

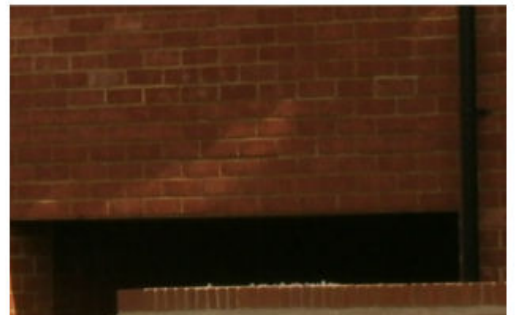


Energy Report

Drakelow Phase 2

Client: David Wilson East Midlands

Author: Andrew Maughan



www.environmental-economics.co.uk

Revision History

<i>Version</i>	<i>Date Issued</i>	<i>Issued by</i>	<i>QA Check</i>
1	17/12/2021	<i>Andrew Maughan</i>	<i>William Vincent</i>

About Environmental Economics

Our team of experienced consultants specialise in construction and building energy. We have qualifications in sustainability, energy, engineering, building physics and construction as well as environmental, quality management and auditing.

Over the last decade, we have provided assessments and consultancy for some of the largest UK house builders, including Barratt Developments, David Wilson Homes, Bellway Homes, Abbey New Homes and Davidsons. We develop flexible, practical, cost-effective specifications for our clients through identifying solutions and delivering design advice. This includes the following disciplines:

- *Energy Reports*
- *Compliance assessments and advice covering*
 - *Part L (SAP)*
 - *Part F (ventilation)*
 - *Part G (water)*
- *BREEAM*
- *SBEM (existing and new build)*
- *Minimum Energy Efficiency Standards (MEES)*
- *Thermal Bridging (Psi value calculations)*

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1. Project Overview

1.1. Introduction

- 1.1.1. This energy study was prepared by Environmental Economics Ltd on behalf of David Wilson East Midlands. The report assesses the performance of the proposed dwellings against current building regulations.

1.2. Description of Site

- 1.2.1. The site consists of 168 plots. These units comprise a range of detached, semi-detached and terraced dwellings.
- 1.2.2. The proposed site location/boundary for the whole site is shown in Appendix A.
- 1.2.3. This report addresses a domestic development being undertaken by David Wilson East Midlands, and does not include any further proposals for subsequent developments or non-residential parcels.

1.3. Planning Policy

- 1.3.1. The purpose of this planning report is to demonstrate the site meets the minimum compliance levels in accordance with Approved Document L1A of the building regulations.
- 1.3.2. Condition 19 of the outline planning permission states:

"Any application for approval of reserved matters relating to provision of dwellings shall be accompanied by a sustainability statement that sets out the measures to be adopted to achieve a reduction in both energy and water use. The development of phase(s) shall be carried out in accordance with the approved statement."

1.4. Building regulations

- 1.4.1. The SAP assessments have been undertaken using the appropriate legislative guidance; Approved Document Part L1A 2013. It should be noted that future policies and building regulations will reflect changes to the carbon content of fuels. In particular grid electricity is expected to become significantly decarbonized due to the ongoing investment in wind, solar and nuclear energy.
- 1.4.2. Currently, it is expected that Approved Document L will be updated in late 2021, and to be enforced in 2022. For the purposes of this report the site has been assessed to Part L 2013 as that is current at the time of writing.
- 1.4.3. In the case that the site does fall under the new regulations then the build specification on site will be upgraded for all plots to reflect at least minimum compliance levels. This can be evidenced by design stage SAP calculations.
- 1.4.4. As there are no specific carbon or energy targets set and the new Part L building regulations will be an estimated 31% improvement over current regulations then the site will comply with the condition regardless of the regulations being applied.

2. Improvement Measures

2.1. Assessment Methodology

2.1.1. Environmental Economics have modelled the proposed dwellings using Design SAP 2012 software. The software provides a number of outputs which can be used to assess and compare the improvements from any number of build specifications in terms of:

- *Building regulations compliance*
- *Energy usage per year (kWh/annum)*
- *Carbon emissions as a measure of building regulations compliance (kg CO₂/m²/year)*
- *Energy costs per year (£/annum)*
- *More detailed breakdowns by end use (space heating, water heating, cooking, lighting, appliances)*
- *Code for Sustainable Homes compliance*
- *Effective air change rate*

2.1.2. Each of these outputs can be used in different ways to analyse the performance of the dwelling. The total regulated carbon emissions for each property is based upon:

- *Space heating*
- *Water heating*
- *Electricity for pumps and fans*
- *Electricity for lighting*

2.1.3. Two models were created in order to calculate the energy demand. The required data for the site is calculated for each of the models, and then the difference used to establish the level of improvement. In order to achieve this representative house types have been utilised.

2.1.4. The emissions calculation for the space and water heating, as well as the electricity for pumps, fans and lighting were all assessed using the Standard Assessment Procedure (SAP 2012) through the Design SAP 2012 software. SAP worksheets for the house types used can be found in Appendix C.

2.2. Design Philosophy

2.2.1. Upgrades have been made to a number of elements from a standard build specification in order to improve energy efficiency across the development. The site adopts the good design principles endorsed and promoted by The Zero Carbon Hub, the construction industries' key advisors and partners with the Governments Communities and Local Government Department. This guidance follows the general good principles of energy efficiency as the industry moves towards zero carbon. The principles are illustrated in figure 1 below.

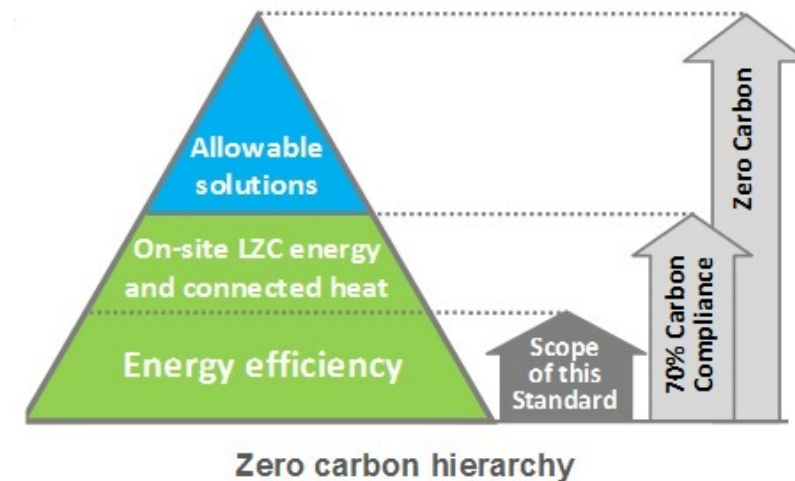


Figure 1

2.2.2. In order to reduce the residual carbon emissions a number of improvements were made to the standard material and product specification. These improvements include:

- *Upgraded heating and hot water controls*
- *Delayed start thermostat*
- *Design air permeability of 5.01m³/hr/m²*
- *Bespoke thermal bridging details*

2.3. Fabric First Approach

2.3.1. Although Low and Zero Carbon (LZC) technologies will have their part to play in the achieving low carbon efficient homes there is still a number of passive measures that can be implemented to achieve the same level of emissions reductions. Carbon emissions reductions achieved through energy efficiency measures have a number of advantages over the equivalent savings through LZC technologies:

- Longer lifespans – *If the passive improvement measures are fully integrated into the building construction then the resulting carbon savings are secured for the lifetime of the dwelling, which is typically around 60 years. Most LZC technologies have a 25 year period of use before requiring replacement.*
- Lower maintenance – *There is little or no need to maintain fabric improvements in a property. This ensures future occupiers need not be responsible for the cost or upkeep of the upgrades. LZC technologies will require regular maintenance to ensure they are operating at their optimum performance levels. As soon as this is neglected, design predictions for carbon emissions will no longer be relevant.*
- Less dependency on occupier behaviour – *By adding a renewable technology to a property there is also the additional complication that comes with informing the occupier of their correct use. Many types of LZC require diligent operation in order to achieve the stated carbon savings. If this instruction is not effectively communicated or understood by the occupier, the carbon savings levels will fall below design levels.*

2.3.2. This behavioural change, maintenance and replacement at end-of-life are beyond the control of David Wilson East Midlands, and the diminishing performance of the LZC technology is unavoidable. Therefore, a situation could easily be justified whereby the technology is only present and performing for its design life of 25 years, and with a diminishing efficiency.

2.4. Product Improvements

- 2.4.1. The systems used in a property to supply hot water and heating, as well as control it, are important to the overall energy demand of a property. The 2013 Building Regulations state that all systems and their controls must adhere to the minimum standards shown in Domestic Heating Compliance Guide.
- 2.4.2. For a mains gas fired system the minimum boiler efficiency required is 86%. Ideal Logic condensing boilers have been specified throughout the site for both combination and cylinder based systems. These boilers achieve a SAP 2009 rated efficiency of at least 89% and are recommended by the Energy Saving Trust.
- 2.4.3. Where installed, hot water cylinders can lose a significant amount of energy. In order to minimise this energy loss and corresponding carbon emissions, cylinders which have higher levels of insulation in comparison to typical hot water cylinders will be used.
- 2.4.4. Finally 100% Low-E lighting fixtures shall be fitted to all properties.

2.5. Fabric Improvements

2.5.1. The building fabric for all dwellings was improved from basic compliance with Part L1A 2013 to an enhanced specification. These fabric improvements reduce the space heating requirement upon a property. The improvements have been made through a combination of upgraded materials and increased insulation thicknesses. Enhanced glazing with a larger transmittance factor allowing for increased solar gains will also be used. Changes to the U-Value of external elements are shown in table 1 below.

<i>Element</i>	<i>Minimum Standard</i>	<i>Improved Specification</i>	
-	<i>W/m²k</i>	<i>Description</i>	<i>W/m²k</i>
Walls	0.30	50mm Alreflex Platinum Cavity	0.27
Roof	0.20	400mm Mineral Wool Horizontal Ceiling, Loft Space	0.11
		Flat Roof	0.17
Floors	0.25	150mm TE Platinum Insulation	0.13 - 0.16
Doors	2.00	Double glazed Low-E, u-PVC frame	1.00 – 1.70
Glazing	2.00	Double glazed Low-E, u-PVC frame	1.41

Table 1

2.5.2. As improvements are made to the thermal conductivity of main elements, thermal bridging and air permeability becomes increasingly significant in the overall fabric performance. Bespoke thermal bridging designs have been utilised, which achieve much lower heat loss levels in comparison with standard practice.

2.5.3. As a result of following these junction details and focusing on build quality air permeability will also decrease. A target air pressure rating of 5.01m³/hr.m² has been set for all houses on site which is a 50% improvement on the maximum allowable rating in the 2013 Building Regulations.

2.6. Water Consumption

- 2.6.1. The criteria for measuring potable water usage are set out in Approved Document Part G of the Building Regulations (which also addresses water pressure, flow rates, quality).
- 2.6.2. The water consumption on site will be to the enhanced standard of Part G, which is 110 litres/person/day.

It is currently proposed to meet this standard by adhering to the fittings approach displayed in Approved Document Part G, as shown in table 2 below. As long as the rates set out below are not surpassed, then the enhanced standard will be achieved.

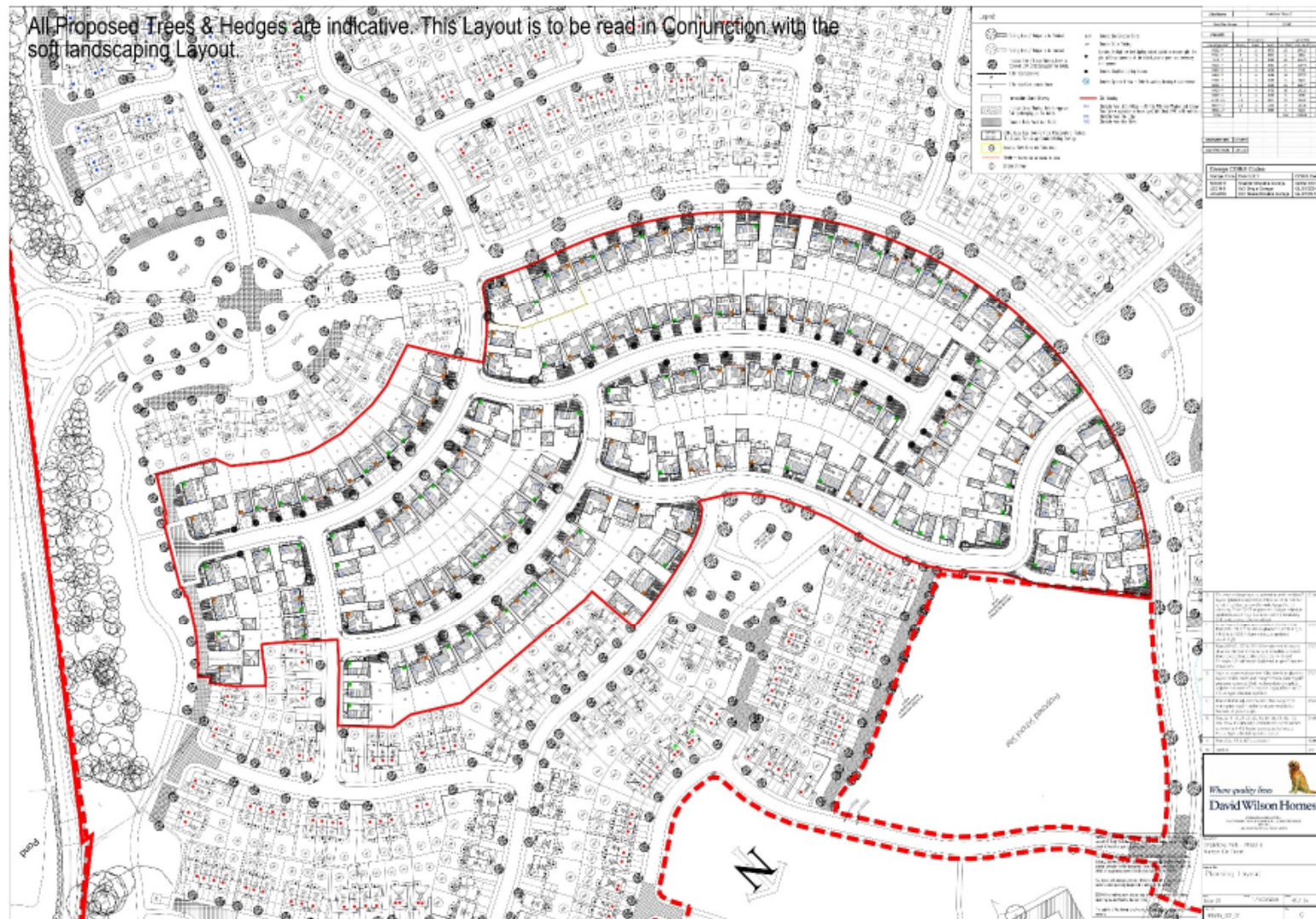
Table 2.2 Maximum fittings consumption optional requirement level	
Water fitting	Maximum consumption
WC	4/2.6 litres dual flush
Shower	8 l/min
Bath	170 litres
Basin taps	5 l/min
Sink taps	6 l/min
Dishwasher	1.25 l/place setting
Washing machine	8.17 l/kilogram

Table 2

3. Conclusion

- 3.1.1. The table presented in Appendix B shows reduction in carbon emissions compared to building regulation standards.
- 3.1.2. The baseline carbon emissions are 344,157 kgCO₂/Annum. After taking into account the improved specification, the carbon emissions are reduced to 337,836 kgCO₂/Annum. This represents a reduction 6,321 kgCO₂/Annum which is equivalent to 1.84% over current building regulations, surpassing minimum standards.
- 3.1.3. By keeping to the fittings approach set out in Part G the water consumption on site will meet the 110 litres/person/day requirement.

