.70	373.71	240.78	139.44	96.31	(83)
Total gains												
536.29	623.56	719.55	838.01	933.00	935.62	890.11	804.67	709.39	604.15	531.85	509.19	(84)

**Lighting calculations**

	Area	g	FF x Shading	
Window - Single-glazed (North) FRONT	0.9 x 8.31	0.90	1.00 x 0.83	5.59
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (West) SIDE	0.9 x 3.74	0.80	0.70 x 0.83	1.56

**SAP 2012 worksheet for Existing dwelling - calculation of energy ratings**

**7. Mean internal temperature**

Temperature during heating periods in the living area, Th1 (°C) 21.00 (85)  
 Heating system responsiveness 1.00

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

tau

21.31	21.39	21.46	21.84	21.92	22.26	22.26	22.32	22.13	21.92	21.77	21.62
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

alpha

2.42	2.43	2.43	2.46	2.46	2.48	2.48	2.49	2.48	2.46	2.45	2.44
------	------	------	------	------	------	------	------	------	------	------	------

Utilisation factor for gains for living area

0.99	0.99	0.99	0.97	0.94	0.87	0.79	0.83	0.93	0.98	0.99	1.00	(86)
------	------	------	------	------	------	------	------	------	------	------	------	------

Mean internal temperature in living area T1

17.76	17.97	18.41	19.06	19.72	20.32	20.65	20.58	20.07	19.24	18.41	17.75	(87)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Temperature during heating periods in rest of dwelling Th2

18.15	18.16	18.17	18.22	18.23	18.27	18.27	18.28	18.26	18.23	18.21	18.19	(88)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Utilisation factor for gains for rest of dwelling

0.99	0.99	0.98	0.95	0.88	0.71	0.43	0.51	0.83	0.96	0.99	0.99	(89)
------	------	------	------	------	------	------	------	------	------	------	------	------

Mean internal temperature in the rest of dwelling T2

15.54	15.75	16.20	16.87	17.51	18.05	18.24	18.23	17.86	17.06	16.23	15.55	(90)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Living area fraction (28.45/46.01) 0.62 (91)

Mean internal temperature (for the whole dwelling)

16.91	17.12	17.56	18.22	18.88	19.45	19.73	19.68	19.23	18.41	17.58	16.91	(92)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Apply adjustment to the mean internal temperature, where appropriate

17.51	17.72	18.16	18.82	19.48	20.05	20.33	20.28	19.83	19.01	18.18	17.51	(93)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

**8. Space heating requirement**

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Utilisation factor for gains

0.99	0.99	0.98	0.95	0.91	0.83	0.73	0.78	0.90	0.97	0.99	0.99	(94)
------	------	------	------	------	------	------	------	------	------	------	------	------

Useful gains

531.33	614.94	702.85	800.26	849.59	778.93	650.56	625.30	641.78	584.70	524.73	505.09	(95)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Monthly average external temperature

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 for mean internal temperature

3463.7	3350.5	3036.0	2537.4	1982.69	1368.87	936.59	971.97	1447.09	2144.4	2843.7	3439.5	(97)
--------	--------	--------	--------	---------	---------	--------	--------	---------	--------	--------	--------	------

Fraction of month for heating

1.00	1.00	1.00	1.00	1.00	-	-	-	-	1.00	1.00	1.00
------	------	------	------	------	---	---	---	---	------	------	------

Space heating requirement for each month, kWh/month

2181.7	1838.29	1735.88	1250.72	843.03	-	-	-	-	1160.40	1669.69	2183.2
--------	---------	---------	---------	--------	---	---	---	---	---------	---------	--------

Total space heating requirement per year (kWh/year) (October to May) 12862.93 (98)

Space heating requirement per m<sup>2</sup> (kWh/m<sup>2</sup>/year) 279.57 (99)

