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SAP Calculations

Client: Stephen Morgan-Hyland

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1. INTRODUCTION

1.1. General

The Standard Assessment Procedure (SAP) 2012 is adopted by the government as the UK methodology for calculating the energy performance of dwellings. The SAP defines the procedure for demonstrating compliance with the Building Regulations Part L1B (October 2010). This involves calculating the annual energy use for the existing house plus the proposed extension and comparing it with the energy use of a comparable “notional” extension.

1.2. Calculation Model Used

The program known as Elmhurst 2012 has been used and has been examined by BRE on behalf of DEFRA and found to provide the correct calculations for SAP ratings, Environmental Impact ratings, and, for new dwellings, correct calculation of the Target Emissions Rate (TER) and Dwelling Emissions Rate (DER).

1.3. Main Summary

CO₂ Emissions (KgCO₂/m²/annum)

Existing Dwelling + Notional Extension	2.99
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Existing Dwelling + Proposed Extension	2.66
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The building as described is compliant with Part L1B 2010 (Building as Designed).

Important Note:

To comply with the Building Regulations Approved Document L1B, this building should be subject to a further SAP assessment once it has been constructed to ensure it is still compliant (“as-built SAP Assessment”)

Any changes made to the materials and systems used during the construction phase of your project may alter the carbon emission rating of the building. This could then effect whether the building is still compliant. Therefore, any alterations should be considered carefully as they may result in a non-compliant building.

See Appendix C for “Notional” allowable glazing.

2. MAIN AREAS FOR COMPLIANCE

2.1. Thermal U Values

Extension Floor	0.21 W/m²/k	Chipboard / 110mm celotex between joists
Basement Floor upgraded	0.14 W/m²/k	Screed / 100mm Kooltherm K3 Floorboard / concrete
Extension Walls	0.25 W/m²/k	brick / 50mm retained cavity / 50mm Kooltherm K8 / 100mm Fibolite 3.6N / Plasterboard on dabs or fixings
Basement Walls upgraded	0.12 W/m²/k	Existing wall / void / 90mm Kooltherm K8 in metal studs / plasterboard
Stud wall to Loft	0.27 W/m²/k	Loft void / 100mm celotex between studs / plasterboard
Dormer Cheeks	0.27 W/m²/k	Lead / breather membrane / ply / 125mm Thermapitch TP10 between studs / membrane / plasterboard
Loft Slope Roof	0.17 W/m²/k	100mm celotex between rafters / Celotex PL4040 [52.5mm] Insulated Plasterboard
Flat Ceilings	0.14 W/m²/k	Loft void / 200mm quilt / 100mm quilt between joists / Plasterboard
Lead Flat Roof	0.17 W/m²/k	Lead / breather membrane / ply / 125mm Thermapitch TP10 / ply / joist void / membrane / plasterboard
New Windows	1.60 W/m²/k	low e, 0.05 soft coat
New Roof Lights	1.60 W/m²/k	low e, 0.05 soft coat

Please refer to the appendix for detailed information on construction elements.

2.2. Upgrade of existing elements and controlled fittings and systems

The new elements shall be improved to the above standards.

2.3. Air Pressure Test

An air pressure test **IS NOT** required.

2.4. Thermal Bridging and Accredited Construction Details

Accredited construction details (ACD) have **NOT** been specified using a default value of $y=0.15$ for thermal bridging.

Further information about ACD's is available from the planning portal website www.planningportal.gov.uk

2.5. Primary Heating System

The building is heated by an existing gas combi boiler having a seasonal efficiency of not less than 88.7%, this is specified as an Ideal isar HE30. The current boiler is to be replaced with a Worcester Greenstar 4000 GR4700iW 30 C NG

Radiators are installed.

The controls consist a central thermostat, timer and TRV's.

2.6. Domestic Hot Water Generation

Domestic hot water is provided by the new gas fired boiler.

2.7. Secondary Heating System

An existing Ideal HUNTER: Eco 4 is to remain.

2.8. Mechanical Extract System

There are 3 extractor fans installed.

2.9. Lighting

100% of the artificial lighting within the extension is to be low energy type.

2.10. Photovoltaic System

None specified

Appendix (A)

Existing House + Notional Extension

SUMMARY FOR INPUT DATA

Calculation Type: Existing Dwelling

Property Reference	A998-0001-23-42			Issued on Date	07/05/2023
Assessment Reference	Notional	Prop Type Ref	Extension		
Property	24 Brookfield Avenue, MANCHESTER, M21 8TX				
SAP Rating	76 C	DER	N/A	TER	N/A
Environmental	75 C	% DER<TER	N/A		
CO ₂ Emissions (t/year)	2.99	DFEE	N/A	TFEE	N/A
General Requirements Compliance	N/A	% DFEE<TFEE	N/A		
Assessor Details	Mr. Andrew Underwood, AC Systems, Tel: 07870 638476, info@sap-calculations.co.uk			Assessor ID	A998-0001
Client					

SUMMARY FOR INPUT DATA FOR: Existing Dwelling

Orientation	East
Property Tenure	Owner-occupied
Transaction Type	None of the above
Terrain Type	Urban
1.0 Property Type	House, Mid-Terrace
2.0 Number of Storeys	4
3.0 Date Built	
3.0 Property Age Band	A before 1900
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Basement:	23.90 m	30.22 m ²	2.80 m
1st Storey:	12.30 m	44.50 m ²	2.59 m
2nd Storey:	11.75 m	38.66 m ²	2.60 m
3rd Storey:	17.80 m	19.38 m ²	1.81 m

7.0 Living Area 11.64 m²

8.0 Thermal Mass Parameter
Thermal Mass Simple calculation - High
450.00 kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m ² K)	Gross Area (m ²)	Nett Area (m ²)
Existing Wall	Solid Wall	1.70	46.80	33.43
Basement Wall to be upgraded	Solid Wall	0.30	63.42	63.42
Extension Wall	Cavity Wall	0.28	18.72	11.41
Stud to Loft	Timber Frame	0.28	4.56	4.56
Dormer Cheek	Timber Frame	0.28	11.37	11.37

9.1 Party Walls

Description	Type	Construction	U-Value (W/m ² K)	Area (m ²)
Party Wall	Solid Wall		0.00	150.18

10.0 External Roofs

SUMMARY FOR INPUT DATA

Calculation Type: Existing Dwelling

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Protected Ceiling	External Plane Roof	0.16	8.36	8.36
Slope Ceiling	External Slope Roof	0.18	7.60	3.94
Flat Roof Dormer	External Flat Roof	0.18	10.64	10.64
Ceiling over Bed 3	External Plane Roof	0.16	8.52	8.52
Glazed Roof	External Slope Roof	0.18	4.90	1.24

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Basement Floor	Ground Floor - Solid		0.25	30.22
Extension Floor	Ground Floor - Solid		0.22	14.28

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Existing Windows	Manufacture r	Window	Double Low-E Soft 0.05			0.63		0.70	1.80
New Windows	Manufacture r	Window	Double Low-E Soft 0.05			0.63		0.70	1.60
New Roof Windows	Manufacture r	Roof Window	Double Low-E Soft 0.05			0.63		0.70	1.60

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
Front Elevation	Window	[1] Existing Wall	East	None	0.00					11.04	
Rear Elevation	Window	[1] Existing Wall	West	None	0.00					2.33	
Allowable	Window	[3] Extension Wall	West	None	0.00					7.31	
Allowable	Roof Window	[5] Glazed Roof	South	None						3.66	
Allowable	Roof Window	[2] Slope Ceiling	East	None						3.66	

14.0 Conservatory

15.0 Draught Proofing

%

16.0 Draught Lobby

17.0 Thermal Bridging

Y-value

W/m²K

18.0 Pressure Testing

19.0 Mechanical Ventilation

Summer Overheating

Mechanical Ventilation

Mechanical Ventilation System Present

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0	0	0	0
Number of open flues	0	0	0	0
Number of intermittent fans				3
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System

22.0 Lighting

Internal

Total number of light fittings

SUMMARY FOR INPUT DATA

Calculation Type: Existing Dwelling

Total number of L.E.L. fittings	19	
Percentage of L.E.L. fittings	100.00	%
External		
External lights fitted	Yes	
Light and motion sensor	Yes	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	10068	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	89.6	
In Summer	79.5	
Controls	CBE Programmer, room thermostat and TRVs	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2106	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
27.0 Secondary Heating	RWM	
Secondary Heating	Manufacturer	
Description	Wood Logs RWM Closed room heater	
SHS efficiency	78.00	%
SAP Code	633	
HETAS Approved System	Yes	
Smoke Control Area	Unknown	
Test Method	BS EN 1266	
Manufacturer	IDEAL	
Model Name	HUNTER: Eco 4	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	

SUMMARY FOR INPUT DATA

Calculation Type: Existing Dwelling

Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	No
SAP Code	901

29.0 Hot Water Cylinder	None
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Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£86	C 77	
	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar photovoltaic panels, 2.5 kWp	£3,500 - £5,500	£601	B 84	

FULL SAP CALCULATION PRINTOUT

Calculation Type: Existing Dwelling

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Environmental	75 C	% DER<TER	N/A		
CO ₂ Emissions (t/year)	2.99	DFEE	N/A	TFEE	N/A
General Requirements Compliance	N/A	% DFEE<TFEE	N/A		

Assessor Details	Mr. Andrew Underwood, AC Systems, Tel: 07870 638476, info@sap-calculations.co.uk	Assessor ID	A998-0001
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Client	
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CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR Existing dwelling (SAP) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)		Storey height (m)		Volume (m ³)
Basement floor	30.2200 (1a)	x	2.8000 (2a)	=	84.6160 (1a) - (3a)
Ground floor	44.5000 (1b)	x	2.5900 (2b)	=	115.2550 (1b) - (3b)
First floor	38.6600 (1c)	x	2.6000 (2c)	=	100.5160 (1c) - (3c)
Second floor	19.3800 (1d)	x	1.8100 (2d)	=	35.0778 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	132.7600				(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	335.4648 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
					Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.0894 (8)
Number of storeys in the dwelling (ns)					4 (9)
Additional infiltration					[(9) - 1] x 0.1 = 0.3000 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction					0.3500 (11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0					0.0000 (12)
If no draught lobby, enter 0.05, else enter 0					0.0500 (13)
Percentage of windows and doors draught stripped					100.0000 (14)
Window infiltration				0.25 - [0.2 * (14) / 100] =	0.0500 (15)
Pressure test					No
Measured/design AP50					15.0000
Infiltration rate					0.8394 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.7135 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.3000	4.2000	4.2000	3.9000	4.0000	3.4000	3.3000	3.3000	3.4000	3.8000	3.8000	3.9000 (22)
Wind factor	1.0750	1.0500	1.0500	0.9750	1.0000	0.8500	0.8250	0.8250	0.8500	0.9500	0.9500	0.9750 (22a)
Adj infilt rate	0.7670	0.7492	0.7492	0.6957	0.7135	0.6065	0.5886	0.5886	0.6065	0.6778	0.6778	0.6957 (22b)
Effective ac	0.7942	0.7806	0.7806	0.7420	0.7546	0.6839	0.6733	0.6733	0.6839	0.7297	0.7297	0.7420 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Existing Windows (Uw = 1.80)			13.3700	1.6791	22.4496		(27)
New Windows (Uw = 1.60)			7.3100	1.5038	10.9925		(27)
New Roof Windows (Uw = 1.60)			7.3200	1.5038	11.0075		(27a)
Basement Floor			30.2200	0.2500	7.5550		(28a)
Extension Floor			14.2800	0.2200	3.1416		(28a)
Existing Wall	46.8000	13.3700	33.4300	1.7000	56.8310		(29a)
Basement Wall to be upgraded	63.4200		63.4200	0.3000	19.0260		(29a)

FULL SAP CALCULATION PRINTOUT

Calculation Type: Existing Dwelling

CALCULATION OF HEAT DEMAND 09 Jan 2014

Extension Wall	18.7200	7.3100	11.4100	0.2800	3.1948	(29a)
Stud to Loft	4.5600		4.5600	0.2800	1.2768	(29a)
Dormer Cheek	11.3700		11.3700	0.2800	3.1836	(29a)
Protected Ceiling	8.3600		8.3600	0.1600	1.3376	(30)
Slope Ceiling	7.6000	3.6600	3.9400	0.1800	0.7092	(30)
Flat Roof Dormer	10.6400		10.6400	0.1800	1.9152	(30)
Ceiling over Bed 3	8.5200		8.5200	0.1600	1.3632	(30)
Glazed Roof	4.9000	3.6600	1.2400	0.1800	0.2232	(30)
Total net area of external elements Aum(A, m2)			229.3900			(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	144.2068		(33)
Party Wall			150.1800	0.0000	0.0000	(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 450.0000 (35)
Thermal bridges (Default value 0.150 * total exposed area) 34.4085 (36)
Total fabric heat loss (33) + (36) = 178.6153 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	87.9168	86.4198	86.4198	82.1400	83.5314	75.7115	74.5315	74.5315	75.7115	80.7838	80.7838	82.1400	(38)
Heat transfer coeff	266.5321	265.0351	265.0351	260.7553	262.1467	254.3268	253.1468	253.1468	254.3268	259.3992	259.3992	260.7553	(39)
Average = Sum(39)m / 12 =												259.5004	(39)
HLP	2.0076	1.9963	1.9963	1.9641	1.9746	1.9157	1.9068	1.9068	1.9157	1.9539	1.9539	1.9641	(40)
HLP (average)												1.9547	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9018	(42)
Average daily hot water use (litres/day)												108.5452	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	119.3997	115.0579	110.7161	106.3743	102.0325	97.6906	97.6906	102.0325	106.3743	110.7161	115.0579	119.3997	(44)
Energy content	177.0663	154.8633	159.8050	139.3219	133.6827	115.3580	106.8961	122.6649	124.1299	144.6614	157.9093	171.4792	(45)
Energy content (annual)											Total = Sum(45) m =	1707.8381	(45)
Distribution loss	(46)m = 0.15 x (45)m												
	26.5599	23.2295	23.9708	20.8983	20.0524	17.3037	16.0344	18.3997	18.6195	21.6992	23.6864	25.7219	(46)
Water storage loss													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	48.1762	49.7821	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	228.0252	200.8907	210.7640	188.6370	184.6416	163.5342	156.6782	173.6238	173.4450	195.6203	207.2243	222.4381	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
	Solar input (sum of months) = Sum(63)m =											0.0000	(63)
Output from w/h	228.0252	200.8907	210.7640	188.6370	184.6416	163.5342	156.6782	173.6238	173.4450	195.6203	207.2243	222.4381	(64)
	Total per year (kWh/year) = Sum(64)m =											2305.5224	(64)
RHI water heating demand												2306	(64)
Heat gains from water heating, kWh/month	71.6143	62.9989	65.8749	58.6533	57.1892	50.4006	47.9885	53.5258	53.6020	60.8397	64.8336	69.7566	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts													
(66)m	174.1084	174.1084	174.1084	174.1084	174.1084	174.1084	174.1084	174.1084	174.1084	174.1084	174.1084	174.1084	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	67.0946	59.5928	48.4641	36.6905	27.4266	23.1547	25.0194	32.5212	43.6499	55.4235	64.6875	68.9594	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	449.2794	453.9415	442.1931	417.1822	385.6104	355.9374	336.1140	331.4519	343.2003	368.2112	399.7830	429.4560	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.3126	55.3126	55.3126	55.3126	55.3126	55.3126	55.3126	55.3126	55.3126	55.3126	55.3126	55.3126	(69)
Pumps, fans	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-116.0723	-116.0723	-116.0723	-116.0723	-116.0723	-116.0723	-116.0723	-116.0723	-116.0723	-116.0723	-116.0723	-116.0723	(71)
Water heating gains (Table 5)	96.2557	93.7484	88.5415	81.4629	76.8672	70.0008	64.5007	71.9433	74.4472	81.7737	90.0467	93.7588	(72)
Total internal gains	735.9785	730.6314	702.5476	658.6844	613.2530	572.4417	548.9829	559.2652	584.6461	628.7572	677.8659	715.5229	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	

East					11.0400	17.3606		0.6300	0.7000	0.7700		58.5740 (76)	
West					2.3300	17.3606		0.6300	0.7000	0.7700		12.3621 (80)	
West					7.3100	17.3606		0.6300	0.7000	0.7700		38.7841 (80)	
East					3.6600	23.5284		0.6300	0.7000	1.0000		34.1786 (82)	
South					3.6600	30.8318		0.6300	0.7000	1.0000		44.7879 (82)	

Solar gains	188.6867	379.9533	658.7210	990.2842	1194.2745	1256.6973	1165.5377	981.2158	790.3755	475.4615	241.9819	158.5922	(83)
Total gains	924.6652	1110.5847	1361.2685	1648.9685	1807.5275	1829.1389	1714.5206	1540.4810	1375.0216	1104.2188	919.8478	874.1152	(84)

FULL SAP CALCULATION PRINTOUT

Calculation Type: Existing Dwelling

CALCULATION OF HEAT DEMAND 09 Jan 2014

7. Mean internal temperature (heating season)												

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	62.2627	62.6143	62.6143	63.6420	63.3043	65.2507	65.5548	65.5548	65.2507	63.9748	63.9748	63.6420
alpha	5.1508	5.1743	5.1743	5.2428	5.2203	5.3500	5.3703	5.3703	5.3500	5.2650	5.2650	5.2428
util living area	0.9997	0.9991	0.9960	0.9768	0.8986	0.6927	0.5365	0.6185	0.8993	0.9926	0.9993	0.9998 (86)
MIT	19.7000	19.8442	20.1096	20.4900	20.8019	20.9677	20.9933	20.9862	20.8540	20.4353	20.0142	19.6898 (87)
Th 2	19.3283	19.3358	19.3358	19.3574	19.3503	19.3901	19.3962	19.3962	19.3901	19.3642	19.3642	19.3574 (88)
util rest of house	0.9995	0.9984	0.9927	0.9563	0.8100	0.5059	0.3091	0.3761	0.7771	0.9834	0.9986	0.9996 (89)
MIT 2	18.2044	18.3543	18.6187	19.0041	19.2603	19.3849	19.3959	19.3954	19.3405	18.9642	18.5469	18.2172 (90)
Living area fraction	fLA = Living area / (4) = 0.0877 (91)											
MIT	18.3356	18.4850	18.7490	19.1344	19.3955	19.5237	19.5360	19.5349	19.4732	19.0932	18.6755	18.3463 (92)
Temperature adjustment	0.0000											
adjusted MIT	18.3356	18.4850	18.7490	19.1344	19.3955	19.5237	19.5360	19.5349	19.4732	19.0932	18.6755	18.3463 (93)

8. Space heating requirement												

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9992	0.9978	0.9909	0.9522	0.8132	0.5230	0.3296	0.3984	0.7857	0.9808	0.9981	0.9995 (94)
Useful gains	923.9497	1108.1702	1348.8538	1570.1514	1469.8312	956.6749	565.0414	613.6760	1080.3880	1082.9811	918.0718	873.6472 (95)
Ext temp.	5.2000	5.8000	7.4000	9.9000	12.9000	15.7000	17.3000	17.1000	14.7000	11.3000	7.9000	5.0000 (96)
Heat loss rate W	3501.0528	3361.9591	3007.8900	2407.9221	1702.7672	972.4684	566.0287	616.3852	1213.9565	2021.5381	2795.1681	3480.1290 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	1917.3648	1514.5462	1234.3229	603.1949	173.3044	0.0000	0.0000	0.0000	0.0000	698.2865	1351.5094	1939.2224 (98)
Space heating												9431.7514 (98)
RHI space heating demand												9432 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: Existing Dwelling

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR Existing dwelling (SAP) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Basement floor	30.2200 (1a)	x 2.8000 (2a)	= 84.6160 (1a) - (3a)
Ground floor	44.5000 (1b)	x 2.5900 (2b)	= 115.2550 (1b) - (3b)
First floor	38.6600 (1c)	x 2.6000 (2c)	= 100.5160 (1c) - (3c)
Second floor	19.3800 (1d)	x 1.8100 (2d)	= 35.0778 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	132.7600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	335.4648 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.0894 (8)
Number of storeys in the dwelling (ns)					4 (9)
Additional infiltration					[(9) - 1] x 0.1 = 0.3000 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction					0.3500 (11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0					0.0000 (12)
If no draught lobby, enter 0.05, else enter 0					0.0500 (13)
Percentage of windows and doors draught stripped					100.0000 (14)
Window infiltration					0.25 - [0.2 * (14) / 100] = 0.0500 (15)
Pressure test					No
Measured/design AP50					15.0000
Infiltration rate					0.8394 (18)
Number of sides sheltered					2 (19)
Shelter factor					(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor					(21) = (18) x (20) = 0.7135 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.9097	0.8919	0.8741	0.7849	0.7670	0.6778	0.6778	0.6600	0.7135	0.7670	0.8027	0.8384 (22b)
Effective ac	0.9138	0.8977	0.8820	0.8080	0.7942	0.7297	0.7297	0.7178	0.7546	0.7942	0.8222	0.8514 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Existing Windows (Uw = 1.80)			13.3700	1.6791	22.4496		(27)
New Windows (Uw = 1.60)			7.3100	1.5038	10.9925		(27)
New Roof Windows (Uw = 1.60)			7.3200	1.5038	11.0075		(27a)
Basement Floor			30.2200	0.2500	7.5550		(28a)
Extension Floor			14.2800	0.2200	3.1416		(28a)
Existing Wall	46.8000	13.3700	33.4300	1.7000	56.8310		(29a)
Basement Wall to be upgraded	63.4200		63.4200	0.3000	19.0260		(29a)
Extension Wall	18.7200	7.3100	11.4100	0.2800	3.1948		(29a)
Stud to Loft	4.5600		4.5600	0.2800	1.2768		(29a)
Dormer Cheek	11.3700		11.3700	0.2800	3.1836		(29a)
Protected Ceiling	8.3600		8.3600	0.1600	1.3376		(30)
Slope Ceiling	7.6000	3.6600	3.9400	0.1800	0.7092		(30)
Flat Roof Dormer	10.6400		10.6400	0.1800	1.9152		(30)
Ceiling over Bed 3	8.5200		8.5200	0.1600	1.3632		(30)
Glazed Roof	4.9000	3.6600	1.2400	0.1800	0.2232		(30)
Total net area of external elements Aum(A, m ²)			229.3900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	144.2068		(33)
Party Wall			150.1800	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							450.0000 (35)
Thermal bridges (Default value 0.150 * total exposed area)							34.4085 (36)
Total fabric heat loss						(33) + (36) =	178.6153 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	101.1613	99.3824	97.6388	89.4491	87.9168	80.7838	80.7838	79.4629	83.5314	87.9168	91.0166	94.2572 (38)
Heat transfer coeff	279.7766	277.9977	276.2541	268.0644	266.5321	259.3992	259.3992	258.0782	262.1467	266.5321	269.6319	272.8726 (39)
Average = Sum(39)m / 12 =												268.0571 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	2.1074	2.0940	2.0809	2.0192	2.0076	1.9539	1.9539	1.9439	1.9746	2.0076	2.0310	2.0554 (40)
HLP (average)												2.0191 (40)
Days in month												

FULL SAP CALCULATION PRINTOUT

Calculation Type: Existing Dwelling

CALCULATION OF ENERGY RATINGS 09 Jan 2014

	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)												

Assumed occupancy												2.9018 (42)
Average daily hot water use (litres/day)												108.5452 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	119.3997	115.0579	110.7161	106.3743	102.0325	97.6906	97.6906	102.0325	106.3743	110.7161	115.0579	119.3997 (44)
Energy content (annual)	177.0663	154.8633	159.8050	139.3219	133.6827	115.3580	106.8961	122.6649	124.1299	144.6614	157.9093	171.4792 (45)
Distribution loss (46)m = 0.15 x (45)m	26.5599	23.2295	23.9708	20.8983	20.0524	17.3037	16.0344	18.3997	18.6195	21.6992	23.6864	25.7219 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	48.1762	49.7821	50.9589	49.3151	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month	228.0252	200.8907	210.7640	188.6370	184.6416	163.5342	156.6782	173.6238	173.4450	195.6203	207.2243	222.4381 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h	228.0252	200.8907	210.7640	188.6370	184.6416	163.5342	156.6782	173.6238	173.4450	195.6203	207.2243	222.4381 (64)
								Total per year (kWh/year) = Sum(64)m =				2305.5224 (64)
Heat gains from water heating, kWh/month	71.6143	62.9989	65.8749	58.6533	57.1892	50.4006	47.9885	53.5258	53.6020	60.8397	64.8336	69.7566 (65)

5. Internal gains (see Table 5 and 5a)												

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	174.1084	174.1084	174.1084	174.1084	174.1084	174.1084	174.1084	174.1084	174.1084	174.1084	174.1084	174.1084 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	67.0946	59.5928	48.4641	36.6905	27.4266	23.1547	25.0194	32.5212	43.6499	55.4235	64.6875	68.9594 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	449.2794	453.9415	442.1931	417.1822	385.6104	355.9374	336.1140	331.4519	343.2003	368.2112	399.7830	429.4560 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.3126	55.3126	55.3126	55.3126	55.3126	55.3126	55.3126	55.3126	55.3126	55.3126	55.3126	55.3126 (69)
Pumps, fans	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-116.0723	-116.0723	-116.0723	-116.0723	-116.0723	-116.0723	-116.0723	-116.0723	-116.0723	-116.0723	-116.0723	-116.0723 (71)
Water heating gains (Table 5)	96.2557	93.7484	88.5415	81.4629	76.8672	70.0008	64.5007	71.9433	74.4472	81.7737	90.0467	93.7588 (72)
Total internal gains	735.9785	730.6314	702.5476	658.6844	613.2530	572.4417	548.9829	559.2652	584.6461	628.7572	677.8659	715.5229 (73)

6. Solar gains												

[Jan]			Area		Solar flux		g		FF		Access	Gains
			m2		Table 6a		Specific data		Specific data		factor	W
					W/m2		or Table 6b		or Table 6c		Table 6d	
East			11.0400		19.6403		0.6300		0.7000		0.7700	66.2656 (76)
West			2.3300		19.6403		0.6300		0.7000		0.7700	13.9854 (80)
West			7.3100		19.6403		0.6300		0.7000		0.7700	43.8770 (80)
East			3.6600		26.6072		0.6300		0.7000		1.0000	38.6511 (82)
South			3.6600		34.8864		0.6300		0.7000		1.0000	50.6779 (82)

Solar gains	213.4569	419.0089	695.3092	1024.8779	1267.2758	1302.6483	1237.9438	1055.5549	811.9644	498.4219	266.3739	175.4195 (83)
Total gains	949.4354	1149.6404	1397.8568	1683.5623	1880.5288	1875.0899	1786.9267	1614.8200	1396.6105	1127.1791	944.2397	890.9424 (84)

7. Mean internal temperature (heating season)												

Temperature during heating periods in the living area from Table 9, Thl (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	59.3152	59.6947	60.0715	61.9068	62.2627	63.9748	63.9748	64.3022	63.3043	62.2627	61.5469	60.8159
alpha	4.9543	4.9796	5.0048	5.1271	5.1508	5.2650	5.2650	5.2868	5.2203	5.1508	5.1031	5.0544
util living area	0.9997	0.9991	0.9966	0.9830	0.9288	0.7852	0.6155	0.6904	0.9261	0.9942	0.9993	0.9998 (86)
MIT	19.5423	19.6956	19.9744	20.3724	20.7104	20.9253	20.9835	20.9712	20.7955	20.3469	19.8935	19.5463 (87)
Th 2	19.2627	19.2714	19.2800	19.3206	19.3283	19.3642	19.3642	19.3710	19.3503	19.3283	19.3128	19.2967 (88)
util rest of house	0.9995	0.9986	0.9941	0.9690	0.8683	0.6321	0.3993	0.4699	0.8330	0.9875	0.9988	0.9997 (89)
MIT 2	17.9952	18.1551	18.4395	18.8615	19.1699	19.3441	19.3628	19.3678	19.2658	18.8484	18.3856	18.0258 (90)
Living area fraction	18.1309	18.2902	18.5741	18.9940	19.3050	19.4827	19.5049	19.5084	19.3999	18.9798	18.5178	18.1591 (92)
Temperature adjustment	18.1309	18.2902	18.5741	18.9940	19.3050	19.4827	19.5049	19.5084	19.3999	18.9798	18.5178	18.1591 (93)
adjusted MIT	18.1309	18.2902	18.5741	18.9940	19.3050	19.4827	19.5049	19.5084	19.3999	18.9798	18.5178	18.1591 (93)

8. Space heating requirement												

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9993	0.9980	0.9925	0.9649	0.8671	0.6451	0.4191	0.4905	0.8370	0.9852	0.9983	0.9995 (94)
Useful gains	948.7559	1147.3517	1387.3463	1624.4975	1630.6498	1209.6096	748.8966	792.0910	1169.0254	1110.4429	942.6656	890.5008 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	3869.5564	3722.4454	3335.5180	2705.8435	2026.9692	1266.5797	753.5401	802.2090	1389.3638	2233.4846	3078.6045	3809.0677 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	2173.0755	1730.4629	1449.4398	778.5691	294.8617	0.0000	0.0000	0.0000	0.0000	835.5430	1537.8760	2171.4137 (98)
Space heating												10971.2417 (98)
Space heating per m2										(98) / (4) =		82.6397 (99)

Not applicable

Electricity for pumps and fans:		
central heating pump	120.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	165.0000	(231)
Electricity for lighting (calculated in Appendix L)	473.9646	(232)
Total delivered energy for all uses	15773.4734	(238)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	11020.2204	3.4800	383.5037 (240)
Space heating - secondary	1406.5694	4.2300	59.4979 (242)
Water heating (other fuel)	2707.7189	3.4800	94.2286 (247)
Pumps and fans for heating	165.0000	13.1900	21.7635 (249)
Energy for lighting	473.9646	13.1900	62.5159 (250)
Additional standing charges			120.0000 (251)
Total energy cost			741.5096 (255)