Appendix A



Appendix B

Client:	David Wilson East Midlands					
Project:	Drakelow Phase 2					
Report:	Carbon Emissions Reduction from Fabric and General Specification Improvements					
House Type/ Plot Number	Standard Regulatory Model CO ₂ Emissions Rate	Improved Model CO ₂ Emissions Rate	Improvement over Regulatory Model	SAP Floor Area	Number of Plots	Annual Carbon Emissions from Improved Model
-	kgCO ₂ /m ² .yr	kgCO ₂ /m ² .yr	%	m ²	-	kgCO ₂ /yr
H303--G7 Detach	18.00	17.53	2.6%	99	24	41,651
H312--7 Detach	19.46	18.42	5.3%	94	23	39,786
H417--H7 Detach	16.49	15.98	3.1%	132	5	10,527
H418--H7 Detach	17.26	17.15	0.6%	136	14	32,538
H429--H7 Detach	17.14	16.97	1.0%	127	23	49,484
H442--H7 Detach	16.29	15.83	2.8%	124	6	11,812
H456--X7 Detach	16.14	15.92	1.4%	137	10	21,777
H469--H7 Detach	15.37	15.11	1.7%	141	6	12,809
H500--X7 Detach	14.93	14.82	0.7%	173	11	28,136
H588---7 Detach	15.37	15.32	0.3%	182	3	8,377
H597---7 Detach	13.28	13.25	0.2%	215	9	25,591
P341 WDH7 Detach	19.02	18.86	0.8%	92	4	6,913
T310 -I-7 Mid Terrace	15.28	14.50	5.1%	106	2	3,085
T310-E-7 End Terrace	15.46	15.28	1.2%	106	28	45,351
Total Annual Carbon Emissions (kgCO ₂ /yr)						337,836
Floor Area Weighted Average Improvement (%)						1.84%
Notes						
#1: Calculated by SAP2012 to include total energy demand for space heating, hot water, lighting, pumps and fans.						

Appendix C

See below for SAP Worksheets

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	H303--G7 Detached			Issued on Date	17/12/2021
Assessment Reference	1	Prop Type Ref			
Property	DS04 Ingelby (Gable Roof), Detached, Part L2013 Masonry, David Wilson Homes				
SAP Rating	84 B	DER	17.53	TER	18.00
Environmental	85 B	% DER<TER	2.63		
CO ₂ Emissions (t/year)	1.54	DFEE	50.93	TFEE	55.08
General Requirements Compliance	Pass	% DFEE<TFEE	7.54		
Assessor Details	Mr. Andrew Maughan, Andrew Maughan, Tel: 01582 544250, Andrew.Maughan@ee-ltd.co.uk			Assessor ID	V844-0001
Client					

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS DESIGNED

Detached House, total floor area 99 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.00 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 17.53 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)55.1 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)50.9 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Floor	0.15 (max. 0.25)	0.15 (max. 0.70)	OK
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.37 (max. 2.00)	1.41 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals: 5.01 (design value)
Maximum 10.0 OK

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Ideal LOGIC COMBI ESPl 35
Combi boiler
Efficiency: 89.6% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock

Yes OK

7 Low energy lights

Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Midlands): Not significant OK

Based on:

Overshading: Average

Windows facing North: 0.66 m², No overhang

Windows facing East: 7.13 m², No overhang

Windows facing South: 1.98 m², No overhang

Windows facing West: 4.29 m², No overhang

Air change rate: 4.00 ach

Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features

Roof U-value 0.11 W/m²K

Door U-value 1.10 W/m²K

Thermal bridging y-value 0.037 W/m²K

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	49.5000 (1b)	x 2.3100 (2b)	= 114.3450 (1b) - (3b)
First floor	49.5000 (1c)	x 2.5600 (2c)	= 126.7200 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	99.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 241.0650 (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					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) =	0.1659 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.4164 (18)
Number of sides sheltered					0 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		1.0000 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.4164 (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												
Effective ac	0.5309	0.5205	0.5101	0.4581	0.4477	0.3956	0.3956	0.3852	0.4164	0.4477	0.4685	0.4893 (22b)
	0.6410	0.6355	0.6301	0.6049	0.6002	0.5783	0.5783	0.5742	0.5867	0.6002	0.6097	0.6197 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Opening Type 1 (Uw = 1.41)			14.0600	1.3347	18.7662		(27)					
Opening Type 2			2.3800	1.1000	2.6180		(26)					
150mm TE Platinum GF			49.5000	0.1500	7.4250		(28a)					
50mm Alreflex Plat	140.4400	16.4400	124.0000	0.2700	33.4800		(29a)					
1st Flr Horiz Cl	49.5000		49.5000	0.1100	5.4450		(30)					
Total net area of external elements Aum(A, m2)			239.4400				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		67.7342		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							160.3600 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.8145 (36)					
Total fabric heat loss						(33) + (36) =	76.5487 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 50.9888	Feb 50.5533	Mar 50.1266	Apr 48.1219	May 47.7469	Jun 46.0009	Jul 46.0009	Aug 45.6775	Sep 46.6734	Oct 47.7469	Nov 48.5056	Dec 49.2988 (38)
Heat transfer coeff	127.5374	127.1020	126.6752	124.6706	124.2955	122.5496	122.5496	122.2262	123.2221	124.2955	125.0543	125.8475 (39)
Average = Sum(39)m / 12 =												124.6688 (39)
HLP	Jan 1.2883	Feb 1.2839	Mar 1.2795	Apr 1.2593	May 1.2555	Jun 1.2379	Jul 1.2379	Aug 1.2346	Sep 1.2447	Oct 1.2555	Nov 1.2632	Dec 1.2712 (40)
HLP (average)												1.2593 (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												2.7301 (42)
Average daily hot water use (litres/day)												99.0393 (43)
Daily hot water use	108.9432	104.9816	101.0200	97.0585	93.0969	89.1353	89.1353	93.0969	97.0585	101.0200	104.9816	108.9432 (44)
Energy conte	161.5596	141.3010	145.8100	127.1207	121.9753	105.2555	97.5346	111.9224	113.2591	131.9926	144.0803	156.4618 (45)
Energy content (annual)										Total = Sum(45)m =		1558.2731 (45)
Distribution loss (46)m = 0.15 x (45)m	24.2339	21.1952	21.8715	19.0681	18.2963	15.7883	14.6302	16.7884	16.9889	19.7989	21.6120	23.4693 (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												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Combi 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 (57)
Total heat required for water heating calculated for each month	14.1443	12.7644	14.1065	13.6089	14.0291	13.5380	13.9652	14.0066	13.5766	14.0733	13.6586	14.1321 (61)
Solar input	175.7039	154.0654	159.9165	140.7296	136.0044	118.7934	111.4999	125.9291	126.8358	146.0660	157.7388	170.5939 (62)
Output from w/h	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)
Heat gains from water heating, kWh/month	175.7039	154.0654	159.9165	140.7296	136.0044	118.7934	111.4999	125.9291	126.8358	146.0660	157.7388	170.5939 (64)
	57.2546	50.1737	52.0085	45.6699	44.0641	38.3819	35.9216	40.7159	41.0528	47.4059	51.3213	55.5566 (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)
(66)m	136.5037	136.5037	136.5037	136.5037	136.5037	136.5037	136.5037	136.5037	136.5037	136.5037	136.5037	136.5037	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.2846	21.5694	17.5414	13.2800	9.9269	8.3807	9.0557	11.7709	15.7989	20.0603	23.4133	24.9595	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	254.7009	257.3439	250.6836	236.5047	218.6064	201.7844	190.5464	187.9034	194.5636	208.7426	226.6409	243.4628	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.6504	36.6504	36.6504	36.6504	36.6504	36.6504	36.6504	36.6504	36.6504	36.6504	36.6504	36.6504	(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)	-109.2030	-109.2030	-109.2030	-109.2030	-109.2030	-109.2030	-109.2030	-109.2030	-109.2030	-109.2030	-109.2030	-109.2030	(71)
Water heating gains (Table 5)	76.9552	74.6632	69.9038	63.4304	59.2259	53.3082	48.2817	54.7256	57.0178	63.7176	71.2796	74.6728	(72)
Total internal gains	422.8918	420.5276	405.0800	380.1661	354.7103	330.4245	314.8348	321.3510	334.3314	359.4716	388.2850	410.0463	(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
North				0.6600	10.6334		0.7100		0.7000		0.7700		2.4172 (74)
East				7.1300	19.6403		0.7100		0.7000		0.7700		48.2310 (76)
South				1.9800	46.7521		0.7100		0.7000		0.7700		31.8827 (78)
West				4.2900	19.6403		0.7100		0.7000		0.7700		29.0198 (80)
Solar gains	111.5507	207.9540	323.2343	450.7469	540.1471	548.9293	524.1545	457.3883	368.3665	241.1336	137.0965	93.0920	(83)
Total gains	534.4425	628.4816	728.3143	830.9131	894.8574	879.3538	838.9893	778.7393	702.6979	600.6052	525.3815	503.1383	(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	34.5773	34.6958	34.8126	35.3724	35.4792	35.9846	35.9846	36.0798	35.7882	35.4792	35.2639	35.0416	
alpha	3.3052	3.3131	3.3208	3.3582	3.3653	3.3990	3.3990	3.4053	3.3859	3.3653	3.3509	3.3361	
util living area	0.9922	0.9860	0.9715	0.9345	0.8582	0.7266	0.5831	0.6351	0.8393	0.9579	0.9873	0.9936	(86)
MIT	18.9542	19.1734	19.5527	20.0571	20.4997	20.8118	20.9352	20.9123	20.6633	20.0751	19.4306	18.9267	(87)
Th 2	19.8500	19.8535	19.8569	19.8729	19.8758	19.8898	19.8898	19.8924	19.8844	19.8758	19.8698	19.8635	(88)
util rest of house	0.9904	0.9827	0.9644	0.9170	0.8173	0.6441	0.4590	0.5137	0.7775	0.9433	0.9837	0.9922	(89)
MIT 2	17.1265	17.4476	17.9992	18.7294	19.3379	19.7346	19.8556	19.8416	19.5693	18.7685	17.8340	17.0944	(90)
Living area fraction	17.4086	17.7139	18.2389	18.9343	19.5172	19.9008	20.0222	20.0068	19.7381	18.9702	18.0804	17.3772	(92)
Temperature adjustment	17.2586	17.5639	18.0889	18.7843	19.3672	19.7508	19.8722	19.8568	19.5881	18.8202	17.9304	17.2272	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9837	0.9725	0.9484	0.8943	0.7946	0.6323	0.4568	0.5094	0.7570	0.9235	0.9740	0.9864	(94)
Ext temp.	525.7102	611.1938	690.7075	743.1019	711.0150	556.0161	383.2906	396.6733	531.9224	554.6760	511.6956	496.3207	(95)
Heat loss rate W	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)
Month fracti	1652.7076	1609.6114	1468.0313	1232.2819	953.0009	631.2341	401.0055	422.5137	676.2570	1021.7336	1354.3860	1639.4427	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating	838.4861	670.9366	578.3289	352.2096	180.0375	0.0000	0.0000	0.0000	0.0000	347.4909	606.7371	850.4828	(98)
Space heating per m2												4424.7094	(98)
												44.6940	(99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4889.1817 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	838.4861	670.9366	578.3289	352.2096	180.0375	0.0000	0.0000	0.0000	0.0000	347.4909	606.7371	850.4828	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	926.5039	741.3664	639.0374	389.1819	198.9365	0.0000	0.0000	0.0000	0.0000	383.9678	670.4277	939.7600	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	175.7039	154.0654	159.9165	140.7296	136.0044	118.7934	111.4999	125.9291	126.8358	146.0660	157.7388	170.5939	(64)
Efficiency of water heater (217)m	89.9289	89.8847	89.7871	89.5628	89.0946	87.3000	87.3000	87.3000	87.3000	89.5288	89.8207	89.9491	(217)
Fuel for water heating, kWh/month	195.3809	171.4034	178.1064	157.1296	152.6517	136.0749	127.7203	144.2486	145.2872	163.1497	175.6153	189.6559	(219)
Water heating fuel used												1936.4241	(219)
Annual totals kWh/year													
Space heating fuel - main system												4889.1817	(211)
Space heating fuel - secondary												0.0000	(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)												428.8735	(232)
Total delivered energy for all uses												7329.4793	(238)

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	4889.1817	0.2160	1056.0632 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1936.4241	0.2160	418.2676 (264)
Space and water heating			1474.3308 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	428.8735	0.5190	222.5854 (268)
Total CO2, kg/year			1735.8412 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			17.5300 (273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		17.5300	ZC1
Total Floor Area	TFA	99.0000	
Assumed number of occupants	N	2.7301	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.2455	ZC2
CO2 emissions from cooking, equation (L16)		1.8639	ZC3
Total CO2 emissions		34.6394	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		34.6394	ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	49.5000 (1b)	x 2.3100 (2b)	= 114.3450 (1b) - (3b)
First floor	49.5000 (1c)	x 2.5600 (2c)	= 126.7200 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	99.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 241.0650 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
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) =	0.1244 (8)
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.3744 (18)							
Number of sides sheltered										0 (19)							
Shelter factor										(20) = 1 - [0.075 x (19)] =					1.0000	(20)	
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.3744	(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	0.4774	0.4681	0.4587	0.4119	0.4025	0.3557	0.3557	0.3464	0.3744	0.4025	0.4213	0.4400	(22b)				
Effective ac	0.6140	0.6095	0.6052	0.5848	0.5810	0.5633	0.5633	0.5600	0.5701	0.5810	0.5887	0.5968	(25)				