**8c. Space cooling requirement - not applicable**

**SAP 2012 worksheet for Existing dwelling - calculation of energy ratings**

**9a. Energy requirements**

												kWh/year
No secondary heating system selected												
Fraction of space heat from main system(s)										1.0000		(202)
Efficiency of main heating system										71.00%		(206)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement												
2181.7	1838.29	1735.88	1250.72	843.03	-	-	-	-	1160.40	1669.69	2183.2	(98)
Appendix Q - monthly energy saved (main heating system 1)												
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(210)
Space heating fuel (main heating system 1)												
3072.8	2589.1	2444.9	1761.57	1187.36	-	-	-	-	1634.36	2351.7	3075.0	(211)
Appendix Q - monthly energy saved (main heating system 2)												
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(212)
Space heating fuel (main heating system 2)												
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(213)
Appendix Q - monthly energy saved (secondary heating system)												
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(214)
Space heating fuel (secondary)												
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(215)
Water heating												
Water heating requirement												
165.13	144.25	150.08	133.11	128.88	113.51	108.75	121.23	122.57	139.57	148.99	161.26	(64)
Efficiency of water heater										62.00		(216)
70.28	70.26	70.19	70.02	69.66	62.00	62.00	62.00	62.00	69.91	70.17	70.30	(217)
Water heating fuel												
234.96	205.31	213.82	190.10	185.01	183.08	175.40	195.53	197.69	199.64	212.34	229.39	(219)
Annual totals												kWh/year
Space heating fuel used, main system 1										18116.80		(211)
Space heating fuel (secondary)										0.00		(215)
Water heating fuel										2422.28		(219)
Electricity for pumps, fans and electric keep-hot												
central heating pump										130.00		(230c)
boiler with a fan-assisted flue										45.00		(230e)
Total electricity for the above, kWh/year										175.00		(231)
Electricity for lighting (0.00% fixed LEL)										431.04		(232)
Energy saving/generation technologies												
Appendix Q -												
Energy saved or generated ():										0.000		(236a)
Energy used ():										0.000		(237a)
Total delivered energy for all uses										21145.13		(238)



**SAP 2012 worksheet for Existing dwelling - calculation of energy ratings**

**10a. Fuel costs using Table 12 prices**

	kWh/year	Fuel price p/kWh	£/year	
Space heating - main system 1	18116.805	3.480	630.46	(240)
Space heating - main system 2	0.000	0.000	0.00	(241)
Water heating				
Water heating cost	2422.28	3.480	84.30	(247)
Mech vent fans cost	0.000	13.190	0.00	(249)
Pump/fan energy cost	175.000	13.190	23.08	(249)
Energy for lighting	431.040	13.190	56.85	(250)
Additional standing charges			120.00	(251)
Electricity generated - PVs	0.000	0.000	0.00	(252)
Appendix Q -				
Energy saved or generated ():	0.000	0.000	0.00	(253)
Energy used ():	0.000	0.000	0.00	(254)
Total energy cost			914.70	(255)

**11a. SAP rating**

Energy cost deflator		0.42	(256)
Energy cost factor (ECF)		4.22	(257)
SAP value		41.32	
<b>SAP rating</b>		<b>41</b>	(258)
<b>SAP band</b>		<b>E</b>	

**12a. Carbon dioxide emissions**

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating, main system 1	18116.80	0.216	3913.23	(261)
Space heating, main system 2	0.00	0.000	0.00	(262)
Space heating, secondary	0.00	0.519	0.00	(263)
Water heating	2422.28	0.216	523.21	(264)
Space and water heating			4436.44	(265)
Electricity for pumps and fans	175.00	0.519	90.83	(267)
Electricity for lighting	431.04	0.519	223.71	(268)
Electricity generated - PVs	0.00	0.519	0.00	(269)
Electricity generated - µCHP	0.00	0.000	0.00	(269)
Appendix Q -				
Energy saved ():	0.00	0.000	0.00	(270)
Energy used ():	0.00	0.000	0.00	(271)
Total CO2, kg/year			4750.98	(272)

	kg/m <sup>2</sup> /year	
<b>CO2 emissions per m<sup>2</sup></b>	<b>103.26</b>	(273)
El value	36.82	(273a)
<b>El rating</b>	<b>37</b>	(274)
<b>El band</b>	<b>F</b>	