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	11020.2204	0.2160	2380.3676 (261)
Space heating - secondary	1406.5694	0.0190	26.7248 (263)
Water heating (other fuel)	2707.7189	0.2160	584.8673 (264)
Space and water heating			2991.9597 (265)
Pumps and fans	165.0000	0.5190	85.6350 (267)
Energy for lighting	473.9646	0.5190	245.9876 (268)
Total kg/year			3323.5823 (272)
CO2 emissions per m2			25.0300 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: Existing Dwelling



CALCULATION OF ENERGY RATINGS 09 Jan 2014

EI value 74.9460
EI rating 75 (274)
EI band C

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.8960 = 3.884$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.8960 = 0.2411$, stars = 4
Water heating energy efficiency	$3.48 / 0.8493 = 4.098$, stars = 4
Water heating environmental impact	$0.216 / 0.8493 = 0.2543$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: Existing Dwelling

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR Existing dwelling (SAP) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)		Storey height (m)		Volume (m ³)	
Basement floor	30.2200 (1a)	x	2.8000 (2a)	=	84.6160 (1a) - (3a)	
Ground floor	44.5000 (1b)	x	2.5900 (2b)	=	115.2550 (1b) - (3b)	
First floor	38.6600 (1c)	x	2.6000 (2c)	=	100.5160 (1c) - (3c)	
Second floor	19.3800 (1d)	x	1.8100 (2d)	=	35.0778 (1d) - (3d)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	132.7600				(4)	
Dwelling volume					(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	335.4648 (5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans							3 * 10 =	30.0000 (7a)
Number of passive vents							0 * 10 =	0.0000 (7b)
Number of flueless gas fires							0 * 40 =	0.0000 (7c)
Air changes per hour								
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =							30.0000 / (5) =	0.0894 (8)
Number of storeys in the dwelling (ns)								4 (9)
Additional infiltration							[(9) - 1] x 0.1 =	0.3000 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction								0.3500 (11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0								0.0000 (12)
If no draught lobby, enter 0.05, else enter 0								0.0500 (13)
Percentage of windows and doors draught stripped								100.0000 (14)
Window infiltration							0.25 - [0.2 * (14) / 100] =	0.0500 (15)
Pressure test								No
Measured/design AP50								15.0000
Infiltration rate								0.8394 (18)
Number of sides sheltered								2 (19)
Shelter factor							(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor							(21) = (18) x (20) =	0.7135 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.3000	4.2000	4.2000	3.9000	4.0000	3.4000	3.3000	3.3000	3.4000	3.8000	3.8000	3.9000 (22)
Wind factor	1.0750	1.0500	1.0500	0.9750	1.0000	0.8500	0.8250	0.8250	0.8500	0.9500	0.9500	0.9750 (22a)
Adj infilt rate	0.7670	0.7492	0.7492	0.6957	0.7135	0.6065	0.5886	0.5886	0.6065	0.6778	0.6778	0.6957 (22b)
Effective ac	0.7942	0.7806	0.7806	0.7420	0.7546	0.6839	0.6733	0.6733	0.6839	0.7297	0.7297	0.7420 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Existing Windows (Uw = 1.80)			13.3700	1.6791	22.4496		(27)
New Windows (Uw = 1.60)			7.3100	1.5038	10.9925		(27)
New Roof Windows (Uw = 1.60)			7.3200	1.5038	11.0075		(27a)
Basement Floor			30.2200	0.2500	7.5550		(28a)
Extension Floor			14.2800	0.2200	3.1416		(28a)
Existing Wall	46.8000	13.3700	33.4300	1.7000	56.8310		(29a)
Basement Wall to be upgraded	63.4200		63.4200	0.3000	19.0260		(29a)
Extension Wall	18.7200	7.3100	11.4100	0.2800	3.1948		(29a)
Stud to Loft	4.5600		4.5600	0.2800	1.2768		(29a)
Dormer Cheek	11.3700		11.3700	0.2800	3.1836		(29a)
Protected Ceiling	8.3600		8.3600	0.1600	1.3376		(30)
Slope Ceiling	7.6000	3.6600	3.9400	0.1800	0.7092		(30)
Flat Roof Dormer	10.6400		10.6400	0.1800	1.9152		(30)
Ceiling over Bed 3	8.5200		8.5200	0.1600	1.3632		(30)
Glazed Roof	4.9000	3.6600	1.2400	0.1800	0.2232		(30)
Total net area of external elements Aum(A, m ²)			229.3900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	144.2068		(33)
Party Wall			150.1800	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							450.0000 (35)
Thermal bridges (Default value 0.150 * total exposed area)							34.4085 (36)
Total fabric heat loss						(33) + (36) =	178.6153 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	87.9168	86.4198	86.4198	82.1400	83.5314	75.7115	74.5315	74.5315	75.7115	80.7838	80.7838	82.1400 (38)
Heat transfer coeff	266.5321	265.0351	265.0351	260.7553	262.1467	254.3268	253.1468	253.1468	254.3268	259.3992	259.3992	260.7553 (39)
Average = Sum(39)m / 12 =												259.5004 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	2.0076	1.9963	1.9963	1.9641	1.9746	1.9157	1.9068	1.9068	1.9157	1.9539	1.9539	1.9641 (40)
HLP (average)												1.9547 (40)
Days in month												

FULL SAP CALCULATION PRINTOUT

Calculation Type: Existing Dwelling

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)												

Assumed occupancy												2.9018 (42)
Average daily hot water use (litres/day)												108.5452 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	119.3997	115.0579	110.7161	106.3743	102.0325	97.6906	97.6906	102.0325	106.3743	110.7161	115.0579	119.3997 (44)
Energy content (annual)	177.0663	154.8633	159.8050	139.3219	133.6827	115.3580	106.8961	122.6649	124.1299	144.6614	157.9093	171.4792 (45)
Distribution loss (46)m = 0.15 x (45)m	26.5599	23.2295	23.9708	20.8983	20.0524	17.3037	16.0344	18.3997	18.6195	21.6992	23.6864	25.7219 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	48.1762	49.7821	50.9589	49.3151	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month	228.0252	200.8907	210.7640	188.6370	184.6416	163.5342	156.6782	173.6238	173.4450	195.6203	207.2243	222.4381 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum (63)m =												0.0000 (63)
Output from w/h	228.0252	200.8907	210.7640	188.6370	184.6416	163.5342	156.6782	173.6238	173.4450	195.6203	207.2243	222.4381 (64)
Total per year (kWh/year) = Sum (64)m =												2305.5224 (64)
Heat gains from water heating, kWh/month	71.6143	62.9989	65.8749	58.6533	57.1892	50.4006	47.9885	53.5258	53.6020	60.8397	64.8336	69.7566 (65)

5. Internal gains (see Table 5 and 5a)												

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	174.1084	174.1084	174.1084	174.1084	174.1084	174.1084	174.1084	174.1084	174.1084	174.1084	174.1084	174.1084 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	67.0946	59.5928	48.4641	36.6905	27.4266	23.1547	25.0194	32.5212	43.6499	55.4235	64.6875	68.9594 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	449.2794	453.9415	442.1931	417.1822	385.6104	355.9374	336.1140	331.4519	343.2003	368.2112	399.7830	429.4560 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.3126	55.3126	55.3126	55.3126	55.3126	55.3126	55.3126	55.3126	55.3126	55.3126	55.3126	55.3126 (69)
Pumps, fans	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-116.0723	-116.0723	-116.0723	-116.0723	-116.0723	-116.0723	-116.0723	-116.0723	-116.0723	-116.0723	-116.0723	-116.0723 (71)
Water heating gains (Table 5)	96.2557	93.7484	88.5415	81.4629	76.8672	70.0008	64.5007	71.9433	74.4472	81.7737	90.0467	93.7588 (72)
Total internal gains	735.9785	730.6314	702.5476	658.6844	613.2530	572.4417	548.9829	559.2652	584.6461	628.7572	677.8659	715.5229 (73)

6. Solar gains												

[Jan]												
	Area											
	m2											
	Solar flux											
	Table 6a											
	W/m2											
	Specific data											
	or Table 6b											
	FF											
	factor											
	Table 6c											
	Access											
	factor											
	Table 6d											
	Gains											
	W											
East	11.0400											58.5740 (76)
West	2.3300											12.3621 (80)
West	7.3100											38.7841 (80)
East	3.6600											34.1786 (82)
South	3.6600											44.7879 (82)

Solar gains	188.6867	379.9533	658.7210	990.2842	1194.2745	1256.6973	1165.5377	981.2158	790.3755	475.4615	241.9819	158.5922 (83)
Total gains	924.6652	1110.5847	1361.2685	1648.9685	1807.5275	1829.1389	1714.5206	1540.4810	1375.0216	1104.2188	919.8478	874.1152 (84)

7. Mean internal temperature (heating season)												

Temperature during heating periods in the living area from Table 9, Thl (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	62.2627	62.6143	62.6143	63.6420	63.3043	65.2507	65.5548	65.5548	65.2507	63.9748	63.9748	63.6420
alpha	5.1508	5.1743	5.1743	5.2428	5.2203	5.3500	5.3703	5.3703	5.3500	5.2650	5.2650	5.2428
util living area	0.9997	0.9991	0.9960	0.9768	0.8986	0.6927	0.5365	0.6185	0.8993	0.9926	0.9993	0.9998 (86)
MIT	19.7000	19.8442	20.1096	20.4900	20.8019	20.9677	20.9933	20.9862	20.8540	20.4353	20.0142	19.6898 (87)
Th 2	19.3283	19.3358	19.3358	19.3574	19.3503	19.3901	19.3962	19.3962	19.3901	19.3642	19.3642	19.3574 (88)
util rest of house	0.9995	0.9984	0.9927	0.9563	0.8100	0.5059	0.3091	0.3761	0.7771	0.9834	0.9986	0.9996 (89)
MIT 2	18.2044	18.3543	18.6183	19.0041	19.2603	19.3849	19.3959	19.3954	19.3405	18.9642	18.5469	18.2172 (90)
Living area fraction									fLA = Living area / (4) =			0.0877 (91)
MIT	18.3356	18.4850	18.7490	19.1344	19.3955	19.5237	19.5360	19.5349	19.4732	19.0932	18.6755	18.3463 (92)
Temperature adjustment												0.0000
adjusted MIT	18.3356	18.4850	18.7490	19.1344	19.3955	19.5237	19.5360	19.5349	19.4732	19.0932	18.6755	18.3463 (93)

8. Space heating requirement												

FULL SAP CALCULATION PRINTOUT

Calculation Type: Existing Dwelling

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9992	0.9978	0.9909	0.9522	0.8132	0.5230	0.3296	0.3984	0.7857	0.9808	0.9981	0.9995	(94)
Useful gains	923.9497	1108.1702	1348.8538	1570.1514	1469.8312	956.6749	565.0414	613.6760	1080.3880	1082.9811	918.0718	873.6472	(95)
Ext temp.	5.2000	5.8000	7.4000	9.9000	12.9000	15.7000	17.3000	17.1000	14.7000	11.3000	7.9000	5.0000	(96)
Heat loss rate W													
3501.0528	3361.9591	3007.8900	2407.9221	1702.7672	972.4684	566.0287	616.3852	1213.9565	2021.5381	2795.1681	3480.1290	1939.2224	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
1917.3648	1514.5462	1234.3229	603.1949	173.3044	0.0000	0.0000	0.0000	0.0000	698.2865	1351.5094	1939.2224	9431.7514	(98)
Space heating													
Space heating per m2											(98) / (4) =	71.0436	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)													0.1000	(201)
Fraction of space heat from main system(s)													0.9000	(202)
Efficiency of main space heating system 1 (in %)													89.6000	(206)
Efficiency of secondary/supplementary heating system, %													78.0000	(208)
Space heating requirement													9473.8574	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	1917.3648	1514.5462	1234.3229	603.1949	173.3044	0.0000	0.0000	0.0000	0.0000	698.2865	1351.5094	1939.2224	(98)	
Space heating efficiency (main heating system 1)	89.6000	89.6000	89.6000	89.6000	89.6000	0.0000	0.0000	0.0000	0.0000	89.6000	89.6000	89.6000	(210)	
Space heating fuel (main heating system)	1925.9244	1521.3075	1239.8333	605.8878	174.0780	0.0000	0.0000	0.0000	0.0000	701.4038	1357.5429	1947.8797	(211)	
Water heating requirement	245.8160	194.1726	158.2465	77.3327	22.2185	0.0000	0.0000	0.0000	0.0000	89.5239	173.2704	248.6183	(215)	
Water heating														
Water heating requirement	228.0252	200.8907	210.7640	188.6370	184.6416	163.5342	156.6782	173.6238	173.4450	195.6203	207.2243	222.4381	(64)	
Efficiency of water heater													79.5000	(216)
(217)m	88.2908	88.1613	87.8208	86.7577	83.8270	79.5000	79.5000	79.5000	79.5000	86.9770	87.9731	88.3314	(217)	
Fuel for water heating, kWh/month	258.2661	227.8671	239.9933	217.4296	220.2651	205.7034	197.0795	218.3947	218.1698	224.9105	235.5542	251.8222	(219)	
Water heating fuel used													2715.4555	(219)
Annual totals kWh/year														
Space heating fuel - main system													9473.8574	(211)
Space heating fuel - secondary													1209.1989	(215)
Electricity for pumps and fans:														
central heating pump													120.0000	(230c)
main heating flue fan													45.0000	(230e)
Total electricity for the above, kWh/year													165.0000	(231)
Electricity for lighting (calculated in Appendix L)													473.9646	(232)
Total delivered energy for all uses													14037.4764	(238)

10a. Fuel costs - using BEDF prices (514)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	9473.8574	9.7400	922.7537	(240)
Space heating - secondary	1209.1989	10.2500	123.9429	(242)
Water heating (other fuel)	2715.4555	9.7400	264.4854	(247)
Pumps and fans for heating	165.0000	36.8500	60.8025	(249)
Energy for lighting	473.9646	36.8500	174.6560	(250)
Additional standing charges			104.0000	(251)
Total energy cost			1650.6404	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	9473.8574	0.2160	2046.3532	(261)
Space heating - secondary	1209.1989	0.0190	22.9748	(263)
Water heating (other fuel)	2715.4555	0.2160	586.5384	(264)
Space and water heating			2655.8664	(265)
Pumps and fans	165.0000	0.5190	85.6350	(267)
Energy for lighting	473.9646	0.5190	245.9876	(268)
Total kg/year			2987.4890	(272)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	9473.8574	1.2200	11558.1061	(261)
Space heating - secondary	1209.1989	1.0400	1257.5669	(263)
Water heating (other fuel)	2715.4555	1.2200	3312.8557	(264)
Space and water heating			16128.5286	(265)

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Pumps and fans	165.0000	3.0700	506.5500 (267)
Energy for lighting	473.9646	3.0700	1455.0713 (268)
Primary energy kWh/year			18090.1500 (272)
Primary energy kWh/m2/year			136.2621 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: C 76
Current environmental impact rating: C 75

(For testing purposes):	
A Loft insulation	Not considered
B Cavity wall insulation	Not considered
C Hot water cylinder insulation	Not considered
D Draughtproofing	Not considered
E Low energy lighting	Already installed
F Cylinder thermostat	Not considered
G Heating controls	Not considered
H Heating controls	Not considered
I Condensing boiler	Not considered
J Biomass boiler	Not considered
K Biomass stove with boiler	Not considered
M Replacement warm air unit	Not considered
N Solar water heating	Recommended
O Double glazing	Not considered
P Secondary glazing	Not considered
R Condensing oil boiler	Not considered
S Condensing boiler	Not considered
T Gas condensing boiler	Not considered
U Solar photovoltaic panels	Recommended
A2 Flat roof insulation	Not considered
A3 Room-in-roof insulation	Not considered
T2 Flue gas heat recovery	Not considered
W Floor insulation	Not considered
X High performance external doors	Not considered
Y Heat recovery system for mixer showers	Not considered
J2 Biomass boiler	Not considered
Q2 External and cavity wall insulation	Not considered
Z1 Air or ground source heat pump	Not considered
Z2 Air or ground source heat pump with underfloor heating	Not considered
Z3 Micro CHP	Not considered
Z4	Not considered
Z5	Not considered
V2 Wind turbine	Not applicable
L2 High heat retention storage heaters	Not considered
Q3 System built wall insulation	Not considered
O3	Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.0	-£ 86	-205 kg (6.8%)
U Solar photovoltaic panels	+ 7.5	-£ 601	-847 kg (30.4%)

	Typical annual savings	Energy efficiency	Environmental impact
Recommended measures			
Solar water heating	£86	1.54 kg/m²	C 77 C 77
Solar photovoltaic panels	£601	6.38 kg/m²	B 84 B 83
Total Savings	£687	7.92 kg/m²	

Potential energy efficiency rating: B 84
Potential environmental impact rating: B 83

Fuel prices for cost data on this page from database revision number 514 TEST (30 Mar 2023)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, West Pennines (England)):

	Current	Potential	Saving
Electricity	£235	£254	-£18
Mains gas	£1291	£1187	£104
Wood	£124	£124	£0
Space heating	£1211	£1211	£0
Water heating	£264	£179	£86
Lighting	£175	£175	£0
Generated (PV)	-£0	-£601	£601
Total cost of fuels	£1650	£964	£687
Total cost of uses	£1650	£964	£687
Delivered energy	106 kWh/m²	86 kWh/m²	20 kWh/m²
Carbon dioxide emissions	3.0 tonnes	1.9 tonnes	1.1 tonnes
CO2 emissions per m²	23 kg/m²	15 kg/m²	8 kg/m²
Primary energy	136 kWh/m²	90 kWh/m²	46 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: Existing Dwelling

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR Existing dwelling (SAP) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Basement floor	30.2200 (1a)	x	2.8000 (2a) = 84.6160 (1a) - (3a)
Ground floor	44.5000 (1b)	x	2.5900 (2b) = 115.2550 (1b) - (3b)
First floor	38.6600 (1c)	x	2.6000 (2c) = 100.5160 (1c) - (3c)
Second floor	19.3800 (1d)	x	1.8100 (2d) = 35.0778 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	132.7600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	335.4648 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.0894 (8)
Number of storeys in the dwelling (ns)					4 (9)
Additional infiltration					[(9) - 1] x 0.1 = 0.3000 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction					0.3500 (11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0					0.0000 (12)
If no draught lobby, enter 0.05, else enter 0					0.0500 (13)
Percentage of windows and doors draught stripped					100.0000 (14)
Window infiltration					0.25 - [0.2 * (14) / 100] = 0.0500 (15)
Pressure test					No
Measured/design AP50					15.0000
Infiltration rate					0.8394 (18)
Number of sides sheltered					2 (19)
Shelter factor					(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor					(21) = (18) x (20) = 0.7135 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.9097	0.8919	0.8741	0.7849	0.7670	0.6778	0.6778	0.6600	0.7135	0.7670	0.8027	0.8384 (22b)
Effective ac	0.9138	0.8977	0.8820	0.8080	0.7942	0.7297	0.7297	0.7178	0.7546	0.7942	0.8222	0.8514 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Existing Windows (Uw = 1.80)			13.3700	1.6791	22.4496		(27)
New Windows (Uw = 1.60)			7.3100	1.5038	10.9925		(27)
New Roof Windows (Uw = 1.60)			7.3200	1.5038	11.0075		(27a)
Basement Floor			30.2200	0.2500	7.5550		(28a)
Extension Floor			14.2800	0.2200	3.1416		(28a)
Existing Wall	46.8000	13.3700	33.4300	1.7000	56.8310		(29a)
Basement Wall to be upgraded	63.4200		63.4200	0.3000	19.0260		(29a)
Extension Wall	18.7200	7.3100	11.4100	0.2800	3.1948		(29a)
Stud to Loft	4.5600		4.5600	0.2800	1.2768		(29a)
Dormer Cheek	11.3700		11.3700	0.2800	3.1836		(29a)
Protected Ceiling	8.3600		8.3600	0.1600	1.3376		(30)
Slope Ceiling	7.6000	3.6600	3.9400	0.1800	0.7092		(30)
Flat Roof Dormer	10.6400		10.6400	0.1800	1.9152		(30)
Ceiling over Bed 3	8.5200		8.5200	0.1600	1.3632		(30)
Glazed Roof	4.9000	3.6600	1.2400	0.1800	0.2232		(30)
Total net area of external elements Aum(A, m ²)			229.3900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	144.2068		(33)
Party Wall			150.1800	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							450.0000 (35)
Thermal bridges (Default value 0.150 * total exposed area)							34.4085 (36)
Total fabric heat loss						(33) + (36) =	178.6153 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	101.1613	99.3824	97.6388	89.4491	87.9168	80.7838	80.7838	79.4629	83.5314	87.9168	91.0166	Dec 94.2572 (38)
Heat transfer coeff	279.7766	277.9977	276.2541	268.0644	266.5321	259.3992	259.3992	258.0782	262.1467	266.5321	269.6319	272.8726 (39)
Average = Sum(39)m / 12 =												268.0571 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	2.1074	2.0940	2.0809	2.0192	2.0076	1.9539	1.9539	1.9439	1.9746	2.0076	2.0310	Dec 2.0554 (40)
HLP (average)												2.0191 (40)
Days in month												

FULL SAP CALCULATION PRINTOUT

Calculation Type: Existing Dwelling

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)												

Assumed occupancy												2.9018 (42)
Average daily hot water use (litres/day)												108.5452 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	119.3997	115.0579	110.7161	106.3743	102.0325	97.6906	97.6906	102.0325	106.3743	110.7161	115.0579	119.3997 (44)
Energy content	177.0663	154.8633	159.8050	139.3219	133.6827	115.3580	106.8961	122.6649	124.1299	144.6614	157.9093	171.4792 (45)
Energy content (annual)												Total = Sum(45)m = 1707.8381 (45)
Distribution loss (46)m = 0.15 x (45)m	26.5599	23.2295	23.9708	20.8983	20.0524	17.3037	16.0344	18.3997	18.6195	21.6992	23.6864	25.7219 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	48.1762	49.7821	50.9589	49.3151	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month	228.0252	200.8907	210.7640	188.6370	184.6416	163.5342	156.6782	173.6238	173.4450	195.6203	207.2243	222.4381 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1079.5246 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1813.6014 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.0619 (H8)
Utilisation factor												0.6100 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												108.5452 (H14)
Volume ratio Veff/V												0.6910 (H15)
Solar storage volume factor												0.9261 (H16)
Solar input												-900.8810 (H17)
Solar input	-26.1238	-43.5930	-74.2439	-99.5015	-122.9257	-120.8556	-119.2584	-104.1967	-81.6069	-55.7279	-30.9865	-21.8611 (63)
	Solar input (sum of months) = Sum(63)m =											-900.8810 (63)
Output from w/h	201.9014	157.2977	136.5200	89.1355	61.7159	42.6787	37.4198	69.4271	91.8381	139.8924	176.2378	200.5770 (64)
	Total per year (kWh/year) = Sum(64)m =											1404.6414 (64)
Heat gains from water heating, kWh/month	71.6143	62.9989	65.8749	58.6533	57.1892	50.4006	47.9885	53.5258	53.6020	60.8397	64.8336	69.7566 (65)

5. Internal gains (see Table 5 and 5a)												

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	174.1084	174.1084	174.1084	174.1084	174.1084	174.1084	174.1084	174.1084	174.1084	174.1084	174.1084	174.1084 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	67.0946	59.5928	48.4641	36.6905	27.4266	23.1547	25.0194	32.5212	43.6499	55.4235	64.6875	68.9594 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	449.2794	453.9415	442.1931	417.1822	385.6104	355.9374	336.1140	331.4519	343.2003	368.2112	399.7830	429.4560 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.3126	55.3126	55.3126	55.3126	55.3126	55.3126	55.3126	55.3126	55.3126	55.3126	55.3126	55.3126 (69)
Pumps, fans	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-116.0723	-116.0723	-116.0723	-116.0723	-116.0723	-116.0723	-116.0723	-116.0723	-116.0723	-116.0723	-116.0723	-116.0723 (71)
Water heating gains (Table 5)	96.2557	93.7484	88.5415	81.4629	76.8672	70.0008	64.5007	71.9433	74.4472	81.7737	90.0467	93.7588 (72)
Total internal gains	735.9785	730.6314	702.5476	658.6844	613.2530	572.4417	548.9829	559.2652	584.6461	628.7572	677.8659	715.5229 (73)

6. Solar gains												

[Jan]	Area	Solar flux	g	FF	Access	Gains						
	m2	Table 6a	Specific data	Specific data	factor	W						
		W/m2	or Table 6b	or Table 6c	Table 6d							
East	11.0400	19.6403	0.6300	0.7000	0.7700	66.2656 (76)						
West	2.3300	19.6403	0.6300	0.7000	0.7700	13.9854 (80)						
West	7.3100	19.6403	0.6300	0.7000	0.7700	43.8770 (80)						
East	3.6600	26.6072	0.6300	0.7000	1.0000	38.6511 (82)						
South	3.6600	34.8864	0.6300	0.7000	1.0000	50.6779 (82)						

Solar gains	213.4569	419.0089	695.3092	1024.8779	1267.2758	1302.6483	1237.9438	1055.5549	811.9644	498.4219	266.3739	175.4195 (83)
Total gains	949.4354	1149.6404	1397.8568	1683.5623	1880.5288	1875.0899	1786.9267	1614.8200	1396.6105	1127.1791	944.2397	890.9424 (84)

7. Mean internal temperature (heating season)												

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

FULL SAP CALCULATION PRINTOUT

Calculation Type: Existing Dwelling

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

tau	59.3152	59.6947	60.0715	61.9068	62.2627	63.9748	63.9748	64.3022	63.3043	62.2627	61.5469	60.8159
alpha	4.9543	4.9796	5.0048	5.1271	5.1508	5.2650	5.2650	5.2868	5.2203	5.1508	5.1031	5.0544
util living area	0.9997	0.9991	0.9966	0.9830	0.9288	0.7852	0.6155	0.6904	0.9261	0.9942	0.9993	0.9998 (86)
MIT	19.5423	19.6956	19.9744	20.3724	20.7104	20.9253	20.9835	20.9712	20.7955	20.3469	19.8935	19.5463 (87)
Th 2	19.2627	19.2714	19.2800	19.3206	19.3283	19.3642	19.3642	19.3710	19.3503	19.3283	19.3128	19.2967 (88)
util rest of house	0.9995	0.9986	0.9941	0.9690	0.8683	0.6321	0.3993	0.4699	0.8330	0.9875	0.9988	0.9997 (89)
MIT 2	17.9952	18.1551	18.4395	18.8615	19.1699	19.3441	19.3628	19.3678	19.2658	18.8484	18.3856	18.0258 (90)
Living area fraction									fLA = Living area / (4) =			
MIT	18.1309	18.2902	18.5741	18.9940	19.3050	19.4827	19.5049	19.5084	19.3999	18.9798	18.5178	18.1591 (92)
Temperature adjustment												0.0000
adjusted MIT	18.1309	18.2902	18.5741	18.9940	19.3050	19.4827	19.5049	19.5084	19.3999	18.9798	18.5178	18.1591 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9993	0.9980	0.9925	0.9649	0.8671	0.6451	0.4191	0.4905	0.8370	0.9852	0.9983	0.9995 (94)
Useful gains	948.7559	1147.3517	1387.3463	1624.4975	1630.6498	1209.6096	748.8966	792.0910	1169.0254	1110.4429	942.6656	890.5008 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	3869.5564	3722.4454	3335.5180	2705.8435	2026.9692	1266.5797	753.5401	802.2090	1389.3638	2233.4846	3078.6045	3809.0677 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	2173.0755	1730.4629	1449.4398	778.5691	294.8617	0.0000	0.0000	0.0000	0.0000	835.5430	1537.8760	2171.4137 (98)
Space heating												10971.2417 (98)
Space heating per m2										(98) / (4) =		82.6397 (99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.1000 (201)
Fraction of space heat from main system(s)												0.9000 (202)
Efficiency of main space heating system 1 (in %)												89.6000 (206)
Efficiency of secondary/supplementary heating system, %												78.0000 (208)
Space heating requirement												11020.2204 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	2173.0755	1730.4629	1449.4398	778.5691	294.8617	0.0000	0.0000	0.0000	0.0000	835.5430	1537.8760	2171.4137 (98)
Space heating efficiency (main heating system 1)	89.6000	89.6000	89.6000	89.6000	89.6000	0.0000	0.0000	0.0000	0.0000	89.6000	89.6000	89.6000 (210)
Space heating fuel (main heating system)	2182.7768	1738.1882	1455.9105	782.0448	296.1780	0.0000	0.0000	0.0000	0.0000	839.2731	1544.7415	2181.1075 (211)
Water heating requirement	278.5994	221.8542	185.8256	99.8165	37.8028	0.0000	0.0000	0.0000	0.0000	107.1209	197.1636	278.3864 (215)
Water heating requirement	201.9014	157.2977	136.5200	89.1355	61.7159	42.6787	37.4198	69.4271	91.8381	139.8924	176.2378	200.5770 (64)
Efficiency of water heater (217)m	88.5473	88.5678	88.5344	88.3336	87.5025	79.5000	79.5000	79.5000	79.5000	87.8494	88.3325	79.5000 (216)
Fuel for water heating, kWh/month	228.0152	177.6014	154.2000	100.9079	70.5304	53.6838	47.0690	87.3297	115.5196	159.2411	199.5164	226.5055 (219)
Water heating fuel used												1620.1201 (219)
Annual totals kWh/year												
Space heating fuel - main system												11020.2204 (211)
Space heating fuel - secondary												1406.5694 (215)
Electricity for pumps and fans:												
central heating pump												120.0000 (230c)
main heating flue fan												45.0000 (230e)
pump for solar water heating												50.0000 (230g)
Total electricity for the above, kWh/year												215.0000 (231)
Electricity for lighting (calculated in Appendix L)												473.9646 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 2.50 * 1080 * 0.80) =									-1727.2394			-1727.2394 (233)
Total delivered energy for all uses												13008.6352 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	11020.2204	3.4800	383.5037 (240)
Space heating - secondary	1406.5694	4.2300	59.4979 (242)
Water heating (other fuel)	1620.1201	3.4800	56.3802 (247)
Pumps and fans for heating	165.0000	13.1900	21.7635 (249)
Pump for solar water heating	50.0000	13.1900	6.5950 (249)
Energy for lighting	473.9646	13.1900	62.5159 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-1727.2394	13.1900	-227.8229 (252)
Total energy cost			482.4333 (255)