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.3800	1.0000	2.3800		(26)					
TER Opening Type (Uw = 1.40)			14.0600	1.3258	18.6402		(27)					
150mm TE Platinum GF			49.5000	0.1300	6.4350		(28a)					
50mm Alreflex Plat	140.4400	16.4400	124.0000	0.1800	22.3200		(29a)					
1st Flr Horiz Cl	49.5000		49.5000	0.1300	6.4350		(30)					
Total net area of external elements Aum(A, m2)			239.4400				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	56.2102		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.8360 (36)					
Total fabric heat loss						(33) + (36) =	67.0462 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 48.8418	Feb 48.4898	Mar 48.1447	Apr 46.5239	May 46.2206	Jun 44.8090	Jul 44.8090	Aug 44.5475	Sep 45.3527	Oct 46.2206	Nov 46.8341	Dec 47.4755 (38)
Heat transfer coeff	115.8880	115.5359	115.1909	113.5700	113.2668	111.8551	111.8551	111.5937	112.3989	113.2668	113.8803	114.5216 (39)
Average = Sum(39)m / 12 =												113.5686 (39)
HLP	Jan 1.1706	Feb 1.1670	Mar 1.1635	Apr 1.1472	May 1.1441	Jun 1.1298	Jul 1.1298	Aug 1.1272	Sep 1.1353	Oct 1.1441	Nov 1.1503	Dec 1.1568 (40)
HLP (average)												1.1472 (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												2.7301 (42)
Average daily hot water use (litres/day)												99.0393 (43)
Daily hot water use	Jan 108.9432	Feb 104.9816	Mar 101.0200	Apr 97.0585	May 93.0969	Jun 89.1353	Jul 89.1353	Aug 93.0969	Sep 97.0585	Oct 101.0200	Nov 104.9816	Dec 108.9432 (44)
Energy conte	161.5596	141.3010	145.8100	127.1207	121.9753	105.2555	97.5346	111.9224	113.2591	131.9926	144.0803	156.4618 (45)
Energy content (annual)										Total = Sum(45)m =		1558.2731 (45)
Distribution loss (46)m = 0.15 x (45)m												
Water storage loss:	24.2339	21.1952	21.8715	19.0681	18.2963	15.7883	14.6302	16.7884	16.9889	19.7989	21.6120	23.4693 (46)
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												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Combi 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 (57)
Total heat required for water heating calculated for each month	50.9589	46.0274	50.9589	47.8644	47.4412	43.9571	45.4224	47.4412	47.8644	50.9589	49.3151	50.9589 (61)
Solar input	212.5185	187.3284	196.7689	174.9852	169.4165	149.2126	142.9570	159.3636	161.1236	182.9515	193.3953	207.4207 (62)
Output from w/h	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)
Heat gains from water heating, kWh/month	212.5185	187.3284	196.7689	174.9852	169.4165	149.2126	142.9570	159.3636	161.1236	182.9515	193.3953	207.4207 (64)
	66.4583	58.4894	61.2216	54.2337	52.4171	45.9867	43.7859	49.0745	49.6248	56.6273	60.2355	64.7633 (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	136.5037	136.5037	136.5037	136.5037	136.5037	136.5037	136.5037	136.5037	136.5037	136.5037	136.5037	136.5037	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.2846	21.5694	17.5414	13.2800	9.9269	8.3807	9.0557	11.7709	15.7989	20.0603	23.4133	24.9595	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	254.7009	257.3439	250.6836	236.5047	218.6064	201.7844	190.5464	187.9034	194.5636	208.7426	226.6409	243.4628	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.6504	36.6504	36.6504	36.6504	36.6504	36.6504	36.6504	36.6504	36.6504	36.6504	36.6504	36.6504	(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)	-109.2030	-109.2030	-109.2030	-109.2030	-109.2030	-109.2030	-109.2030	-109.2030	-109.2030	-109.2030	-109.2030	-109.2030	(71)
Water heating gains (Table 5)	89.3257	87.0379	82.2870	75.3247	70.4531	63.8705	58.8520	65.9603	68.9233	76.1119	83.6604	87.0474	(72)
Total internal gains	435.2623	432.9022	417.4632	392.0604	365.9375	340.9867	325.4051	332.5857	346.2369	371.8659	400.6657	422.4209	(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	
North					0.6600	10.6334	0.6300	0.7000	0.7700		2.1448 (74)	
East					7.1300	19.6403	0.6300	0.7000	0.7700		42.7965 (76)	
South					1.9800	46.7521	0.6300	0.7000	0.7700		28.2903 (78)	
West					4.2900	19.6403	0.6300	0.7000	0.7700		25.7500 (80)	
Solar gains	98.9816	184.5226	286.8136	399.9586	479.2855	487.0781	465.0949	405.8516	326.8604	213.9636	121.6490	82.6028 (83)
Total gains	534.2439	617.4248	704.2767	792.0190	845.2230	828.0648	790.5000	738.4373	673.0973	585.8295	522.3147	505.0237 (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	59.3245	59.5053	59.6836	60.5353	60.6974	61.4634	61.4634	61.6074	61.1661	60.6974	60.3704	60.0323	
alpha	4.9550	4.9670	4.9789	5.0357	5.0465	5.0976	5.0976	5.1072	5.0777	5.0465	5.0247	5.0022	
util living area	0.9988	0.9972	0.9921	0.9726	0.9116	0.7697	0.6004	0.6580	0.8886	0.9850	0.9974	0.9991	(86)
MIT	19.6752	19.8231	20.0806	20.4268	20.7314	20.9253	20.9833	20.9739	20.8312	20.4293	19.9926	19.6552	(87)
Th 2	19.9436	19.9465	19.9493	19.9625	19.9650	19.9765	19.9765	19.9787	19.9721	19.9650	19.9600	19.9547	(88)
util rest of house	0.9983	0.9962	0.9891	0.9614	0.8742	0.6809	0.4719	0.5298	0.8272	0.9770	0.9964	0.9988	(89)
MIT 2	18.1724	18.3905	18.7675	19.2745	19.6906	19.9241	19.9701	19.9673	19.8282	19.2857	18.6483	18.1509	(90)
Living area fraction	18.4043	18.6116	18.9702	19.4524	19.8512	20.0786	20.1265	20.1227	19.9830	19.4622	18.8558	18.3831	(92)
Temperature adjustment	18.4043	18.6116	18.9702	19.4524	19.8512	20.0786	20.1265	20.1227	19.9830	19.4622	18.8558	18.3831	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9974	0.9943	0.9851	0.9541	0.8692	0.6907	0.4917	0.5491	0.8280	0.9714	0.9946	0.9980	(94)
Ext temp.	532.8313	613.9168	693.8049	755.6708	734.6400	571.9581	388.6568	405.5041	557.2947	569.0762	519.4916	504.0141	(95)
Heat loss rate W	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)
Month fracti	1634.5247	1584.1866	1436.4544	1198.4319	923.2598	612.8135	394.4533	415.4280	661.2453	1003.7896	1338.7530	1624.2678	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating	819.6599	652.0213	552.5313	318.7881	140.3332	0.0000	0.0000	0.0000	0.0000	323.4267	589.8682	833.4688	(98)
Space heating per m2												4230.0974	(98)
												42.7283	(99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4529.0122 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	819.6599	652.0213	552.5313	318.7881	140.3332	0.0000	0.0000	0.0000	0.0000	323.4267	589.8682	833.4688	(98)
Space heating efficiency (main heating system 1)	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)	877.5802	698.0956	591.5752	341.3148	150.2497	0.0000	0.0000	0.0000	0.0000	346.2813	631.5505	892.3649	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	212.5185	187.3284	196.7689	174.9852	169.4165	149.2126	142.9570	159.3636	161.1236	182.9515	193.3953	207.4207	(64)
Efficiency of water heater (217)m	88.1180	87.9316	87.5096	86.5425	84.5813	80.3000	80.3000	80.3000	80.3000	86.4705	87.6771	88.1896	(216)
Fuel for water heating, kWh/month	241.1748	213.0388	224.8542	202.1957	200.3002	185.8189	178.0287	198.4603	200.6520	211.5767	220.5768	235.1986	(219)
Water heating fuel used												2511.8757	(219)
Annual totals kWh/year													
Space heating fuel - main system												4529.0122	(211)
Space heating fuel - secondary												0.0000	(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)												428.8735	(232)
Total delivered energy for all uses												7544.7614	(238)

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	4529.0122	0.2160	978.2666 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2511.8757	0.2160	542.5652 (264)
Space and water heating			1520.8318 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	428.8735	0.5190	222.5854 (268)
Total CO2, kg/m2/year			1782.3422 (272)
Emissions per m2 for space and water heating			15.3619 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.2483 (272b)
Emissions per m2 for pumps and fans			0.3932 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.3619 * 1.00) + 2.2483 + 0.3932, rounded to 2 d.p.			18.0000 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	49.5000 (1b)	x 2.3100 (2b)	= 114.3450 (1b) - (3b)
First floor	49.5000 (1c)	x 2.5600 (2c)	= 126.7200 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	99.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 241.0650 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
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) =	0.1244 (8)	
Pressure test															Yes		
Measured/design AP50																5.0100	
Infiltration rate																0.3749 (18)	
Number of sides sheltered																0 (19)	
Shelter factor														(20) = 1 - [0.075 x (19)] =		1.0000 (20)	
Infiltration rate adjusted to include shelter factor														(21) = (18) x (20) =		0.3749 (21)	
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
	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	0.4781	0.4687	0.4593	0.4124	0.4031	0.3562	0.3562	0.3468	0.3749	0.4031	0.4218	0.4406	(22b)				
Effective ac	0.6143	0.6098	0.6055	0.5851	0.5812	0.5634	0.5634	0.5601	0.5703	0.5812	0.5890	0.5970	(25)				

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Opening Type 1 (Uw = 1.41)			14.0600	1.3347	18.7662		(27)					
Opening Type 2			2.3800	1.1000	2.6180		(26)					
150mm TE Platinum GF			49.5000	0.1500	7.4250		(28a)					
50mm Alreflex Plat	140.4400	16.4400	124.0000	0.2700	33.4800		(29a)					
1st Flr Horiz Cl	49.5000		49.5000	0.1100	5.4450		(30)					
Total net area of external elements Aum(A, m2)			239.4400				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	67.7342		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							160.3600 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.8145 (36)					
Total fabric heat loss						(33) + (36) =	76.5487 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 48.8661	Feb 48.5131	Mar 48.1671	Apr 46.5419	May 46.2379	Jun 44.8224	Jul 44.8224	Aug 44.5603	Sep 45.3676	Oct 46.2379	Nov 46.8530	Dec 47.4960 (38)
Heat transfer coeff	125.4147	125.0618	124.7158	123.0906	122.7865	121.3711	121.3711	121.1090	121.9163	122.7865	123.4017	124.0447 (39)
Average = Sum(39)m / 12 =												123.0891 (39)
HLP	Jan 1.2668	Feb 1.2633	Mar 1.2598	Apr 1.2433	May 1.2403	Jun 1.2260	Jul 1.2260	Aug 1.2233	Sep 1.2315	Oct 1.2403	Nov 1.2465	Dec 1.2530 (40)
HLP (average)												1.2433 (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												2.7301 (42)
Average daily hot water use (litres/day)												99.0393 (43)
Daily hot water use	Jan 108.9432	Feb 104.9816	Mar 101.0200	Apr 97.0585	May 93.0969	Jun 89.1353	Jul 89.1353	Aug 93.0969	Sep 97.0585	Oct 101.0200	Nov 104.9816	Dec 108.9432 (44)
Energy conte	161.5596	141.3010	145.8100	127.1207	121.9753	105.2555	97.5346	111.9224	113.2591	131.9926	144.0803	156.4618 (45)
Energy content (annual)										Total = Sum(45)m =		1558.2731 (45)
Distribution loss (46)m = 0.15 x (45)m												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (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												

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Primary 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 (57)
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
	34.3314	30.0265	30.9846	27.0132	25.9198	22.3668	20.7261	23.7835	24.0676	28.0484	30.6171	33.2481 (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	136.5037	136.5037	136.5037	136.5037	136.5037	136.5037	136.5037	136.5037	136.5037	136.5037	136.5037	136.5037	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.2846	21.5694	17.5414	13.2800	9.9269	8.3807	9.0557	11.7709	15.7989	20.0603	23.4133	24.9595	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	254.7009	257.3439	250.6836	236.5047	218.6064	201.7844	190.5464	187.9034	194.5636	208.7426	226.6409	243.4628	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.6504	36.6504	36.6504	36.6504	36.6504	36.6504	36.6504	36.6504	36.6504	36.6504	36.6504	36.6504	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-109.2030	-109.2030	-109.2030	-109.2030	-109.2030	-109.2030	-109.2030	-109.2030	-109.2030	-109.2030	-109.2030	-109.2030	(71)
Water heating gains (Table 5)	46.1444	44.6822	41.6460	37.5183	34.8384	31.0650	27.8577	31.9671	33.4272	37.6995	42.5237	44.6884	(72)
Total internal gains	389.0810	387.5466	373.8221	351.2540	327.3228	305.1812	291.4108	295.5925	307.7408	330.4535	356.5290	377.0618	(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
North					0.6600	10.6334	0.7100		0.7000	0.7700		2.4172 (74)
East					7.1300	19.6403	0.7100		0.7000	0.7700		48.2310 (76)
South					1.9800	46.7521	0.7100		0.7000	0.7700		31.8827 (78)
West					4.2900	19.6403	0.7100		0.7000	0.7700		29.0198 (80)
Solar gains	111.5507	207.9540	323.2343	450.7469	540.1471	548.9293	524.1545	457.3883	368.3665	241.1336	137.0965	93.0920 (83)
Total gains	500.6317	595.5006	697.0565	802.0010	867.4699	854.1106	815.5653	752.9808	676.1073	571.5871	493.6255	470.1538 (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	35.1625	35.2618	35.3596	35.8265	35.9152	36.3340	36.3340	36.4127	36.1715	35.9152	35.7361	35.5509		
alpha	3.3442	3.3508	3.3573	3.3884	3.3943	3.4223	3.4223	3.4275	3.4114	3.3943	3.3824	3.3701		
util living area	0.9936	0.9881	0.9746	0.9393	0.8652	0.7358	0.5921	0.6468	0.8494	0.9628	0.9894	0.9949	(86)	
MIT	18.9467	19.1661	19.5458	20.0481	20.4934	20.8074	20.9336	20.9090	20.6538	20.0596	19.4146	18.9148	(87)	
Th 2	19.8669	19.8697	19.8725	19.8855	19.8879	19.8993	19.8993	19.9014	19.8949	19.8879	19.8830	19.8779	(88)	
util rest of house	0.9921	0.9852	0.9682	0.9229	0.8257	0.6545	0.4681	0.5258	0.7900	0.9498	0.9864	0.9937	(89)	
MIT 2	17.9954	18.2155	18.5937	19.0940	19.5138	19.7899	19.8750	19.8649	19.6713	19.1145	18.4738	17.9715	(90)	
Living area fraction														
MIT	18.1422	18.3622	18.7406	19.2412	19.6650	19.9470	20.0384	20.0260	19.8230	19.2604	18.6190	18.1171	(92)	
Temperature adjustment														
adjusted MIT	18.1422	18.3622	18.7406	19.2412	19.6650	19.9470	20.0384	20.0260	19.8230	19.2604	18.6190	18.1171	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	495.0372	583.5428	668.8811	730.5765	708.1710	562.3832	395.6281	407.3942	530.9658	537.2004	484.5327	465.8689	(94)
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	1736.0148	1683.6111	1526.5983	1272.9098	977.9967	648.9678	417.3235	439.1435	697.7234	1063.3808	1421.4633	1726.3479	(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	923.2873	739.2458	638.1416	390.4800	200.7503	0.0000	0.0000	0.0000	0.0000	391.4783	674.5900	937.7963	(98)
Space heating												4895.7697	(98)
Space heating per m2												49.4522	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1140.8883	898.1461	920.4282	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7608	0.8321	0.7997	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	868.0010	747.3425	736.0605	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1103.5053	1056.2545	985.1688	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	169.5631	229.8305	185.3366	0.0000	0.0000	0.0000	0.0000	(104)

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Space cooling												584.7302 (104)
Cooled fraction												1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)	
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	42.3908	57.4576	46.3341	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												146.1825 (107)
Space cooling per m2												1.4766 (108)
Energy for space heating												49.4522 (99)
Energy for space cooling												1.4766 (108)
Total												50.9288 (109)
Dwelling Fabric Energy Efficiency (DFEE)												50.9 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	49.5000 (1b)	x 2.3100 (2b)	= 114.3450 (1b) - (3b)
First floor	49.5000 (1c)	x 2.5600 (2c)	= 126.7200 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	99.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 241.0650 (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)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1244 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3744 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3744 (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	0.4774	0.4681	0.4587	0.4119	0.4025	0.3557	0.3557	0.3464	0.3744	0.4025	0.4213	0.4400 (22b)
Effective ac	0.6140	0.6095	0.6052	0.5848	0.5810	0.5633	0.5633	0.5600	0.5701	0.5810	0.5887	0.5968 (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
TER Opaque door			2.3800	1.0000	2.3800		(26)
TER Opening Type (Uw = 1.40)			14.0600	1.3258	18.6402		(27)
150mm TE Platinum GF			49.5000	0.1300	6.4350		(28a)
50mm Alreflex Plat	140.4400	16.4400	124.0000	0.1800	22.3200		(29a)
1st Flr Horiz Cl	49.5000		49.5000	0.1300	6.4350		(30)
Total net area of external elements Aum(A, m ²)			239.4400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	56.2102		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.8360 (36)
Total fabric heat loss						(33) + (36) =	67.0462 (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	48.8418	48.4898	48.1447	46.5239	46.2206	44.8090	44.8090	44.5475	45.3527	46.2206	46.8341	47.4755 (38)
Heat transfer coeff	115.8880	115.5359	115.1909	113.5700	113.2668	111.8551	111.8551	111.5937	112.3989	113.2668	113.8803	114.5216 (39)
Average = Sum(39)m / 12 =												113.5686 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1706	1.1670	1.1635	1.1472	1.1441	1.1298	1.1298	1.1272	1.1353	1.1441	1.1503	1.1568 (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												2.7301 (42)
Average daily hot water use (litres/day)												99.0393 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	108.9432	104.9816	101.0200	97.0585	93.0969	89.1353	89.1353	93.0969	97.0585	101.0200	104.9816	108.9432 (44)
Energy conte	161.5596	141.3010	145.8100	127.1207	121.9753	105.2555	97.5346	111.9224	113.2591	131.9926	144.0803	156.4618 (45)
Energy content (annual)										Total = Sum(45)m =		1558.2731 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (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												