**Calculation of stars for heating and DHW**

Main heating energy efficiency	$(3.48 / 0.7100) \times (1 + (0.29 \times 0.00)) = 4.9014$ , stars = 4
Main heating environmental impact	$(0.2160 / 0.7100) \times (1 + (0.29 \times 0.00)) = 0.3042$ , stars = 4
Water heating energy efficiency	$3.48 / 0.6740 = 5.1633$ , stars = 4
Water heating environmental impact	$0.2160 / 0.6740 = 0.3205$ , stars = 4

**Project Information**

Building type Ground-floor flat

Reference

Date 28 October 2020

Email: none Project 123 Station Road  
LONDON  
TW12 2AL**SAP 2012 worksheet for New dwelling created by change of use - calculation of energy ratings****1. Overall dwelling dimensions**

	<b>Area (m<sup>2</sup>)</b>	<b>Av. Storey height (m)</b>	<b>Volume (m<sup>3</sup>)</b>	
Ground floor (1)	46.01	3.06	140.79	(3a)
Total floor area	46.01			(4)
Dwelling volume (m <sup>3</sup> )			140.79	(5)

**SAP 2012 worksheet for New dwelling created by change of use - calculation of energy ratings**

**2. Ventilation rate**

	<b>main + secondary + other heating</b>		<b>m<sup>3</sup> per hour</b>									
Number of chimneys	0 + 0 + 0	x 40	0.00	(6a)								
Number of open flues	0 + 0 + 0	x 20	0.00	(6b)								
Number of intermittent fans	3	x 10	30.00	(7a)								
Number of passive vents	0	x 10	0.00	(7b)								
Number of flueless gas fires	0	x 40	0.00	(7c)								
			<b>Air changes per hour</b>									
Infiltration due to chimneys, fans and flues			0.21	(8)								
Number of storeys (ns)	1			(9)								
Additional infiltration			0.00	(10)								
Structural infiltration, masonry construction			0.35	(11)								
Draught lobby present			0.00	(13)								
Percentage of windows & doors draught stripped		100.00		(14)								
Window infiltration			0.05	(15)								
Infiltration rate			0.61	(16)								
Air permeability			0.61	(18)								
Number of sides on which sheltered			2.00	(19)								
Shelter factor			0.85	(20)								
Infiltration rate incorporating shelter factor			0.52	(21)								
Infiltration rate modified for monthly wind speed												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70	52.50
												(22)
Wind Factor												
1.27	1.25	1.23	1.10	1.08	0.95	0.95	0.93	1.00	1.08	1.13	1.18	13.13
												(22a)
Adjusted infiltration rate (allowing for shelter and wind speed)												
0.66	0.65	0.64	0.57	0.56	0.50	0.50	0.48	0.52	0.56	0.59	0.61	6.84
												(22b)
Ventilation : natural ventilation, intermittent extract fans												
Effective air change rate												
0.72	0.71	0.70	0.66	0.66	0.62	0.62	0.62	0.64	0.66	0.67	0.69	(25)

**SAP 2012 worksheet for New dwelling created by change of use - calculation of energy ratings**

**3. Heat losses and heat loss parameter**

Element	Gross area, m <sup>2</sup>	Openings m <sup>2</sup>	Net area A, m <sup>2</sup>	U-value W/m <sup>2</sup> K	A x U W/K	kappa-value kJ/m <sup>2</sup> K	A x K kJ/K	
Window - Single-glazed (North) FRONT			<b>8.310</b>	<b>4.84 (6.00)</b>	40.21			(27)
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (West) SIDE			<b>3.740</b>	<b>1.15 (1.20)</b>	4.28			(27)
Full glazed door - Single-glazed (North) FRONT			<b>2.020</b>	<b>5.70</b>	11.51			(26)
Full glazed door - Double-glazed, argon filled, low-E, En=0.1, soft coat (South) REAR			<b>2.810</b>	<b>1.20</b>	3.37			(26)
Walls HALLWAY/LOBBY			29.22	0.24 (Ru=0.78)	7.10	135.00	3944.70	(29)
Walls FRONTENTRANCE			1.57	2.10	3.30	135.00	212.41	(29)
Walls UPGRADED, EXTERNAL #WINDOWS DOORS			49.69	0.28	13.91	70.00	3478.30	(29)
Ground floors UNDERGROUND			46.01	0.22	10.12	110.00	5061.10	(28)
Party wall SOLID			33.54	0.00	0.00	180.00	6037.20	
Party ceiling ANOTHER DWELLING ABOVE			46.01	0.00	0.00	30.00	1380.30	