FULL SAP CALCULATION PRINTOUT

Calculation Type: Existing Dwelling

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12): 0.4200 (256)
Energy cost factor (ECF) $[(255) \times (256)] / [(4) + 45.0] =$ 1.1399 (257)
SAP value 84.0989
SAP rating (Section 12) 84 (258)
SAP band B

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	11020.2204	0.2160	2380.3676	(261)
Space heating - secondary	1406.5694	0.0190	26.7248	(263)
Water heating (other fuel)	1620.1201	0.2160	349.9459	(264)
Space and water heating			2757.0384	(265)
Pumps and fans	215.0000	0.5190	111.5850	(267)
Energy for lighting	473.9646	0.5190	245.9876	(268)
Energy saving/generation technologies				
PV Unit	-1727.2394	0.5190	-896.4372	(269)
Total kg/year			2218.1738	(272)
CO2 emissions per m2			16.7100	(273)
EI value			83.2788	
EI rating			83	(274)
EI band			B	

FULL SAP CALCULATION PRINTOUT

Calculation Type: Existing Dwelling

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR Existing dwelling (SAP) (Version 9.92, January 2014)
 CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Basement floor	30.2200 (1a)	x	2.8000 (2a) = 84.6160 (1a) - (3a)
Ground floor	44.5000 (1b)	x	2.5900 (2b) = 115.2550 (1b) - (3b)
First floor	38.6600 (1c)	x	2.6000 (2c) = 100.5160 (1c) - (3c)
Second floor	19.3800 (1d)	x	1.8100 (2d) = 35.0778 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	132.7600		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 335.4648 (5)
Dwelling volume			

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.0894 (8)
Number of storeys in the dwelling (ns)					4 (9)
Additional infiltration					[(9) - 1] x 0.1 = 0.3000 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction					0.3500 (11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0					0.0000 (12)
If no draught lobby, enter 0.05, else enter 0					0.0500 (13)
Percentage of windows and doors draught stripped					100.0000 (14)
Window infiltration					0.25 - [0.2 * (14) / 100] = 0.0500 (15)
Pressure test					No
Measured/design AP50					15.0000
Infiltration rate					0.8394 (18)
Number of sides sheltered					2 (19)
Shelter factor					(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor					(21) = (18) x (20) = 0.7135 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.3000	4.2000	4.2000	3.9000	4.0000	3.4000	3.3000	3.3000	3.4000	3.8000	3.8000	3.9000 (22)
Wind factor	1.0750	1.0500	1.0500	0.9750	1.0000	0.8500	0.8250	0.8250	0.8500	0.9500	0.9500	0.9750 (22a)
Adj infilt rate	0.7670	0.7492	0.7492	0.6957	0.7135	0.6065	0.5886	0.5886	0.6065	0.6778	0.6778	0.6957 (22b)
Effective ac	0.7942	0.7806	0.7806	0.7420	0.7546	0.6839	0.6733	0.6733	0.6839	0.7297	0.7297	0.7420 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Existing Windows (Uw = 1.80)			13.3700	1.6791	22.4496		(27)
New Windows (Uw = 1.60)			7.3100	1.5038	10.9925		(27)
New Roof Windows (Uw = 1.60)			7.3200	1.5038	11.0075		(27a)
Basement Floor			30.2200	0.2500	7.5550		(28a)
Extension Floor			14.2800	0.2200	3.1416		(28a)
Existing Wall	46.8000	13.3700	33.4300	1.7000	56.8310		(29a)
Basement Wall to be upgraded	63.4200		63.4200	0.3000	19.0260		(29a)
Extension Wall	18.7200	7.3100	11.4100	0.2800	3.1948		(29a)
Stud to Loft	4.5600		4.5600	0.2800	1.2768		(29a)
Dormer Cheek	11.3700		11.3700	0.2800	3.1836		(29a)
Protected Ceiling	8.3600		8.3600	0.1600	1.3376		(30)
Slope Ceiling	7.6000	3.6600	3.9400	0.1800	0.7092		(30)
Flat Roof Dormer	10.6400		10.6400	0.1800	1.9152		(30)
Ceiling over Bed 3	8.5200		8.5200	0.1600	1.3632		(30)
Glazed Roof	4.9000	3.6600	1.2400	0.1800	0.2232		(30)
Total net area of external elements Aum(A, m ²)			229.3900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	144.2068		(33)
Party Wall			150.1800	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							450.0000 (35)
Thermal bridges (Default value 0.150 * total exposed area)							34.4085 (36)
Total fabric heat loss						(33) + (36) =	178.6153 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	87.9168	86.4198	86.4198	82.1400	83.5314	75.7115	74.5315	74.5315	75.7115	80.7838	80.7838	82.1400 (38)
Heat transfer coeff	266.5321	265.0351	265.0351	260.7553	262.1467	254.3268	253.1468	253.1468	254.3268	259.3992	259.3992	260.7553 (39)
Average = Sum(39)m / 12 =												259.5004 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	2.0076	1.9963	1.9963	1.9641	1.9746	1.9157	1.9068	1.9068	1.9157	1.9539	1.9539	1.9641 (40)
HLP (average)												1.9547 (40)
Days in month												

FULL SAP CALCULATION PRINTOUT

Calculation Type: Existing Dwelling

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)												

Assumed occupancy												2.9018 (42)
Average daily hot water use (litres/day)												108.5452 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	119.3997	115.0579	110.7161	106.3743	102.0325	97.6906	97.6906	102.0325	106.3743	110.7161	115.0579	119.3997 (44)
Energy content	177.0663	154.8633	159.8050	139.3219	133.6827	115.3580	106.8961	122.6649	124.1299	144.6614	157.9093	171.4792 (45)
Energy content (annual)												Total = Sum(45)m = 1707.8381 (45)
Distribution loss (46)m = 0.15 x (45)m	26.5599	23.2295	23.9708	20.8983	20.0524	17.3037	16.0344	18.3997	18.6195	21.6992	23.6864	25.7219 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	48.1762	49.7821	50.9589	49.3151	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month	228.0252	200.8907	210.7640	188.6370	184.6416	163.5342	156.6782	173.6238	173.4450	195.6203	207.2243	222.4381 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1019.5221 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1712.7972 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.0029 (H8)
Utilisation factor												0.6311 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												108.5452 (H14)
Volume ratio Veff/V												0.6910 (H15)
Solar storage volume factor												0.9261 (H16)
Solar input												-880.1311 (H17)
Solar input	-23.8694	-40.8618	-72.7159	-99.4122	-119.8009	-120.5816	-116.1218	-100.1584	-82.1293	-54.9541	-29.0966	-20.4291 (63)
Solar input (sum of months) = Sum(63)m =												-880.1311 (63)
Output from w/h	204.1558	160.0289	138.0480	89.2248	64.8407	42.9526	40.5564	73.4654	91.3157	140.6662	178.1277	202.0090 (64)
Total per year (kWh/year) = Sum(64)m =												1425.3913 (64)
Heat gains from water heating, kWh/month	71.6143	62.9989	65.8749	58.6533	57.1892	50.4006	47.9885	53.5258	53.6020	60.8397	64.8336	69.7566 (65)

5. Internal gains (see Table 5 and 5a)												

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	174.1084	174.1084	174.1084	174.1084	174.1084	174.1084	174.1084	174.1084	174.1084	174.1084	174.1084	174.1084 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	67.0946	59.5928	48.4641	36.6905	27.4266	23.1547	25.0194	32.5212	43.6499	55.4235	64.6875	68.9594 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	449.2794	453.9415	442.1931	417.1822	385.6104	355.9374	336.1140	331.4519	343.2003	368.2112	399.7830	429.4560 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.3126	55.3126	55.3126	55.3126	55.3126	55.3126	55.3126	55.3126	55.3126	55.3126	55.3126	55.3126 (69)
Pumps, fans	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-116.0723	-116.0723	-116.0723	-116.0723	-116.0723	-116.0723	-116.0723	-116.0723	-116.0723	-116.0723	-116.0723	-116.0723 (71)
Water heating gains (Table 5)	96.2557	93.7484	88.5415	81.4629	76.8672	70.0008	64.5007	71.9433	74.4472	81.7737	90.0467	93.7588 (72)
Total internal gains	735.9785	730.6314	702.5476	658.6844	613.2530	572.4417	548.9829	559.2652	584.6461	628.7572	677.8659	715.5229 (73)

6. Solar gains												

[Jan]	Area	Solar flux		g		FF		Access		Gains		
	m2	Table 6a		Specific data		Specific data		factor		W		
		W/m2		or Table 6b		or Table 6c		Table 6d				
East	11.0400	17.3606		0.6300		0.7000		0.7700		58.5740 (76)		
West	2.3300	17.3606		0.6300		0.7000		0.7700		12.3621 (80)		
West	7.3100	17.3606		0.6300		0.7000		0.7700		38.7841 (80)		
East	3.6600	23.5284		0.6300		0.7000		1.0000		34.1786 (82)		
South	3.6600	30.8318		0.6300		0.7000		1.0000		44.7879 (82)		

Solar gains	188.6867	379.9533	658.7210	990.2842	1194.2745	1256.6973	1165.5377	981.2158	790.3755	475.4615	241.9819	158.5922 (83)
Total gains	924.6652	1110.5847	1361.2685	1648.9685	1807.5275	1829.1389	1714.5206	1540.4810	1375.0216	1104.2188	919.8478	874.1152 (84)

7. Mean internal temperature (heating season)												

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

FULL SAP CALCULATION PRINTOUT

Calculation Type: Existing Dwelling

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

tau	62.2627	62.6143	62.6143	63.6420	63.3043	65.2507	65.5548	65.5548	65.2507	63.9748	63.9748	63.6420
alpha	5.1508	5.1743	5.1743	5.2428	5.2203	5.3500	5.3703	5.3703	5.3500	5.2650	5.2650	5.2428
util living area	0.9997	0.9991	0.9960	0.9768	0.8986	0.6927	0.5365	0.6185	0.8993	0.9926	0.9993	0.9998 (86)
MIT	19.7000	19.8442	20.1096	20.4900	20.8019	20.9677	20.9933	20.9862	20.8540	20.4353	20.0142	19.6898 (87)
Th 2	19.3283	19.3358	19.3358	19.3574	19.3503	19.3901	19.3962	19.3962	19.3901	19.3642	19.3642	19.3574 (88)
util rest of house	0.9995	0.9984	0.9927	0.9563	0.8100	0.5059	0.3091	0.3761	0.7771	0.9834	0.9986	0.9996 (89)
MIT 2	18.2044	18.3543	18.6183	19.0041	19.2603	19.3849	19.3959	19.3954	19.3405	18.9642	18.5469	18.2172 (90)
Living area fraction									fLA = Living area / (4) =			0.0877 (91)
MIT	18.3356	18.4850	18.7490	19.1344	19.3955	19.5237	19.5360	19.5349	19.4732	19.0932	18.6755	18.3463 (92)
Temperature adjustment												0.0000
adjusted MIT	18.3356	18.4850	18.7490	19.1344	19.3955	19.5237	19.5360	19.5349	19.4732	19.0932	18.6755	18.3463 (93)

8. Space heating requirement

Utilisation	Jan 0.9992	Feb 0.9978	Mar 0.9909	Apr 0.9522	May 0.8132	Jun 0.5230	Jul 0.3296	Aug 0.3984	Sep 0.7857	Oct 0.9808	Nov 0.9981	Dec 0.9995 (94)
Useful gains	923.9497	1108.1702	1348.8538	1570.1514	1469.8312	956.6749	565.0414	613.6760	1080.3880	1082.9811	918.0718	873.6472 (95)
Ext temp.	5.2000	5.8000	7.4000	9.9000	12.9000	15.7000	17.3000	17.1000	14.7000	11.3000	7.9000	5.0000 (96)
Heat loss rate W	3501.0528	3361.9591	3007.8900	2407.9221	1702.7672	972.4684	566.0287	616.3852	1213.9565	2021.5381	2795.1681	3480.1290 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	1917.3648	1514.5462	1234.3229	603.1949	173.3044	0.0000	0.0000	0.0000	0.0000	698.2865	1351.5094	1939.2224 (98)
Space heating												9431.7514 (98)
Space heating per m2										(98) / (4) =		71.0436 (99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.1000 (201)
Fraction of space heat from main system(s)												0.9000 (202)
Efficiency of main space heating system 1 (in %)												89.6000 (206)
Efficiency of secondary/supplementary heating system, %												78.0000 (208)
Space heating requirement												9473.8574 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1917.3648	1514.5462	1234.3229	603.1949	173.3044	0.0000	0.0000	0.0000	0.0000	698.2865	1351.5094	1939.2224 (98)
Space heating efficiency (main heating system 1)	89.6000	89.6000	89.6000	89.6000	89.6000	0.0000	0.0000	0.0000	0.0000	89.6000	89.6000	89.6000 (210)
Space heating fuel (main heating system)	1925.9244	1521.3075	1239.8333	605.8878	174.0780	0.0000	0.0000	0.0000	0.0000	701.4038	1357.5429	1947.8797 (211)
Water heating requirement	245.8160	194.1726	158.2465	77.3327	22.2185	0.0000	0.0000	0.0000	0.0000	89.5239	173.2704	248.6183 (215)
Water heating requirement	204.1558	160.0289	138.0480	89.2248	64.8407	42.9526	40.5564	73.4654	91.3157	140.6662	178.1277	202.0090 (64)
Efficiency of water heater (217)m	88.4117	88.4198	88.3592	88.0215	86.3776	79.5000	79.5000	79.5000	79.5000	87.5654	88.1692	79.5000 (216)
Fuel for water heating, kWh/month	230.9148	180.9877	156.2350	101.3670	75.0666	54.0284	51.0144	92.4093	114.8625	160.6413	202.0295	228.4279 (219)
Water heating fuel used												1647.9844 (219)
Annual totals kWh/year												
Space heating fuel - main system												9473.8574 (211)
Space heating fuel - secondary												1209.1989 (215)
Electricity for pumps and fans:												
central heating pump												120.0000 (230c)
main heating flue fan												45.0000 (230e)
pump for solar water heating												50.0000 (230g)
Total electricity for the above, kWh/year												215.0000 (231)
Electricity for lighting (calculated in Appendix L)												473.9646 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 2.50 * 1020 * 0.80) =									-1631.2354			-1631.2354 (233)
Total delivered energy for all uses												11388.7699 (238)

10a. Fuel costs - using BEDF prices (514)

	Fuel	Fuel price	Fuel cost
	kWh/year	p/kWh	£/year
Space heating - main system 1	9473.8574	9.7400	922.7537 (240)
Space heating - secondary	1209.1989	10.2500	123.9429 (242)
Water heating (other fuel)	1647.9844	9.7400	160.5137 (247)
Pumps and fans for heating	165.0000	36.8500	60.8025 (249)
Pump for solar water heating	50.0000	36.8500	18.4250 (249)
Energy for lighting	473.9646	36.8500	174.6560 (250)
Additional standing charges			104.0000 (251)
Energy saving/generation technologies			
PV Unit	-1631.2354	36.8500	-601.1102 (252)
Total energy cost			963.9835 (255)

FULL SAP CALCULATION PRINTOUT

Calculation Type: Existing Dwelling

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	9473.8574	0.2160	2046.3532 (261)
Space heating - secondary	1209.1989	0.0190	22.9748 (263)
Water heating (other fuel)	1647.9844	0.2160	355.9646 (264)
Space and water heating			2425.2926 (265)
Pumps and fans	215.0000	0.5190	111.5850 (267)
Energy for lighting	473.9646	0.5190	245.9876 (268)
Energy saving/generation technologies			
PV Unit	-1631.2354	0.5190	-846.6112 (269)
Total kg/year			1936.2541 (272)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	9473.8574	1.2200	11558.1061 (261)
Space heating - secondary	1209.1989	1.0400	1257.5669 (263)
Water heating (other fuel)	1647.9844	1.2200	2010.5409 (264)
Space and water heating			14826.2139 (265)
Pumps and fans	215.0000	3.0700	660.0500 (267)
Energy for lighting	473.9646	3.0700	1455.0713 (268)
Energy saving/generation technologies			
PV Unit	-1631.2354	3.0700	-5007.8927 (269)
Primary energy kWh/year			11933.4425 (272)
Primary energy kWh/m2/year			89.8873 (273)

Appendix (B)

Existing House + Proposed Extension

SUMMARY FOR INPUT DATA

Calculation Type: Existing Dwelling

Property Reference	A998-0001-23-42				Issued on Date	07/05/2023
Assessment Reference	Proposed		Prop Type Ref	Extension		
Property	24 Brookfield Avenue, MANCHESTER, M21 8TX					
SAP Rating	78 C	DER	N/A	TER	N/A	
Environmental	78 C	% DER<TER	N/A			
CO ₂ Emissions (t/year)	2.66	DFEE	N/A	TFEE	N/A	
General Requirements Compliance	N/A	% DFEE<TFEE	N/A			
Assessor Details	Mr. Andrew Underwood, AC Systems, Tel: 07870 638476, info@sap-calculations.co.uk				Assessor ID	A998-0001
Client						

SUMMARY FOR INPUT DATA FOR: Existing Dwelling

Orientation	East
Property Tenure	Owner-occupied
Transaction Type	None of the above
Terrain Type	Urban
1.0 Property Type	House, Mid-Terrace
2.0 Number of Storeys	4
3.0 Date Built	
3.0 Property Age Band	A before 1900
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Basement:	23.90 m	30.22 m ²	2.80 m
1st Storey:	12.30 m	44.50 m ²	2.59 m
2nd Storey:	11.75 m	38.66 m ²	2.60 m
3rd Storey:	17.80 m	19.38 m ²	1.81 m

7.0 Living Area 11.64 m²

8.0 Thermal Mass Parameter
Thermal Mass Simple calculation - High
450.00 kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m ² K)	Gross Area (m ²)	Nett Area (m ²)
Existing Wall	Solid Wall	1.70	46.80	32.05
Basement Wall upgraded	Solid Wall	0.12	63.42	63.42
Extension Wall	Cavity Wall	0.25	18.72	11.20
Stud to Loft	Timber Frame	0.27	4.56	4.56
Dormer Cheek	Timber Frame	0.26	11.37	5.70

9.1 Party Walls

Description	Type	Construction	U-Value (W/m ² K)	Area (m ²)
Party Wall	Solid Wall		0.00	150.18

10.0 External Roofs

SUMMARY FOR INPUT DATA

Calculation Type: Existing Dwelling

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Protected Ceiling	External Plane Roof	0.13	8.36	8.36
Slope Ceiling	External Slope Roof	0.17	7.60	4.84
Flat Roof Dormer	External Flat Roof	0.17	10.64	10.64
Ceiling over Bed 3	External Plane Roof	0.14	8.52	8.52
Glazed Roof	External Slope Roof	0.18	4.90	0.00

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Basement Floor	Ground Floor - Solid		0.14	30.22
Extension Floor	Ground Floor - Timber		0.21	14.28

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Existing Windows	Manufacture r	Window	Double Low-E Soft 0.05			0.63		0.70	1.80
New Windows	Manufacture r	Window	Double Low-E Soft 0.05			0.63		0.70	1.60
New Roof Windows	Manufacture r	Roof Window	Double Low-E Soft 0.05			0.63		0.70	1.60

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
Front Elevation	Window	[1] Existing Wall	East	None	0.00					11.04	
Rear Elevation	Window	[1] Existing Wall	West	None	0.00					2.33	
Rear Elevation	Window	[3] Extension Wall	West	None	0.00					7.52	
Rear Elevation	Window	[5] Dormer Cheek	West	None	0.00					5.67	
Side Elevation	Roof Window	[5] Glazed Roof	South	None						4.90	
Front Elevation	Roof Window	[2] Slope Ceiling	East	None						2.76	
Front Elevation	Window	[1] Existing Wall	East	None	0.00					1.38	

14.0 Conservatory

None

15.0 Draught Proofing

100

%

16.0 Draught Lobby

No

17.0 Thermal Bridging

Default

Y-value

0.150

W/m²K

18.0 Pressure Testing

No

19.0 Mechanical Ventilation

Summer Overheating

Mechanical Ventilation

Mechanical Ventilation System Present

No

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0	0	0	0
Number of open flues	0	0	0	0
Number of intermittent fans				3
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System

No

22.0 Lighting

SUMMARY FOR INPUT DATA

Calculation Type: Existing Dwelling

Internal

Total number of light fittings	27	
Total number of L.E.L. fittings	27	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	Yes
Light and motion sensor	Yes

23.0 Electricity Tariff	Standard
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24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	18907	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.2	
In Summer	87.6	
Controls	CBE Programmer, room thermostat and TRVs	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2106	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	

25.0 Main Heating 2	None
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Community Heating	None
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27.0 Secondary Heating	RWM	
Secondary Heating	Manufacturer	
Description	Wood Logs RWM Closed room heater	
SHS efficiency	78.00	%
SAP Code	633	
HETAS Approved System	Yes	
Smoke Control Area	Unknown	
Test Method	BS EN 1266	
Manufacturer	IDEAL	
Model Name	HUNTER: Eco 4	

28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	

SUMMARY FOR INPUT DATA

Calculation Type: Existing Dwelling

Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	No
SAP Code	901

29.0 Hot Water Cylinder	None
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Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar photovoltaic panels, 2.5 kWp	£3,500 - £5,500	£601	B 85	

FULL SAP CALCULATION PRINTOUT

Calculation Type: Existing Dwelling

Property Reference	A998-0001-23-42	Issued on Date	07/05/2023
Assessment Reference	Proposed	Prop Type Ref	Extension
Property	24 Brookfield Avenue, MANCHESTER, M21 8TX		

SAP Rating	78 C	DER	N/A	TER	N/A
Environmental	78 C	% DER<TER	N/A		
CO ₂ Emissions (t/year)	2.66	DFEE	N/A	TFEE	N/A
General Requirements Compliance	N/A	% DFEE<TFEE	N/A		

Assessor Details	Mr. Andrew Underwood, AC Systems, Tel: 07870 638476, info@sap-calculations.co.uk	Assessor ID	A998-0001
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Client	
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CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR Existing dwelling (SAP) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)		Storey height (m)		Volume (m ³)
Basement floor	30.2200 (1a)	x	2.8000 (2a)	=	84.6160 (1a) - (3a)
Ground floor	44.5000 (1b)	x	2.5900 (2b)	=	115.2550 (1b) - (3b)
First floor	38.6600 (1c)	x	2.6000 (2c)	=	100.5160 (1c) - (3c)
Second floor	19.3800 (1d)	x	1.8100 (2d)	=	35.0778 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	132.7600				(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	335.4648 (5)

2. Ventilation rate

	main heating		secondary heating		other		total	m ³ per hour
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans							3 * 10 =	30.0000 (7a)
Number of passive vents							0 * 10 =	0.0000 (7b)
Number of flueless gas fires							0 * 40 =	0.0000 (7c)
								Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =							30.0000 / (5) =	0.0894 (8)
Number of storeys in the dwelling (ns)								4 (9)
Additional infiltration							[(9) - 1] x 0.1 =	0.3000 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction								0.3500 (11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0								0.0000 (12)
If no draught lobby, enter 0.05, else enter 0								0.0500 (13)
Percentage of windows and doors draught stripped								100.0000 (14)
Window infiltration						0.25 - [0.2 * (14) / 100] =		0.0500 (15)
Pressure test								No
Measured/design AP50								15.0000
Infiltration rate								0.8394 (18)
Number of sides sheltered								2 (19)
Shelter factor						(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor						(21) = (18) x (20) =		0.7135 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.3000	4.2000	4.2000	3.9000	4.0000	3.4000	3.3000	3.3000	3.4000	3.8000	3.8000	3.9000 (22)
Wind factor	1.0750	1.0500	1.0500	0.9750	1.0000	0.8500	0.8250	0.8250	0.8500	0.9500	0.9500	0.9750 (22a)
Adj infilt rate	0.7670	0.7492	0.7492	0.6957	0.7135	0.6065	0.5886	0.5886	0.6065	0.6778	0.6778	0.6957 (22b)
Effective ac	0.7942	0.7806	0.7806	0.7420	0.7546	0.6839	0.6733	0.6733	0.6839	0.7297	0.7297	0.7420 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Existing Windows (Uw = 1.80)			13.3700	1.6791	22.4496		(27)
New Windows (Uw = 1.60)			14.5700	1.5038	21.9098		(27)
New Roof Windows (Uw = 1.60)			7.6600	1.5038	11.5188		(27a)
Basement Floor			30.2200	0.1400	4.2308		(28a)
Extension Floor			14.2800	0.2100	2.9988		(28a)
Existing Wall	46.8000	14.7500	32.0500	1.7000	54.4850		(29a)
Basement Wall upgraded	63.4200		63.4200	0.1200	7.6104		(29a)

FULL SAP CALCULATION PRINTOUT

Calculation Type: Existing Dwelling

CALCULATION OF HEAT DEMAND 09 Jan 2014

Extension Wall	18.7200	7.5200	11.2000	0.2500	2.8000	(29a)
Stud to Loft	4.5600		4.5600	0.2700	1.2312	(29a)
Dormer Cheek	11.3700	5.6700	5.7000	0.2600	1.4820	(29a)
Protected Ceiling	8.3600		8.3600	0.1300	1.0868	(30)
Slope Ceiling	7.6000	2.7600	4.8400	0.1700	0.8228	(30)
Flat Roof Dormer	10.6400		10.6400	0.1700	1.8088	(30)
Ceiling over Bed 3	8.5200		8.5200	0.1400	1.1928	(30)
Glazed Roof	4.9000	4.9000	0.0000	0.1800	0.0000	(30)
Total net area of external elements Aum(A, m2)			229.3900			(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	135.6276		(33)
Party Wall			150.1800	0.0000	0.0000	(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	450.0000	(35)
Thermal bridges (Default value 0.150 * total exposed area)	34.4085	(36)
Total fabric heat loss	(33) + (36) =	170.0361 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	87.9168	86.4198	86.4198	82.1400	83.5314	75.7115	74.5315	74.5315	75.7115	80.7838	80.7838	82.1400	(38)
Heat transfer coeff	257.9529	256.4559	256.4559	252.1761	253.5675	245.7476	244.5676	244.5676	245.7476	250.8199	250.8199	252.1761	(39)
Average = Sum(39)m / 12 =												250.9212	(39)
HLP	1.9430	1.9317	1.9317	1.8995	1.9100	1.8511	1.8422	1.8422	1.8511	1.8893	1.8893	1.8995	(40)
HLP (average)												1.8900	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9018	(42)	
Average daily hot water use (litres/day)												108.5452	(43)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Daily hot water use	119.3997	115.0579	110.7161	106.3743	102.0325	97.6906	97.6906	102.0325	106.3743	110.7161	115.0579	119.3997	(44)	
Energy content	177.0663	154.8633	159.8050	139.3219	133.6827	115.3580	106.8961	122.6649	124.1299	144.6614	157.9093	171.4792	(45)	
Energy content (annual)											Total = Sum(45) m =	1707.8381	(45)	
Distribution loss	(46)m = 0.15 x (45)m													
	26.5599	23.2295	23.9708	20.8983	20.0524	17.3037	16.0344	18.3997	18.6195	21.6992	23.6864	25.7219	(46)	
Water storage loss:														
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)	
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)	
Combi loss	28.4588	25.7027	28.4519	27.5279	28.4414	27.5173	28.4297	28.4370	27.5219	28.4458	27.5354	28.4565	(61)	
Total heat required for water heating calculated for each month	205.5250	180.5660	188.2569	166.8498	162.1241	142.8753	135.3259	151.1019	151.6517	173.1072	185.4446	199.9358	(62)	
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)	
								Solar input (sum of months) =	Sum(63)m =				0.0000	(63)
Output from w/h	205.5250	180.5660	188.2569	166.8498	162.1241	142.8753	135.3259	151.1019	151.6517	173.1072	185.4446	199.9358	(64)	
								Total per year (kWh/year) =	Sum(64)m =				2042.7643	(64)
RHI water heating demand													2043	(64)
Heat gains from water heating, kWh/month	65.9892	57.9177	60.2481	53.2065	51.5598	45.2359	42.6504	47.8953	48.1537	55.2114	59.3887	64.1310	(65)	

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts													
(66)m	174.1084	174.1084	174.1084	174.1084	174.1084	174.1084	174.1084	174.1084	174.1084	174.1084	174.1084	174.1084	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	67.0898	59.5885	48.4606	36.6878	27.4246	23.1530	25.0176	32.5188	43.6467	55.4195	64.6828	68.9544	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	449.2794	453.9415	442.1931	417.1822	385.6104	355.9374	336.1140	331.4519	343.2003	368.2112	399.7830	429.4560	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.3126	55.3126	55.3126	55.3126	55.3126	55.3126	55.3126	55.3126	55.3126	55.3126	55.3126	55.3126	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-116.0723	-116.0723	-116.0723	-116.0723	-116.0723	-116.0723	-116.0723	-116.0723	-116.0723	-116.0723	-116.0723	-116.0723	(71)
Water heating gains (Table 5)	88.6952	86.1871	80.9787	73.8979	69.3009	62.8276	57.3258	64.3754	66.8801	74.2088	82.4843	86.1976	(72)
Total internal gains	721.4131	716.0659	687.9812	644.1168	598.6847	558.2668	534.8062	544.6950	570.0759	614.1883	663.2988	700.9567	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W