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Primary 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	0.0000 (57)
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
	34.3314	30.0265	30.9846	27.0132	25.9198	22.3668	20.7261	23.7835	24.0676	28.0484	30.6171	33.2481	(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	136.5037	136.5037	136.5037	136.5037	136.5037	136.5037	136.5037	136.5037	136.5037	136.5037	136.5037	136.5037	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.2846	21.5694	17.5414	13.2800	9.9269	8.3807	9.0557	11.7709	15.7989	20.0603	23.4133	24.9595	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	254.7009	257.3439	250.6836	236.5047	218.6064	201.7844	190.5464	187.9034	194.5636	208.7426	226.6409	243.4628	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.6504	36.6504	36.6504	36.6504	36.6504	36.6504	36.6504	36.6504	36.6504	36.6504	36.6504	36.6504	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-109.2030	-109.2030	-109.2030	-109.2030	-109.2030	-109.2030	-109.2030	-109.2030	-109.2030	-109.2030	-109.2030	-109.2030	(71)
Water heating gains (Table 5)	46.1444	44.6822	41.6460	37.5183	34.8384	31.0650	27.8577	31.9671	33.4272	37.6995	42.5237	44.6884	(72)
Total internal gains	389.0810	387.5466	373.8221	351.2540	327.3228	305.1812	291.4108	295.5925	307.7408	330.4535	356.5290	377.0618	(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	
North	0.6600	10.6334	0.6300	0.7000	0.7700	2.1448	(74)
East	7.1300	19.6403	0.6300	0.7000	0.7700	42.7965	(76)
South	1.9800	46.7521	0.6300	0.7000	0.7700	28.2903	(78)
West	4.2900	19.6403	0.6300	0.7000	0.7700	25.7500	(80)

Solar gains	98.9816	184.5226	286.8136	399.9586	479.2855	487.0781	465.0949	405.8516	326.8604	213.9636	121.6490	82.6028	(83)
Total gains	488.0626	572.0692	660.6357	751.2126	806.6083	792.2594	756.5057	701.4441	634.6012	544.4171	478.1780	459.6646	(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	59.3245	59.5053	59.6836	60.5353	60.6974	61.4634	61.4634	61.6074	61.1661	60.6974	60.3704	60.0323		
alpha	4.9550	4.9670	4.9789	5.0357	5.0465	5.0976	5.0976	5.1072	5.0777	5.0465	5.0247	5.0022		
util living area	0.9992	0.9980	0.9940	0.9778	0.9239	0.7909	0.6232	0.6850	0.9068	0.9890	0.9983	0.9994	(86)	
MIT	19.6318	19.7808	20.0408	20.3928	20.7074	20.9150	20.9803	20.9687	20.8097	20.3926	19.9513	19.6124	(87)	
Th 2	19.9436	19.9465	19.9493	19.9625	19.9650	19.9765	19.9765	19.9787	19.9721	19.9650	19.9600	19.9547	(88)	
util rest of house	0.9989	0.9973	0.9917	0.9684	0.8901	0.7040	0.4919	0.5551	0.8514	0.9829	0.9976	0.9992	(89)	
MIT 2	18.6910	18.8420	19.1032	19.4605	19.7577	19.9349	19.9712	19.9691	19.8582	19.4658	19.0232	18.6804	(90)	
Living area fraction									fLA = Living area / (4) =			0.1543	(91)	
MIT	18.8362	18.9869	19.2479	19.6044	19.9043	20.0862	20.1270	20.1234	20.0051	19.6088	19.1665	18.8243	(92)	
Temperature adjustment												0.0000		
adjusted MIT	18.8362	18.9869	19.2479	19.6044	19.9043	20.0862	20.1270	20.1234	20.0051	19.6088	19.1665	18.8243	(93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9985	0.9964	0.9896	0.9642	0.8877	0.7144	0.5123	0.5750	0.8536	0.9800	0.9968	0.9989	(94)
Useful gains	487.3139	570.0049	653.7661	724.3238	715.9918	566.0012	387.5457	403.3335	541.7093	533.5100	476.6254	459.1464	(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	1684.5703	1627.5418	1468.4440	1215.7006	929.2769	613.6601	394.5099	415.5105	663.7232	1020.4028	1374.1335	1674.7930	(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	890.7588	710.6648	606.1204	353.7913	158.6841	0.0000	0.0000	0.0000	0.0000	362.2482	646.2058	904.4410	(98)
Space heating												4632.9144	(98)
Space heating per m2											(98) / (4) =	46.7971	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1051.4381	827.7279	848.1121	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8278	0.9001	0.8703	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	870.3534	745.0201	738.0774	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1031.2117	987.2238	924.9311	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	115.8179	180.1995	139.0192	0.0000	0.0000	0.0000	0.0000	(104)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling												435.0366 (104)
Cooled fraction												1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)	
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	28.9545	45.0499	34.7548	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												108.7592 (107)
Space cooling per m2												1.0986 (108)
Energy for space heating												46.7971 (99)
Energy for space cooling												1.0986 (108)
Total												47.8957 (109)
Target Fabric Energy Efficiency (TFEE)												55.1 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	H312--7 Detached			Issued on Date	17/12/2021
Assessment Reference	1	Prop Type Ref			
Property	H349--H7 DS02, Detached, Hipped Roof, Part L2013 Masonry, David Wilson Homes, June 2019				
SAP Rating	83 B	DER	18.42	TER	19.46
Environmental	85 B	% DER<TER	5.36		
CO ₂ Emissions (t/year)	1.56	DFEE	54.76	TFEE	61.49
General Requirements Compliance	Pass	% DFEE<TFEE	10.95		
Assessor Details	Mr. Andrew Maughan, Andrew Maughan, Tel: 01582 544250, Andrew.Maughan@ee-ltd.co.uk			Assessor ID	V844-0001
Client					

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS DESIGNED

Detached House, total floor area 94 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating: Mains gas
Fuel factor: 1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 19.46 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 18.42 kgCO₂/m² OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 61.5 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 54.8 kWh/m²/yr OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Floor	0.16 (max. 0.25)	0.18 (max. 0.70)	OK
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.38 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals: 5.01 (design value)
Maximum 10.0 OK

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Ideal LOGIC COMBI ESPl 35
Combi boiler
Efficiency: 89.6% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation

Hot water storage: No cylinder

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock

Yes OK

7 Low energy lights

Percentage of fixed lights with low-energy fittings: 100%
Minimum 75% OK

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Midlands): Not significant OK

Based on:

Overshading: Average
Windows facing North East: 3.98 m², No overhang
Windows facing South East: 1.83 m², No overhang
Windows facing South West: 7.90 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features

Roof U-value 0.11 W/m²K
Door U-value 1.10 W/m²K

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	40.8200 (1b)	x 2.3100 (2b)	= 94.2942 (1b) - (3b)
First floor	53.0900 (1c)	x 2.5600 (2c)	= 135.9104 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.9100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 230.2046 (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					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) = 0.1738 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.4243 (18)
Number of sides sheltered					0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.4243 (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	0.5409	0.5303	0.5197	0.4667	0.4561	0.4030	0.4030	0.3924	0.4243	0.4561	0.4773	0.4985 (22b)
Effective ac	0.6463	0.6406	0.6351	0.6089	0.6040	0.5812	0.5812	0.5770	0.5900	0.6040	0.6139	0.6243 (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
Opening Type 1 (Uw = 1.41)			13.7100	1.3347	18.2990		(27)
Opening Type 10			2.1400	1.1000	2.3540		(26)
Opening Type 12			2.0000	1.5000	3.0000		(26a)
150mm TE Platinum			40.8200	0.1600	6.5312		(28a)
Above Garage			12.2700	0.1800	2.2086		(28b)
50mm Alreflex	130.8000	17.8500	112.9500	0.2700	30.4965		(29a)
Wall to Garage	16.5300		16.5300	0.2700	4.4631		(29a)
400mm Mineral Wool	53.0800		53.0800	0.1100	5.8388		(30)
Total net area of external elements Aum(A, m ²)			253.5000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		73.1912		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							139.3100 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.0972 (36)
Total fabric heat loss						(33) + (36) =	83.2885 (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	49.0980	48.6664	48.2434	46.2564	45.8846	44.1541	44.1541	43.8336	44.8207	45.8846	46.6367	47.4229 (38)
Heat transfer coeff	132.3864	131.9549	131.5318	129.5449	129.1731	127.4425	127.4425	127.1220	128.1091	129.1731	129.9252	130.7114 (39)
Average = Sum(39)m / 12 =												129.5431 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.4097	1.4051	1.4006	1.3795	1.3755	1.3571	1.3571	1.3537	1.3642	1.3755	1.3835	1.3919 (40)
HLP (average)												1.3794 (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												2.6755 (42)
Average daily hot water use (litres/day)												97.7443 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	107.5187	103.6089	99.6992	95.7894	91.8796	87.9698	87.9698	91.8796	95.7894	99.6992	103.6089	107.5187 (44)
Energy conte	159.4471	139.4535	143.9035	125.4586	120.3805	103.8792	96.2593	110.4590	111.7782	130.2668	142.1963	154.4160 (45)
Energy content (annual)										Total = Sum(45)m =		1537.8980 (45)
Distribution loss (46)m = 0.15 x (45)m												
	23.9171	20.9180	21.5855	18.8188	18.0571	15.5819	14.4389	16.5689	16.7667	19.5400	21.3295	23.1624 (46)
Water storage loss:												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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	14.1392	12.7600	14.1009	13.6012	14.0220	13.5321	13.9598	14.0001	13.5698	14.0683	13.6541	14.1272 (61)
Total heat required for water heating calculated for each month	173.5864	152.2134	158.0044	139.0598	134.4025	117.4113	110.2191	124.4591	125.3480	144.3350	155.8504	168.5432 (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	173.5864	152.2134	158.0044	139.0598	134.4025	117.4113	110.2191	124.4591	125.3480	144.3350	155.8504	168.5432 (64)
Heat gains from water heating, kWh/month	56.5510	49.5583	51.3731	45.1153	43.5320	37.9229	35.4962	40.2277	40.5587	46.8308	50.6938	54.8751 (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	133.7774	133.7774	133.7774	133.7774	133.7774	133.7774	133.7774	133.7774	133.7774	133.7774	133.7774	133.7774 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.3250	20.7171	16.8483	12.7552	9.5347	8.0496	8.6978	11.3058	15.1746	19.2676	22.4882	23.9733 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	246.0901	248.6438	242.2087	228.5091	211.2159	194.9626	184.1045	181.5508	187.9859	201.6855	218.9788	235.2320 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3777	36.3777	36.3777	36.3777	36.3777	36.3777	36.3777	36.3777	36.3777	36.3777	36.3777	36.3777 (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)	-107.0219	-107.0219	-107.0219	-107.0219	-107.0219	-107.0219	-107.0219	-107.0219	-107.0219	-107.0219	-107.0219	-107.0219 (71)
Water heating gains (Table 5)	76.0094	73.7474	69.0499	62.6601	58.5108	52.6706	47.7099	54.0694	56.3315	62.9446	70.4081	73.7569 (72)
Total internal gains	411.5578	409.2415	394.2401	370.0577	345.3945	321.8161	306.6455	313.0593	325.6253	350.0310	378.0082	399.0954 (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
Northeast	3.9800				11.2829		0.7100		0.7000		0.7700		15.4666 (75)
Southeast	1.8300				36.7938		0.7100		0.7000		0.7700		23.1908 (77)
Southwest	7.9000				36.7938		0.7100		0.7000		0.7700		100.1133 (79)
Solar gains	138.7707	241.5152	344.0975	449.2259	524.0474	529.4408	506.6158	449.3917	380.2835	270.6050	167.1509	118.1534	(83)
Total gains	550.3285	650.7567	738.3375	819.2835	869.4419	851.2568	813.2613	762.4510	705.9088	620.6360	545.1591	517.2488	(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	27.4504	27.5401	27.6287	28.0525	28.1332	28.5153	28.5153	28.5871	28.3669	28.1332	27.9704	27.8021
alpha	2.8300	2.8360	2.8419	2.8702	2.8755	2.9010	2.9010	2.9058	2.8911	2.8755	2.8647	2.8535
util living area	0.9853	0.9755	0.9576	0.9193	0.8474	0.7276	0.5944	0.6388	0.8198	0.9385	0.9772	0.9876 (86)
MIT	18.6068	18.8610	19.2746	19.8228	20.3277	20.7145	20.8875	20.8578	20.5569	19.8988	19.1613	18.5719 (87)
Th 2	19.7559	19.7594	19.7629	19.7791	19.7822	19.7964	19.7964	19.7909	19.7909	19.7822	19.7760	19.7696 (88)
util rest of house	0.9821	0.9703	0.9480	0.8994	0.8055	0.6444	0.4648	0.5138	0.7549	0.9194	0.9714	0.9850 (89)
MIT 2	16.5930	16.9636	17.5634	18.3553	19.0537	19.5543	19.7339	19.7130	19.3738	18.4776	17.4127	16.5497 (90)
Living area fraction	0.9821	0.9703	0.9480	0.8994	0.8055	0.6444	0.4648	0.5138	0.7549	0.9194	0.9714	0.9850 (91)
MIT	16.8990	17.2519	17.8234	18.5783	19.2473	19.7306	19.9092	19.8870	19.5536	18.6936	17.6784	16.8570 (92)
Temperature adjustment	16.7490	17.1019	17.6734	18.4283	19.0973	19.5806	19.7592	19.7370	19.4036	18.5436	17.5284	-0.1500
adjusted MIT	16.7490	17.1019	17.6734	18.4283	19.0973	19.5806	19.7592	19.7370	19.4036	18.5436	17.5284	16.7070 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	533.6329	620.1079	682.4239	712.4563	674.5951	533.6724	374.3523	386.0958	514.3539	553.2648	520.4208	503.8331 (94)
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	1648.0830	1610.1012	1469.6622	1234.3401	955.5317	634.7432	402.6172	424.2060	679.4390	1026.0986	1354.9101	1634.8075 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	829.1509	665.2755	585.7053	375.7563	209.0168	0.0000	0.0000	0.0000	0.0000	351.7883	600.8323	841.4450 (98)
Space heating												4458.9704 (98)
Space heating per m2												47.4813 (99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4927.0391 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	829.1509	665.2755	585.7053	375.7563	209.0168	0.0000	0.0000	0.0000	0.0000	351.7883	600.8323	841.4450	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	916.1888	735.1111	647.1882	415.2003	230.9578	0.0000	0.0000	0.0000	0.0000	388.7164	663.9031	929.7734	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	173.5864	152.2134	158.0044	139.0598	134.4025	117.4113	110.2191	124.4591	125.3480	144.3350	155.8504	168.5432	(64)
Efficiency of water heater (217)m	89.9294	89.8865	89.8007	89.6127	89.2201	87.3000	87.3000	87.3000	87.3000	89.5451	89.8219	89.9498	(216)
Fuel for water heating, kWh/month	193.0252	169.3396	175.9501	155.1786	150.6415	134.4918	126.2533	142.5649	143.5831	161.1870	173.5105	187.3747	(219)
Water heating fuel used												1913.1003	(219)
Annual totals kWh/year													
Space heating fuel - main system												4927.0391	(211)
Space heating fuel - secondary												0.0000	(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)												411.9270	(232)
Total delivered energy for all uses												7327.0664	(238)

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	4927.0391	0.2160	1064.2405 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1913.1003	0.2160	413.2297 (264)
Space and water heating			1477.4701 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	411.9270	0.5190	213.7901 (268)
Total CO2, kg/year			1730.1852 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			18.4200 (273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		18.4200	ZC1
Total Floor Area	TFA	93.9100	
Assumed number of occupants	N	2.6755	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.5285	ZC2
CO2 emissions from cooking, equation (L16)		1.9509	ZC3
Total CO2 emissions		35.8994	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		35.8994	ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	40.8200 (1b)	x 2.3100 (2b)	= 94.2942 (1b) - (3b)
First floor	53.0900 (1c)	x 2.5600 (2c)	= 135.9104 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.9100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 230.2046 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
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) =	0.1303 (8)
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.3803 (18)							
Number of sides sheltered										0 (19)							
Shelter factor										(20) = 1 - [0.075 x (19)] =					1.0000	(20)	
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.3803	(21)	
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind factor	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)				
Adj infilt rate	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)				
	0.4849	0.4754	0.4659	0.4184	0.4088	0.3613	0.3613	0.3518	0.3803	0.4088	0.4279	0.4469	(22b)				
Effective ac	0.6176	0.6130	0.6085	0.5875	0.5836	0.5653	0.5653	0.5619	0.5723	0.5836	0.5915	0.5998	(25)				