**SAP 2012 worksheet for New dwelling created by change of use - calculation of energy ratings**

**3. Heat losses and heat loss parameter**

Element	Gross area, m <sup>2</sup>	Openings m <sup>2</sup>	Net area A, m <sup>2</sup>	U-value W/m <sup>2</sup> K	A x U W/K	kappa-value kJ/m <sup>2</sup> K	A x K kJ/K
Total area of external elements Sigma A, m <sup>2</sup>							143.37 (31)
Fabric heat loss, W/K							93.82 (33)
Heat capacity							20114.01 (34)
Thermal mass parameter, kJ/m <sup>2</sup> K							437.17 (35)
Effect of thermal bridges							21.51 (36)
Total fabric heat loss							115.33 (37)

Ventilation heat loss calculated monthly												(38)
33.49	33.09	32.70	30.86	30.52	28.92	28.92	28.63	29.54	30.52	31.21	31.94	

Heat transfer coefficient, W/K												(39)
148.81	148.42	148.02	146.19	145.85	144.25	144.25	143.96	144.87	145.85	146.54	147.27	146.19

Heat loss parameter (HLP), W/m <sup>2</sup> K												(40)
3.23	3.23	3.22	3.18	3.17	3.14	3.14	3.13	3.15	3.17	3.19	3.20	3.18

HLP (average)												(40)
Number of days in month (Table 1a)												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
31	28	31	30	31	30	31	31	30	31	30	31	

Heat pump calculations	
Design heat loss	3537.7886
Plant size ratio	1.5886
Service provision	space and water heating all year
DHW vessel	integral within package
Heating duration	variable
Secondary fraction	0.0000
Space heating thermal efficiency	249.8497
Summer thermal efficiency	312.0750
Space heating specific electricity consumed	0.0000
Water heating specific electricity consumed	0.0000
Annual electricity consumed	0.00

**SAP 2012 worksheet for New dwelling created by change of use - calculation of energy ratings**

**4. Water heating energy requirements**

												<b>kWh/year</b>	
Assumed occupancy, N												1.57	(42)
Annual average hot water usage in litres per day Vd,average												75.34	(43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage in litres per day for each month													
82.87	79.86	76.85	73.83	70.82	67.81	67.81	70.82	73.83	76.85	79.86	82.87	(44)	
Energy content of hot water used													
122.90	107.49	110.92	96.70	92.79	80.07	74.20	85.14	86.16	100.41	109.60	119.02		
Energy content (annual)												1185.40	(45)
Distribution loss													
18.44	16.12	16.64	14.51	13.92	12.01	11.13	12.77	12.92	15.06	16.44	17.85	(46)	
Cylinder volume, l												180.00	(47)
Manufacturer's declared cylinder loss factor (kWh/day)												1.20	(48)
Temperature Factor												0.5400	(49)
Energy lost from hot water cylinder (kWh/day)												0.65	(55)
Total storage loss													
20.09	18.14	20.09	19.44	20.09	19.44	20.09	20.09	19.44	20.09	19.44	20.09	(56)	
Net storage loss													
20.09	18.14	20.09	19.44	20.09	19.44	20.09	20.09	19.44	20.09	19.44	20.09	(57)	
Primary loss													
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)	
Total heat required for water heating calculated for each month													
142.99	125.63	131.01	116.14	112.88	99.51	94.28	105.23	105.60	120.50	129.04	139.11	(62)	
Output from water heater for each month, kWh/month													
142.99	125.63	131.01	116.14	112.88	99.51	94.28	105.23	105.60	120.50	129.04	139.11	(64)	
												1421.92	(64)
Heat gains from water heating, kWh/month													
40.86	35.74	36.88	32.15	30.85	26.62	24.67	28.31	28.65	33.39	36.44	39.58	(65)	