East				11.0400	17.3606		0.6300		0.7000		0.7700		58.5740 (76)
West				2.3300	17.3606		0.6300		0.7000		0.7700		12.3621 (80)
East				1.3800	17.3606		0.6300		0.7000		0.7700		7.3218 (76)
West				13.1900	17.3606		0.6300		0.7000		0.7700		69.9811 (80)
East				2.7600	23.5284		0.6300		0.7000		1.0000		25.7740 (82)
South				4.9000	30.8318		0.6300		0.7000		1.0000		59.9620 (82)

Solar gains	233.9750	469.9353	811.7230	1215.7650	1462.4658	1537.2645	1426.4061	1203.2441	972.4506	587.2554	299.8406	196.7999	(83)

FULL SAP CALCULATION PRINTOUT

Calculation Type: Existing Dwelling

CALCULATION OF HEAT DEMAND 09 Jan 2014

Total gains 955.3881 1186.0011 1499.7042 1859.8818 2061.1504 2095.5313 1961.2123 1747.9390 1542.5264 1201.4437 963.1394 897.7566 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	64.3334	64.7090	64.7090	65.8072	65.4461	67.5286	67.8545	67.8545	67.5286	66.1630	66.1630	65.8072
alpha	5.2889	5.3139	5.3139	5.3871	5.3631	5.5019	5.5236	5.5236	5.5019	5.4109	5.4109	5.3871
util living area	0.9996	0.9988	0.9935	0.9600	0.8414	0.6035	0.4579	0.5368	0.8478	0.9888	0.9991	0.9998 (86)
MIT	19.7576	19.9184	20.2037	20.5946	20.8723	20.9848	20.9972	20.9937	20.9033	20.5016	20.0698	19.7454 (87)
Th 2	19.3716	19.3792	19.3792	19.4012	19.3940	19.4345	19.4406	19.4406	19.4345	19.4082	19.4082	19.4012 (88)
util rest of house	0.9994	0.9978	0.9885	0.9287	0.7355	0.4353	0.2668	0.3270	0.7075	0.9754	0.9982	0.9996 (89)
MIT 2	18.2964	18.4629	18.7456	19.1338	19.3418	19.4323	19.4405	19.4403	19.4055	19.0632	18.6375	18.3077 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	18.4245	18.5905	18.8735	19.2618	19.4760	19.5684	19.5770	19.5765	19.5368	19.1893	18.7631	18.4338 (92)
Temperature adjustment	0.0000											
adjusted MIT	18.4245	18.5905	18.8735	19.2618	19.4760	19.5684	19.5770	19.5765	19.5368	19.1893	18.7631	18.4338 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9991	0.9971	0.9862	0.9249	0.7420	0.4504	0.2838	0.3459	0.7190	0.9725	0.9977	0.9994 (94)
Useful gains	954.5673	1182.5960	1478.9412	1720.2450	1529.4502	943.8940	556.5015	604.5352	1109.0004	1168.3690	960.8948	897.2407 (95)
Ext temp.	5.2000	5.8000	7.4000	9.9000	12.9000	15.7000	17.3000	17.1000	14.7000	11.3000	7.9000	5.0000 (96)
Heat loss rate W	3411.2908	3280.1981	2942.4419	2360.8307	1667.4661	950.6449	556.8823	605.6714	1188.6352	1978.7941	2724.6846	3387.6806 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	1827.8023	1409.5886	1088.8446	461.2217	102.6838	0.0000	0.0000	0.0000	0.0000	602.9563	1269.9286	1852.8873 (98)
Space heating												8615.9131 (98)
RHI space heating demand												8616 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: Existing Dwelling

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR Existing dwelling (SAP) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Basement floor	30.2200 (1a)	x 2.8000 (2a)	= 84.6160 (1a) - (3a)
Ground floor	44.5000 (1b)	x 2.5900 (2b)	= 115.2550 (1b) - (3b)
First floor	38.6600 (1c)	x 2.6000 (2c)	= 100.5160 (1c) - (3c)
Second floor	19.3800 (1d)	x 1.8100 (2d)	= 35.0778 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	132.7600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 335.4648 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.0894 (8)
Number of storeys in the dwelling (ns)					4 (9)
Additional infiltration					[(9) - 1] x 0.1 = 0.3000 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction					0.3500 (11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0					0.0000 (12)
If no draught lobby, enter 0.05, else enter 0					0.0500 (13)
Percentage of windows and doors draught stripped					100.0000 (14)
Window infiltration					0.25 - [0.2 * (14) / 100] = 0.0500 (15)
Pressure test					No
Measured/design AP50					15.0000
Infiltration rate					0.8394 (18)
Number of sides sheltered					2 (19)
Shelter factor					(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor					(21) = (18) x (20) = 0.7135 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.9097	0.8919	0.8741	0.7849	0.7670	0.6778	0.6778	0.6600	0.7135	0.7670	0.8027	0.8384 (22b)
Effective ac	0.9138	0.8977	0.8820	0.8080	0.7942	0.7297	0.7297	0.7178	0.7546	0.7942	0.8222	0.8514 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Existing Windows (Uw = 1.80)			13.3700	1.6791	22.4496		(27)
New Windows (Uw = 1.60)			14.5700	1.5038	21.9098		(27)
New Roof Windows (Uw = 1.60)			7.6600	1.5038	11.5188		(27a)
Basement Floor			30.2200	0.1400	4.2308		(28a)
Extension Floor			14.2800	0.2100	2.9988		(28a)
Existing Wall	46.8000	14.7500	32.0500	1.7000	54.4850		(29a)
Basement Wall upgraded	63.4200		63.4200	0.1200	7.6104		(29a)
Extension Wall	18.7200	7.5200	11.2000	0.2500	2.8000		(29a)
Stud to Loft	4.5600		4.5600	0.2700	1.2312		(29a)
Dormer Cheek	11.3700	5.6700	5.7000	0.2600	1.4820		(29a)
Protected Ceiling	8.3600		8.3600	0.1300	1.0868		(30)
Slope Ceiling	7.6000	2.7600	4.8400	0.1700	0.8228		(30)
Flat Roof Dormer	10.6400		10.6400	0.1700	1.8088		(30)
Ceiling over Bed 3	8.5200		8.5200	0.1400	1.1928		(30)
Glazed Roof	4.9000	4.9000	0.0000	0.1800	0.0000		(30)
Total net area of external elements Aum(A, m ²)			229.3900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	135.6276		(33)
Party Wall			150.1800	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							450.0000 (35)
Thermal bridges (Default value 0.150 * total exposed area)							34.4085 (36)
Total fabric heat loss						(33) + (36) =	170.0361 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	101.1613	99.3824	97.6388	89.4491	87.9168	80.7838	80.7838	79.4629	83.5314	87.9168	91.0166	Dec 2572 (38)
Heat transfer coeff	271.1974	269.4185	267.6749	259.4852	257.9529	250.8199	250.8199	249.4990	253.5675	257.9529	261.0527	264.2933 (39)
Average = Sum(39)m / 12 =												259.4778 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	2.0428	2.0294	2.0162	1.9545	1.9430	1.8893	1.8893	1.8793	1.9100	1.9430	1.9664	Dec 1.9908 (40)
HLP (average)												1.9545 (40)
Days in month												

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Calculation Type: Existing Dwelling

CALCULATION OF ENERGY RATINGS 09 Jan 2014

	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)												

Assumed occupancy												2.9018 (42)
Average daily hot water use (litres/day)												108.5452 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	119.3997	115.0579	110.7161	106.3743	102.0325	97.6906	97.6906	102.0325	106.3743	110.7161	115.0579	119.3997 (44)
Energy content (annual)	177.0663	154.8633	159.8050	139.3219	133.6827	115.3580	106.8961	122.6649	124.1299	144.6614	157.9093	171.4792 (45)
Distribution loss (46)m = 0.15 x (45)m	26.5599	23.2295	23.9708	20.8983	20.0524	17.3037	16.0344	18.3997	18.6195	21.6992	23.6864	25.7219 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	28.4588	25.7027	28.4519	27.5279	28.4414	27.5173	28.4297	28.4370	27.5219	28.4458	27.5354	28.4565 (61)
Total heat required for water heating calculated for each month	205.5250	180.5660	188.2569	166.8498	162.1241	142.8753	135.3259	151.1019	151.6517	173.1072	185.4446	199.9358 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	205.5250	180.5660	188.2569	166.8498	162.1241	142.8753	135.3259	151.1019	151.6517	173.1072	185.4446	199.9358 (64)
Heat gains from water heating, kWh/month	65.9892	57.9177	60.2481	53.2065	51.5598	45.2359	42.6504	47.8953	48.1537	55.2114	59.3887	64.1310 (65)

5. Internal gains (see Table 5 and 5a)												

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	174.1084	174.1084	174.1084	174.1084	174.1084	174.1084	174.1084	174.1084	174.1084	174.1084	174.1084	174.1084 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	67.0898	59.5885	48.4606	36.6878	27.4246	23.1530	25.0176	32.5188	43.6467	55.4195	64.6828	68.9544 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	449.2794	453.9415	442.1931	417.1822	385.6104	355.9374	336.1140	331.4519	343.2003	368.2112	399.7830	429.4560 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.3126	55.3126	55.3126	55.3126	55.3126	55.3126	55.3126	55.3126	55.3126	55.3126	55.3126	55.3126 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-116.0723	-116.0723	-116.0723	-116.0723	-116.0723	-116.0723	-116.0723	-116.0723	-116.0723	-116.0723	-116.0723	-116.0723 (71)
Water heating gains (Table 5)	88.6952	86.1871	80.9787	73.8979	69.3009	62.8276	57.3258	64.3754	66.8801	74.2088	82.4843	86.1976 (72)
Total internal gains	721.4131	716.0659	687.9812	644.1168	598.6847	558.2668	534.8062	544.6950	570.0759	614.1883	663.2988	700.9567 (73)

6. Solar gains												

[Jan]	Area	Solar flux	g	FF	Access	Gains						
	m2	Table 6a	Specific data	factor	Table 6d	W						
		W/m2	or Table 6b	or Table 6c								
East	11.0400	19.6403	0.6300	0.7000	0.7700	66.2656 (76)						
West	2.3300	19.6403	0.6300	0.7000	0.7700	13.9854 (80)						
East	1.3800	19.6403	0.6300	0.7000	0.7700	8.2832 (76)						
West	13.1900	19.6403	0.6300	0.7000	0.7700	79.1706 (80)						
East	2.7600	26.6072	0.6300	0.7000	1.0000	29.1467 (82)						
South	4.9000	34.8864	0.6300	0.7000	1.0000	67.8474 (82)						
Solar gains	264.6990	518.2575	856.8382	1258.2737	1551.9011	1593.5120	1515.0554	1294.4416	999.0452	615.6351	330.0754	217.6879 (83)
Total gains	986.1121	1234.3234	1544.8194	1902.3905	2150.5857	2151.7787	2049.8616	1839.1366	1569.1211	1229.8234	993.3742	918.6446 (84)

7. Mean internal temperature (heating season)												

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	61.1916	61.5956	61.9968	63.9536	64.3334	66.1630	66.1630	66.5133	65.4461	64.3334	63.5695	62.7901
alpha	5.0794	5.1064	5.1331	5.2636	5.2889	5.4109	5.4109	5.4342	5.3631	5.2889	5.2380	5.1860
util living area	0.9997	0.9988	0.9947	0.9705	0.8832	0.7002	0.5295	0.6050	0.8849	0.9912	0.9992	0.9998 (86)
MIT	19.6036	19.7748	20.0735	20.4857	20.8011	20.9605	20.9927	20.9860	20.8557	20.4173	19.9530	19.6048 (87)
Th 2	19.3050	19.3138	19.3225	19.3638	19.3716	19.4082	19.4082	19.4150	19.3940	19.3716	19.3559	19.3395 (88)
util rest of house	0.9994	0.9980	0.9908	0.9484	0.8040	0.5495	0.3429	0.4071	0.7705	0.9814	0.9985	0.9996 (89)
MIT 2	18.0897	18.2675	18.5711	19.0016	19.2722	19.3987	19.4076	19.4136	19.3407	18.9513	18.4791	18.1181 (90)
Living area fraction	18.2224	18.3996	18.7028	19.1317	19.4062	19.5356	19.5466	19.5515	19.4736	19.0798	18.6083	18.2484 (92)
MIT	18.2224	18.3996	18.7028	19.1317	19.4062	19.5356	19.5466	19.5515	19.4736	19.0798	18.6083	18.2484 (92)
Temperature adjustment	18.2224	18.3996	18.7028	19.1317	19.4062	19.5356	19.5466	19.5515	19.4736	19.0798	18.6083	18.2484 (93)
adjusted MIT	18.2224	18.3996	18.7028	19.1317	19.4062	19.5356	19.5466	19.5515	19.4736	19.0798	18.6083	18.2484 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: Existing Dwelling

CALCULATION OF ENERGY RATINGS 09 Jan 2014

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9992	0.9973	0.9886	0.9440	0.8061	0.5627	0.3596	0.4251	0.7779	0.9786	0.9980	0.9995	(94)
Useful gains	985.3161	1231.0466	1527.2030	1795.8995	1733.6733	1210.7651	737.1644	781.8246	1220.5999	1203.5096	991.3526	918.1502	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	3775.7261	3637.0538	3266.3842	2654.9734	1987.8431	1237.9540	739.0606	786.2891	1362.5612	2187.4018	3004.2763	3712.9059	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	2076.0650	1616.8368	1293.9508	618.5332	189.1023	0.0000	0.0000	0.0000	0.0000	732.0158	1449.3051	2079.2983	(98)
Space heating												10055.1074	(98)
Space heating per m2												(98) / (4) =	75.7390 (99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)													0.1000 (201)
Fraction of space heat from main system(s)													0.9000 (202)
Efficiency of main space heating system 1 (in %)													90.2000 (206)
Efficiency of secondary/supplementary heating system, %													78.0000 (208)
Space heating requirement													10032.8123 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	2076.0650	1616.8368	1293.9508	618.5332	189.1023	0.0000	0.0000	0.0000	0.0000	732.0158	1449.3051	2079.2983	(98)
Space heating efficiency (main heating system 1)	90.2000	90.2000	90.2000	90.2000	90.2000	0.0000	0.0000	0.0000	0.0000	90.2000	90.2000	90.2000	(210)
Space heating fuel (main heating system)	2071.4618	1613.2518	1291.0817	617.1617	188.6830	0.0000	0.0000	0.0000	0.0000	730.3927	1446.0915	2074.6879	(211)
Water heating requirement	266.1622	207.2868	165.8911	79.2991	24.2439	0.0000	0.0000	0.0000	0.0000	93.8482	185.8083	266.5767	(215)
Water heating													
Water heating requirement	205.5250	180.5660	188.2569	166.8498	162.1241	142.8753	135.3259	151.1019	151.6517	173.1072	185.4446	199.9358	(64)
Efficiency of water heater	89.9355	89.9054	89.8290	89.5868	88.9126	87.6000	87.6000	87.6000	87.6000	89.6464	89.8680	89.9423	(216)
(217)m	89.9355	89.9054	89.8290	89.5868	88.9126	87.6000	87.6000	87.6000	87.6000	89.6464	89.8680	89.9423	(217)
Fuel for water heating, kWh/month	228.5250	200.8399	209.5726	186.2437	182.3411	163.0996	154.4816	172.4907	173.1184	193.1001	206.3523	222.2933	(219)
Water heating fuel used													2292.4584 (219)
Annual totals kWh/year													
Space heating fuel - main system													10032.8123 (211)
Space heating fuel - secondary													1289.1163 (215)
Electricity for pumps and fans:													
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													75.0000 (231)
Electricity for lighting (calculated in Appendix L)													473.9304 (232)
Total delivered energy for all uses													14163.3174 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	10032.8123	3.4800	349.1419	(240)
Space heating - secondary	1289.1163	4.2300	54.5296	(242)
Water heating (other fuel)	2292.4584	3.4800	79.7776	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	473.9304	13.1900	62.5114	(250)
Additional standing charges			120.0000	(251)
Total energy cost			675.8530	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.5969 (257)
SAP value		77.7238
SAP rating (Section 12)		78 (258)
SAP band		C

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	10032.8123	0.2160	2167.0875	(261)
Space heating - secondary	1289.1163	0.0190	24.4932	(263)
Water heating (other fuel)	2292.4584	0.2160	495.1710	(264)
Space and water heating			2686.7517	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	473.9304	0.5190	245.9699	(268)
Total kg/year			2971.6465	(272)

FULL SAP CALCULATION PRINTOUT

Calculation Type: Existing Dwelling

CALCULATION OF ENERGY RATINGS 09 Jan 2014

CO2 emissions per m2	22.3800 (273)
EI value	77.5990
EI rating	78 (274)
EI band	C

----- Calculation of stars for heating and DHW -----

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9020 = 3.858$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9020 = 0.2395$, stars = 4
Water heating energy efficiency	$3.48 / 0.8900 = 3.910$, stars = 4
Water heating environmental impact	$0.216 / 0.8900 = 0.2427$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: Existing Dwelling

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR Existing dwelling (SAP) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Basement floor	30.2200 (1a)	x 2.8000 (2a)	= 84.6160 (1a) - (3a)
Ground floor	44.5000 (1b)	x 2.5900 (2b)	= 115.2550 (1b) - (3b)
First floor	38.6600 (1c)	x 2.6000 (2c)	= 100.5160 (1c) - (3c)
Second floor	19.3800 (1d)	x 1.8100 (2d)	= 35.0778 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	132.7600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	335.4648 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.0894 (8)
Number of storeys in the dwelling (ns)					4 (9)
Additional infiltration					[(9) - 1] x 0.1 = 0.3000 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction					0.3500 (11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0					0.0000 (12)
If no draught lobby, enter 0.05, else enter 0					0.0500 (13)
Percentage of windows and doors draught stripped					100.0000 (14)
Window infiltration					0.25 - [0.2 * (14) / 100] = 0.0500 (15)
Pressure test					No
Measured/design AP50					15.0000
Infiltration rate					0.8394 (18)
Number of sides sheltered					2 (19)
Shelter factor					(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor					(21) = (18) x (20) = 0.7135 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.3000	4.2000	4.2000	3.9000	4.0000	3.4000	3.3000	3.3000	3.4000	3.8000	3.8000	3.9000 (22)
Wind factor	1.0750	1.0500	1.0500	0.9750	1.0000	0.8500	0.8250	0.8250	0.8500	0.9500	0.9500	0.9750 (22a)
Adj infilt rate	0.7670	0.7492	0.7492	0.6957	0.7135	0.6065	0.5886	0.5886	0.6065	0.6778	0.6778	0.6957 (22b)
Effective ac	0.7942	0.7806	0.7806	0.7420	0.7546	0.6839	0.6733	0.6733	0.6839	0.7297	0.7297	0.7420 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Existing Windows (Uw = 1.80)			13.3700	1.6791	22.4496		(27)
New Windows (Uw = 1.60)			14.5700	1.5038	21.9098		(27)
New Roof Windows (Uw = 1.60)			7.6600	1.5038	11.5188		(27a)
Basement Floor			30.2200	0.1400	4.2308		(28a)
Extension Floor			14.2800	0.2100	2.9988		(28a)
Existing Wall	46.8000	14.7500	32.0500	1.7000	54.4850		(29a)
Basement Wall upgraded	63.4200		63.4200	0.1200	7.6104		(29a)
Extension Wall	18.7200	7.5200	11.2000	0.2500	2.8000		(29a)
Stud to Loft	4.5600		4.5600	0.2700	1.2312		(29a)
Dormer Cheek	11.3700	5.6700	5.7000	0.2600	1.4820		(29a)
Protected Ceiling	8.3600		8.3600	0.1300	1.0868		(30)
Slope Ceiling	7.6000	2.7600	4.8400	0.1700	0.8228		(30)
Flat Roof Dormer	10.6400		10.6400	0.1700	1.8088		(30)
Ceiling over Bed 3	8.5200		8.5200	0.1400	1.1928		(30)
Glazed Roof	4.9000	4.9000	0.0000	0.1800	0.0000		(30)
Total net area of external elements Aum(A, m ²)			229.3900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	135.6276		(33)
Party Wall			150.1800	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							450.0000 (35)
Thermal bridges (Default value 0.150 * total exposed area)							34.4085 (36)
Total fabric heat loss						(33) + (36) =	170.0361 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	87.9168	86.4198	86.4198	82.1400	83.5314	75.7115	74.5315	74.5315	75.7115	80.7838	80.7838	82.1400 (38)
Heat transfer coeff	257.9529	256.4559	256.4559	252.1761	253.5675	245.7476	244.5676	244.5676	245.7476	250.8199	250.8199	252.1761 (39)
Average = Sum(39)m / 12 =												250.9212 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.9430	1.9317	1.9317	1.8995	1.9100	1.8511	1.8422	1.8422	1.8511	1.8893	1.8893	1.8995 (40)
HLP (average)												1.8900 (40)
Days in month												

FULL SAP CALCULATION PRINTOUT

Calculation Type: Existing Dwelling

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)												

Assumed occupancy												2.9018 (42)
Average daily hot water use (litres/day)												108.5452 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	119.3997	115.0579	110.7161	106.3743	102.0325	97.6906	97.6906	102.0325	106.3743	110.7161	115.0579	119.3997 (44)
Energy content (annual)	177.0663	154.8633	159.8050	139.3219	133.6827	115.3580	106.8961	122.6649	124.1299	144.6614	157.9093	171.4792 (45)
Distribution loss (46)m = 0.15 x (45)m	26.5599	23.2295	23.9708	20.8983	20.0524	17.3037	16.0344	18.3997	18.6195	21.6992	23.6864	25.7219 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	28.4588	25.7027	28.4519	27.5279	28.4414	27.5173	28.4297	28.4370	27.5219	28.4458	27.5354	28.4565 (61)
Total heat required for water heating calculated for each month	205.5250	180.5660	188.2569	166.8498	162.1241	142.8753	135.3259	151.1019	151.6517	173.1072	185.4446	199.9358 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	205.5250	180.5660	188.2569	166.8498	162.1241	142.8753	135.3259	151.1019	151.6517	173.1072	185.4446	199.9358 (64)
Heat gains from water heating, kWh/month	65.9892	57.9177	60.2481	53.2065	51.5598	45.2359	42.6504	47.8953	48.1537	55.2114	59.3887	64.1310 (65)

5. Internal gains (see Table 5 and 5a)												

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	174.1084	174.1084	174.1084	174.1084	174.1084	174.1084	174.1084	174.1084	174.1084	174.1084	174.1084	174.1084 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	67.0898	59.5885	48.4606	36.6878	27.4246	23.1530	25.0176	32.5188	43.6467	55.4195	64.6828	68.9544 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	449.2794	453.9415	442.1931	417.1822	385.6104	355.9374	336.1140	331.4519	343.2003	368.2112	399.7830	429.4560 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.3126	55.3126	55.3126	55.3126	55.3126	55.3126	55.3126	55.3126	55.3126	55.3126	55.3126	55.3126 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-116.0723	-116.0723	-116.0723	-116.0723	-116.0723	-116.0723	-116.0723	-116.0723	-116.0723	-116.0723	-116.0723	-116.0723 (71)
Water heating gains (Table 5)	88.6952	86.1871	80.9787	73.8979	69.3009	62.8276	57.3258	64.3754	66.8801	74.2088	82.4843	86.1976 (72)
Total internal gains	721.4131	716.0659	687.9812	644.1168	598.6847	558.2668	534.8062	544.6950	570.0759	614.1883	663.2988	700.9567 (73)

6. Solar gains												

[Jan]	Area	Solar flux	g	FF	Access	Gains						
	m2	Table 6a	Specific data	factor	Table 6d	W						
		W/m2	or Table 6b	or Table 6c								
East	11.0400	17.3606	0.6300	0.7000	0.7700	58.5740 (76)						
West	2.3300	17.3606	0.6300	0.7000	0.7700	12.3621 (80)						
East	1.3800	17.3606	0.6300	0.7000	0.7700	7.3218 (76)						
West	13.1900	17.3606	0.6300	0.7000	0.7700	69.9811 (80)						
East	2.7600	23.5284	0.6300	0.7000	1.0000	25.7740 (82)						
South	4.9000	30.8318	0.6300	0.7000	1.0000	59.9620 (82)						
Solar gains	233.9750	469.9353	811.7230	1215.7650	1462.4658	1537.2645	1426.4061	1203.2441	972.4506	587.2554	299.8406	196.7999 (83)
Total gains	955.3881	1186.0011	1499.7042	1859.8818	2061.1504	2095.5313	1961.2123	1747.9390	1542.5264	1201.4437	963.1394	897.7566 (84)

7. Mean internal temperature (heating season)												

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	64.3334	64.7090	64.7090	65.8072	65.4461	67.5286	67.8545	67.8545	67.5286	66.1630	66.1630	65.8072
alpha	5.2889	5.3139	5.3139	5.3871	5.3631	5.5019	5.5236	5.5236	5.5019	5.4109	5.4109	5.3871
util living area	0.9996	0.9988	0.9935	0.9600	0.8414	0.6035	0.4579	0.5368	0.8478	0.9888	0.9991	0.9998 (86)
MIT	19.7576	19.9184	20.2037	20.5946	20.8723	20.9848	20.9972	20.9937	20.9033	20.5016	20.0698	19.7454 (87)
Th 2	19.3716	19.3792	19.3792	19.4012	19.3940	19.4345	19.4406	19.4406	19.4345	19.4082	19.4082	19.4012 (88)
util rest of house	0.9994	0.9978	0.9885	0.9287	0.7355	0.4353	0.2668	0.3270	0.7075	0.9754	0.9982	0.9996 (89)
MIT 2	18.2964	18.4629	18.7456	19.1338	19.3418	19.4323	19.4405	19.4403	19.4055	19.0632	18.6375	18.3077 (90)
Living area fraction	18.4245	18.5905	18.8735	19.2618	19.4760	19.5684	19.5770	19.5765	19.5368	19.1893	18.7631	18.4338 (92)
MIT	18.4245	18.5905	18.8735	19.2618	19.4760	19.5684	19.5770	19.5765	19.5368	19.1893	18.7631	18.4338 (92)
Temperature adjustment	18.4245	18.5905	18.8735	19.2618	19.4760	19.5684	19.5770	19.5765	19.5368	19.1893	18.7631	18.4338 (93)
adjusted MIT	18.4245	18.5905	18.8735	19.2618	19.4760	19.5684	19.5770	19.5765	19.5368	19.1893	18.7631	18.4338 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: Existing Dwelling

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9991	0.9971	0.9862	0.9249	0.7420	0.4504	0.2838	0.3459	0.7190	0.9725	0.9977	0.9994	(94)
Useful gains	954.5673	1182.5960	1478.9412	1720.2450	1529.4502	943.8940	556.5015	604.5352	1109.0004	1168.3690	960.8948	897.2407	(95)
Ext temp.	5.2000	5.8000	7.4000	9.9000	12.9000	15.7000	17.3000	17.1000	14.7000	11.3000	7.9000	5.0000	(96)
Heat loss rate W	3411.2908	3280.1981	2942.4419	2360.8307	1667.4661	950.6449	556.8823	605.6714	1188.6352	1978.7941	2724.6846	3387.6806	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	1827.8023	1409.5886	1088.8446	461.2217	102.6838	0.0000	0.0000	0.0000	0.0000	602.9563	1269.9286	1852.8873	(98)
Space heating												8615.9131	(98)
Space heating per m2												64.8984	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)													0.1000	(201)
Fraction of space heat from main system(s)													0.9000	(202)
Efficiency of main space heating system 1 (in %)													90.2000	(206)
Efficiency of secondary/supplementary heating system, %													78.0000	(208)
Space heating requirement													8596.8091	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	1827.8023	1409.5886	1088.8446	461.2217	102.6838	0.0000	0.0000	0.0000	0.0000	602.9563	1269.9286	1852.8873	(98)	
Space heating efficiency (main heating system 1)	90.2000	90.2000	90.2000	90.2000	90.2000	0.0000	0.0000	0.0000	0.0000	90.2000	90.2000	90.2000	(210)	
Space heating fuel (main heating system)	1823.7495	1406.4631	1086.4303	460.1991	102.4561	0.0000	0.0000	0.0000	0.0000	601.6193	1267.1128	1848.7789	(211)	
Water heating requirement	234.3336	180.7165	139.5955	59.1310	13.1646	0.0000	0.0000	0.0000	0.0000	77.3021	162.8114	237.5496	(215)	
Water heating														
Water heating requirement	205.5250	180.5660	188.2569	166.8498	162.1241	142.8753	135.3259	151.1019	151.6517	173.1072	185.4446	199.9358	(64)	
Efficiency of water heater	89.9036	89.8677	89.7706	89.4389	88.5265	87.6000	87.6000	87.6000	87.6000	89.5571	89.8278	89.9143	(216)	
Fuel for water heating, kWh/month	228.6059	200.9243	209.7088	186.5517	183.1363	163.0996	154.4816	172.4907	173.1184	193.2925	206.4446	222.3626	(219)	
Water heating fuel used												2294.2171	(219)	
Annual totals kWh/year														
Space heating fuel - main system												8596.8091	(211)	
Space heating fuel - secondary												1104.6042	(215)	
Electricity for pumps and fans:														
central heating pump													30.0000	(230c)
main heating flue fan													45.0000	(230e)
Total electricity for the above, kWh/year													75.0000	(231)
Electricity for lighting (calculated in Appendix L)													473.9304	(232)
Total delivered energy for all uses													12544.5608	(238)

10a. Fuel costs - using BEDF prices (514)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	8596.8091	9.7400	837.3292	(240)
Space heating - secondary	1104.6042	10.2500	113.2219	(242)
Water heating (other fuel)	2294.2171	9.7400	223.4567	(247)
Pumps and fans for heating	75.0000	36.8500	27.6375	(249)
Energy for lighting	473.9304	36.8500	174.6433	(250)
Additional standing charges			104.0000	(251)
Total energy cost			1480.2887	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	8596.8091	0.2160	1856.9108	(261)
Space heating - secondary	1104.6042	0.0190	20.9875	(263)
Water heating (other fuel)	2294.2171	0.2160	495.5509	(264)
Space and water heating			2373.4491	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	473.9304	0.5190	245.9699	(268)
Total kg/year			2658.3440	(272)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	8596.8091	1.2200	10488.1071	(261)
Space heating - secondary	1104.6042	1.0400	1148.7884	(263)
Water heating (other fuel)	2294.2171	1.2200	2798.9449	(264)