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
TER Opaque door			2.1400	1.0000	2.1400			(26)					
TER Semi-glazed door			2.0000	1.2000	2.4000			(26a)					
TER Opening Type (Uw = 1.40)			13.7100	1.3258	18.1761			(27)					
150mm TE Platinum			40.8200	0.1300	5.3066			(28a)					
Above Garage			12.2700	0.1300	1.5951			(28b)					
50mm Alreflex	130.8000	17.8500	112.9500	0.1800	20.3310			(29a)					
Wall to Garage	16.5300		16.5300	0.1800	2.9754			(29a)					
400mm Mineral Wool	53.0800		53.0800	0.1300	6.9004			(30)					
Total net area of external elements Aum(A, m2)			253.5000					(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	59.8246		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								15.7371 (36)					
Total fabric heat loss						(33) + (36) =		75.5617 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 46.9150	Feb 46.5682	Mar 46.2283	Apr 44.6316	May 44.3328	Jun 42.9422	Jul 42.9422	Aug 42.6846	Sep 43.4778	Oct 44.3328	Nov 44.9372	Dec 45.5690	(38)
Heat transfer coeff	122.4768	122.1300	121.7900	120.1933	119.8946	118.5039	118.5039	118.2464	119.0396	119.8946	120.4989	121.1307	(39)
Average = Sum(39)m / 12 =												120.1919	(39)
HLP	Jan 1.3042	Feb 1.3005	Mar 1.2969	Apr 1.2799	May 1.2767	Jun 1.2619	Jul 1.2619	Aug 1.2591	Sep 1.2676	Oct 1.2767	Nov 1.2831	Dec 1.2899	(40)
HLP (average)												1.2799	(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												2.6755 (42)
Average daily hot water use (litres/day)												97.7443 (43)
Daily hot water use	Jan 107.5187	Feb 103.6089	Mar 99.6992	Apr 95.7894	May 91.8796	Jun 87.9698	Jul 87.9698	Aug 91.8796	Sep 95.7894	Oct 99.6992	Nov 103.6089	Dec 107.5187 (44)
Energy conte	159.4471	139.4535	143.9035	125.4586	120.3805	103.8792	96.2593	110.4590	111.7782	130.2668	142.1963	154.4160 (45)
Energy content (annual)												Total = Sum(45)m = 1537.8980 (45)
Distribution loss (46)m = 0.15 x (45)m												
	23.9171	20.9180	21.5855	18.8188	18.0571	15.5819	14.4389	16.5689	16.7667	19.5400	21.3295	23.1624 (46)
Water storage loss:												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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	50.8056	47.2386	46.8208	43.3824	44.8285	46.8208	47.2386	50.8056	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month	210.4060	185.4809	194.7091	172.6972	167.2013	147.2616	141.0878	157.2798	159.0168	181.0724	191.5114	205.3749 (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	210.4060	185.4809	194.7091	172.6972	167.2013	147.2616	141.0878	157.2798	159.0168	181.0724	191.5114	205.3749 (64)
Heat gains from water heating, kWh/month	65.7559	57.8751	60.5493	53.5246	51.7317	45.3854	43.2133	48.4328	48.9759	56.0151	59.6091	64.0831 (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	133.7774	133.7774	133.7774	133.7774	133.7774	133.7774	133.7774	133.7774	133.7774	133.7774	133.7774	133.7774 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.3250	20.7171	16.8483	12.7552	9.5347	8.0496	8.6978	11.3058	15.1746	19.2676	22.4882	23.9733 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	246.0901	248.6438	242.2087	228.5091	211.2159	194.9626	184.1045	181.5508	187.9859	201.6855	218.9788	235.2320 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3777	36.3777	36.3777	36.3777	36.3777	36.3777	36.3777	36.3777	36.3777	36.3777	36.3777	36.3777 (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)	-107.0219	-107.0219	-107.0219	-107.0219	-107.0219	-107.0219	-107.0219	-107.0219	-107.0219	-107.0219	-107.0219	-107.0219 (71)
Water heating gains (Table 5)	88.3816	86.1237	81.3835	74.3397	69.5319	63.0353	58.0825	65.0979	68.0221	75.2891	82.7904	86.1331 (72)
Total internal gains	423.9300	421.6178	406.5736	381.7373	356.4156	332.1807	317.0180	324.0877	337.3159	362.3755	390.3905	411.4716 (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		
Northeast				3.9800	11.2829	0.6300	0.7000	0.7700	13.7239 (75)			
Southeast				1.8300	36.7938	0.6300	0.7000	0.7700	20.5778 (77)			
Southwest				7.9000	36.7938	0.6300	0.7000	0.7700	88.8329 (79)			
Solar gains	123.1346	214.3022	305.3259	398.6089	464.9998	469.7855	449.5324	398.7561	337.4346	240.1143	148.3170	104.8404 (83)
Total gains	547.0645	635.9200	711.8996	780.3462	821.4154	801.9662	766.5504	722.8438	674.7505	602.4898	538.7075	516.3120 (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	53.2471	53.3983	53.5473	54.2587	54.3939	55.0322	55.0322	55.1520	54.7845	54.3939	54.1210	53.8388
alpha	4.5498	4.5599	4.5698	4.6172	4.6263	4.6688	4.6688	4.6768	4.6523	4.6263	4.6081	4.5893
util living area	0.9982	0.9961	0.9905	0.9730	0.9220	0.7999	0.6397	0.6910	0.8934	0.9818	0.9964	0.9986 (86)
MIT	19.5416	19.7026	19.9668	20.3210	20.6504	20.8854	20.9695	20.9564	20.7860	20.3594	19.8887	19.5183 (87)
Th 2	19.8376	19.8404	19.8433	19.8566	19.8591	19.8708	19.8708	19.8730	19.8663	19.8591	19.8541	19.8488 (88)
util rest of house	0.9975	0.9947	0.9869	0.9616	0.8859	0.7081	0.4951	0.5500	0.8301	0.9720	0.9948	0.9981 (89)
MIT 2	17.9038	18.1408	18.5273	19.0460	19.5004	19.7893	19.8592	19.8541	19.6851	19.1082	18.4227	17.8774 (90)
Living area fraction	0.9975	0.9947	0.9869	0.9616	0.8859	0.7081	0.4951	0.5500	0.8301	0.9720	0.9948	0.9981 (89)
MIT	18.1527	18.3782	18.7460	19.2397	19.6751	19.9559	20.0279	20.0216	19.8524	19.2984	18.6454	18.1267 (92)
Temperature adjustment	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (91)
adjusted MIT	18.1527	18.3782	18.7460	19.2397	19.6751	19.9559	20.0279	20.0216	19.8524	19.2984	18.6454	18.1267 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	544.9100	630.7904	699.0171	743.8025	721.6417	574.2221	396.0939	412.3418	559.4288	581.4295	534.5189	514.7450 (94)
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	1696.6315	1646.0864	1491.4445	1242.7658	956.1733	634.6907	406.2187	428.2425	684.7662	1042.8862	1391.2113	1686.9528 (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	856.8807	682.2789	589.5659	359.2536	174.4915	0.0000	0.0000	0.0000	0.0000	343.3238	616.8185	872.1226 (98)
Space heating	4494.7356 (98)											
Space heating per m2	(98) / (4) = 47.8622 (99)											

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4812.3508 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	856.8807	682.2789	589.5659	359.2536	174.4915	0.0000	0.0000	0.0000	0.0000	343.3238	616.8185	872.1226	(98)
Space heating efficiency (main heating system 1)	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)	917.4312	730.4913	631.2269	384.6398	186.8217	0.0000	0.0000	0.0000	0.0000	367.5844	660.4053	933.7501	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	210.4060	185.4809	194.7091	172.6972	167.2013	147.2616	141.0878	157.2798	159.0168	181.0724	191.5114	205.3749	(64)
Efficiency of water heater (217)m	88.2127	88.0333	87.6626	86.8534	85.1587	80.3000	80.3000	80.3000	80.3000	86.6373	87.7841	88.2835	(216)
Fuel for water heating, kWh/month	238.5213	210.6941	222.1119	198.8374	196.3408	183.3893	175.7009	195.8653	198.0284	209.0005	218.1619	232.6311	(219)
Water heating fuel used												2479.2831	(219)
Annual totals kWh/year													
Space heating fuel - main system												4812.3508	(211)
Space heating fuel - secondary												0.0000	(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)												411.9270	(232)
Total delivered energy for all uses												7778.5609	(238)

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	4812.3508	0.2160	1039.4678 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2479.2831	0.2160	535.5252 (264)
Space and water heating			1574.9929 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	411.9270	0.5190	213.7901 (268)
Total CO2, kg/m2/year			1827.7080 (272)
Emissions per m2 for space and water heating			16.7713 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.2765 (272b)
Emissions per m2 for pumps and fans			0.4145 (272c)
Target Carbon Dioxide Emission Rate (TER) = (16.7713 * 1.00) + 2.2765 + 0.4145, rounded to 2 d.p.			19.4600 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	40.8200 (1b)	x 2.3100 (2b)	= 94.2942 (1b) - (3b)
First floor	53.0900 (1c)	x 2.5600 (2c)	= 135.9104 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.9100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 230.2046 (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)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1303 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.3808 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3808 (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	0.4855	0.4760	0.4665	0.4189	0.4094	0.3618	0.3618	0.3523	0.3808	0.4094	0.4284	0.4475 (22b)
Effective ac	0.6179	0.6133	0.6088	0.5877	0.5838	0.5654	0.5654	0.5620	0.5725	0.5838	0.5918	0.6001 (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
Opening Type 1 (Uw = 1.41)			13.7100	1.3347	18.2990		(27)
Opening Type 10			2.1400	1.1000	2.3540		(26)
Opening Type 12			2.0000	1.5000	3.0000		(26a)
150mm TE Platinum			40.8200	0.1600	6.5312		(28a)
Above Garage			12.2700	0.1800	2.2086		(28b)
50mm Alreflex	130.8000	17.8500	112.9500	0.2700	30.4965		(29a)
Wall to Garage	16.5300		16.5300	0.2700	4.4631		(29a)
400mm Mineral Wool	53.0800		53.0800	0.1100	5.8388		(30)
Total net area of external elements Aum(A, m ²)			253.5000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		73.1912		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							139.3100 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.0972 (36)
Total fabric heat loss						(33) + (36) =	83.2885 (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	46.9385	46.5908	46.2500	44.6491	44.3495	42.9552	42.9552	42.6970	43.4923	44.3495	44.9555	45.5890 (38)
Heat transfer coeff	130.2270	129.8793	129.5384	127.9375	127.6380	126.2437	126.2437	125.9854	126.7807	127.6380	128.2439	128.8774 (39)
Average = Sum(39)m / 12 =												127.9361 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.3867	1.3830	1.3794	1.3623	1.3592	1.3443	1.3443	1.3416	1.3500	1.3592	1.3656	1.3724 (40)
HLP (average)												1.3623 (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												2.6755 (42)
Average daily hot water use (litres/day)												97.7443 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	107.5187	103.6089	99.6992	95.7894	91.8796	87.9698	87.9698	91.8796	95.7894	99.6992	103.6089	107.5187 (44)
Energy conte	159.4471	139.4535	143.9035	125.4586	120.3805	103.8792	96.2593	110.4590	111.7782	130.2668	142.1963	154.4160 (45)
Energy content (annual)										Total = Sum(45)m =		1537.8980 (45)
Distribution loss (46)m = 0.15 x (45)m												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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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)
Primary 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 (59)
Heat gains from water heating, kWh/month	33.8825	29.6339	30.5795	26.6599	25.5808	22.0743	20.4551	23.4725	23.7529	27.6817	30.2167	32.8134 (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	133.7774	133.7774	133.7774	133.7774	133.7774	133.7774	133.7774	133.7774	133.7774	133.7774	133.7774	133.7774	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.3250	20.7171	16.8483	12.7552	9.5347	8.0496	8.6978	11.3058	15.1746	19.2676	22.4882	23.9733	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	246.0901	248.6438	242.2087	228.5091	211.2159	194.9626	184.1045	181.5508	187.9859	201.6855	218.9788	235.2320	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3777	36.3777	36.3777	36.3777	36.3777	36.3777	36.3777	36.3777	36.3777	36.3777	36.3777	36.3777	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-107.0219	-107.0219	-107.0219	-107.0219	-107.0219	-107.0219	-107.0219	-107.0219	-107.0219	-107.0219	-107.0219	-107.0219	(71)
Water heating gains (Table 5)	45.5410	44.0980	41.1015	37.0277	34.3829	30.6588	27.4934	31.5491	32.9901	37.2066	41.9677	44.1040	(72)
Total internal gains	378.0894	376.5921	363.2916	341.4252	318.2666	296.8042	283.4290	287.5390	299.2839	321.2930	346.5679	366.4425	(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	
Northeast	3.9800	11.2829	0.7100	0.7000	0.7700	15.4666	(75)
Southeast	1.8300	36.7938	0.7100	0.7000	0.7700	23.1908	(77)
Southwest	7.9000	36.7938	0.7100	0.7000	0.7700	100.1133	(79)

Solar gains	138.7707	241.5152	344.0975	449.2259	524.0474	529.4408	506.6158	449.3917	380.2835	270.6050	167.1509	118.1534	(83)
Total gains	516.8601	618.1073	707.3891	790.6511	842.3140	826.2450	790.0448	736.9307	679.5674	591.8980	513.7187	484.5960	(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	27.9056	27.9803	28.0539	28.4049	28.4716	28.7861	28.7861	28.8450	28.6641	28.4716	28.3371	28.1978	
alpha	2.8604	2.8654	2.8703	2.8937	2.8981	2.9191	2.9191	2.9230	2.9109	2.8981	2.8891	2.8799	
util living area	0.9874	0.9784	0.9613	0.9245	0.8543	0.7364	0.6034	0.6501	0.8295	0.9443	0.9803	0.9896	(86)
MIT	18.5984	18.8533	19.2677	19.8134	20.3206	20.7089	20.8850	20.8533	20.5468	19.8830	19.1442	18.5586	(87)
Th 2	19.7735	19.7764	19.7792	19.7923	19.7948	19.8063	19.8063	19.8084	19.8019	19.7948	19.7898	19.7846	(88)
util rest of house	0.9847	0.9737	0.9525	0.9057	0.8138	0.6546	0.4741	0.5257	0.7668	0.9267	0.9753	0.9873	(89)
MIT 2	17.6004	17.8551	18.2665	18.8085	19.2894	19.6364	19.7622	19.7471	19.5079	18.8863	18.1555	17.5685	(90)
Living area fraction										fLA = Living area / (4) =		0.1520	(91)
MIT	17.7521	18.0068	18.4186	18.9612	19.4461	19.7994	19.9328	19.9152	19.6657	19.0378	18.3057	17.7190	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.7521	18.0068	18.4186	18.9612	19.4461	19.7994	19.9328	19.9152	19.6657	19.0378	18.3057	17.7190	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	505.6624	596.0678	664.5039	703.0802	673.5775	540.3953	386.5951	396.7136	515.2072	539.8072	496.5036	475.7565	(94)
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	1751.8205	1702.2964	1543.9187	1287.2088	988.6975	656.3906	420.7466	442.8612	705.6295	1076.9781	1437.0673	1742.2901	(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	927.1416	743.3856	654.2846	420.5726	234.4493	0.0000	0.0000	0.0000	0.0000	399.6551	677.2058	942.3010	(98)
Space heating												4998.9956	(98)
Space heating per m2												53.2318	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1186.6903	934.2030	957.4893	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7043	0.7777	0.7473	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	835.8107	726.5730	715.5684	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1067.8384	1023.4090	963.2879	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)