**SAP 2012 worksheet for New dwelling created by change of use - calculation of energy ratings**

**5. Internal gains**

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains, Watts												
94.42	94.42	94.42	94.42	94.42	94.42	94.42	94.42	94.42	94.42	94.42	94.42	(66)
Lighting gains												
30.51	27.10	22.04	16.68	12.47	10.53	11.38	14.79	19.85	25.20	29.41	31.36	(67)
Appliances gains												
204.31	206.43	201.09	189.71	175.36	161.86	152.85	150.73	156.07	167.44	181.80	195.30	(68)
Cooking gains												
46.02	46.02	46.02	46.02	46.02	46.02	46.02	46.02	46.02	46.02	46.02	46.02	(69)
Pumps and fans gains												
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(70)
Losses e.g. evaporation (negative values)												
-62.95	-62.95	-62.95	-62.95	-62.95	-62.95	-62.95	-62.95	-62.95	-62.95	-62.95	-62.95	(71)
Water heating gains												
54.93	53.19	49.57	44.66	41.47	36.98	33.16	38.05	39.79	44.87	50.62	53.19	(72)
Total internal gains												
367.23	364.20	350.18	328.54	306.78	286.86	274.87	281.05	293.20	315.01	339.32	357.33	(73)

**6. Solar gains (calculation for January)**

	Area & Flux	g & FF	Shading	Gains								
Window - Single-glazed (North) FRONT	0.9 x 8.310	10.63 0.85 x 0.80	0.77	41.6404								
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (West) SIDE	0.9 x 3.740	19.64 0.63 x 0.70	0.77	22.4487								
Full glazed door - Single-glazed (North) FRONT	0.9 x 2.020	10.63 0.85 x 0.80	0.77	10.1220								
Full glazed door - Double-glazed, argon filled, low-E, En=0.1, soft coat (South) REAR	0.9 x 2.810	46.75 0.63 x 0.70	0.77	40.1494								
Total solar gains, January				114.36	(83-1)							
Solar gains												
114.36	208.59	324.17	470.14	591.62	616.62	582.26	486.70	373.71	240.78	139.44	96.31	(83)
Total gains												
481.59	572.79	674.35	798.68	898.41	903.48	857.13	767.75	666.90	555.79	478.76	453.64	(84)

**Lighting calculations**

	Area	g	FF x Shading	
Window - Single-glazed (North) FRONT	0.9 x 8.31	0.90	1.00 x 0.83	5.59
Window - Double-glazed, argon filled, low-E, En=0.1, soft coat (West) SIDE	0.9 x 3.74	0.80	0.70 x 0.83	1.56

**SAP 2012 worksheet for New dwelling created by change of use - calculation of energy ratings**

**7. Mean internal temperature**

Temperature during heating periods in the living area, Th1 (°C) 21.00 (85)  
 Heating system responsiveness 0.75

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

tau

37.55	37.65	37.75	38.22	38.31	38.73	38.73	38.81	38.57	38.31	38.13	37.94
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

alpha

3.50	3.51	3.52	3.55	3.55	3.58	3.58	3.59	3.57	3.55	3.54	3.53
------	------	------	------	------	------	------	------	------	------	------	------

Utilisation factor for gains for living area

1.00	0.99	0.99	0.97	0.91	0.79	0.65	0.72	0.91	0.98	1.00	1.00	(86)
------	------	------	------	------	------	------	------	------	------	------	------	------

Tweekday

19.14	19.30	19.60	20.02	20.43	20.73	20.85	20.82	20.56	20.05	19.52	19.12
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

Tweekend

19.94	20.04	20.21	20.45	20.68	20.85	20.91	20.90	20.75	20.46	20.16	19.93
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

24 instead of 16

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
------	------	------	------	------	------	------	------	------	------	------	------

24 instead of 9

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
------	------	------	------	------	------	------	------	------	------	------	------

16 instead of 9

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
------	------	------	------	------	------	------	------	------	------	------	------