FULL SAP CALCULATION PRINTOUT

Calculation Type: Existing Dwelling

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Space and water heating			14435.8403 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	473.9304	3.0700	1454.9663 (268)
Primary energy kWh/year			16121.0567 (272)
Primary energy kWh/m2/year			121.4301 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: C 78
Current environmental impact rating: C 78

(For testing purposes):

A Loft insulation	Not considered
B Cavity wall insulation	Not considered
C Hot water cylinder insulation	Not considered
D Draughtproofing	Not considered
E Low energy lighting	Already installed
F Cylinder thermostat	Not considered
G Heating controls	Not considered
H Heating controls	Not considered
I Condensing boiler	Not considered
J Biomass boiler	Not considered
K Biomass stove with boiler	Not considered
M Replacement warm air unit	Not considered
N Solar water heating	SAP increase too small
O Double glazing	Not considered
P Secondary glazing	Not considered
R Condensing oil boiler	Not considered
S Condensing boiler	Not considered
T Gas condensing boiler	Not considered
U Solar photovoltaic panels	Recommended
A2 Flat roof insulation	Not considered
A3 Room-in-roof insulation	Not considered
T2 Flue gas heat recovery	Not considered
W Floor insulation	Not considered
X High performance external doors	Not considered
Y Heat recovery system for mixer showers	Not considered
J2 Biomass boiler	Not considered
Q2 External and cavity wall insulation	Not considered
Z1 Air or ground source heat pump	Not considered
Z2 Air or ground source heat pump with underfloor heating	Not considered
Z3 Micro CHP	Not considered
Z4	Not considered
Z5	Not considered
V2 Wind turbine	Not applicable
L2 High heat retention storage heaters	Not considered
Q3 System built wall insulation	Not considered
O3	Not considered

Recommended measures:	SAP change	Cost change	CO2 change
U Solar photovoltaic panels	+ 7.5	-£ 601	-847 kg (31.8%)

Measures omitted - SAP change or cost saving too small:			
N Solar water heating	+ 1.0	-£ 79	-189 kg (7.1%)

Recommended measures	Typical annual savings		Energy efficiency	Environmental impact
Solar photovoltaic panels	£601	6.38 kg/m²	B 85	B 84
Total Savings	£601	6.38 kg/m²		

Potential energy efficiency rating: B 85
Potential environmental impact rating: B 84

Fuel prices for cost data on this page from database revision number 514 TEST (30 Mar 2023)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, West Pennines (England)):

	Current	Potential	Saving
Electricity	£202	£202	£0
Mains gas	£1165	£1165	£0
Wood	£113	£113	£0
Space heating	£1082	£1082	£0
Water heating	£223	£223	£0
Lighting	£175	£175	£0
Generated (PV)	-£0	-£601	£601
Total cost of fuels	£1480	£879	£601
Total cost of uses	£1480	£879	£601
Delivered energy	94 kWh/m²	82 kWh/m²	12 kWh/m²
Carbon dioxide emissions	2.7 tonnes	1.8 tonnes	0.8 tonnes
CO2 emissions per m²	20 kg/m²	14 kg/m²	6 kg/m²
Primary energy	121 kWh/m²	84 kWh/m²	38 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: Existing Dwelling

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR Existing dwelling (SAP) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Basement floor	30.2200 (1a)	x 2.8000 (2a)	= 84.6160 (1a) - (3a)
Ground floor	44.5000 (1b)	x 2.5900 (2b)	= 115.2550 (1b) - (3b)
First floor	38.6600 (1c)	x 2.6000 (2c)	= 100.5160 (1c) - (3c)
Second floor	19.3800 (1d)	x 1.8100 (2d)	= 35.0778 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	132.7600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 335.4648 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.0894 (8)
Number of storeys in the dwelling (ns)					4 (9)
Additional infiltration					[(9) - 1] x 0.1 = 0.3000 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction					0.3500 (11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0					0.0000 (12)
If no draught lobby, enter 0.05, else enter 0					0.0500 (13)
Percentage of windows and doors draught stripped					100.0000 (14)
Window infiltration					0.25 - [0.2 * (14) / 100] = 0.0500 (15)
Pressure test					No
Measured/design AP50					15.0000
Infiltration rate					0.8394 (18)
Number of sides sheltered					2 (19)
Shelter factor					(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor					(21) = (18) x (20) = 0.7135 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.9097	0.8919	0.8741	0.7849	0.7670	0.6778	0.6778	0.6600	0.7135	0.7670	0.8027	0.8384 (22b)
Effective ac	0.9138	0.8977	0.8820	0.8080	0.7942	0.7297	0.7297	0.7178	0.7546	0.7942	0.8222	0.8514 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Existing Windows (Uw = 1.80)			13.3700	1.6791	22.4496		(27)
New Windows (Uw = 1.60)			14.5700	1.5038	21.9098		(27)
New Roof Windows (Uw = 1.60)			7.6600	1.5038	11.5188		(27a)
Basement Floor			30.2200	0.1400	4.2308		(28a)
Extension Floor			14.2800	0.2100	2.9988		(28a)
Existing Wall	46.8000	14.7500	32.0500	1.7000	54.4850		(29a)
Basement Wall upgraded	63.4200		63.4200	0.1200	7.6104		(29a)
Extension Wall	18.7200	7.5200	11.2000	0.2500	2.8000		(29a)
Stud to Loft	4.5600		4.5600	0.2700	1.2312		(29a)
Dormer Cheek	11.3700	5.6700	5.7000	0.2600	1.4820		(29a)
Protected Ceiling	8.3600		8.3600	0.1300	1.0868		(30)
Slope Ceiling	7.6000	2.7600	4.8400	0.1700	0.8228		(30)
Flat Roof Dormer	10.6400		10.6400	0.1700	1.8088		(30)
Ceiling over Bed 3	8.5200		8.5200	0.1400	1.1928		(30)
Glazed Roof	4.9000	4.9000	0.0000	0.1800	0.0000		(30)
Total net area of external elements Aum(A, m ²)			229.3900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	135.6276		(33)
Party Wall			150.1800	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							450.0000 (35)
Thermal bridges (Default value 0.150 * total exposed area)							34.4085 (36)
Total fabric heat loss						(33) + (36) =	170.0361 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	101.1613	99.3824	97.6388	89.4491	87.9168	80.7838	80.7838	79.4629	83.5314	87.9168	91.0166	Dec 2572 (38)
Heat transfer coeff	271.1974	269.4185	267.6749	259.4852	257.9529	250.8199	250.8199	249.4990	253.5675	257.9529	261.0527	264.2933 (39)
Average = Sum(39)m / 12 =												259.4778 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	2.0428	2.0294	2.0162	1.9545	1.9430	1.8893	1.8893	1.8793	1.9100	1.9430	1.9664	Dec 1.9908 (40)
HLP (average)												1.9545 (40)
Days in month												

FULL SAP CALCULATION PRINTOUT

Calculation Type: Existing Dwelling

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)												

Assumed occupancy												2.9018 (42)
Average daily hot water use (litres/day)												108.5452 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	119.3997	115.0579	110.7161	106.3743	102.0325	97.6906	97.6906	102.0325	106.3743	110.7161	115.0579	119.3997 (44)
Energy content (annual)	177.0663	154.8633	159.8050	139.3219	133.6827	115.3580	106.8961	122.6649	124.1299	144.6614	157.9093	171.4792 (45)
Distribution loss (46)m = 0.15 x (45)m	26.5599	23.2295	23.9708	20.8983	20.0524	17.3037	16.0344	18.3997	18.6195	21.6992	23.6864	25.7219 (46)
Water storage loss:												
Total storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	28.4588	25.7027	28.4519	27.5279	28.4414	27.5173	28.4297	28.4370	27.5219	28.4458	27.5354	28.4565 (61)
Total heat required for water heating calculated for each month	205.5250	180.5660	188.2569	166.8498	162.1241	142.8753	135.3259	151.1019	151.6517	173.1072	185.4446	199.9358 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	205.5250	180.5660	188.2569	166.8498	162.1241	142.8753	135.3259	151.1019	151.6517	173.1072	185.4446	199.9358 (64)
Heat gains from water heating, kWh/month	65.9892	57.9177	60.2481	53.2065	51.5598	45.2359	42.6504	47.8953	48.1537	55.2114	59.3887	64.1310 (65)

5. Internal gains (see Table 5 and 5a)												

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	174.1084	174.1084	174.1084	174.1084	174.1084	174.1084	174.1084	174.1084	174.1084	174.1084	174.1084	174.1084 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	67.0898	59.5885	48.4606	36.6878	27.4246	23.1530	25.0176	32.5188	43.6467	55.4195	64.6828	68.9544 (67)
Appliances gains (calculated in Appendix L13 or L13a), also see Table 5	449.2794	453.9415	442.1931	417.1822	385.6104	355.9374	336.1140	331.4519	343.2003	368.2112	399.7830	429.4560 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.3126	55.3126	55.3126	55.3126	55.3126	55.3126	55.3126	55.3126	55.3126	55.3126	55.3126	55.3126 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-116.0723	-116.0723	-116.0723	-116.0723	-116.0723	-116.0723	-116.0723	-116.0723	-116.0723	-116.0723	-116.0723	-116.0723 (71)
Water heating gains (Table 5)	88.6952	86.1871	80.9787	73.8979	69.3009	62.8276	57.3258	64.3754	66.8801	74.2088	82.4843	86.1976 (72)
Total internal gains	721.4131	716.0659	687.9812	644.1168	598.6847	558.2668	534.8062	544.6950	570.0759	614.1883	663.2988	700.9567 (73)

6. Solar gains												

[Jan]	Area	Solar flux	g	FF	Access	Gains						
	m2	Table 6a	Specific data	factor	Table 6d	W						
		W/m2	or Table 6b	or Table 6c								
East	11.0400	19.6403	0.6300	0.7000	0.7700	66.2656 (76)						
West	2.3300	19.6403	0.6300	0.7000	0.7700	13.9854 (80)						
East	1.3800	19.6403	0.6300	0.7000	0.7700	8.2832 (76)						
West	13.1900	19.6403	0.6300	0.7000	0.7700	79.1706 (80)						
East	2.7600	26.6072	0.6300	0.7000	1.0000	29.1467 (82)						
South	4.9000	34.8864	0.6300	0.7000	1.0000	67.8474 (82)						
Solar gains	264.6990	518.2575	856.8382	1258.2737	1551.9011	1593.5120	1515.0554	1294.4416	999.0452	615.6351	330.0754	217.6879 (83)
Total gains	986.1121	1234.3234	1544.8194	1902.3905	2150.5857	2151.7787	2049.8616	1839.1366	1569.1211	1229.8234	993.3742	918.6446 (84)

7. Mean internal temperature (heating season)												

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	61.1916	61.5956	61.9968	63.9536	64.3334	66.1630	66.1630	66.5133	65.4461	64.3334	63.5695	62.7901
alpha	5.0794	5.1064	5.1331	5.2636	5.2889	5.4109	5.4109	5.4342	5.3631	5.2889	5.2380	5.1860
util living area	0.9997	0.9988	0.9947	0.9705	0.8832	0.7002	0.5295	0.6050	0.8849	0.9912	0.9992	0.9998 (86)
MIT	19.6036	19.7748	20.0735	20.4857	20.8011	20.9605	20.9927	20.9860	20.8557	20.4173	19.9530	19.6048 (87)
Th 2	19.3050	19.3138	19.3225	19.3638	19.3716	19.4082	19.4082	19.4150	19.3940	19.3716	19.3559	19.3395 (88)
util rest of house	0.9994	0.9980	0.9908	0.9484	0.8040	0.5495	0.3429	0.4071	0.7705	0.9814	0.9985	0.9996 (89)
MIT 2	18.0897	18.2675	18.5711	19.0016	19.2722	19.3987	19.4076	19.4136	19.3407	18.9513	18.4791	18.1181 (90)
Living area fraction	18.2224	18.3996	18.7028	19.1317	19.4062	19.5356	19.5466	19.5515	19.4736	19.0798	18.6083	0.0877 (91)
MIT	18.2224	18.3996	18.7028	19.1317	19.4062	19.5356	19.5466	19.5515	19.4736	19.0798	18.6083	18.2484 (92)
Temperature adjustment	18.2224	18.3996	18.7028	19.1317	19.4062	19.5356	19.5466	19.5515	19.4736	19.0798	18.6083	0.0000
adjusted MIT	18.2224	18.3996	18.7028	19.1317	19.4062	19.5356	19.5466	19.5515	19.4736	19.0798	18.6083	18.2484 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: Existing Dwelling

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9992	0.9973	0.9886	0.9440	0.8061	0.5627	0.3596	0.4251	0.7779	0.9786	0.9980	0.9995	(94)
Useful gains	985.3161	1231.0466	1527.2030	1795.8995	1733.6733	1210.7651	737.1644	781.8246	1220.5999	1203.5096	991.3526	918.1502	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	3775.7261	3637.0538	3266.3842	2654.9734	1987.8431	1237.9540	739.0606	786.2891	1362.5612	2187.4018	3004.2763	3712.9059	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	2076.0650	1616.8368	1293.9508	618.5332	189.1023	0.0000	0.0000	0.0000	0.0000	732.0158	1449.3051	2079.2983	(98)
Space heating												10055.1074	(98)
Space heating per m2												(98) / (4) =	75.7390 (99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)													0.1000 (201)
Fraction of space heat from main system(s)													0.9000 (202)
Efficiency of main space heating system 1 (in %)													90.2000 (206)
Efficiency of secondary/supplementary heating system, %													78.0000 (208)
Space heating requirement													10032.8123 (211)
Space heating requirement	2076.0650	1616.8368	1293.9508	618.5332	189.1023	0.0000	0.0000	0.0000	0.0000	732.0158	1449.3051	2079.2983	(98)
Space heating efficiency (main heating system 1)	90.2000	90.2000	90.2000	90.2000	90.2000	0.0000	0.0000	0.0000	0.0000	90.2000	90.2000	90.2000	(210)
Space heating fuel (main heating system)	2071.4618	1613.2518	1291.0817	617.1617	188.6830	0.0000	0.0000	0.0000	0.0000	730.3927	1446.0915	2074.6879	(211)
Water heating requirement	266.1622	207.2868	165.8911	79.2991	24.2439	0.0000	0.0000	0.0000	0.0000	93.8482	185.8083	266.5767	(215)
Water heating requirement	205.5250	180.5660	188.2569	166.8498	162.1241	142.8753	135.3259	151.1019	151.6517	173.1072	185.4446	199.9358	(64)
Efficiency of water heater	89.9355	89.9054	89.8290	89.5868	88.9126	87.6000	87.6000	87.6000	87.6000	89.6464	89.8680	89.9423	(217)
Fuel for water heating, kWh/month	228.5250	200.8399	209.5726	186.2437	182.3411	163.0996	154.4816	172.4907	173.1184	193.1001	206.3523	222.2933	(219)
Water heating fuel used												2292.4584	(219)
Annual totals kWh/year													
Space heating fuel - main system												10032.8123	(211)
Space heating fuel - secondary												1289.1163	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												473.9304	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.50 * 1080 * 0.80) =									-1727.2394			-1727.2394	(233)
Total delivered energy for all uses												12436.0780	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	10032.8123	3.4800	349.1419	(240)
Space heating - secondary	1289.1163	4.2300	54.5296	(242)
Water heating (other fuel)	2292.4584	3.4800	79.7776	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	473.9304	13.1900	62.5114	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-1727.2394	13.1900	-227.8229	(252)
Total energy cost			448.0301	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):			0.4200 (256)
Energy cost factor (ECF)		[(255) x (256)] / [(4) + 45.0] =	1.0586 (257)
SAP value			85.2329
SAP rating (Section 12)			85 (258)
SAP band			B

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	10032.8123	0.2160	2167.0875	(261)

FULL SAP CALCULATION PRINTOUT

Calculation Type: Existing Dwelling

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Space heating - secondary	1289.1163	0.0190	24.4932 (263)
Water heating (other fuel)	2292.4584	0.2160	495.1710 (264)
Space and water heating			2686.7517 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	473.9304	0.5190	245.9699 (268)
Energy saving/generation technologies			
PV Unit	-1727.2394	0.5190	-896.4372 (269)
Total kg/year			2075.2093 (272)
CO2 emissions per m2			15.6300 (273)
EI value			84.3565
EI rating			84 (274)
EI band			B

FULL SAP CALCULATION PRINTOUT

Calculation Type: Existing Dwelling

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR Existing dwelling (SAP) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Basement floor	30.2200 (1a)	x 2.8000 (2a)	= 84.6160 (1a) - (3a)
Ground floor	44.5000 (1b)	x 2.5900 (2b)	= 115.2550 (1b) - (3b)
First floor	38.6600 (1c)	x 2.6000 (2c)	= 100.5160 (1c) - (3c)
Second floor	19.3800 (1d)	x 1.8100 (2d)	= 35.0778 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	132.7600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 335.4648 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.0894 (8)
Number of storeys in the dwelling (ns)					4 (9)
Additional infiltration					[(9) - 1] x 0.1 = 0.3000 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction					0.3500 (11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0					0.0000 (12)
If no draught lobby, enter 0.05, else enter 0					0.0500 (13)
Percentage of windows and doors draught stripped					100.0000 (14)
Window infiltration					0.25 - [0.2 * (14) / 100] = 0.0500 (15)
Pressure test					No
Measured/design AP50					15.0000
Infiltration rate					0.8394 (18)
Number of sides sheltered					2 (19)
Shelter factor					(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor					(21) = (18) x (20) = 0.7135 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.3000	4.2000	4.2000	3.9000	4.0000	3.4000	3.3000	3.3000	3.4000	3.8000	3.8000	3.9000 (22)
Wind factor	1.0750	1.0500	1.0500	0.9750	1.0000	0.8500	0.8250	0.8250	0.8500	0.9500	0.9500	0.9750 (22a)
Adj infilt rate	0.7670	0.7492	0.7492	0.6957	0.7135	0.6065	0.5886	0.5886	0.6065	0.6778	0.6778	0.6957 (22b)
Effective ac	0.7942	0.7806	0.7806	0.7420	0.7546	0.6839	0.6733	0.6733	0.6839	0.7297	0.7297	0.7420 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Existing Windows (Uw = 1.80)			13.3700	1.6791	22.4496		(27)
New Windows (Uw = 1.60)			14.5700	1.5038	21.9098		(27)
New Roof Windows (Uw = 1.60)			7.6600	1.5038	11.5188		(27a)
Basement Floor			30.2200	0.1400	4.2308		(28a)
Extension Floor			14.2800	0.2100	2.9988		(28a)
Existing Wall	46.8000	14.7500	32.0500	1.7000	54.4850		(29a)
Basement Wall upgraded	63.4200		63.4200	0.1200	7.6104		(29a)
Extension Wall	18.7200	7.5200	11.2000	0.2500	2.8000		(29a)
Stud to Loft	4.5600		4.5600	0.2700	1.2312		(29a)
Dormer Cheek	11.3700	5.6700	5.7000	0.2600	1.4820		(29a)
Protected Ceiling	8.3600		8.3600	0.1300	1.0868		(30)
Slope Ceiling	7.6000	2.7600	4.8400	0.1700	0.8228		(30)
Flat Roof Dormer	10.6400		10.6400	0.1700	1.8088		(30)
Ceiling over Bed 3	8.5200		8.5200	0.1400	1.1928		(30)
Glazed Roof	4.9000	4.9000	0.0000	0.1800	0.0000		(30)
Total net area of external elements Aum(A, m ²)			229.3900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	135.6276		(33)
Party Wall			150.1800	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							450.0000 (35)
Thermal bridges (Default value 0.150 * total exposed area)							34.4085 (36)
Total fabric heat loss						(33) + (36) =	170.0361 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	87.9168	86.4198	86.4198	82.1400	83.5314	75.7115	74.5315	74.5315	75.7115	80.7838	80.7838	82.1400 (38)
Heat transfer coeff	257.9529	256.4559	256.4559	252.1761	253.5675	245.7476	244.5676	244.5676	245.7476	250.8199	250.8199	252.1761 (39)
Average = Sum(39)m / 12 =												250.9212 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.9430	1.9317	1.9317	1.8995	1.9100	1.8511	1.8422	1.8422	1.8511	1.8893	1.8893	1.8995 (40)
HLP (average)												1.8900 (40)
Days in month												

FULL SAP CALCULATION PRINTOUT

Calculation Type: Existing Dwelling

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)												

Assumed occupancy												2.9018 (42)
Average daily hot water use (litres/day)												108.5452 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	119.3997	115.0579	110.7161	106.3743	102.0325	97.6906	97.6906	102.0325	106.3743	110.7161	115.0579	119.3997 (44)
Energy content (annual)	177.0663	154.8633	159.8050	139.3219	133.6827	115.3580	106.8961	122.6649	124.1299	144.6614	157.9093	171.4792 (45)
Distribution loss (46)m = 0.15 x (45)m	26.5599	23.2295	23.9708	20.8983	20.0524	17.3037	16.0344	18.3997	18.6195	21.6992	23.6864	25.7219 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	28.4588	25.7027	28.4519	27.5279	28.4414	27.5173	28.4297	28.4370	27.5219	28.4458	27.5354	28.4565 (61)
Total heat required for water heating calculated for each month	205.5250	180.5660	188.2569	166.8498	162.1241	142.8753	135.3259	151.1019	151.6517	173.1072	185.4446	199.9358 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	205.5250	180.5660	188.2569	166.8498	162.1241	142.8753	135.3259	151.1019	151.6517	173.1072	185.4446	199.9358 (64)
Heat gains from water heating, kWh/month	65.9892	57.9177	60.2481	53.2065	51.5598	45.2359	42.6504	47.8953	48.1537	55.2114	59.3887	64.1310 (65)

5. Internal gains (see Table 5 and 5a)												

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	174.1084	174.1084	174.1084	174.1084	174.1084	174.1084	174.1084	174.1084	174.1084	174.1084	174.1084	174.1084 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	67.0898	59.5885	48.4606	36.6878	27.4246	23.1530	25.0176	32.5188	43.6467	55.4195	64.6828	68.9544 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	449.2794	453.9415	442.1931	417.1822	385.6104	355.9374	336.1140	331.4519	343.2003	368.2112	399.7830	429.4560 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.3126	55.3126	55.3126	55.3126	55.3126	55.3126	55.3126	55.3126	55.3126	55.3126	55.3126	55.3126 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-116.0723	-116.0723	-116.0723	-116.0723	-116.0723	-116.0723	-116.0723	-116.0723	-116.0723	-116.0723	-116.0723	-116.0723 (71)
Water heating gains (Table 5)	88.6952	86.1871	80.9787	73.8979	69.3009	62.8276	57.3258	64.3754	66.8801	74.2088	82.4843	86.1976 (72)
Total internal gains	721.4131	716.0659	687.9812	644.1168	598.6847	558.2668	534.8062	544.6950	570.0759	614.1883	663.2988	700.9567 (73)

6. Solar gains												

[Jan]	Area	Solar flux	g	FF	Access	Gains						
	m2	Table 6a	Specific data	Specific data	factor	W						
		W/m2	or Table 6b	or Table 6c	Table 6d							
East	11.0400	17.3606	0.6300	0.7000	0.7700	58.5740 (76)						
West	2.3300	17.3606	0.6300	0.7000	0.7700	12.3621 (80)						
East	1.3800	17.3606	0.6300	0.7000	0.7700	7.3218 (76)						
West	13.1900	17.3606	0.6300	0.7000	0.7700	69.9811 (80)						
East	2.7600	23.5284	0.6300	0.7000	1.0000	25.7740 (82)						
South	4.9000	30.8318	0.6300	0.7000	1.0000	59.9620 (82)						

Solar gains	233.9750	469.9353	811.7230	1215.7650	1462.4658	1537.2645	1426.4061	1203.2441	972.4506	587.2554	299.8406	196.7999 (83)
Total gains	955.3881	1186.0011	1499.7042	1859.8818	2061.1504	2095.5313	1961.2123	1747.9390	1542.5264	1201.4437	963.1394	897.7566 (84)

7. Mean internal temperature (heating season)												

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	64.3334	64.7090	64.7090	65.8072	65.4461	67.5286	67.8545	67.8545	67.5286	66.1630	66.1630	65.8072
alpha	5.2889	5.3139	5.3139	5.3871	5.3631	5.5019	5.5236	5.5236	5.5019	5.4109	5.4109	5.3871
util living area	0.9996	0.9988	0.9935	0.9600	0.8414	0.6035	0.4579	0.5368	0.8478	0.9888	0.9991	0.9998 (86)
MIT	19.7576	19.9184	20.2037	20.5946	20.8723	20.9848	20.9972	20.9937	20.9033	20.5016	20.0698	19.7454 (87)
Th 2	19.3716	19.3792	19.3792	19.4012	19.3940	19.4345	19.4406	19.4406	19.4345	19.4082	19.4082	19.4012 (88)
util rest of house	0.9994	0.9978	0.9885	0.9287	0.7355	0.4353	0.2668	0.3270	0.7075	0.9754	0.9982	0.9996 (89)
MIT 2	18.2964	18.4629	18.7456	19.1338	19.3418	19.4323	19.4405	19.4403	19.4055	19.0632	18.6375	18.3077 (90)
Living area fraction	18.4245	18.5905	18.8735	19.2618	19.4760	19.5684	19.5770	19.5765	19.5368	19.1893	18.7631	18.4338 (92)
MIT	18.4245	18.5905	18.8735	19.2618	19.4760	19.5684	19.5770	19.5765	19.5368	19.1893	18.7631	18.4338 (92)
Temperature adjustment	18.4245	18.5905	18.8735	19.2618	19.4760	19.5684	19.5770	19.5765	19.5368	19.1893	18.7631	18.4338 (93)
adjusted MIT	18.4245	18.5905	18.8735	19.2618	19.4760	19.5684	19.5770	19.5765	19.5368	19.1893	18.7631	18.4338 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: Existing Dwelling

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9991	0.9971	0.9862	0.9249	0.7420	0.4504	0.2838	0.3459	0.7190	0.9725	0.9977	0.9994	(94)
Useful gains	954.5673	1182.5960	1478.9412	1720.2450	1529.4502	943.8940	556.5015	604.5352	1109.0004	1168.3690	960.8948	897.2407	(95)
Ext temp.	5.2000	5.8000	7.4000	9.9000	12.9000	15.7000	17.3000	17.1000	14.7000	11.3000	7.9000	5.0000	(96)
Heat loss rate W	3411.2908	3280.1981	2942.4419	2360.8307	1667.4661	950.6449	556.8823	605.6714	1188.6352	1978.7941	2724.6846	3387.6806	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	1827.8023	1409.5886	1088.8446	461.2217	102.6838	0.0000	0.0000	0.0000	0.0000	602.9563	1269.9286	1852.8873	(98)
Space heating												8615.9131	(98)
Space heating per m2												64.8984	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)													0.1000	(201)
Fraction of space heat from main system(s)													0.9000	(202)
Efficiency of main space heating system 1 (in %)													90.2000	(206)
Efficiency of secondary/supplementary heating system, %													78.0000	(208)
Space heating requirement													8596.8091	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	1827.8023	1409.5886	1088.8446	461.2217	102.6838	0.0000	0.0000	0.0000	0.0000	602.9563	1269.9286	1852.8873	(98)	
Space heating efficiency (main heating system 1)	90.2000	90.2000	90.2000	90.2000	90.2000	0.0000	0.0000	0.0000	0.0000	90.2000	90.2000	90.2000	(210)	
Space heating fuel (main heating system)	1823.7495	1406.4631	1086.4303	460.1991	102.4561	0.0000	0.0000	0.0000	0.0000	601.6193	1267.1128	1848.7789	(211)	
Water heating requirement	234.3336	180.7165	139.5955	59.1310	13.1646	0.0000	0.0000	0.0000	0.0000	77.3021	162.8114	237.5496	(215)	
Water heating														
Water heating requirement	205.5250	180.5660	188.2569	166.8498	162.1241	142.8753	135.3259	151.1019	151.6517	173.1072	185.4446	199.9358	(64)	
Efficiency of water heater	89.9036	89.8677	89.7706	89.4389	88.5265	87.6000	87.6000	87.6000	87.6000	89.5571	89.8278	89.9143	(217)	
Fuel for water heating, kWh/month	228.6059	200.9243	209.7088	186.5517	183.1363	163.0996	154.4816	172.4907	173.1184	193.2925	206.4446	222.3626	(219)	
Water heating fuel used												2294.2171	(219)	
Annual totals kWh/year														
Space heating fuel - main system												8596.8091	(211)	
Space heating fuel - secondary												1104.6042	(215)	
Electricity for pumps and fans:														
central heating pump													30.0000	(230c)
main heating flue fan													45.0000	(230e)
Total electricity for the above, kWh/year													75.0000	(231)
Electricity for lighting (calculated in Appendix L)													473.9304	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 2.50 * 1020 * 0.80) =										-1631.2354		-1631.2354	(233)	
Total delivered energy for all uses												10913.3254	(238)	