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Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	167.0600	220.8460	184.3033	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												572.2093 (104)
Cooled fraction									fC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	41.7650	55.2115	46.0758	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												143.0523 (107)
Space cooling per m2												1.5233 (108)
Energy for space heating												53.2318 (99)
Energy for space cooling												1.5233 (108)
Total												54.7551 (109)
Dwelling Fabric Energy Efficiency (DFEE)												54.8 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	40.8200 (1b)	x 2.3100 (2b)	= 94.2942 (1b) - (3b)
First floor	53.0900 (1c)	x 2.5600 (2c)	= 135.9104 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.9100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 230.2046 (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)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1303 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3803 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3803 (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	0.4849	0.4754	0.4659	0.4184	0.4088	0.3613	0.3613	0.3518	0.3803	0.4088	0.4279	0.4469 (22b)
Effective ac	0.6176	0.6130	0.6085	0.5875	0.5836	0.5653	0.5653	0.5619	0.5723	0.5836	0.5915	0.5998 (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
TER Opaque door			2.1400	1.0000	2.1400		(26)
TER Semi-glazed door			2.0000	1.2000	2.4000		(26a)
TER Opening Type (Uw = 1.40)			13.7100	1.3258	18.1761		(27)
150mm TE Platinum			40.8200	0.1300	5.3066		(28a)
Above Garage			12.2700	0.1300	1.5951		(28b)
50mm Alreflex	130.8000	17.8500	112.9500	0.1800	20.3310		(29a)
Wall to Garage	16.5300		16.5300	0.1800	2.9754		(29a)
400mm Mineral Wool	53.0800		53.0800	0.1300	6.9004		(30)
Total net area of external elements Aum(A, m ²)			253.5000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		59.8246		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.7371 (36)
Total fabric heat loss						(33) + (36) =	75.5617 (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	46.9150	46.5682	46.2283	44.6316	44.3328	42.9422	42.9422	42.6846	43.4778	44.3328	44.9372	45.5690 (38)
Heat transfer coeff	122.4768	122.1300	121.7900	120.1933	119.8946	118.5039	118.5039	118.2464	119.0396	119.8946	120.4989	121.1307 (39)
Average = Sum(39)m / 12 =												120.1919 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.3042	1.3005	1.2969	1.2799	1.2767	1.2619	1.2619	1.2591	1.2676	1.2767	1.2831	1.2899 (40)
HLP (average)												1.2799 (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		2.6755 (42)
Average daily hot water use (litres/day)		97.7443 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	107.5187	103.6089	99.6992	95.7894	91.8796	87.9698	87.9698	91.8796	95.7894	99.6992	103.6089	107.5187 (44)
Energy conte	159.4471	139.4535	143.9035	125.4586	120.3805	103.8792	96.2593	110.4590	111.7782	130.2668	142.1963	154.4160 (45)
Energy content (annual)												Total = Sum(45)m = 1537.8980 (45)
Distribution loss (46)m = 0.15 x (45)m												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												

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Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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)
Primary 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 (59)
Heat gains from water heating, kWh/month	33.8825	29.6339	30.5795	26.6599	25.5808	22.0743	20.4551	23.4725	23.7529	27.6817	30.2167	32.8134 (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	133.7774	133.7774	133.7774	133.7774	133.7774	133.7774	133.7774	133.7774	133.7774	133.7774	133.7774	133.7774	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.3250	20.7171	16.8483	12.7552	9.5347	8.0496	8.6978	11.3058	15.1746	19.2676	22.4882	23.9733	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	246.0901	248.6438	242.2087	228.5091	211.2159	194.9626	184.1045	181.5508	187.9859	201.6855	218.9788	235.2320	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3777	36.3777	36.3777	36.3777	36.3777	36.3777	36.3777	36.3777	36.3777	36.3777	36.3777	36.3777	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-107.0219	-107.0219	-107.0219	-107.0219	-107.0219	-107.0219	-107.0219	-107.0219	-107.0219	-107.0219	-107.0219	-107.0219	(71)
Water heating gains (Table 5)	45.5410	44.0980	41.1015	37.0277	34.3829	30.6588	27.4934	31.5491	32.9901	37.2066	41.9677	44.1040	(72)
Total internal gains	378.0894	376.5921	363.2916	341.4252	318.2666	296.8042	283.4290	287.5390	299.2839	321.2930	346.5679	366.4425	(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
Northeast	3.9800	11.2829	0.6300	0.7000	0.7700	13.7239 (75)
Southeast	1.8300	36.7938	0.6300	0.7000	0.7700	20.5778 (77)
Southwest	7.9000	36.7938	0.6300	0.7000	0.7700	88.8329 (79)

Solar gains	123.1346	214.3022	305.3259	398.6089	464.9998	469.7855	449.5324	398.7561	337.4346	240.1143	148.3170	104.8404	(83)
Total gains	501.2240	590.8943	668.6176	740.0341	783.2664	766.5897	732.9613	686.2950	636.7185	561.4073	494.8848	471.2829	(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	53.2471	53.3983	53.5473	54.2587	54.3939	55.0322	55.0322	55.1520	54.7845	54.3939	54.1210	53.8388	
alpha	4.5498	4.5599	4.5698	4.6172	4.6263	4.6688	4.6688	4.6768	4.6523	4.6263	4.6081	4.5893	
util living area	0.9987	0.9971	0.9926	0.9778	0.9327	0.8192	0.6624	0.7169	0.9099	0.9861	0.9974	0.9991	(86)
MIT	19.4973	19.6595	19.9264	20.2861	20.6242	20.8721	20.9648	20.9491	20.7630	20.3223	19.8466	19.4746	(87)
Th 2	19.8376	19.8404	19.8433	19.8566	19.8591	19.8708	19.8708	19.8730	19.8663	19.8591	19.8541	19.8488	(88)
util rest of house	0.9983	0.9960	0.9898	0.9681	0.9001	0.7304	0.5157	0.5754	0.8525	0.9784	0.9963	0.9987	(89)
MIT 2	18.4732	18.6372	18.9050	19.2700	19.5921	19.8074	19.8614	19.8575	19.7257	19.3109	18.8349	18.4592	(90)
Living area fraction									fLA = Living area / (4) =			0.1520	(91)
MIT	18.6288	18.7926	19.0602	19.4244	19.7489	19.9692	20.0291	20.0234	19.8833	19.4646	18.9887	18.6135	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6288	18.7926	19.0602	19.4244	19.7489	19.9692	20.0291	20.0234	19.8833	19.4646	18.9887	18.6135	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	500.0266	587.7469	659.9593	712.8585	701.9493	566.7866	394.4072	409.3578	543.5215	547.1891	492.4614	470.4380	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	16.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1754.9438	1696.6988	1529.7085	1264.9641	965.0212	636.2668	406.3593	428.4495	688.4461	1062.8192	1432.5704	1745.9203	(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	933.6584	745.2157	647.0934	397.5160	195.7254	0.0000	0.0000	0.0000	0.0000	383.6288	676.8785	948.9588	(98)
Space heating												4928.6750	(98)
Space heating per m2												52.4830	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1113.9365	876.9288	898.6723	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7756	0.8574	0.8263	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	863.9554	751.9153	742.5884	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	998.1114	956.6881	904.1033	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	96.5924	152.3510	120.1671	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												369.1104 (104)
Cooled fraction									fC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	24.1481	38.0877	30.0418	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												92.2776 (107)
Space cooling per m2												0.9826 (108)
Energy for space heating												52.4830 (99)
Energy for space cooling												0.9826 (108)
Total												53.4656 (109)
Target Fabric Energy Efficiency (TFEE)												61.5 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	H417--H7 Detached			Issued on Date	17/12/2021
Assessment Reference	2	Prop Type Ref			
Property	H417--H7 DS05 (Hipped), Detached, Part L2013 Masonry				
SAP Rating	85 B	DER	15.98	TER	16.49
Environmental	85 B	% DER<TER	3.10		
CO ₂ Emissions (t/year)	1.88	DFEE	50.34	TFEE	55.50
General Requirements Compliance	Pass	% DFEE<TFEE	9.30		
Assessor Details	Mr. Andrew Maughan, Andrew Maughan, Tel: 01582 544250, Andrew.Maughan@ee-ltd.co.uk			Assessor ID	V844-0001
Client					

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS DESIGNED

Detached House, total floor area 132 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.49 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 15.98 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)55.5 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)50.3 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Floor	0.15 (max. 0.25)	0.15 (max. 0.70)	OK
Roof	0.11 (max. 0.20)	0.17 (max. 0.35)	OK
Openings	1.39 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals:	5.01 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Ideal LOGIC COMBI ESPl 35
Combi boiler
Efficiency: 89.6% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

7 Low energy lights

Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Midlands): Not significant OK

Based on:

Overshading: Average

Windows facing North: 6.16 m², No overhang

Windows facing North East: 0.74 m², No overhang

Windows facing East: 2.65 m², No overhang

Windows facing South: 12.43 m², No overhang

Windows facing West: 2.65 m², No overhang

Windows facing North West: 0.74 m², No overhang

Air change rate: 4.00 ach

Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features

Roof U-value 0.11 W/m²K

Door U-value 1.10 W/m²K

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	68.1700 (1b)	x 2.3000 (2b)	= 156.7910 (1b) - (3b)
First floor	63.5800 (1c)	x 2.6400 (2c)	= 167.8512 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	131.7500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	324.6422 (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					5 * 10 = 50.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					50.0000 / (5) = 0.1540 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.4045 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3742 (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	0.4771	0.4677	0.4584	0.4116	0.4022	0.3555	0.3555	0.3461	0.3742	0.4022	0.4209	0.4397 (22b)
Effective ac	0.6138	0.6094	0.6051	0.5847	0.5809	0.5632	0.5632	0.5599	0.5700	0.5809	0.5886	0.5966 (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
Opening Type 1 (Uw = 1.41)			25.3700	1.3347	33.8619		(27)
Opening Type 4			2.3800	1.1000	2.6180		(26)
Opening Type 6			2.0000	1.5000	3.0000		(26a)
150mm TE Platinum GF			68.1700	0.1500	10.2255		(28a)
50mm Alreflex Plat	164.7500	29.7500	135.0000	0.2700	36.4500		(29a)
1st Flr Horiz Cl	63.5800		63.5800	0.1100	6.9938		(30)
Grd Floor Bays	3.0700		3.0700	0.1700	0.5219		(30)
Total net area of external elements Aum(A, m ²)			299.5700				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		93.6711		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							151.3600 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.2982 (36)
Total fabric heat loss						(33) + (36) =	105.9693 (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	65.7576	65.2842	64.8202	62.6406	62.2328	60.3344	60.3344	59.9829	61.0657	62.2328	63.0578	63.9202 (38)
Heat transfer coeff	171.7269	171.2535	170.7894	168.6098	168.2020	166.3037	166.3037	165.9521	167.0349	168.2020	169.0270	169.8895 (39)
Average = Sum(39)m / 12 =												168.6079 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.3034	1.2998	1.2963	1.2798	1.2767	1.2623	1.2623	1.2596	1.2678	1.2767	1.2829	1.2895 (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												2.8994 (42)
Average daily hot water use (litres/day)												103.0605 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	113.3665	109.2441	105.1217	100.9992	96.8768	92.7544	92.7544	96.8768	100.9992	105.1217	109.2441	113.3665 (44)
Energy conte	168.1192	147.0382	151.7302	132.2821	126.9278	109.5290	101.4948	116.4667	117.8577	137.3518	149.9302	162.8145 (45)
Energy content (annual)										Total = Sum(45)m =		1621.5422 (45)
Distribution loss (46)m = 0.15 x (45)m	25.2179	22.0557	22.7595	19.8423	19.0392	16.4294	15.2242	17.4700	17.6787	20.6028	22.4895	24.4222 (46)
Water storage loss:												
Total storage loss												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	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	14.1600	12.7782	14.1207	13.6303	14.0517	13.5566	13.9825	14.0274	13.5957	14.0862	13.6726	14.1473 (61)
Total heat required for water heating calculated for each month	182.2793	159.8163	165.8509	145.9124	140.9795	123.0857	115.4773	130.4941	131.4534	151.4380	163.6028	176.9618 (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	182.2793	159.8163	165.8509	145.9124	140.9795	123.0857	115.4773	130.4941	131.4534	151.4380	163.6028	176.9618 (64)
Heat gains from water heating, kWh/month	59.4397	52.0847	53.9805	47.3914	45.7164	39.8076	37.2426	42.2320	42.5866	49.1910	53.2700	57.6727 (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	144.9694	144.9694	144.9694	144.9694	144.9694	144.9694	144.9694	144.9694	144.9694	144.9694	144.9694	144.9694	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	27.0357	24.0129	19.5286	14.7844	11.0515	9.3302	10.0816	13.1044	17.5887	22.3329	26.0658	27.7872	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	299.8176	302.9287	295.0887	278.3982	257.3294	237.5277	224.2989	221.1878	229.0278	245.7183	266.7871	286.5888	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.4969	37.4969	37.4969	37.4969	37.4969	37.4969	37.4969	37.4969	37.4969	37.4969	37.4969	37.4969	(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)	-115.9755	-115.9755	-115.9755	-115.9755	-115.9755	-115.9755	-115.9755	-115.9755	-115.9755	-115.9755	-115.9755	-115.9755	(71)
Water heating gains (Table 5)	79.8920	77.5070	72.5544	65.8213	61.4468	55.2883	50.0573	56.7635	59.1481	66.1170	73.9860	77.5170	(72)
Total internal gains	476.2361	473.9395	456.6625	428.4947	399.3185	371.6369	353.9286	360.5465	375.2554	403.6590	436.3298	461.3838	(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	
North				6.1600	10.6334	0.7100	0.7000		0.7700		22.5602 (74)	
Northeast				0.7400	11.2829	0.7100	0.7000		0.7700		2.8757 (75)	
East				2.6500	19.6403	0.7100	0.7000		0.7700		17.9260 (76)	
South				12.4300	46.7521	0.7100	0.7000		0.7700		200.1527 (78)	
West				2.6500	19.6403	0.7100	0.7000		0.7700		17.9260 (80)	
Northwest				0.7400	11.2829	0.7100	0.7000		0.7700		2.8757 (81)	
Solar gains	264.3163	452.7534	627.4112	792.6966	903.3060	903.9438	868.4859	784.6139	684.3046	502.4097	317.0200	225.9374 (83)
Total gains	740.5524	926.6929	1084.0737	1221.1914	1302.6245	1275.5808	1222.4145	1145.1603	1059.5600	906.0687	753.3498	687.3212 (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	32.2568	32.3459	32.4338	32.8531	32.9327	33.3087	33.3087	33.3792	33.1629	32.9327	32.7720	32.6056	
alpha	3.1505	3.1564	3.1623	3.1902	3.1955	3.2206	3.2206	3.2253	3.2109	3.1955	3.1848	3.1737	
util living area	0.9895	0.9785	0.9574	0.9116	0.8261	0.6900	0.5466	0.5933	0.7935	0.9371	0.9817	0.9917	(86)
MIT	18.8745	19.1562	19.5653	20.0716	20.5107	20.8147	20.9361	20.9155	20.6868	20.0977	19.3889	18.8295	(87)
Th 2	19.8381	19.8410	19.8437	19.8567	19.8591	19.8705	19.8705	19.8726	19.8661	19.8591	19.8542	19.8491	(88)
util rest of house	0.9872	0.9738	0.9476	0.8901	0.7811	0.6064	0.4261	0.4744	0.7250	0.9174	0.9769	0.9898	(89)
MIT 2	17.0134	17.4237	18.0153	18.7412	19.3382	19.7187	19.8366	19.8239	19.5792	18.7931	17.7730	16.9543	(90)
Living area fraction	17.4400	17.8208	18.3706	19.0462	19.6069	19.9699	20.0886	20.0741	19.8331	19.0921	18.1434	17.3841	(92)
MIT	17.4400	17.8208	18.3706	19.0462	19.6069	19.9699	20.0886	20.0741	19.8331	19.0921	18.1434	17.3841	(92)
Temperature adjustment	17.2900	17.6708	18.2206	18.8962	19.4569	19.8199	19.9386	19.9241	19.6831	18.9421	17.9934	-0.1500	
adjusted MIT	17.2900	17.6708	18.2206	18.8962	19.4569	19.8199	19.9386	19.9241	19.6831	18.9421	17.9934	17.2341	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9791	0.9606	0.9285	0.8670	0.7623	0.6022	0.4340	0.4803	0.7118	0.8958	0.9649	0.9830	(94)
Useful gains	725.0603	890.1421	1006.5781	1058.7419	992.9461	768.0930	530.4842	550.0339	754.1769	811.6545	726.8755	675.6655	(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	2230.7379	2187.0435	2001.7506	1685.4565	1304.7328	868.0890	555.2284	584.8286	932.5694	1403.1591	1841.2795	2214.3567	(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	1120.2241	871.5177	740.4083	451.2345	231.9693	0.0000	0.0000	0.0000	0.0000	440.0794	802.3709	1144.7863	(98)
Space heating												5802.5905	
Space heating per m2												44.0424	(99)
										(98) / (4) =			