Mean internal temperature in living area T1

19.37	19.51	19.78	20.14	20.50	20.76	20.87	20.84	20.62	20.17	19.69	19.35	(87)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Temperature during heating periods in rest of dwelling Th2

18.64	18.64	18.65	18.66	18.67	18.68	18.68	18.69	18.68	18.67	18.66	18.65	(88)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Utilisation factor for gains for rest of dwelling

1.00	0.99	0.98	0.94	0.83	0.59	0.35	0.42	0.78	0.96	0.99	1.00	(89)
------	------	------	------	------	------	------	------	------	------	------	------	------

Tweekday

16.64	16.85	17.24	17.78	18.24	18.51	18.57	18.57	18.40	17.82	17.16	16.63
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

Tweekend

16.64	16.85	17.24	17.78	18.24	18.51	18.57	18.57	18.40	17.82	17.16	16.63
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

Mean internal temperature in the rest of dwelling T2

16.64	16.85	17.24	17.78	18.24	18.51	18.57	18.57	18.40	17.82	17.16	16.63	(90)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Living area fraction (28.45/46.01) 0.62 (91)

Mean internal temperature (for the whole dwelling)

18.33	18.50	18.81	19.24	19.64	19.90	19.99	19.97	19.77	19.27	18.73	18.31	(92)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Apply adjustment to the mean internal temperature, where appropriate

18.33	18.50	18.81	19.24	19.64	19.90	19.99	19.97	19.77	19.27	18.73	18.31	(93)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------



**SAP 2012 worksheet for New dwelling created by change of use - calculation of energy ratings**

**8. Space heating requirement**

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Utilisation factor for gains

1.00	0.99	0.98	0.95	0.87	0.71	0.53	0.61	0.85	0.97	0.99	1.00	(94)
------	------	------	------	------	------	------	------	------	------	------	------	------

Useful gains

479.42	567.84	661.31	757.20	779.16	643.89	458.43	466.26	569.89	538.62	474.90	451.99	(95)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Monthly average external temperature

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 for mean internal temperature

2087.7	2017.8	1821.69	1511.21	1158.04	765.01	488.85	514.19	821.50	1264.82	1703.62	2078.4	(97)
--------	--------	---------	---------	---------	--------	--------	--------	--------	---------	---------	--------	------

Fraction of month for heating

1.00	1.00	1.00	1.00	1.00	-	-	-	-	1.00	1.00	1.00
------	------	------	------	------	---	---	---	---	------	------	------

Space heating requirement for each month, kWh/month

1196.60	974.38	863.32	542.88	281.88	-	-	-	-	540.29	884.68	1210.04
---------	--------	--------	--------	--------	---	---	---	---	--------	--------	---------

Total space heating requirement per year (kWh/year) (October to May) 6494.07 (98)

Space heating requirement per m<sup>2</sup> (kWh/m<sup>2</sup>/year) 141.14 (99)

**8c. Space cooling requirement - not applicable**

**SAP 2012 worksheet for New dwelling created by change of use - calculation of energy ratings**

**9a. Energy requirements**

												kWh/year
No secondary heating system selected												
Fraction of space heat from main system(s)										1.0000		(202)
Efficiency of main heating system										249.85%		(206)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement												
1196.60	974.38	863.32	542.88	281.88	-	-	-	-	540.29	884.68	1210.04	(98)
Appendix Q - monthly energy saved (main heating system 1)												
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(210)
Space heating fuel (main heating system 1)												
478.93	389.99	345.54	217.28	112.82	-	-	-	-	216.25	354.08	484.31	(211)
Appendix Q - monthly energy saved (main heating system 2)												
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(212)
Space heating fuel (main heating system 2)												
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(213)
Appendix Q - monthly energy saved (secondary heating system)												
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(214)
Space heating fuel (secondary)												
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(215)
Water heating												
Water heating requirement												
142.99	125.63	131.01	116.14	112.88	99.51	94.28	105.23	105.60	120.50	129.04	139.11	(64)
Efficiency of water heater										312.08		(216)
312.08	312.08	312.08	312.08	312.08	312.08	312.08	312.08	312.08	312.08	312.08	312.08	(217)
Water heating fuel												
45.82	40.26	41.98	37.22	36.17	31.89	30.21	33.72	33.84	38.61	41.35	44.58	(219)
Annual totals												kWh/year
Space heating fuel used, main system 1										2599.19		(211)
Space heating fuel (secondary)										0.00		(215)
Water heating fuel										455.64		(219)
Electricity for pumps, fans and electric keep-hot										0.00		(231)
Total electricity for the above, kWh/year										215.52		(232)
Electricity for lighting (100.00% fixed LEL)										0.00		(235)
Energy saving/generation technologies										0.00		(235)
Electricity generated - µCHP/heat pump										0.000		(236a)
Appendix Q -										0.000		(237a)
Energy saved or generated ():										0.000		(236a)
Energy used ():										0.000		(237a)
Total delivered energy for all uses										3270.35		(238)