10a. Fuel costs - using BEDF prices (\$14)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	8596.8091	9.7400	837.3292	(240)
Space heating - secondary	1104.6042	10.2500	113.2219	(242)
Water heating (other fuel)	2294.2171	9.7400	223.4567	(247)
Pumps and fans for heating	75.0000	36.8500	27.6375	(249)
Energy for lighting	473.9304	36.8500	174.6433	(250)
Additional standing charges			104.0000	(251)
Energy saving/generation technologies				
PV Unit	-1631.2354	36.8500	-601.1102	(252)
Total energy cost			879.1785	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	8596.8091	0.2160	1856.9108	(261)
Space heating - secondary	1104.6042	0.0190	20.9875	(263)
Water heating (other fuel)	2294.2171	0.2160	495.5509	(264)
Space and water heating			2373.4491	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	473.9304	0.5190	245.9699	(268)
Energy saving/generation technologies				
PV Unit	-1631.2354	0.5190	-846.6112	(269)
Total kg/year			1811.7328	(272)

FULL SAP CALCULATION PRINTOUT

Calculation Type: Existing Dwelling

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	8596.8091	1.2200	10488.1071	(261)
Space heating - secondary	1104.6042	1.0400	1148.7884	(263)
Water heating (other fuel)	2294.2171	1.2200	2798.9449	(264)
Space and water heating			14435.8403	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	473.9304	3.0700	1454.9663	(268)
Energy saving/generation technologies				
PV Unit	-1631.2354	3.0700	-5007.8927	(269)
Primary energy kWh/year			11113.1640	(272)
Primary energy kWh/m2/year			83.7087	(273)

Appendix (C)

Notional Allowable Area of Glazing U Value Calculations Condensation Risk Analysis

5. Notional Allowable Area of Glazing

5.1. The following calculation has been performed to determine the “Notional” allowable glazed area

5.2. Proposed Floor Area of Extension

$$14.28 + 19.38 = 33.66 \text{ m}^2$$

5.3. 25% of extension floor area

$$8.42 \text{ m}^2$$

5.4. Area of existing openings removed / covered as a result of the extension

$$6.20 \text{ m}^2$$

5.5. Notional allowable area of windows, roof windows and doors (25% of floor area + openings removed – split between roof and walls)

$$14.62 / 2 = 7.31 \text{ m}^2$$

5.6. Actual Area of windows and doors in the proposed extension

$$\text{Walls} = 14.57 \text{ m}^2$$

$$\text{Roof} = 7.66 \text{ m}^2$$

The area of glazing in the proposed extension exceeds the notional allowable area permitted under section L1B : Paragraph 4.2 / L1 : Paragraph 10.7 (d)

U-VALUE CALCULATOR REPORT

Property Reference	A998-0001-23-42	Issued on Date	07/05/2023
Assessment Reference	Proposed	Prop Type Ref	Extension
Project	24 Brookfield Avenue, MANCHESTER, M21 8TX		
Calculation Type	Existing Dwelling		

SAP Rating	78 C	DER	N/A	TER	N/A
Environmental	78 C	% DER<TER	N/A		
CO ₂ Emissions (t/year)	2.66	DFEE	N/A	TFEE	N/A
General Requirements Compliance	N/A	% DFEE<TFEE	N/A		

Assessor Details	Mr. Andrew Underwood, AC Systems, Tel: 07870 638476, info@sap-calculations.co.uk	Assessor ID	A998-0001
Client			

Building Elements

Roof Protected Flat Ceiling - Pitched roof - insulated at ceiling

Roof Type: Pitched Roof, insulated flat ceiling

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)	Density (kg/m ³)	Heat Cap. (J/kgK)
Ext surface				0.0400			
Layer 1	Roof space						
	Main construction	0	0.0000	0.0000	100.00		
Layer 2	Mineral wool quilt						
	Main construction	200	0.0400	5.0000	100.00		
	Corrections - Air Gap: Level 0, Fasteners: None or plastic						
Layer 3	Mineral wool quilt						
	Main construction	100	0.0400	2.5000	87.50		
	Main construction	100	0.1300	0.7692	12.50		
	Corrections - Air Gap: Level 0, Fasteners: None or plastic						
Layer 4	Plasterboard, standard						
	Main construction	12.5	0.2100	0.0595	100.00	700	1000
Int surface				0.1000			

Total resistance: Upper limit = 7.430 m² K/W Lower limit = 7.151 m² K/W Average = 7.290 m² K/W
Total correction = 0.0000 m² K/W U-value (unrounded) = 0.13 W/m² K

Unheated space: RoomInRoof

Total thickness: 313 mm

U-value: 0.13 W/m² K

Kappa: 9.10 kJ/m² K

U-VALUE CALCULATOR REPORT

Property Reference	A998-0001-23-42	Issued on Date	07/05/2023
Assessment Reference	Proposed	Prop Type Ref	Extension
Project	24 Brookfield Avenue, MANCHESTER, M21 8TX		
Calculation Type	Existing Dwelling		

SAP Rating	78 C	DER	N/A	TER	N/A
Environmental	78 C	% DER<TER	N/A		
CO ₂ Emissions (t/year)	2.66	DFEE	N/A	TFEE	N/A
General Requirements Compliance	N/A	% DFEE<TFEE	N/A		

Assessor Details	Mr. Andrew Underwood, AC Systems, Tel: 07870 638476, info@sap-calculations.co.uk	Assessor ID	A998-0001
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Building Elements

Roof Slope Ceilings - pitched roof - insulated slope, sloping

Roof Type: Pitched Roof, insulated sloping ceiling

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)	Density (kg/m ³)	Heat Cap. (J/kgK)
Ext surface				0.1000			
Layer 1	Tiles, clay						
	Main construction	15	1.0000	0.0000	100.00		
Layer 2	Air layer ventilated						
	Main construction	25	0.2500	0.0000	100.00		
	Corrections - Cavity Ventilated, Emissivity: Normal						
Layer 3	Breather membrane						
	Main construction	0.5	0.0000	0.0000	100.00		
Layer 4	Air layer ventilated						
	Main construction	50	0.1096	0.4562	87.50		
	Main construction	50	0.1300	0.3846	12.50		
	Corrections - Cavity Unventilated, Emissivity: Normal						
Layer 5	Celotex / Rafters						
	Main construction	100	0.0220	4.5455	87.50		
	Main construction	100	0.1300	0.7692	12.50		
	Corrections - Air Gap: Level 0, Fasteners: None or plastic						
Layer 6	Celotex PL4040 [52.5mm]						
	Main construction	52.5	0.0284	1.8500	100.00	30	1400
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Int surface				0.1000			

Total resistance:	Upper limit = 6.153 m ² K/W	Lower limit = 5.313 m ² K/W	Average = 5.733 m ² K/W
	Total correction = 0.0010 m ² K/W	U-value (unrounded) = 0.17 W/m ² K	

Unheated space: None

Total thickness: 243 mm

U-value: 0.17 W/m² K

Kappa: 0.00 kJ/m² K

U-VALUE CALCULATOR REPORT

Property Reference	A998-0001-23-42	Issued on Date	07/05/2023
Assessment Reference	Proposed	Prop Type Ref	Extension
Project	24 Brookfield Avenue, MANCHESTER, M21 8TX		
Calculation Type	Existing Dwelling		

SAP Rating	78 C	DER	N/A	TER	N/A
Environmental	78 C	% DER<TER	N/A		
CO ₂ Emissions (t/year)	2.66	DFEE	N/A	TFEE	N/A
General Requirements Compliance	N/A	% DFEE<TFEE	N/A		

Assessor Details	Mr. Andrew Underwood, AC Systems, Tel: 07870 638476, info@sap-calculations.co.uk	Assessor ID	A998-0001
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Building Elements

Roof Flat Roof Dormer - Flat roof insulation between timber joists

Roof Type: Flat Roof standard (no precipitation)

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)	Density (kg/m ³)	Heat Cap. (J/kgK)
Ext surface				0.0400			
Layer 1	Code 5 Lead						
	Main construction	10	35.0000	0.0003	100.00		
Layer 2	Breather membrane						
	Main construction	1	0.0000	0.0000	100.00		
Layer 3	Plywood						
	Main construction	19	0.1300	0.1462	100.00		
Layer 4	Thermapitch TP10						
	Main construction	125	0.0220	5.6818	100.00		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 5	Plywood						
	Main construction	6	0.1300	0.0462	100.00		
Layer 6	Joist Void						
	Main construction	100	0.6250	0.1600	87.50		
	Main construction	100	0.1300	0.7692	12.50		
	Corrections - Cavity Unventilated, Emissivity: Normal						
Layer 7	Polythene, 1200 gauge						
	Main construction	3	0.0000	0.0000	100.00		
Layer 8	Plasterboard, standard						
	Main construction	12.5	0.2100	0.0595	100.00	700	1000
Int surface				0.1000			

Total resistance:	Upper limit = 6.304 m ² K/W	Lower limit = 6.252 m ² K/W	Average = 6.278 m ² K/W
	Total correction = 0.0082 m ² K/W	U-value (unrounded) = 0.17 W/m ² K	

Unheated space: None

Total thickness: 277 mm

U-value: 0.17 W/m² K

Kappa: 9.10 kJ/m² K

U-VALUE CALCULATOR REPORT

Property Reference	A998-0001-23-42	Issued on Date	07/05/2023
Assessment Reference	Proposed	Prop Type Ref	Extension
Project	24 Brookfield Avenue, MANCHESTER, M21 8TX		
Calculation Type	Existing Dwelling		

SAP Rating	78 C	DER	N/A	TER	N/A
Environmental	78 C	% DER<TER	N/A		
CO ₂ Emissions (t/year)	2.66	DFEE	N/A	TFEE	N/A
General Requirements Compliance	N/A	% DFEE<TFEE	N/A		

Assessor Details	Mr. Andrew Underwood, AC Systems, Tel: 07870 638476, info@sap-calculations.co.uk	Assessor ID	A998-0001
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Client	
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Building Elements

Roof Flat Ceilings - Pitched roof - insulated at ceiling

Roof Type: Pitched Roof, insulated flat ceiling

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)	Density (kg/m ³)	Heat Cap. (J/kgK)
Ext surface				0.0400			
Layer 1	Roof space						
	Main construction	0	0.0000	0.0000	100.00		
Layer 2	Mineral wool quilt						
	Main construction	200	0.0400	5.0000	100.00		
	Corrections - Air Gap: Level 0, Fasteners: None or plastic						
Layer 3	Mineral wool quilt						
	Main construction	100	0.0400	2.5000	87.50		
	Main construction	100	0.1300	0.7692	12.50		
	Corrections - Air Gap: Level 0, Fasteners: None or plastic						
Layer 4	Plasterboard, standard						
	Main construction	12.5	0.2100	0.0595	100.00	700	1000
Int surface				0.1000			

Total resistance:	Upper limit = 7.430 m ² K/W	Lower limit = 7.151 m ² K/W	Average = 7.290 m ² K/W
	Total correction = 0.0000 m ² K/W	U-value (unrounded) = 0.14 W/m ² K	

Unheated space: None

Total thickness: 313 mm

U-value: 0.14 W/m² K

Kappa: 9.10 kJ/m² K

U-VALUE CALCULATOR REPORT

Property Reference	A998-0001-23-42	Issued on Date	07/05/2023
Assessment Reference	Proposed	Prop Type Ref	Extension
Project	24 Brookfield Avenue, MANCHESTER, M21 8TX		
Calculation Type	Existing Dwelling		

SAP Rating	78 C	DER	N/A	TER	N/A
Environmental	78 C	% DER<TER	N/A		
CO ₂ Emissions (t/year)	2.66	DFEE	N/A	TFEE	N/A
General Requirements Compliance	N/A	% DFEE<TFEE	N/A		

Assessor Details	Mr. Andrew Underwood, AC Systems, Tel: 07870 638476, info@sap-calculations.co.uk	Assessor ID	A998-0001
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Client	
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Building Elements

Wall Basement Wall - Masonry wall partial cavity fill

Wall Type: Basement Wall

Floor Area = 22.51 m², Floor Perimeter = 14.25 m

Floor Resistance = 0.100 m²K/W

Depth of floor below ground level = 2.38 m

Soil= Unknown

Earth Conductivity = 2.00 W(m.K)

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)	Density (kg/m ³)	Heat Cap. (J/kgK)
Ext surface				0.0400			
Layer 1	Brick, outer leaf						
	Main construction	220	0.7700	0.2857	82.81		
	Main construction	220	0.9407	0.2339	17.19		
Layer 2	Retained Cavity						
	Main construction	40	0.0601	0.6651	100.00		
	Corrections - Cavity Unventilated, Emissivity: Normal						
Layer 3	Kooltherm K8 Cavity Board (45mm +)						
	Main construction	90	0.0200	4.5000	100.00		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 4	Gyproc Wallboard (12.5mm)						
	Main construction	12.5	0.1900	0.0658	100.00	700	1000
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Int surface				0.1300			

Total resistance:	Upper limit = 5.508 m ² K/W	Lower limit = 5.506 m ² K/W	Average = 5.507 m ² K/W
	Total correction = 0.0067 m ² K/W	U-value (unrounded) = 0.12 W/m ² K	

Unheated space: None

Total thickness: 363 mm

U-value: 0.12 W/m² K

Kappa: 9.10 kJ/m² K

U-VALUE CALCULATOR REPORT

Property Reference	A998-0001-23-42	Issued on Date	07/05/2023
Assessment Reference	Proposed	Prop Type Ref	Extension
Project	24 Brookfield Avenue, MANCHESTER, M21 8TX		
Calculation Type	Existing Dwelling		

SAP Rating	78 C	DER	N/A	TER	N/A
Environmental	78 C	% DER<TER	N/A		
CO ₂ Emissions (t/year)	2.66	DFEE	N/A	TFEE	N/A
General Requirements Compliance	N/A	% DFEE<TFEE	N/A		

Assessor Details	Mr. Andrew Underwood, AC Systems, Tel: 07870 638476, info@sap-calculations.co.uk	Assessor ID	A998-0001
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Client	
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Building Elements

Wall Extension Wall - Masonry wall full cavity fill-slabs

Wall Type: Standard Wall

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)
Ext surface				0.0400	
Layer 1	Brick, outer leaf				
	Main construction	100	0.7700	0.1299	82.81
	Main construction	100	0.9407	0.1063	17.19
Layer 2	Retained Cavity				
	Main construction	50	0.0752	0.6651	100.00
	Corrections - Cavity Unventilated, Emissivity: Normal				
Layer 3	Kooltherm K8 Cavity Board (45mm +)				
	Main construction	50	0.0200	2.5000	100.00
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 4	Fibolite 3.6N				
	Main construction	100	0.2400	0.4167	93.43
	Main construction	100	0.8803	0.1136	6.57
Layer 5	airspace/plaster dabs				
	Main construction	15	0.0882	0.1700	80.00
	Main construction	15	0.0882	0.1700	20.00
	Corrections - Cavity Unventilated, Emissivity: Normal				
Layer 6	Gyproc Wallboard (12.5mm)				
	Main construction	12.5	0.1900	0.0658	100.00
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Int surface				0.1300	

Total resistance:	Upper limit = 4.092 m ² K/W	Lower limit = 4.051 m ² K/W	Average = 4.071 m ² K/W
	Total correction = 0.0038 m ² K/W	U-value (unrounded) = 0.25 W/m ² K	

Unheated space: None

Total thickness: 328 mm

U-value: 0.25 W/m² K

Kappa: n/a

U-VALUE CALCULATOR REPORT

Property Reference	A998-0001-23-42	Issued on Date	07/05/2023
Assessment Reference	Proposed	Prop Type Ref	Extension
Project	24 Brookfield Avenue, MANCHESTER, M21 8TX		
Calculation Type	Existing Dwelling		

SAP Rating	78 C	DER	N/A	TER	N/A
Environmental	78 C	% DER<TER	N/A		
CO ₂ Emissions (t/year)	2.66	DFEE	N/A	TFEE	N/A
General Requirements Compliance	N/A	% DFEE<TFEE	N/A		

Assessor Details	Mr. Andrew Underwood, AC Systems, Tel: 07870 638476, info@sap-calculations.co.uk	Assessor ID	A998-0001
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Client	
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Building Elements

Wall Stud to Loft - Loft Stud Wall

Wall Type: Standard Wall

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)	Density (kg/m ³)	Heat Cap. (J/kgK)
Ext surface				0.0400			
Layer 1	insulation/timber frame						
	Main construction	100	0.0220	4.5455	87.50		
	Main construction	100	0.1200	0.8333	12.50		
	Corrections - Air Gap: Level 0, Fasteners: None or plastic						
Layer 2	Plasterboard, standard						
	Main construction	12.5	0.2100	0.0595	100.00	700	1000
Int surface				0.1300			

Total resistance: Upper limit = 3.324 m² K/W Lower limit = 3.149 m² K/W Average = 3.237 m² K/W
Total correction = 0.0000 m² K/W U-value (unrounded) = 0.27 W/m² K

Unheated space: RoomInRoof

Total thickness: 113 mm

U-value: 0.27 W/m² K

Kappa: 9.10 kJ/m² K

U-VALUE CALCULATOR REPORT

Property Reference	A998-0001-23-42	Issued on Date	07/05/2023
Assessment Reference	Proposed	Prop Type Ref	Extension
Project	24 Brookfield Avenue, MANCHESTER, M21 8TX		
Calculation Type	Existing Dwelling		

SAP Rating	78 C	DER	N/A	TER	N/A
Environmental	78 C	% DER<TER	N/A		
CO ₂ Emissions (t/year)	2.66	DFEE	N/A	TFEE	N/A
General Requirements Compliance	N/A	% DFEE<TFEE	N/A		

Assessor Details	Mr. Andrew Underwood, AC Systems, Tel: 07870 638476, info@sap-calculations.co.uk	Assessor ID	A998-0001
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Client	
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Building Elements

Wall Dormer Cheeks - Timber framed insulation between studs

Wall Type: Standard Wall

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)	Density (kg/m ³)	Heat Cap. (J/kgK)
Ext surface				0.0400			
Layer 1	Code 5 Lead						
	Main construction	10	35.0000	0.0003	100.00		
Layer 2	Breather membrane						
	Main construction	1	0.0000	0.0000	100.00		
Layer 3	Plywood						
	Main construction	12	0.1300	0.0923	100.00		
Layer 4	Thermapitch TP10						
	Main construction	125	0.0220	5.6818	87.50		
	Main construction	125	0.1300	0.9615	12.50		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 5	Polythene, 500 gauge						
	Main construction	0.5	0.0000	0.0000	100.00		
Layer 6	Plasterboard, standard						
	Main construction	12.5	0.2100	0.0595	100.00	700	1000
Int surface				0.1300			

Total resistance: Upper limit = 4.113 m² K/W Lower limit = 3.843 m² K/W Average = 3.978 m² K/W

Total correction = 0.0078 m² K/W

U-value (unrounded) = 0.26 W/m² K

Unheated space: None

Total thickness: 161 mm

U-value: 0.26 W/m² K

Kappa: 9.10 kJ/m² K

U-VALUE CALCULATOR REPORT

Property Reference	A998-0001-23-42	Issued on Date	07/05/2023
Assessment Reference	Proposed	Prop Type Ref	Extension
Project	24 Brookfield Avenue, MANCHESTER, M21 8TX		
Calculation Type	Existing Dwelling		

SAP Rating	78 C	DER	N/A	TER	N/A
Environmental	78 C	% DER<TER	N/A		
CO ₂ Emissions (t/year)	2.66	DFEE	N/A	TFEE	N/A
General Requirements Compliance	N/A	% DFEE<TFEE	N/A		

Assessor Details	Mr. Andrew Underwood, AC Systems, Tel: 07870 638476, info@sap-calculations.co.uk	Assessor ID	A998-0001
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Client	
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Building Elements

Floor Basement Floor

Floor Type: Basement Floor

Area = 45.01 m², Perimeter = 23.90 m, Wall thickness = 300.00 mm, Soil: Unknown

Depth of floor below ground level: 2.380 m

Earth Conductivity = 2.00 W/(m.K)

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)	Density (kg/m ³)	Heat Cap. (J/kgK)
Ext surface				0.0400			
Layer 1	Concrete, dense						
	Main construction	100	2.0000	0.0500	100.00		
Layer 2	Kooltherm K3 Floorboard						
	Main construction	100	0.0200	5.0000	100.00		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 3	Screed						
	Main construction	65	1.1500	0.0565	100.00	1200	1000
Int surface				0.1700			

Total resistance:	Upper limit = 5.317 m ² K/W	Lower limit = 5.317 m ² K/W	Average = 5.317 m ² K/W
	Total correction = 0.0088 m ² K/W	U-value (unrounded) = 0.14 W/m ² K	

Unheated space: None

Total thickness: 265 mm

U-value: 0.14 W/m² K

Kappa: 78.00 kJ/m² K

U-VALUE CALCULATOR REPORT

Property Reference	A998-0001-23-42	Issued on Date	07/05/2023
Assessment Reference	Proposed	Prop Type Ref	Extension
Project	24 Brookfield Avenue, MANCHESTER, M21 8TX		
Calculation Type	Existing Dwelling		

SAP Rating	78 C	DER	N/A	TER	N/A
Environmental	78 C	% DER<TER	N/A		
CO ₂ Emissions (t/year)	2.66	DFEE	N/A	TFEE	N/A
General Requirements Compliance	N/A	% DFEE<TFEE	N/A		

Assessor Details	Mr. Andrew Underwood, AC Systems, Tel: 07870 638476, info@sap-calculations.co.uk	Assessor ID	A998-0001
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Client	
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Building Elements

Floor Extension Floor - floor- suspended timber floor

Floor Type: Suspended Floor

Area = 14.28 m², Perimeter = 7.20 m, Wall thickness = 300.00 mm, Soil: Clay

Depth of underfloor space below ground: 0.200 m Floor wind shielding: Average (suburban)

Floor height above ground: h = 0.200 m

U-value of walls above ground: U_w = 1.500 m

Ventilation openings per perimeter length: e = 0.0015 %

Mean wind speed: v = 5.000 m/s

Resistance on solum: R_g = 0.000 m²K/W

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)
Ext surface				0.1700	
Layer 1	Celotex XR4000				
	Main construction	110	0.0220	5.0000	87.50
	Main construction	110	0.1300	0.8462	12.50
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 2	Chipboard				
	Main construction	19	0.1300	0.1462	100.00
Int surface				0.1700	

Total resistance:	Upper limit = 3.948 m ² K/W	Lower limit = 3.585 m ² K/W	Average = 3.766 m ² K/W
	Total correction = 0.0068 m ² K/W	U-value (unrounded) = 0.21 W/m ² K	

Unheated space: None

Total thickness: 129 mm

U-value: 0.21 W/m² K

Kappa: n/a

CONDENSATION RISK ANALYSIS

Property Reference	A998-0001-23-42			Issued on Date	07/05/2023	
Assessment Reference	Proposed		Prop Type Ref	Extension		
Project	24 Brookfield Avenue, MANCHESTER, M21 8TX					
Calculation Type	Existing Dwelling					
SAP Rating	78 C	DER	N/A	TER	N/A	
Environmental	78 C	% DER<TER	N/A			
CO ₂ Emissions (t/year)	2.66	DFEE	N/A	TFEE	N/A	
General Requirements Compliance	N/A	% DFEE<TFEE	N/A			
Assessor Details	Mr. Andrew Underwood, AC Systems, Tel: 07870 638476, info@sap-calculations.co.uk			Assessor ID	A998-0001	
Client						

Roof - Protected Flat Ceiling

Environmental conditions

External conditions	Temperature:	5	°C	Relative Humidity:	95	%
Internal conditions	Temperature:	15	°C	Relative Humidity:	65	%

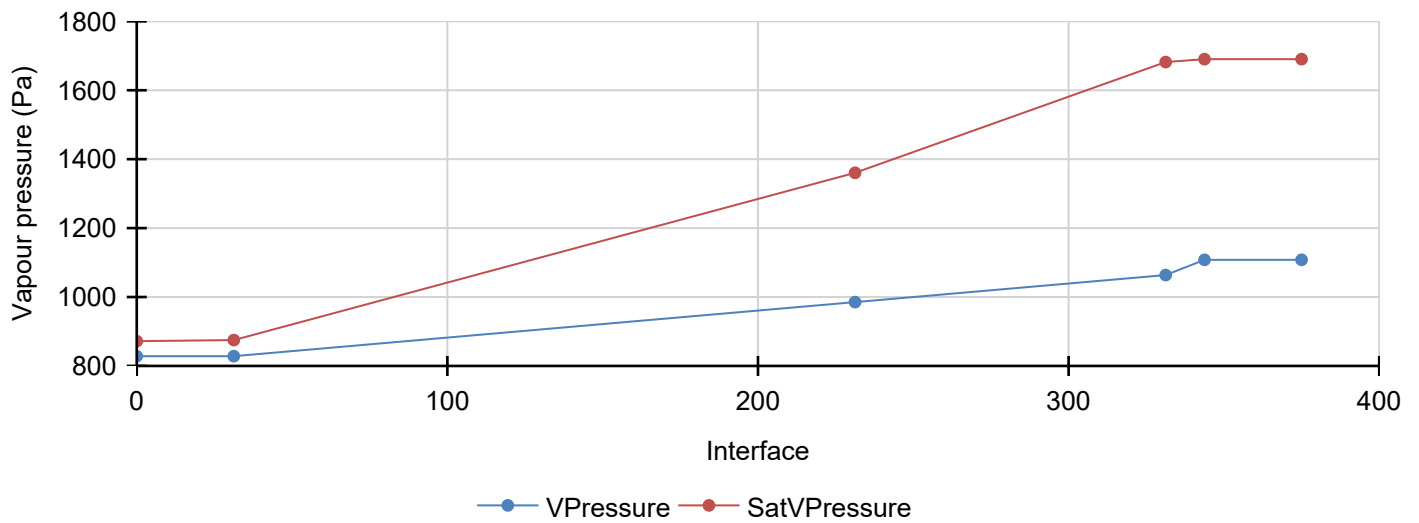
Table of layers

Layer	Thickness mm	Thermal conduct. W/m.K	Thermal resistance m ² .K/W	Cumulative thermal resistance m ² .K/W	Vapour resistivity GN.s/kg.m	Vapour resistance GN.s/kg.m	Cumulative vapour resistance GN.s/kg.m
External surface	-	0.0000	0.0400	0.0400	0.0	0.00	0.00
1.Roof space	-	0.0000	0.0000	0.0400	0.0	0.00	0.00
2.Mineral wool quilt	200.0	0.0400	5.0000	5.0400	10.0	2.00	2.00
3.Mineral wool quilt	100.0	0.0400	2.5000	7.5400	10.0	1.00	3.00
4.Plasterboard, standard	12.5	0.2100	0.0595	7.5995	45.0	0.56	3.56
Internal surface	-	0.0000	0.1000	7.5995	0.0	0.00	3.56

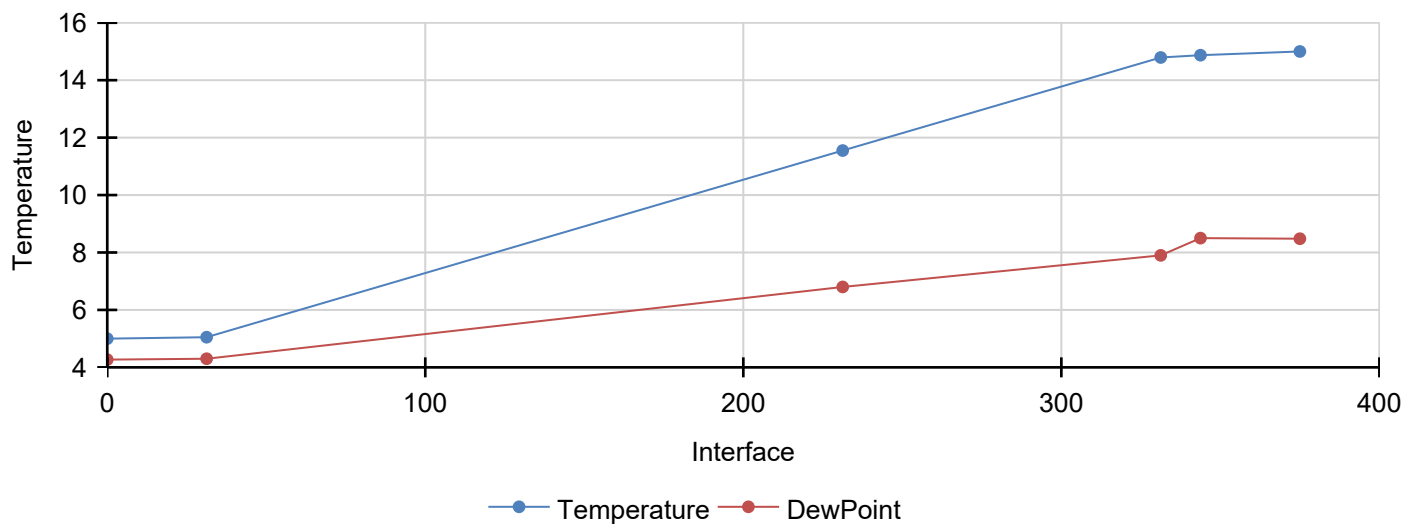
Vapour pressure table

Interface - between layers	Interface temp. °C	Vapour pressure Pa	Satur. vapour pressure Pa	Dew point °C	Cond. rate g/m ² h	Cond. rate 60 days g/m ² h	Cond. risk Y/N
External surface	5.00	828.3	871.9	4.27	0.00	0.00	No
1. External surface / Roof space	5.05	828.3	875.0	4.3	0.00	0.00	No
2. Roof space / Mineral wool quilt	5.05	828.3	875.0	4.3	0.28	406.85	No
3. Mineral wool quilt / Mineral wool quilt	11.55	985.2	1360.4	6.8	0.00	0.00	No
4. Mineral wool quilt / Plasterboard, standard	14.79	1063.7	1681.8	7.9	0.00	0.00	No
Plasterboard, standard / Internal surface	14.87	1107.9	1690.2	8.5	0.00	0.00	No
Internal surface	15.00	1107.9	1690.2	8.48	0.00	0.00	No