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													6411.7022 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1120.2241	871.5177	740.4083	451.2345	231.9693	0.0000	0.0000	0.0000	0.0000	440.0794	802.3709	1144.7863	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	1237.8167	963.0030	818.1308	498.6016	256.3196	0.0000	0.0000	0.0000	0.0000	486.2756	886.5977	1264.9572	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	182.2793	159.8163	165.8509	145.9124	140.9795	123.0857	115.4773	130.4941	131.4534	151.4380	163.6028	176.9618	(64)
Efficiency of water heater (217)m	90.0381	89.9889	89.8970	89.6966	89.2632	87.3000	87.3000	87.3000	87.3000	89.6586	89.9416	90.0580	(216)
Fuel for water heating, kWh/month	202.4468	177.5957	184.4900	162.6732	157.9369	140.9916	132.2764	149.4777	150.5766	168.9051	181.8989	196.4975	(219)
Water heating fuel used												2005.7665	(219)
Annual totals kWh/year													
Space heating fuel - main system												6411.7022	(211)
Space heating fuel - secondary												0.0000	(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)												477.4597	(232)
Total delivered energy for all uses												8969.9284	(238)

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	6411.7022	0.2160	1384.9277 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2005.7665	0.2160	433.2456 (264)
Space and water heating			1818.1732 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	477.4597	0.5190	247.8016 (268)
Total CO2, kg/year			2104.8998 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			15.9800 (273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		15.9800	ZC1
Total Floor Area	TFA	131.7500	
Assumed number of occupants	N	2.8994	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		13.4851	ZC2
CO2 emissions from cooking, equation (L16)		1.4314	ZC3
Total CO2 emissions		30.8964	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		30.8964	ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	68.1700 (1b)	x 2.3000 (2b)	= 156.7910 (1b) - (3b)
First floor	63.5800 (1c)	x 2.6400 (2c)	= 167.8512 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	131.7500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 324.6422 (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					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1232 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3732 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3452 (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	0.4402	0.4315	0.4229	0.3797	0.3711	0.3280	0.3280	0.3193	0.3452	0.3711	0.3884	0.4056 (22b)
Effective ac	0.5969	0.5931	0.5894	0.5721	0.5689	0.5538	0.5538	0.5510	0.5596	0.5689	0.5754	0.5823 (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
TER Opaque door			2.3800	1.0000	2.3800		(26)
TER Semi-glazed door			2.0000	1.2000	2.4000		(26a)
TER Opening Type (Uw = 1.40)			25.3700	1.3258	33.6345		(27)
150mm TE Platinum GF			68.1700	0.1300	8.8621		(28a)
50mm Alreflex Plat	164.7500	29.7500	135.0000	0.1800	24.3000		(29a)
1st Flr Horiz Cl	63.5800		63.5800	0.1300	8.2654		(30)
Grd Floor Bays	3.0700		3.0700	0.1300	0.3991		(30)
Total net area of external elements Aum(A, m ²)			299.5700				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		80.2411		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.6023 (36)
Total fabric heat loss						(33) + (36) =	94.8434 (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	63.9438	63.5408	63.1458	61.2905	60.9433	59.3274	59.3274	59.0282	59.9498	60.9433	61.6456	62.3797 (38)
Heat transfer coeff	158.7871	158.3841	157.9891	156.1338	155.7867	154.1708	154.1708	153.8715	154.7932	155.7867	156.4889	157.2231 (39)
Average = Sum(39)m / 12 =												156.1322 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2052	1.2022	1.1992	1.1851	1.1824	1.1702	1.1702	1.1679	1.1749	1.1824	1.1878	1.1933 (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												2.8994 (42)
Average daily hot water use (litres/day)												103.0605 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	113.3665	109.2441	105.1217	100.9992	96.8768	92.7544	92.7544	96.8768	100.9992	105.1217	109.2441	113.3665 (44)
Energy conte	168.1192	147.0382	151.7302	132.2821	126.9278	109.5290	101.4948	116.4667	117.8577	137.3518	149.9302	162.8145 (45)
Energy content (annual)										Total = Sum(45)m =		1621.5422 (45)
Distribution loss (46)m = 0.15 x (45)m	25.2179	22.0557	22.7595	19.8423	19.0392	16.4294	15.2242	17.4700	17.6787	20.6028	22.4895	24.4222 (46)
Water storage loss:												
Total storage loss												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	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	49.3674	45.7419	47.2666	49.3674	49.3151	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month	219.0781	193.0656	202.6891	181.5971	176.2952	155.2709	148.7614	165.8341	167.1728	188.3107	199.2453	213.7734 (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	219.0781	193.0656	202.6891	181.5971	176.2952	155.2709	148.7614	165.8341	167.1728	188.3107	199.2453	213.7734 (64)
Heat gains from water heating, kWh/month	68.6394	60.3970	63.1900	56.3126	54.5453	47.8539	45.5637	51.0670	51.5165	58.4092	62.1806	66.8755 (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	144.9694	144.9694	144.9694	144.9694	144.9694	144.9694	144.9694	144.9694	144.9694	144.9694	144.9694	144.9694	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	27.0357	24.0129	19.5286	14.7844	11.0515	9.3302	10.0816	13.1044	17.5887	22.3329	26.0658	27.7872	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	299.8176	302.9287	295.0887	278.3982	257.3294	237.5277	224.2989	221.1878	229.0278	245.7183	266.7871	286.5888	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.4969	37.4969	37.4969	37.4969	37.4969	37.4969	37.4969	37.4969	37.4969	37.4969	37.4969	37.4969	(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)	-115.9755	-115.9755	-115.9755	-115.9755	-115.9755	-115.9755	-115.9755	-115.9755	-115.9755	-115.9755	-115.9755	-115.9755	(71)
Water heating gains (Table 5)	92.2572	89.8765	84.9328	78.2119	73.3136	66.4637	61.2415	68.6385	71.5506	78.5070	86.3619	89.8865	(72)
Total internal gains	488.6014	486.3090	469.0409	440.8853	411.1853	382.8124	365.1128	372.4215	387.6580	416.0490	448.7056	473.7533	(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
North				6.1600	10.6334		0.6300		0.7000		0.7700		20.0182 (74)
Northeast				0.7400	11.2829		0.6300		0.7000		0.7700		2.5517 (75)
East				2.6500	19.6403		0.6300		0.7000		0.7700		15.9061 (76)
South				12.4300	46.7521		0.6300		0.7000		0.7700		177.6003 (78)
West				2.6500	19.6403		0.6300		0.7000		0.7700		15.9061 (80)
Northwest				0.7400	11.2829		0.6300		0.7000		0.7700		2.5517 (81)
Solar gains	234.5341	401.7389	556.7170	703.3787	801.5250	802.0910	770.6283	696.2067	607.1999	445.8001	281.2995	200.4797	(83)
Total gains	723.1355	888.0479	1025.7579	1144.2640	1212.7104	1184.9034	1135.7411	1068.6282	994.8578	861.8492	730.0051	674.2330	(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	57.6199	57.7665	57.9110	58.5991	58.7297	59.3453	59.3453	59.4607	59.1066	58.7297	58.4662	58.1931	
alpha	4.8413	4.8511	4.8607	4.9066	4.9153	4.9564	4.9564	4.9640	4.9404	4.9153	4.8977	4.8795	
util living area	0.9987	0.9961	0.9888	0.9645	0.8956	0.7480	0.5777	0.6307	0.8598	0.9785	0.9968	0.9990	(86)
MIT	19.6382	19.8240	20.0981	20.4436	20.7429	20.9287	20.9842	20.9760	20.8490	20.4495	19.9752	19.6083	(87)
Th 2	19.9158	19.9183	19.9207	19.9320	19.9341	19.9439	19.9439	19.9458	19.9401	19.9341	19.9298	19.9253	(88)
util rest of house	0.9982	0.9947	0.9846	0.9505	0.8534	0.6558	0.4489	0.5015	0.7895	0.9674	0.9955	0.9987	(89)
MIT 2	18.0989	18.3718	18.7717	19.2733	19.6768	19.8952	19.9380	19.9357	19.8169	19.2902	18.6015	18.0618	(90)
Living area fraction									fLA =	Living area / (4) =			(91)
MIT	18.4517	18.7047	19.0758	19.5416	19.9212	20.1321	20.1778	20.1742	20.0535	19.5559	18.9164	18.4163	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4517	18.7047	19.0758	19.5416	19.9212	20.1321	20.1778	20.1742	20.0535	19.5559	18.9164	18.4163	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9972	0.9925	0.9801	0.9439	0.8528	0.6738	0.4786	0.5311	0.7983	0.9620	0.9936	0.9980	(94)
Useful gains	721.1066	881.3476	1005.3802	1080.0234	1034.1935	798.3537	543.5776	567.5421	794.2176	829.0865	725.3266	672.8731	(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	2247.1149	2186.4420	1986.8344	1661.5061	1280.7551	852.8925	551.5980	580.7351	921.5601	1395.2096	1849.1344	2235.1262	(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	1135.3502	877.0234	730.2019	418.6676	183.4418	0.0000	0.0000	0.0000	0.0000	421.1956	809.1416	1162.3163	(98)
Space heating												5737.3384	(98)
Space heating per m2													(98) / (4) = 43.5472 (99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													6142.7606 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1135.3502	877.0234	730.2019	418.6676	183.4418	0.0000	0.0000	0.0000	0.0000	421.1956	809.1416	1162.3163	(98)
Space heating efficiency (main heating system 1)	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)	1215.5784	938.9973	781.8008	448.2522	196.4045	0.0000	0.0000	0.0000	0.0000	450.9589	866.3187	1244.4500	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	219.0781	193.0656	202.6891	181.5971	176.2952	155.2709	148.7614	165.8341	167.1728	188.3107	199.2453	213.7734	(64)
Efficiency of water heater (217)m	88.5975	88.3941	87.9953	87.0862	85.1513	80.3000	80.3000	80.3000	80.3000	87.0185	88.2078	88.6675	(216)
Fuel for water heating, kWh/month	247.2734	218.4146	230.3409	208.5257	207.0376	193.3636	185.2570	206.5182	208.1853	216.4031	225.8816	241.0956	(219)
Water heating fuel used												2588.2965	(219)
Annual totals kWh/year													
Space heating fuel - main system												6142.7606	(211)
Space heating fuel - secondary												0.0000	(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)												477.4597	(232)
Total delivered energy for all uses												9283.5169	(238)

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	6142.7606	0.2160	1326.8363 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2588.2965	0.2160	559.0721 (264)
Space and water heating			1885.9083 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	477.4597	0.5190	247.8016 (268)
Total CO2, kg/m2/year			2172.6349 (272)
Emissions per m2 for space and water heating			14.3143 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			1.8808 (272b)
Emissions per m2 for pumps and fans			0.2954 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.3143 * 1.00) + 1.8808 + 0.2954, rounded to 2 d.p.			16.4900 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	68.1700 (1b)	x 2.3000 (2b)	= 156.7910 (1b) - (3b)
First floor	63.5800 (1c)	x 2.6400 (2c)	= 167.8512 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	131.7500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 324.6422 (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					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1232 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.3737 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3457 (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	0.4407	0.4321	0.4235	0.3803	0.3716	0.3284	0.3284	0.3198	0.3457	0.3716	0.3889	0.4062 (22b)
Effective ac	0.5971	0.5934	0.5897	0.5723	0.5690	0.5539	0.5539	0.5511	0.5597	0.5690	0.5756	0.5825 (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
Opening Type 1 (Uw = 1.41)			25.3700	1.3347	33.8619		(27)
Opening Type 4			2.3800	1.1000	2.6180		(26)
Opening Type 6			2.0000	1.5000	3.0000		(26a)
150mm TE Platinum GF			68.1700	0.1500	10.2255		(28a)
50mm Alreflex Plat	164.7500	29.7500	135.0000	0.2700	36.4500		(29a)
1st Flr Horiz Cl	63.5800		63.5800	0.1100	6.9938		(30)
Grd Floor Bays	3.0700		3.0700	0.1700	0.5219		(30)
Total net area of external elements Aum(A, m ²)			299.5700				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		93.6711		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							151.3600 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.2982 (36)
Total fabric heat loss						(33) + (36) =	105.9693 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	63.9716	63.5675	63.1715	61.3112	60.9631	59.3429	59.3429	59.0428	59.9670	60.9631	61.6672	62.4033 (38)
Heat transfer coeff	169.9408	169.5368	169.1407	167.2804	166.9324	165.3121	165.3121	165.0121	165.9362	166.9324	167.6365	168.3726 (39)
Average = Sum(39)m / 12 =												167.2788 (39)
HLP	1.2899	1.2868	1.2838	1.2697	1.2670	1.2547	1.2547	1.2525	1.2595	1.2670	1.2724	1.2780 (40)
HLP (average)												1.2697 (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												2.8994 (42)
Average daily hot water use (litres/day)												103.0605 (43)
Daily hot water use	113.3665	109.2441	105.1217	100.9992	96.8768	92.7544	92.7544	96.8768	100.9992	105.1217	109.2441	113.3665 (44)
Energy conte	168.1192	147.0382	151.7302	132.2821	126.9278	109.5290	101.4948	116.4667	117.8577	137.3518	149.9302	162.8145 (45)
Energy content (annual)												1621.5422 (45)
Distribution loss (46)m = 0.15 x (45)m												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:												
Total storage loss												

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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 (56)
Primary 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 (57)
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
	35.7253	31.2456	32.2427	28.1099	26.9722	23.2749	21.5676	24.7492	25.0448	29.1873	31.8602	34.5981 (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	144.9694	144.9694	144.9694	144.9694	144.9694	144.9694	144.9694	144.9694	144.9694	144.9694	144.9694	144.9694 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	27.0357	24.0129	19.5286	14.7844	11.0515	9.3302	10.0816	13.1044	17.5887	22.3329	26.0658	27.7872 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	299.8176	302.9287	295.0887	278.3982	257.3294	237.5277	224.2989	221.1878	229.0278	245.7183	266.7871	286.5888 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.4969	37.4969	37.4969	37.4969	37.4969	37.4969	37.4969	37.4969	37.4969	37.4969	37.4969	37.4969 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-115.9755	-115.9755	-115.9755	-115.9755	-115.9755	-115.9755	-115.9755	-115.9755	-115.9755	-115.9755	-115.9755	-115.9755 (71)
Water heating gains (Table 5)	48.0179	46.4964	43.3369	39.0416	36.2529	32.3263	28.9888	33.2650	34.7844	39.2302	44.2502	46.5028 (72)
Total internal gains	441.3621	439.9289	424.4450	398.7150	371.1246	345.6749	329.8601	334.0480	347.8917	373.7722	403.5940	427.3696 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	FF Access factor Table 6d	Gains W
North	6.1600	10.6334	0.7100	0.7000	0.7700	22.5602 (74)
Northeast	0.7400	11.2829	0.7100	0.7000	0.7700	2.8757 (75)
East	2.6500	19.6403	0.7100	0.7000	0.7700	17.9260 (76)
South	12.4300	46.7521	0.7100	0.7000	0.7700	200.1527 (78)
West	2.6500	19.6403	0.7100	0.7000	0.7700	17.9260 (80)
Northwest	0.7400	11.2829	0.7100	0.7000	0.7700	2.8757 (81)