**SAP 2012 worksheet for New dwelling created by change of use - calculation of energy ratings**

**10a. Fuel costs using Table 12 prices**

	<b>kWh/year</b>	<b>Fuel price p/kWh</b>	<b>£/year</b>	
Space heating - main system 1	2599.193	13.190	342.83	(240)
Space heating - main system 2	0.000	0.000	0.00	(241)
Water heating				
High-rate percentage	100.000%			(243)
Low-rate percentage	0.000%			(244)
High-rate cost	455.64	13.190	60.10	(245)
Low-rate	0.00	13.190	0.00	(246)
Mech vent fans cost	0.000	13.190	0.00	(249)
Pump/fan energy cost	0.000	13.190	0.00	(249)
Energy for lighting	215.520	13.190	28.43	(250)
Additional standing charges			0.00	(251)
Electricity generated - PVs	0.000	0.000	0.00	(252)
Appendix Q -				
Energy saved or generated ():	0.000	0.000	0.00	(253)
Energy used ():	0.000	0.000	0.00	(254)
Total energy cost			431.36	(255)

**11a. SAP rating**

Energy cost deflator		0.42	(256)
Energy cost factor (ECF)		1.99	(257)
SAP value		72.23	
<b>SAP rating</b>		<b>72</b>	(258)
<b>SAP band</b>		<b>C</b>	

**SAP 2012 worksheet for New dwelling created by change of use - calculation of energy ratings**

**12a. Carbon dioxide emissions**

	<b>Energy kWh/year</b>	<b>Emission factor kg CO2/kWh</b>	<b>Emissions kg CO2/year</b>	
Space heating, main system 1	2599.19	0.519	1348.98	(261)
Space heating, main system 2	0.00	0.000	0.00	(262)
Space heating, secondary	0.00	0.519	0.00	(263)
Water heating	455.64	0.519	236.47	(264)
Space and water heating			1585.46	(265)
Electricity for pumps and fans	0.00	0.519	0.00	(267)
Electricity for lighting	215.52	0.519	111.85	(268)
Electricity generated - PVs	0.00	0.519	0.00	(269)
Electricity generated - µCHP	0.00	0.519	0.00	(269)
Appendix Q -				
Energy saved ():	0.00	0.000	0.00	(270)
Energy used ():	0.00	0.000	0.00	(271)
Total CO2, kg/year			1697.31	(272)

	<b>kg/m<sup>2</sup>/year</b>	
<b>CO2 emissions per m<sup>2</sup></b>	<b>36.89</b>	(273)
El value	75.01	(273a)
<b>El rating</b>	<b>75</b>	(274)
<b>El band</b>	<b>C</b>	

**Calculation of stars for heating and DHW**

Main heating energy efficiency	$(13.19 / 2.4985) \times (1 + (0.29 \times 0.25)) = 5.6619$ , stars = 3
Main heating environmental impact	$(0.5190 / 2.4985) \times (1 + (0.29 \times 0.25)) = 0.2228$ , stars = 4
Water heating energy efficiency	$13.19 / 3.1207 = 4.2265$ , stars = 4
Water heating environmental impact	$0.52 / + (0.00 \times 0.52) = 0.1663$ , stars = 5