CONDENSATION RISK ANALYSIS



Interface temperature / Dew point graphical representation



CONDENSATION RISK ANALYSIS

Roof - Slope Ceilings

Environmental conditions

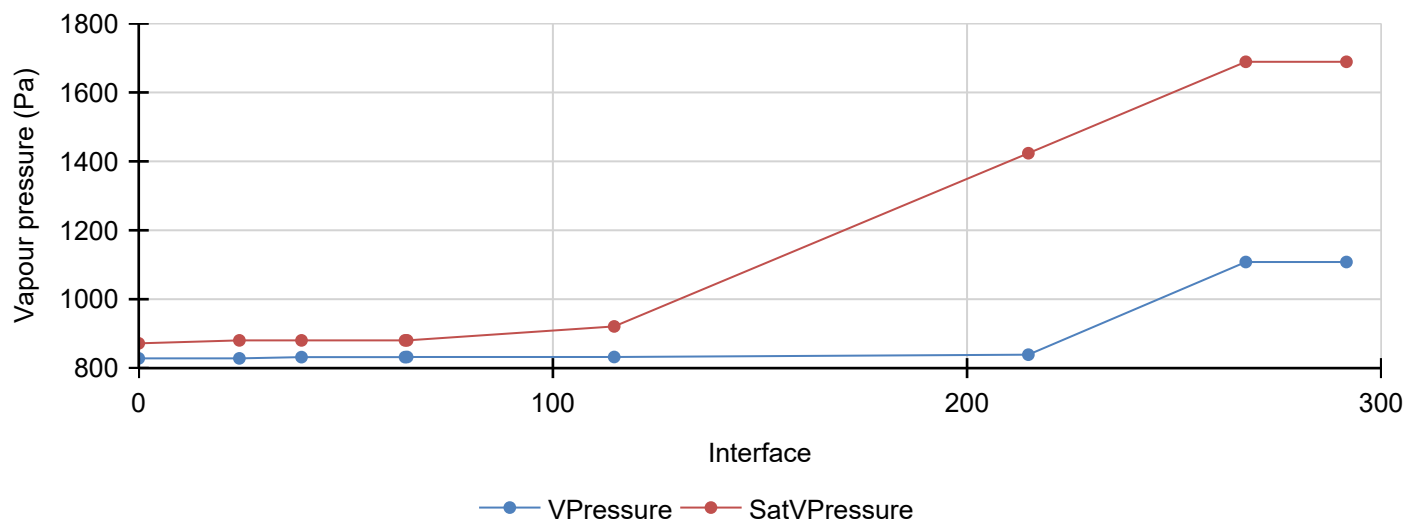
External conditions Temperature: °C Relative Humidity: %
Internal conditions Temperature: °C Relative Humidity: %

Table of layers

Layer	Thickness mm	Thermal conduct. W/m.K	Thermal resistance m².K/W	Cumulative thermal resistance m².K/W	Vapour resistivity GN.s/kg.m	Vapour resistance GN.s/kg.m	Cumulative vapour resistance GN.s/kg.m
External surface	-	0.0000	0.1000	0.1000	0.0	0.00	0.00
1.Tiles, clay	15.0	1.0000	0.0000	0.1000	270.0	4.05	4.05
2.Air layer ventilated	25.0	0.0000	0.0000	0.1000	0.0	0.00	4.05
3.Breather membrane	0.5	0.0000	0.0000	0.1000	0.000	0.40	4.45
4.Air layer ventilated	50.0	0.0000	0.4562	0.5562	0.0	0.00	4.45
5.Celotex / Rafters	100.0	0.0220	4.5455	5.1016	75.0	7.50	11.95
6.Celotex PL4040 [52.5mm]	52.5	0.0000	1.8500	6.9516	0.000	300.00	311.95
Internal surface	-	0.0000	0.1000	6.9516	0.0	0.00	311.95

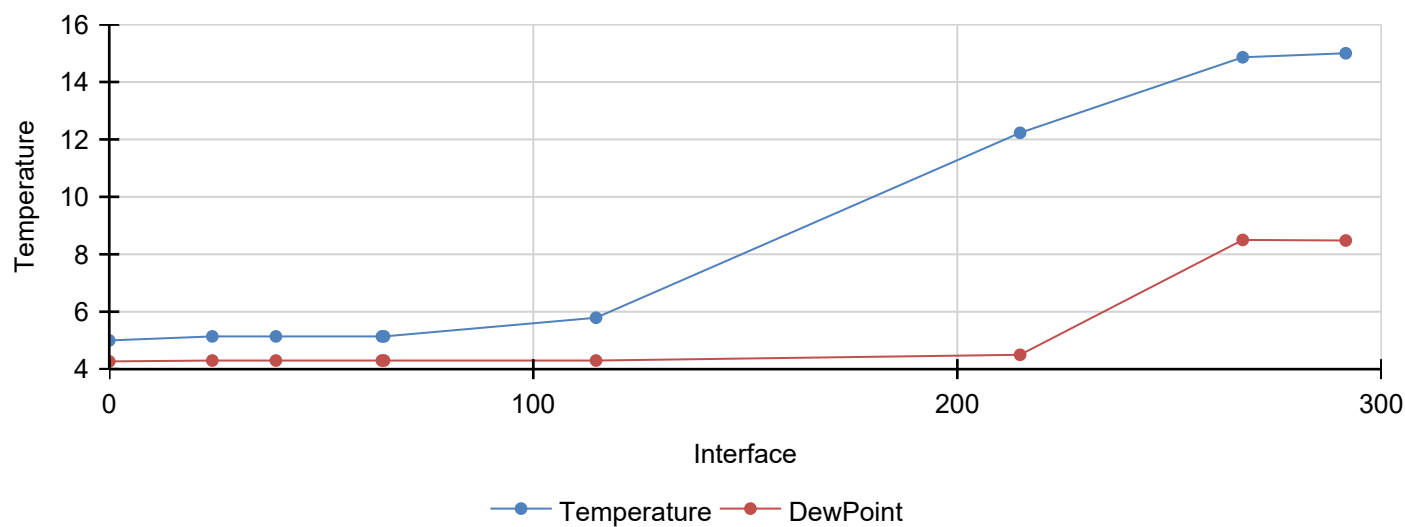
Vapour pressure table

Interface - between layers	Interface temp. °C	Vapour pressure Pa	Satur. vapour pressure Pa	Dew point °C	Cond. rate g/m² h	Cond. rate 60 days g/m² h	Cond. risk Y/N
External surface	5.00	828.3	871.9	4.27	0.00	0.00	No
1. External surface / Tiles, clay	5.14	828.3	880.5	4.3	0.00	0.00	No
2. Tiles, clay / Air layer ventilated	5.14	831.9	880.5	4.3	0.00	0.00	No
3. Air layer ventilated / Breather membrane	5.14	831.9	880.5	4.3	0.00	0.00	No
4. Breather membrane / Air layer ventilated	5.14	832.3	880.5	4.3	0.00	0.00	No
5. Air layer ventilated / Celotex / Rafters	5.79	832.3	921.0	4.3	0.00	0.00	No
6. Celotex / Rafters / Celotex PL4040 [52.5mm]	12.23	839.0	1423.6	4.5	0.00	0.00	No
Celotex PL4040 [52.5mm] / Internal surface	14.86	1107.9	1688.9	8.5	0.00	0.00	No
Internal surface	15.00	1107.9	1688.9	8.48	0.00	0.00	No



Interface temperature / Dew point graphical representation

CONDENSATION RISK ANALYSIS



CONDENSATION RISK ANALYSIS

Roof - Flat Roof Dormer

Environmental conditions

External conditions Temperature: °C Relative Humidity: %
Internal conditions Temperature: °C Relative Humidity: %

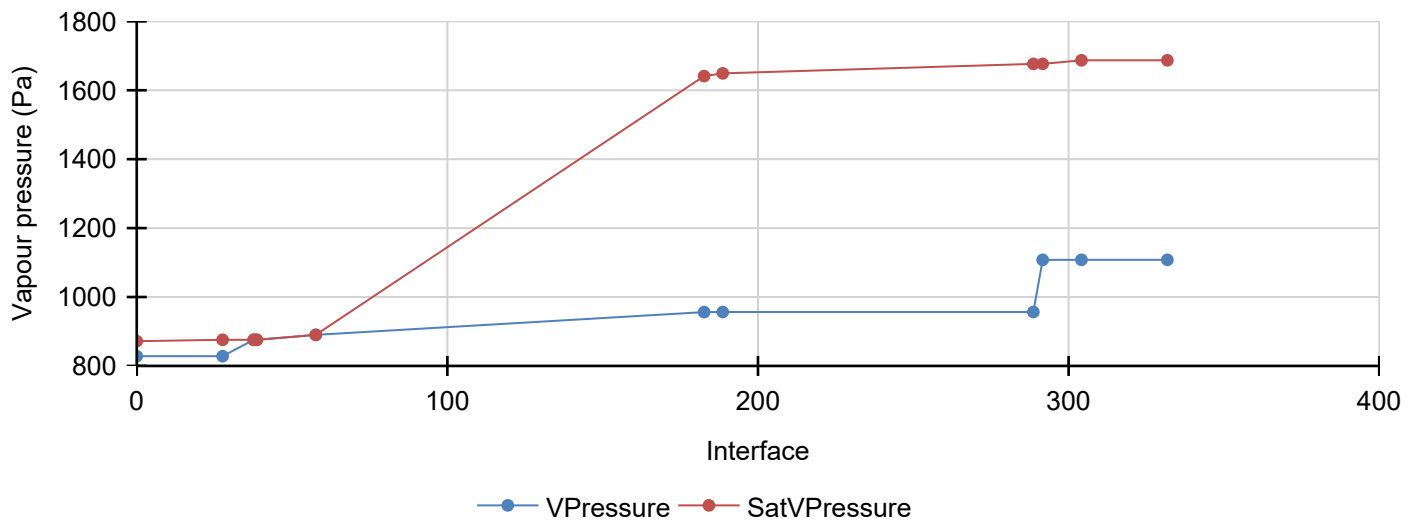
Table of layers

Layer	Thickness mm	Thermal conduct. W/m.K	Thermal resistance m².K/W	Cumulative thermal resistance m².K/W	Vapour resistivity GN.s/kg.m	Vapour resistance GN.s/kg.m	Cumulative vapour resistance GN.s/kg.m
External surface	-	0.0000	0.0400	0.0400	0.0	0.00	0.00
1.Code 5 Lead	10.0	35.0000	0.0003	0.0403	100000.0	1000.00	1000.00
2.Breather membrane	1.0	0.0000	0.0000	0.0403	0.000	0.40	1000.40
3.Plywood	19.0	0.1300	0.1462	0.1864	100.0	1.90	1002.30
4.Thermapitch TP10	125.0	0.0220	5.6818	5.8683	100.0	12.50	1014.80
5.Plywood	6.0	0.1300	0.0462	5.9144	450.0	2.70	1017.50
6.Joist Void	100.0	0.0000	0.1600	6.0744	0.0	0.00	1017.50
7.Polythene,1200 gauge	3.0	0.0000	0.0000	6.0744	0.000	1200.00	2217.50
8.Plasterboard, standard	12.5	0.2100	0.0595	6.1339	45.0	0.56	2218.06
Internal surface	-	0.0000	0.1000	6.1339	0.0	0.00	2218.06

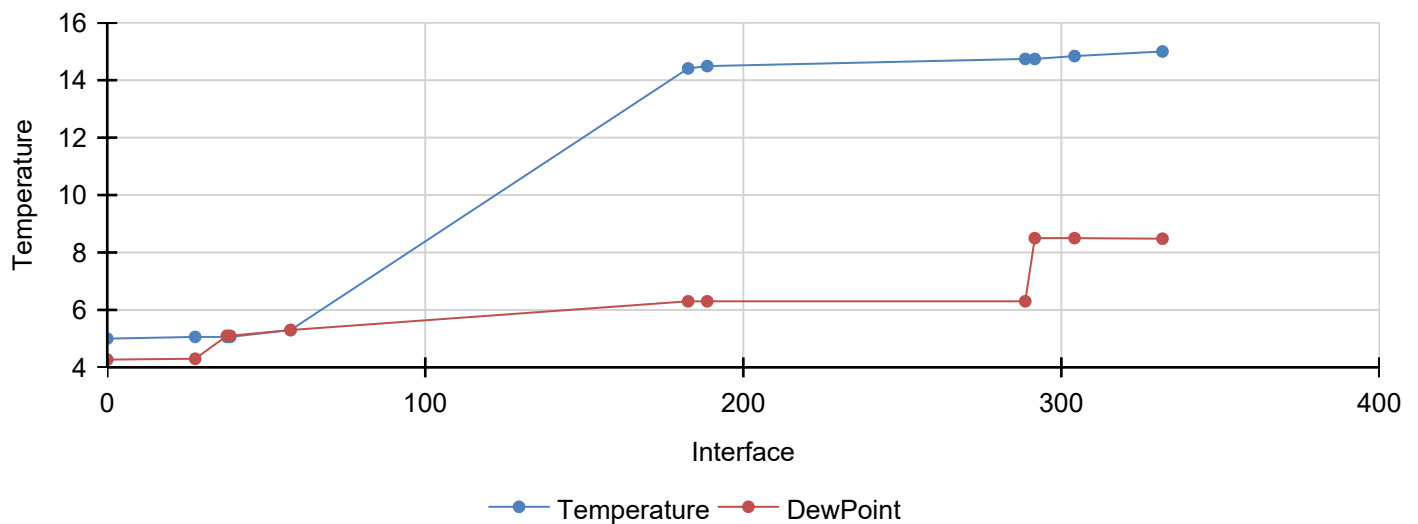
Vapour pressure table

Interface - between layers	Interface temp. °C	Vapour pressure Pa	Satur. vapour pressure Pa	Dew point °C	Cond. rate g/m² h	Cond. rate 60 days g/m² h	Cond. risk Y/N
External surface	5.00	828.3	871.9	4.27	0.00	0.00	No
1. External surface / Code 5 Lead	5.06	828.3	875.8	4.3	0.00	0.00	No
2. Code 5 Lead / Breather membrane	5.06	875.8	875.8	5.1	0.00	0.74	Yes
3. Breather membrane / Plywood	5.06	875.8	875.8	5.1	0.00	0.74	Yes
4. Plywood / Thermapitch TP10	5.30	890.2	890.2	5.3	0.00	0.61	Yes
5. Thermapitch TP10 / Plywood	14.41	956.2	1641.1	6.3	0.00	0.00	No
6. Plywood / Joist Void	14.49	956.5	1649.0	6.3	0.00	0.00	No
7. Joist Void / Polythene,1200 gauge	14.74	956.5	1676.5	6.3	0.00	0.00	No
8. Polythene,1200 gauge / Plasterboard, standard	14.74	1107.8	1676.5	8.5	0.00	0.00	No
Plasterboard, standard / Internal surface	14.84	1107.9	1686.9	8.5	0.00	0.00	No
Internal surface	15.00	1107.9	1686.9	8.48	0.00	0.00	No

CONDENSATION RISK ANALYSIS



Interface temperature / Dew point graphical representation



CONDENSATION RISK ANALYSIS

Roof - Flat Ceilings

Environmental conditions

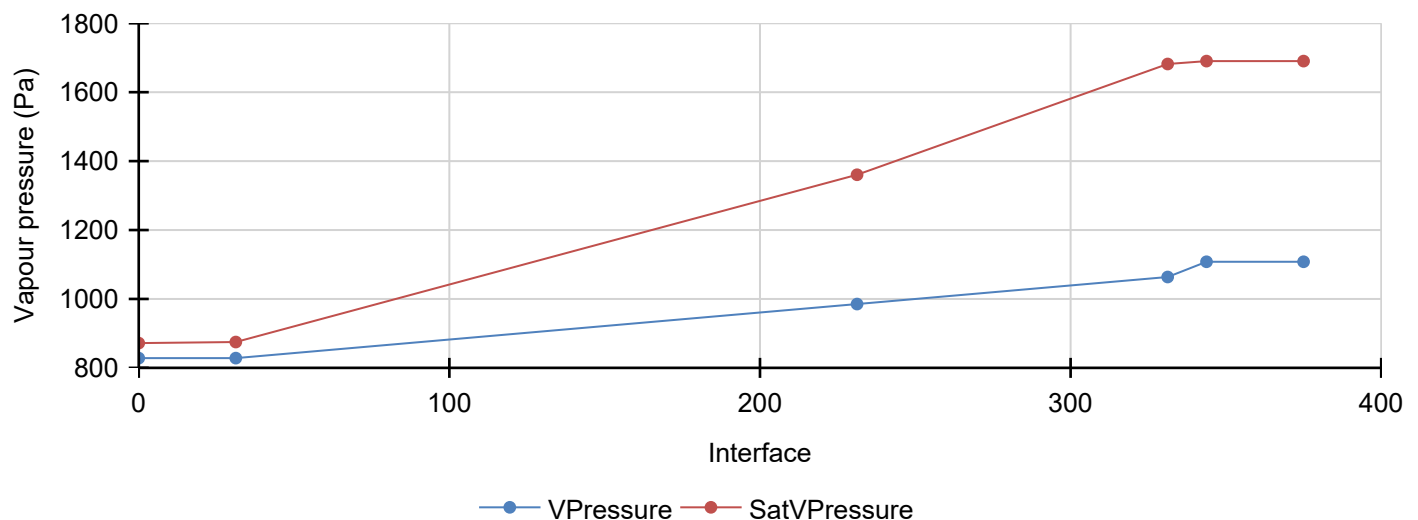
External conditions Temperature: °C Relative Humidity: %
Internal conditions Temperature: °C Relative Humidity: %

Table of layers

Layer	Thickness mm	Thermal conduct. W/m.K	Thermal resistance m².K/W	Cumulative thermal resistance m².K/W	Vapour resistivity GN.s/kg.m	Vapour resistance GN.s/kg.m	Cumulative vapour resistance GN.s/kg.m
External surface	-	0.0000	0.0400	0.0400	0.0	0.00	0.00
1.Roof space	-	0.0000	0.0000	0.0400	0.0	0.00	0.00
2.Mineral wool quilt	200.0	0.0400	5.0000	5.0400	10.0	2.00	2.00
3.Mineral wool quilt	100.0	0.0400	2.5000	7.5400	10.0	1.00	3.00
4.Plasterboard, standard	12.5	0.2100	0.0595	7.5995	45.0	0.56	3.56
Internal surface	-	0.0000	0.1000	7.5995	0.0	0.00	3.56

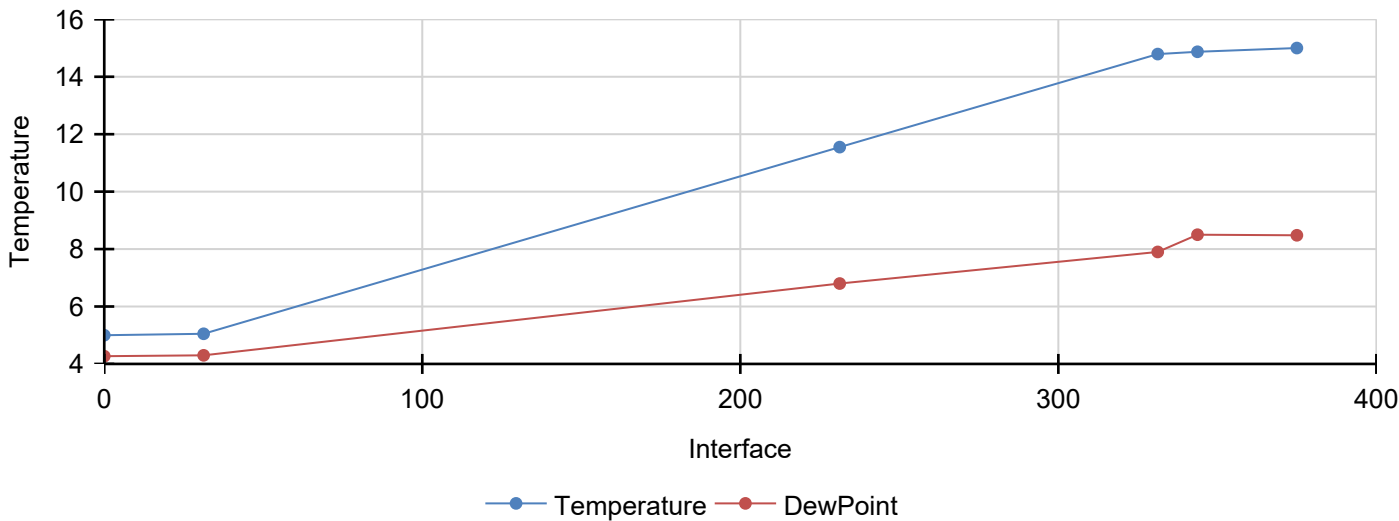
Vapour pressure table

Interface - between layers	Interface temp. °C	Vapour pressure Pa	Satur. vapour pressure Pa	Dew point °C	Cond. rate g/m² h	Cond. rate 60 days g/m² h	Cond. risk Y/N
External surface	5.00	828.3	871.9	4.27	0.00	0.00	No
1. External surface / Roof space	5.05	828.3	875.0	4.3	0.00	0.00	No
2. Roof space / Mineral wool quilt	5.05	828.3	875.0	4.3	0.28	406.85	No
3. Mineral wool quilt / Mineral wool quilt	11.55	985.2	1360.4	6.8	0.00	0.00	No
4. Mineral wool quilt / Plasterboard, standard	14.79	1063.7	1681.8	7.9	0.00	0.00	No
Plasterboard, standard / Internal surface	14.87	1107.9	1690.2	8.5	0.00	0.00	No
Internal surface	15.00	1107.9	1690.2	8.48	0.00	0.00	No



Interface temperature / Dew point graphical representation

CONDENSATION RISK ANALYSIS



CONDENSATION RISK ANALYSIS

Wall - Basement Wall

Environmental conditions

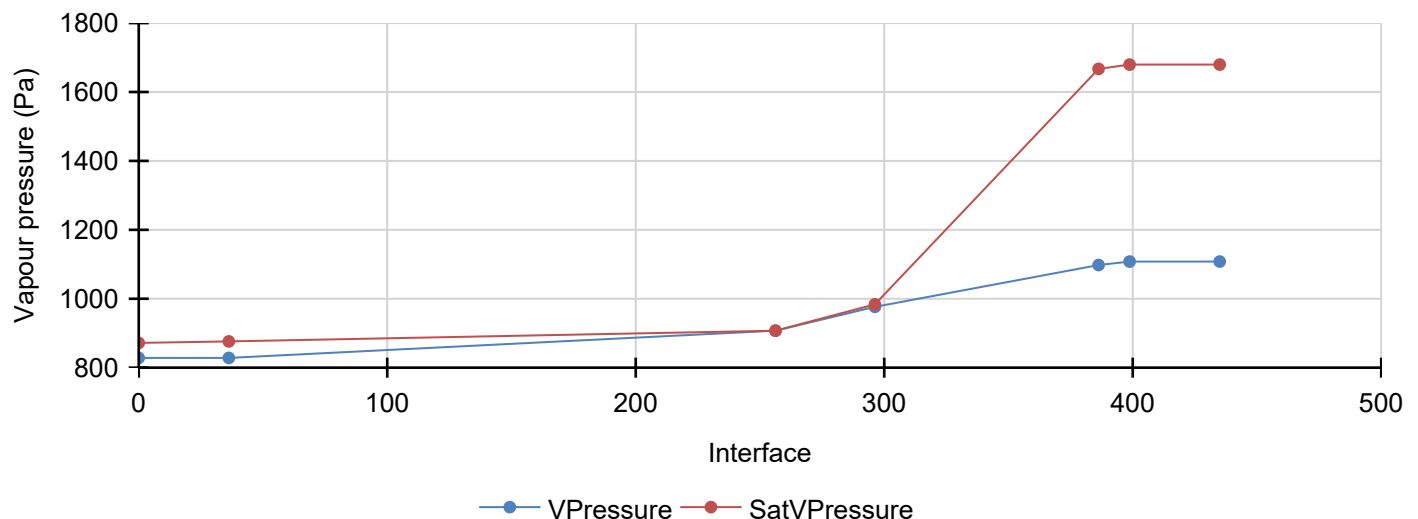
External conditions Temperature: °C Relative Humidity: %
Internal conditions Temperature: °C Relative Humidity: %

Table of layers

Layer	Thickness mm	Thermal conduct. W/m.K	Thermal resistance m².K/W	Cumulative thermal resistance m².K/W	Vapour resistivity GN.s/kg.m	Vapour resistance GN.s/kg.m	Cumulative vapour resistance GN.s/kg.m
External surface	-	0.0000	0.0400	0.0400	0.0	0.00	0.00
1.Brick, outer leaf	220.0	0.7700	0.2857	0.3257	50.0	11.00	11.00
2.Retained Cavity	40.0	0.0000	0.6651	0.9908	0.0	0.00	11.00
3.Kooltherm K8 Cavity Board (45mm +)	90.0	0.0200	4.5000	5.4908	100.0	9.00	20.00
4.Gyproc Wallboard (12.5mm)	12.5	0.1900	0.0658	5.5566	60.0	0.75	20.75
Internal surface	-	0.0000	0.1300	5.5566	0.0	0.00	20.75

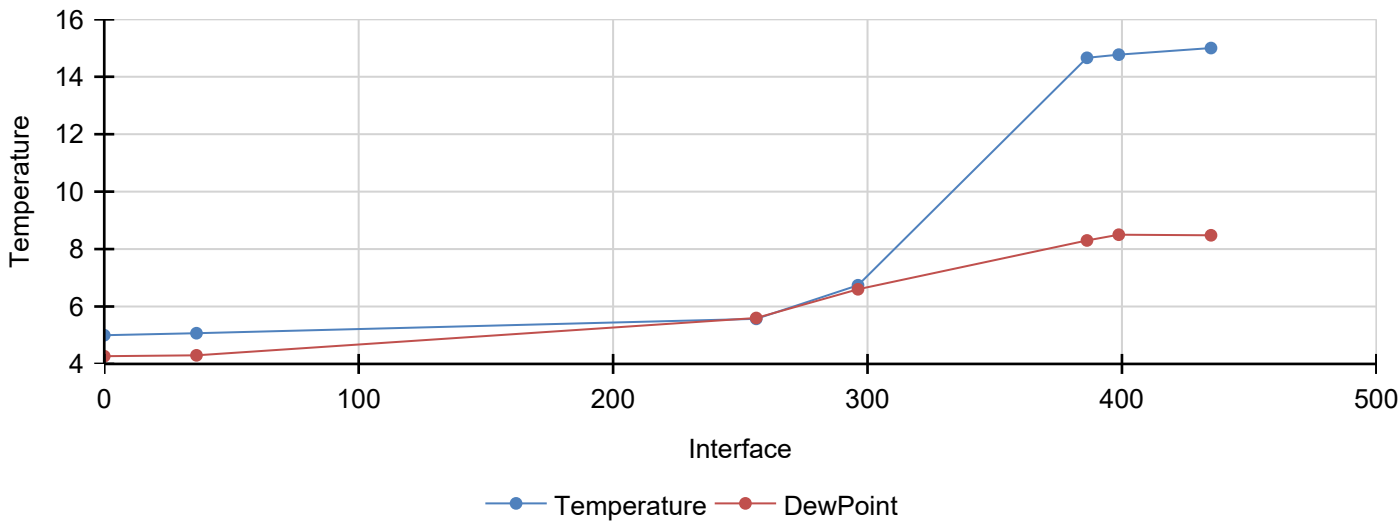
Vapour pressure table

Interface - between layers	Interface temp. °C	Vapour pressure Pa	Satur. vapour pressure Pa	Dew point °C	Cond. rate g/m² h	Cond. rate 60 days g/m² h	Cond. risk Y/N
External surface	5.00	828.3	871.9	4.27	0.00	0.00	No
1. External surface / Brick, outer leaf	5.07	828.3	876.2	4.3	0.00	0.00	No
2. Brick, outer leaf / Retained Cavity	5.57	907.3	907.3	5.6	0.05	69.35	Yes
3. Retained Cavity / Kooltherm K8 Cavity Board (45mm +)	6.74	976.5	983.8	6.6	0.00	0.00	No
4. Kooltherm K8 Cavity Board (45mm +) / Gyproc Wallboard (12.5mm)	14.66	1097.8	1667.0	8.3	0.00	0.00	No
Gyproc Wallboard (12.5mm) / Internal surface	14.77	1107.9	1679.5	8.5	0.00	0.00	No
Internal surface	15.00	1107.9	1679.5	8.48	0.00	0.00	No



Interface temperature / Dew point graphical representation

CONDENSATION RISK ANALYSIS



CONDENSATION RISK ANALYSIS

Wall - Extension Wall

Environmental conditions

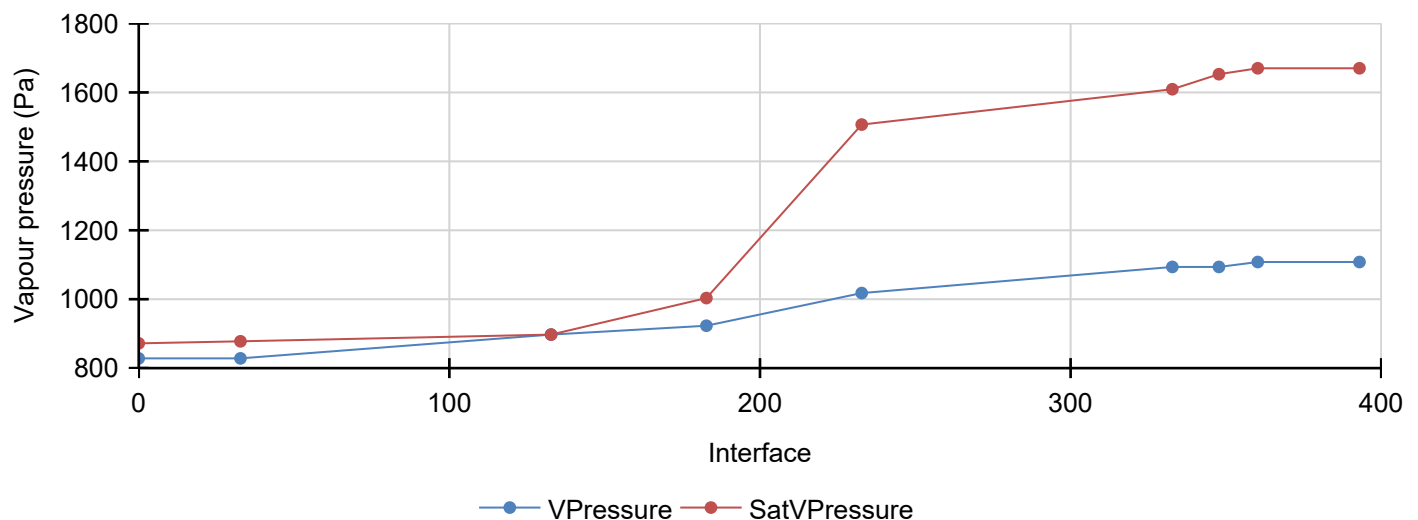
External conditions Temperature: °C Relative Humidity: %
Internal conditions Temperature: °C Relative Humidity: %

Table of layers

Layer	Thickness mm	Thermal conduct. W/m.K	Thermal resistance m².K/W	Cumulative thermal resistance m².K/W	Vapour resistivity GN.s/kg.m	Vapour resistance GN.s/kg.m	Cumulative vapour resistance GN.s/kg.m
External surface	-	0.0000	0.0400	0.0400	0.0	0.00	0.00
1.Brick, outer leaf	100.0	0.7700	0.1299	0.1699	50.0	5.00	5.00
2.Retained Cavity	50.0	0.0000	0.6651	0.8349	0.0	0.00	5.00
3.Kooltherm K8 Cavity Board (45mm +)	50.0	0.0200	2.5000	3.3349	100.0	5.00	10.00
4.Fibolite 3.6N	100.0	0.2400	0.4167	3.7516	40.0	4.00	14.00
5.airspace/plaster dabs	15.0	0.0000	0.1700	3.9216	0.0	0.00	14.00
6.Gyproc Wallboard (12.5mm)	12.5	0.1900	0.0658	3.9874	60.0	0.75	14.75
Internal surface	-	0.0000	0.1300	3.9874	0.0	0.00	14.75

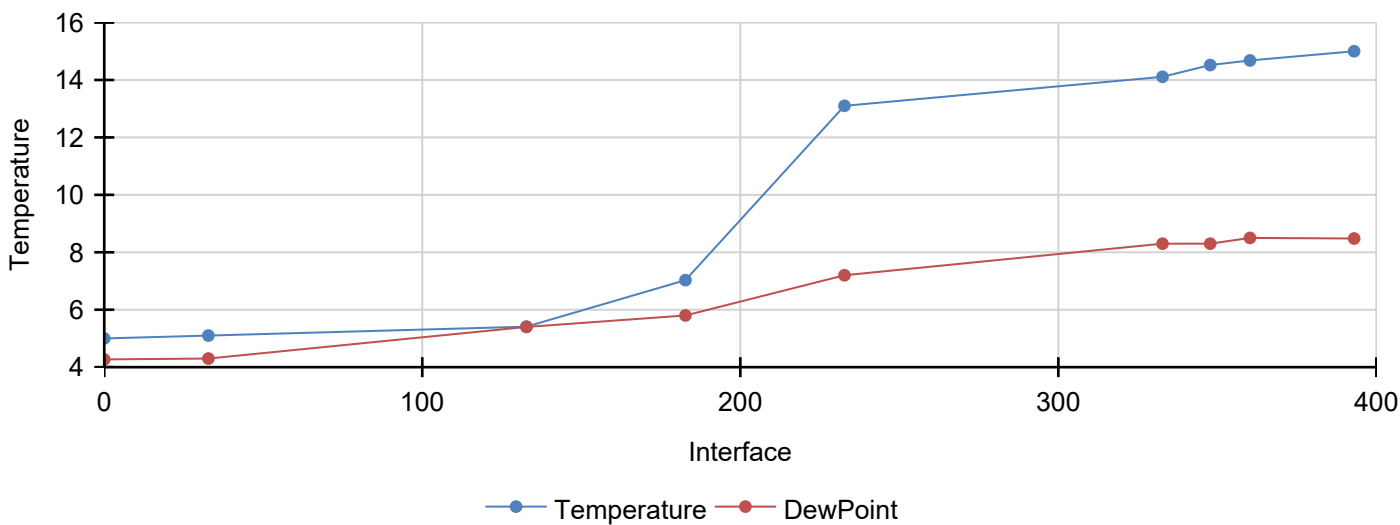
Vapour pressure table

Interface - between layers	Interface temp. °C	Vapour pressure Pa	Satur. vapour pressure Pa	Dew point °C	Cond. rate g/m² h	Cond. rate 60 days g/m² h	Cond. risk Y/N
External surface	5.00	828.3	871.9	4.27	0.00	0.00	No
1. External surface / Brick, outer leaf	5.10	828.3	877.8	4.3	0.00	0.00	No
2. Brick, outer leaf / Retained Cavity	5.41	897.3	897.3	5.4	0.03	40.40	Yes
3. Retained Cavity / Kooltherm K8 Cavity Board (45mm +)	7.03	923.0	1003.3	5.8	0.00	0.00	No
4. Kooltherm K8 Cavity Board (45mm +) / Fibolite 3.6N	13.10	1017.8	1506.7	7.2	0.00	0.00	No
5. Fibolite 3.6N / airspace/plaster dabs	14.11	1093.6	1609.3	8.3	0.00	0.00	No
6. airspace/plaster dabs / Gyproc Wallboard (12.5mm)	14.52	1093.6	1652.9	8.3	0.00	0.00	No
Gyproc Wallboard (12.5mm) / Internal surface	14.68	1107.9	1670.1	8.5	0.00	0.00	No
Internal surface	15.00	1107.9	1670.1	8.48	0.00	0.00	No



Interface temperature / Dew point graphical representation

CONDENSATION RISK ANALYSIS



CONDENSATION RISK ANALYSIS

Wall - Stud to Loft

Environmental conditions

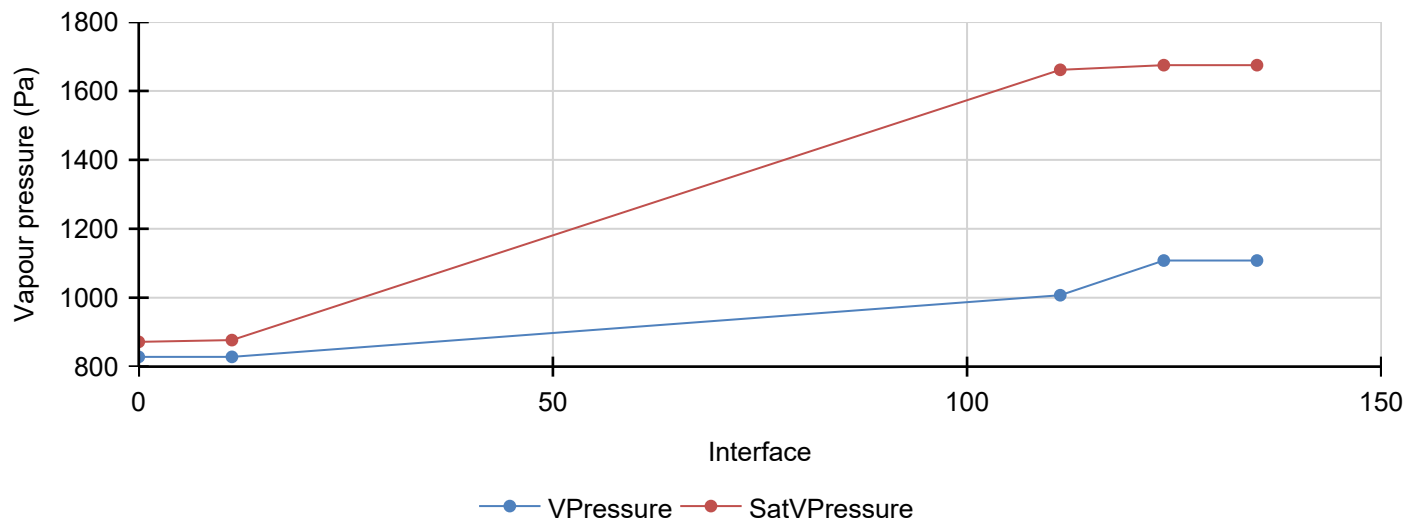
External conditions Temperature: °C Relative Humidity: %
Internal conditions Temperature: °C Relative Humidity: %

Table of layers

Layer	Thickness mm	Thermal conduct. W/m.K	Thermal resistance m².K/W	Cumulative thermal resistance m².K/W	Vapour resistivity GN.s/kg.m	Vapour resistance GN.s/kg.m	Cumulative vapour resistance GN.s/kg.m
External surface	-	0.0000	0.0400	0.0400	0.0	0.00	0.00
1.insulation/timber frame	100.0	0.0220	4.5455	4.5855	10.0	1.00	1.00
2.Plasterboard, standard	12.5	0.2100	0.0595	4.6450	45.0	0.56	1.56
Internal surface	-	0.0000	0.1300	4.6450	0.0	0.00	1.56

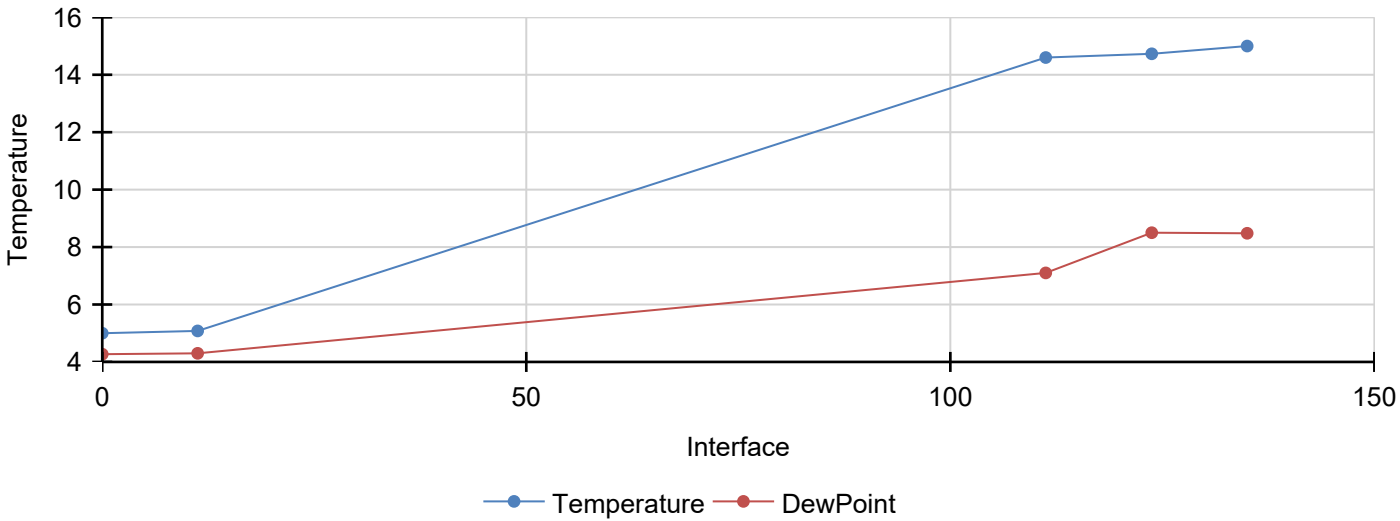
Vapour pressure table

Interface - between layers	Interface temp. °C	Vapour pressure Pa	Satur. vapour pressure Pa	Dew point °C	Cond. rate g/m² h	Cond. rate 60 days g/m² h	Cond. risk Y/N
External surface	5.00	828.3	871.9	4.27	0.00	0.00	No
1. External surface / insulation/timber frame	5.08	828.3	877.0	4.3	0.00	0.00	No
2. insulation/timber frame / Plasterboard, standard	14.60	1007.2	1661.3	7.1	0.00	0.00	No
Plasterboard, standard / Internal surface	14.73	1107.9	1674.8	8.5	0.00	0.00	No
Internal surface	15.00	1107.9	1674.8	8.48	0.00	0.00	No



Interface temperature / Dew point graphical representation

CONDENSATION RISK ANALYSIS



CONDENSATION RISK ANALYSIS

Wall - Dormer Cheeks

Environmental conditions

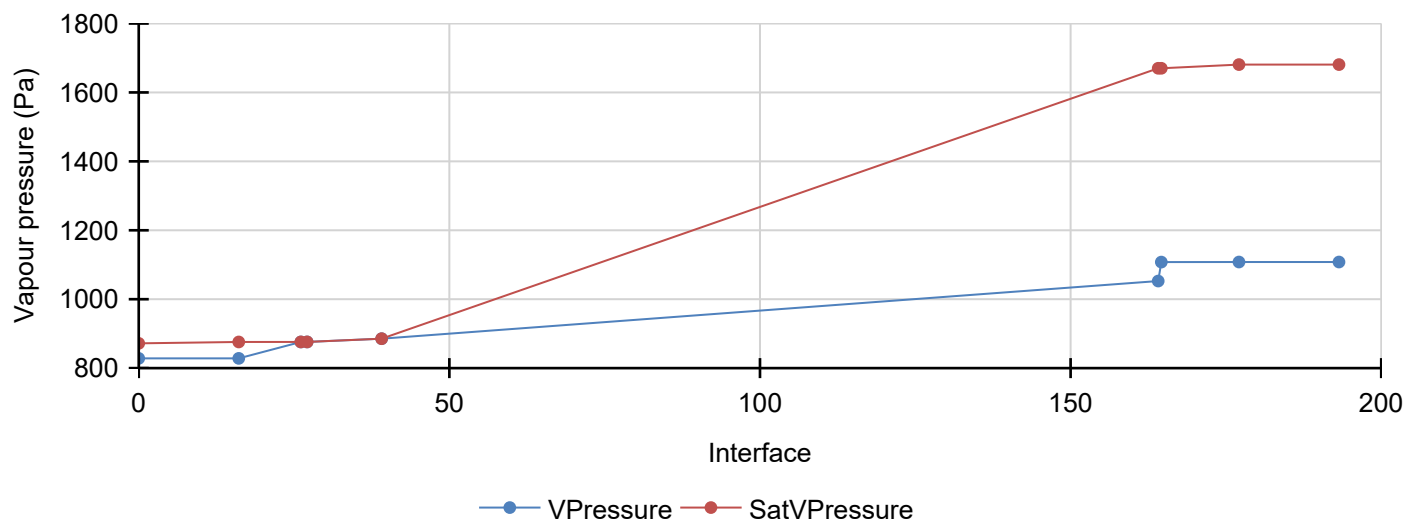
External conditions Temperature: °C Relative Humidity: %
Internal conditions Temperature: °C Relative Humidity: %

Table of layers

Layer	Thickness mm	Thermal conduct. W/m.K	Thermal resistance m².K/W	Cumulative thermal resistance m².K/W	Vapour resistivity GN.s/kg.m	Vapour resistance GN.s/kg.m	Cumulative vapour resistance GN.s/kg.m
External surface	-	0.0000	0.0400	0.0400	0.0	0.00	0.00
1.Code 5 Lead	10.0	35.0000	0.0003	0.0403	100000.0	1000.00	1000.00
2.Breather membrane	1.0	0.0000	0.0000	0.0403	0.000	0.40	1000.40
3.Plywood	12.0	0.1300	0.0923	0.1326	450.0	5.40	1005.80
4.Thermapitch TP10	125.0	0.0220	5.6818	5.8144	100.0	12.50	1018.30
5.Polythene, 500 gauge	0.5	0.0000	0.0000	5.8144	0.000	250.00	1268.30
6.Plasterboard, standard	12.5	0.2100	0.0595	5.8739	45.0	0.56	1268.86
Internal surface	-	0.0000	0.1300	5.8739	0.0	0.00	1268.86

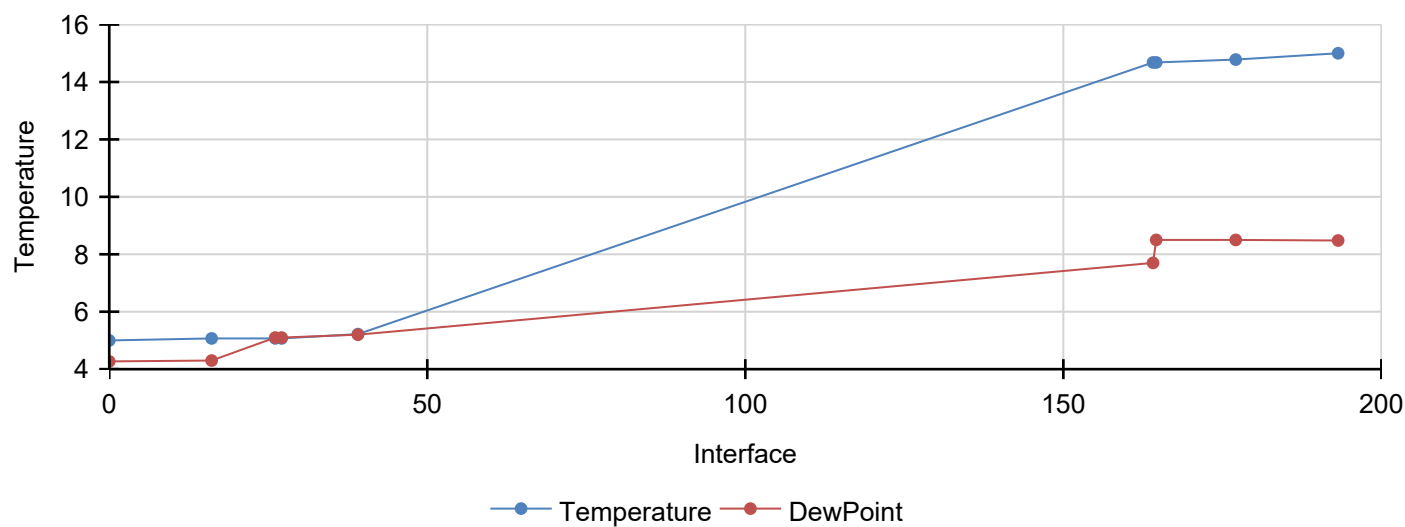
Vapour pressure table

Interface - between layers	Interface temp. °C	Vapour pressure Pa	Satur. vapour pressure Pa	Dew point °C	Cond. rate g/m² h	Cond. rate 60 days g/m² h	Cond. risk Y/N
External surface	5.00	828.3	871.9	4.27	0.00	0.00	No
1. External surface / Code 5 Lead	5.07	828.3	875.9	4.3	0.00	0.00	No
2. Code 5 Lead / Breather membrane	5.07	875.9	876.0	5.1	0.00	4.22	No
3. Breather membrane / Plywood	5.07	876.0	876.0	5.1	0.00	4.23	Yes
4. Plywood / Thermapitch TP10	5.22	885.4	885.4	5.2	0.00	4.09	Yes
5. Thermapitch TP10 / Polythene, 500 gauge	14.68	1052.7	1670.1	7.7	0.00	0.00	No
6. Polythene, 500 gauge / Plasterboard, standard	14.68	1107.7	1670.1	8.5	0.00	0.00	No
Plasterboard, standard / Internal surface	14.78	1107.9	1680.8	8.5	0.00	0.00	No
Internal surface	15.00	1107.9	1680.8	8.48	0.00	0.00	No



Interface temperature / Dew point graphical representation

CONDENSATION RISK ANALYSIS



CONDENSATION RISK ANALYSIS

Floor - Basement Floor

Environmental conditions

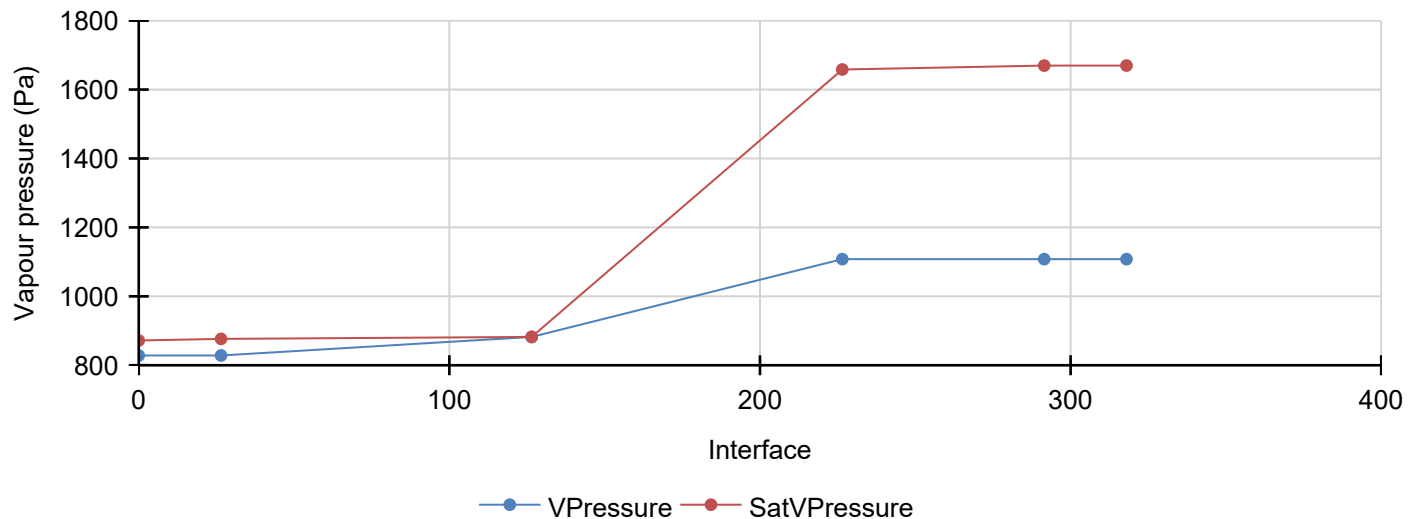
External conditions Temperature: °C Relative Humidity: %
Internal conditions Temperature: °C Relative Humidity: %

Table of layers

Layer	Thickness mm	Thermal conduct. W/m.K	Thermal resistance m².K/W	Cumulative thermal resistance m².K/W	Vapour resistivity GN.s/kg.m	Vapour resistance GN.s/kg.m	Cumulative vapour resistance GN.s/kg.m
External surface	-	0.0000	0.0400	0.0400	0.0	0.00	0.00
1.Concrete, dense	100.0	2.0000	0.0500	0.0900	200.0	20.00	20.00
2.Kooltherm K3 Floorboard	100.0	0.0200	5.0000	5.0900	0.0	0.00	20.00
3.Screed	65.0	1.1500	0.0565	5.1465	0.0	0.00	20.00
Internal surface	-	0.0000	0.1700	5.1465	0.0	0.00	20.00

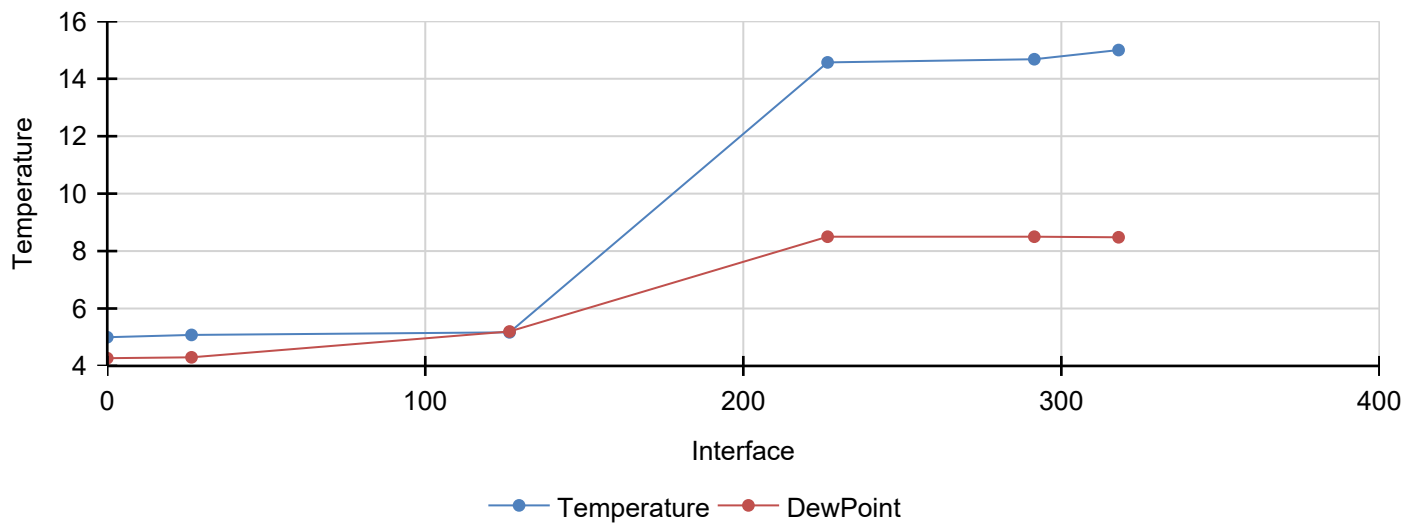
Vapour pressure table

Interface - between layers	Interface temp. °C	Vapour pressure Pa	Satur. vapour pressure Pa	Dew point °C	Cond. rate g/m² h	Cond. rate 60 days g/m² h	Cond. risk Y/N
External surface	5.00	828.3	871.9	4.27	0.00	0.00	No
1. External surface / Concrete, dense	5.08	828.3	876.5	4.3	0.00	0.00	No
2. Concrete, dense / Kooltherm K3 Floorboard	5.17	882.2	882.2	5.2	0.00	0.00	Yes
3. Kooltherm K3 Floorboard / Screed	14.57	1107.9	1658.2	8.5	0.00	0.00	No
Screed / Internal surface	14.68	1107.9	1669.6	8.5	0.00	0.00	No
Internal surface	15.00	1107.9	1669.6	8.48	0.00	0.00	No



Interface temperature / Dew point graphical representation

CONDENSATION RISK ANALYSIS



CONDENSATION RISK ANALYSIS

Floor - Extension Floor

Environmental conditions

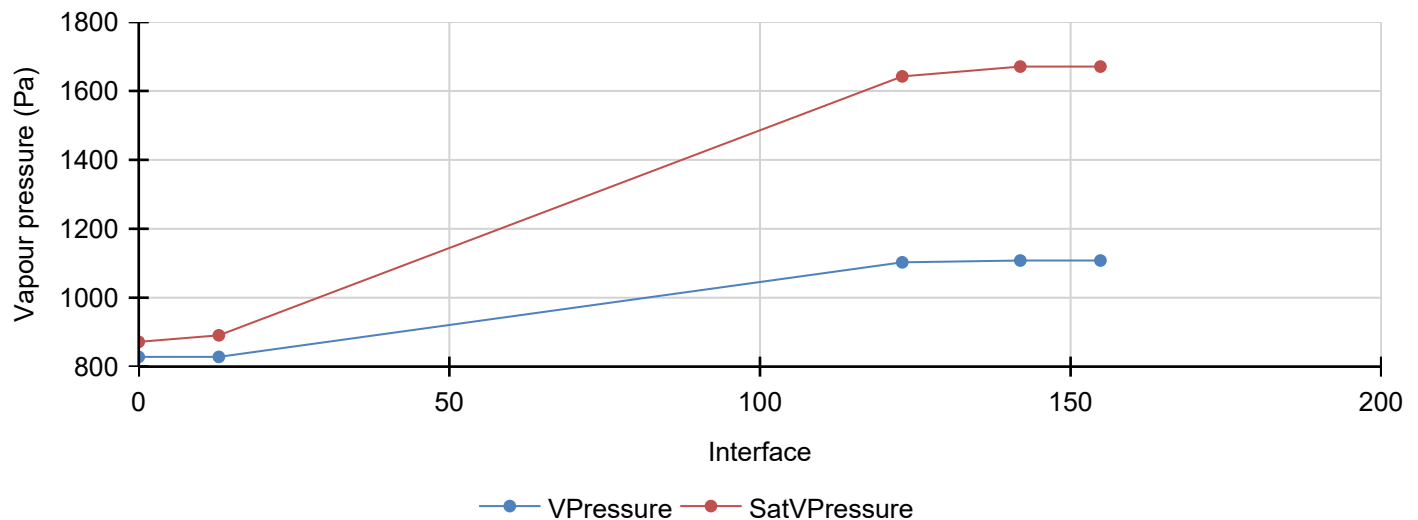
External conditions Temperature: °C Relative Humidity: %
Internal conditions Temperature: °C Relative Humidity: %

Table of layers

Layer	Thickness mm	Thermal conduct. W/m.K	Thermal resistance m².K/W	Cumulative thermal resistance m².K/W	Vapour resistivity GN.s/kg.m	Vapour resistance GN.s/kg.m	Cumulative vapour resistance GN.s/kg.m
External surface	-	0.0000	0.1700	0.1700	0.0	0.00	0.00
1.Celotex XR4000	110.0	0.0220	5.0000	5.1700	0.000	300.00	300.00
2.Chipboard	19.0	0.1300	0.1462	5.3162	300.0	5.70	305.70
Internal surface	-	0.0000	0.1700	5.3162	0.0	0.00	305.70

Vapour pressure table

Interface - between layers	Interface temp. °C	Vapour pressure Pa	Satur. vapour pressure Pa	Dew point °C	Cond. rate g/m² h	Cond. rate 60 days g/m² h	Cond. risk Y/N
External surface	5.00	828.3	871.9	4.27	0.00	0.00	No
1. External surface / Celotex XR4000	5.31	828.3	890.9	4.3	0.00	0.00	No
2. Celotex XR4000 / Chipboard	14.42	1102.7	1642.2	8.4	0.00	0.00	No
Chipboard / Internal surface	14.69	1107.9	1670.7	8.5	0.00	0.00	No
Internal surface	15.00	1107.9	1670.7	8.48	0.00	0.00	No



Interface temperature / Dew point graphical representation

CONDENSATION RISK ANALYSIS