Solar gains	264.3163	452.7534	627.4112	792.6966	903.3060	903.9438	868.4859	784.6139	684.3046	502.4097	317.0200	225.9374 (83)
Total gains	705.6783	892.6823	1051.8562	1191.4116	1274.4306	1249.6188	1198.3460	1118.6619	1032.1963	876.1819	720.6140	653.3070 (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	32.5958	32.6735	32.7500	33.1142	33.1832	33.5085	33.5085	33.5694	33.3824	33.1832	33.0439	32.8994
alpha	3.1731	3.1782	3.1833	3.2076	3.2122	3.2339	3.2339	3.2380	3.2255	3.2122	3.2029	3.1933
util living area	0.9909	0.9805	0.9603	0.9158	0.8317	0.6968	0.5530	0.6015	0.8013	0.9417	0.9838	0.9928 (86)
MIT	18.8634	19.1462	19.5568	20.0631	20.5051	20.8113	20.9348	20.9131	20.6800	20.0846	19.3732	18.8156 (87)
Th 2	19.8488	19.8512	19.8535	19.8647	19.8667	19.8765	19.8765	19.8783	19.8727	19.8667	19.8625	19.8581 (88)
util rest of house	0.9888	0.9762	0.9511	0.8951	0.7876	0.6137	0.4323	0.4825	0.7341	0.9232	0.9795	0.9912 (89)
MIT 2	17.9062	18.1882	18.5947	19.0937	19.5055	19.7703	19.8527	19.8437	19.6712	19.1251	18.4239	17.8653 (90)
Living area fraction									fLA = Living area / (4) =			0.2292 (91)
MIT	18.1256	18.4078	18.8152	19.3159	19.7346	20.0089	20.1007	20.0889	19.9024	19.3450	18.6415	18.0831 (92)
Temperature adjustment												0.0000
adjusted MIT	18.1256	18.4078	18.8152	19.3159	19.7346	20.0089	20.1007	20.0889	19.9024	19.3450	18.6415	18.0831 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	694.7427	864.8631	989.1018	1051.9232	996.2183	780.4178	548.9199	566.8522	759.8414	799.2625	701.1865	645.2366 (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	2349.5354	2290.0728	2083.0003	1742.3833	1341.2374	894.1533	578.7129	608.7058	962.8298	1459.8289	1934.7779	2337.5345 (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	1231.1658	957.7410	813.8605	497.1312	256.6943	0.0000	0.0000	0.0000	0.0000	491.4614	888.1859	1259.0697 (98)
Space heating												6395.3097 (98)
Space heating per m2										(98) / (4) =		48.5413 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1553.9340	1223.3097	1254.0918	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7701	0.8386	0.8107	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1196.7266	1025.8788	1016.6748	0.0000	0.0000	0.0000	0.0000 (102)

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Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1580.0118	1517.3641	1426.5217	0.0000	0.0000	0.0000	0.0000 (103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	275.9654	365.6650	304.9261	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												946.5565 (104)
Cooled fraction									fC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
Intermittency factor	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	68.9913	91.4163	76.2315	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												236.6391 (107)
Space cooling per m2												1.7961 (108)
Energy for space heating												48.5413 (99)
Energy for space cooling												1.7961 (108)
Total												50.3374 (109)
Dwelling Fabric Energy Efficiency (DFEE)												50.3 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	68.1700 (1b)	x 2.3000 (2b)	= 156.7910 (1b) - (3b)
First floor	63.5800 (1c)	x 2.6400 (2c)	= 167.8512 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	131.7500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 324.6422 (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					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1232 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3732 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3452 (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	0.4402	0.4315	0.4229	0.3797	0.3711	0.3280	0.3280	0.3193	0.3452	0.3711	0.3884	0.4056 (22b)
Effective ac	0.5969	0.5931	0.5894	0.5721	0.5689	0.5538	0.5538	0.5510	0.5596	0.5689	0.5754	0.5823 (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
TER Opaque door			2.3800	1.0000	2.3800		(26)
TER Semi-glazed door			2.0000	1.2000	2.4000		(26a)
TER Opening Type (Uw = 1.40)			25.3700	1.3258	33.6345		(27)
150mm TE Platinum GF			68.1700	0.1300	8.8621		(28a)
50mm Alreflex Plat	164.7500	29.7500	135.0000	0.1800	24.3000		(29a)
1st Flr Horiz Cl	63.5800		63.5800	0.1300	8.2654		(30)
Grd Floor Bays	3.0700		3.0700	0.1300	0.3991		(30)
Total net area of external elements Aum(A, m ²)			299.5700				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		80.2411		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.6023 (36)
Total fabric heat loss						(33) + (36) =	94.8434 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	63.9438	63.5408	63.1458	61.2905	60.9433	59.3274	59.3274	59.0282	59.9498	60.9433	61.6456	62.3797 (38)
Heat transfer coeff	158.7871	158.3841	157.9891	156.1338	155.7867	154.1708	154.1708	153.8715	154.7932	155.7867	156.4889	157.2231 (39)
Average = Sum(39)m / 12 =												156.1322 (39)
HLP	1.2052	1.2022	1.1992	1.1851	1.1824	1.1702	1.1702	1.1679	1.1749	1.1824	1.1878	1.1933 (40)
HLP (average)												1.1851 (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												2.8994 (42)
Average daily hot water use (litres/day)												103.0605 (43)
Daily hot water use	113.3665	109.2441	105.1217	100.9992	96.8768	92.7544	92.7544	96.8768	100.9992	105.1217	109.2441	113.3665 (44)
Energy conte	168.1192	147.0382	151.7302	132.2821	126.9278	109.5290	101.4948	116.4667	117.8577	137.3518	149.9302	162.8145 (45)
Energy content (annual)										Total = Sum(45)m =		1621.5422 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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 (56)
Primary 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 (57)
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
	35.7253	31.2456	32.2427	28.1099	26.9722	23.2749	21.5676	24.7492	25.0448	29.1873	31.8602	34.5981 (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	144.9694	144.9694	144.9694	144.9694	144.9694	144.9694	144.9694	144.9694	144.9694	144.9694	144.9694	144.9694 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	27.0357	24.0129	19.5286	14.7844	11.0515	9.3302	10.0816	13.1044	17.5887	22.3329	26.0658	27.7872 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	299.8176	302.9287	295.0887	278.3982	257.3294	237.5277	224.2989	221.1878	229.0278	245.7183	266.7871	286.5888 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.4969	37.4969	37.4969	37.4969	37.4969	37.4969	37.4969	37.4969	37.4969	37.4969	37.4969	37.4969 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-115.9755	-115.9755	-115.9755	-115.9755	-115.9755	-115.9755	-115.9755	-115.9755	-115.9755	-115.9755	-115.9755	-115.9755 (71)
Water heating gains (Table 5)	48.0179	46.4964	43.3369	39.0416	36.2529	32.3263	28.9888	33.2650	34.7844	39.2302	44.2502	46.5028 (72)
Total internal gains	441.3621	439.9289	424.4450	398.7150	371.1246	345.6749	329.8601	334.0480	347.8917	373.7722	403.5940	427.3696 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W
North	6.1600	10.6334	0.6300	0.7000	0.7700	20.0182 (74)	
Northeast	0.7400	11.2829	0.6300	0.7000	0.7700	2.5517 (75)	
East	2.6500	19.6403	0.6300	0.7000	0.7700	15.9061 (76)	
South	12.4300	46.7521	0.6300	0.7000	0.7700	177.6003 (78)	
West	2.6500	19.6403	0.6300	0.7000	0.7700	15.9061 (80)	
Northwest	0.7400	11.2829	0.6300	0.7000	0.7700	2.5517 (81)	

Solar gains	234.5341	401.7389	556.7170	703.3787	801.5250	802.0910	770.6283	696.2067	607.1999	445.8001	281.2995	200.4797 (83)
Total gains	675.8962	841.6678	981.1620	1102.0937	1172.6496	1147.7660	1100.4884	1030.2547	955.0916	819.5724	684.8934	627.8493 (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	57.6199	57.7665	57.9110	58.5991	58.7297	59.3453	59.3453	59.4607	59.1066	58.7297	58.4662	58.1931
alpha	4.8413	4.8511	4.8607	4.9066	4.9153	4.9564	4.9564	4.9640	4.9404	4.9153	4.8977	4.8795
util living area	0.9990	0.9969	0.9907	0.9691	0.9056	0.7636	0.5936	0.6497	0.8745	0.9823	0.9976	0.9993 (86)
MIT	19.6051	19.7919	20.0682	20.4184	20.7258	20.9217	20.9822	20.9727	20.8348	20.4224	19.9438	19.5756 (87)
Th 2	19.9158	19.9183	19.9207	19.9320	19.9341	19.9439	19.9439	19.9458	19.9401	19.9341	19.9298	19.9253 (88)
util rest of house	0.9987	0.9958	0.9872	0.9566	0.8659	0.6723	0.4626	0.5187	0.8080	0.9730	0.9966	0.9991 (89)
MIT 2	18.6423	18.8305	19.1070	19.4587	19.7446	19.9069	19.9393	19.9378	19.8463	19.4687	18.9916	18.6204 (90)
Living area fraction									fLA = Living area / (4) =			0.2292 (91)
MIT	18.8630	19.0508	19.3273	19.6787	19.9695	20.1395	20.1784	20.1750	20.0729	19.6873	19.2099	18.8393 (92)
Temperature adjustment												0.0000
adjusted MIT	18.8630	19.0508	19.3273	19.6787	19.9695	20.1395	20.1784	20.1750	20.0729	19.6873	19.2099	18.8393 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9982	0.9946	0.9846	0.9529	0.8675	0.6909	0.4930	0.5490	0.8179	0.9701	0.9956	0.9987 (94)
Ext temp.	674.6548	837.1114	966.0521	1050.1738	1017.2736	793.0455	542.5570	565.6335	781.1396	795.1029	681.8935	627.0425 (95)
Heat loss rate W	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)
Month fracti	2312.4101	2241.2698	2026.5738	1682.9147	1288.2859	854.0274	551.6833	580.8686	924.5571	1415.6866	1895.0621	2301.6416 (97)
Space heating kWh	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	1218.4899	943.5945	789.0282	455.5734	201.6332	0.0000	0.0000	0.0000	0.0000	461.7143	873.4814	1245.9017 (98)
Space heating per m2										(98) / (4) =		46.9785 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1449.2054	1140.8638	1169.4237	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8355	0.9054	0.8793	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1210.7472	1032.8900	1028.2452	0.0000	0.0000	0.0000	0.0000 (102)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1460.9631	1402.9851	1323.1886	0.0000	0.0000	0.0000	0.0000 (103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	180.1554	275.3507	219.4378	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												674.9440 (104)
Cooled fraction									fC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
Intermittency factor	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	45.0389	68.8377	54.8595	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												168.7360 (107)
Space cooling per m2												1.2807 (108)
Energy for space heating												46.9785 (99)
Energy for space cooling												1.2807 (108)
Total												48.2592 (109)
Target Fabric Energy Efficiency (TFEE)												55.5 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	H418--H7 Detached			Issued on Date	17/12/2021
Assessment Reference	1	Prop Type Ref			
Property	H418--H7 DS03, Detached, Hipped Roof, Part L2013 Masonry, David Wilson Homes, June 2019				
SAP Rating	84 B	DER	17.15	TER	17.26
Environmental	84 B	% DER<TER	0.66		
CO ₂ Emissions (t/year)	1.96	DFEE	54.31	TFEE	61.71
General Requirements Compliance	Pass	% DFEE<TFEE	11.99		
Assessor Details	Mr. Andrew Maughan, Andrew Maughan, Tel: 01582 544250, Andrew.Maughan@ee-ltd.co.uk			Assessor ID	V844-0001
Client					

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS DESIGNED

Detached House, total floor area 136 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating:Mains gas

Fuel factor:1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER) 17.26 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 17.15 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)61.7 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)54.3 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.28 (max. 0.70)	OK
Floor	0.17 (max. 0.25)	0.19 (max. 0.70)	OK
Roof	0.11 (max. 0.20)	0.17 (max. 0.35)	OK
Openings	1.42 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals:	5.01 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas

Data from database

Ideal LOGIC HEAT H18

Efficiency: 89.6% SEDBUK2009

Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation

Hot water storage Measured cylinder loss: 1.20 kWh/day

Permitted by DBSCG 2.10 OK

Primary pipework insulated: Yes OK

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls: Cylinderstat OK

Independent timer for DHW OK

Boiler interlock Yes OK

7 Low energy lights

Percentage of fixed lights with low-energy fittings:100%

Minimum 75% OK

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames Valley): Slight OK

Based on:

Overshading: Average

Windows facing North: 0.74 m², No overhang

Windows facing North East: 2.55 m², No overhang

Windows facing South East: 10.39 m², No overhang

Windows facing South West: 3.41 m², No overhang

Windows facing West: 0.74 m², No overhang

Windows facing North West: 4.94 m², No overhang

Air change rate: 4.00 ach

Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features

Roof U-value 0.11 W/m²K

Thermal bridging y-value 0.038 W/m²K

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	61.3700 (1b)	x 2.3100 (2b)	= 141.7647 (1b) - (3b)
First floor	74.1500 (1c)	x 2.5600 (2c)	= 189.8240 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	135.5200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 331.5887 (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					5 * 10 = 50.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				50.0000 / (5) = 0.1508 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.4013 (18)
Number of sides sheltered					0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.4013 (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	0.5116	0.5016	0.4916	0.4414	0.4314	0.3812	0.3812	0.3712	0.4013	0.4314	0.4515	0.4715 (22b)
Effective ac	0.6309	0.6258	0.6208	0.5974	0.5930	0.5727	0.5727	0.5689	0.5805	0.5930	0.6019	0.6112 (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
Opening Type 1 (Uw = 1.41)			22.7700	1.3347	30.3916		(27)
Opening Type 14			4.1400	1.5000	6.2100		(26a)
150mm TE Platinum			61.3700	0.1600	9.8192		(28a)
Over Garage			17.3700	0.1900	3.3003		(28b)
50mm Alreflex Plat	168.0000	26.9100	141.0900	0.2700	38.0943		(29a)
Wall to Garage	19.8700		19.8700	0.2800	5.5636		(29a)
1st Flr horiz clg	74.1500		74.1500	0.1100	8.1565		(30)
Grd Flr Bay	3.4800		3.4800	0.1700	0.5916		(30)
Total net area of external elements Aum(A, m ²)			344.2400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		102.1271		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							139.8100 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.0180 (36)
Total fabric heat loss						(33) + (36) =	115.1452 (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	69.0346	68.4785	67.9333	65.3728	64.8937	62.6636	62.6636	62.2506	63.5226	64.8937	65.8629	66.8761 (38)
Heat transfer coeff	184.1798	183.6236	183.0785	180.5179	180.0389	177.8087	177.8087	177.3957	178.6677	180.0389	181.0080	182.0212 (39)
Average = Sum(39)m / 12 =												180.5157 (39)
HLP	1.3591	1.3550	1.3509	1.3320	1.3285	1.3120	1.3120	1.3090	1.3184	1.3285	1.3357	1.3431 (40)
HLP (average)												1.3320 (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												2.9080 (42)
Average daily hot water use (litres/day)												103.2655 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	113.5921	109.4615	105.3309	101.2002	97.0696	92.9390	92.9390	97.0696	101.2002	105.3309	109.4615	113.5921 (44)
Energy content (annual)	168.4538	147.3308	152.0322	132.5453	127.1804	109.7470	101.6967	116.6985	118.0922	137.6251	150.2286	163.1385 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1624.7691 (45)
Water storage loss:	25.2681	22.0996	22.8048	19.8818	19.0771	16.4621	15.2545	17.5048	17.7138	20.6438	22.5343	24.4708 (46)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Store volume													180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.2000 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													0.6480 (55)
Total storage loss													
	20.0880	18.1440	20.0880	19.4400	20.0880	19.4400	20.0880	20.0880	19.4400	20.0880	19.4400	20.0880	(56)
If cylinder contains dedicated solar storage													
	20.0880	18.1440	20.0880	19.4400	20.0880	19.4400	20.0880	20.0880	19.4400	20.0880	19.4400	20.0880	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
	211.8042	186.4860	195.3826	174.4973	170.5308	151.6990	145.0471	160.0489	160.0442	180.9755	192.1806	206.4889	(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 =													(63)
Output from w/h													
	211.8042	186.4860	195.3826	174.4973	170.5308	151.6990	145.0471	160.0489	160.0442	180.9755	192.1806	206.4889	(64)
Total per year (kWh/year) = Sum(64)m =													(64)
Heat gains from water heating, kWh/month													
	90.6912	80.3116	85.2310	77.6329	76.9678	70.0525	68.4945	73.4826	72.8273	80.4407	83.5126	88.9239	(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	145.4011	145.4011	145.4011	145.4011	145.4011	145.4011	145.4011	145.4011	145.4011	145.4011	145.4011	145.4011	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	28.0355	24.9009	20.2508	15.3311	11.4602	9.6752	10.4544	13.5890	18.2391	23.1588	27.0297	28.8147	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	304.2579	307.4152	299.4590	282.5213	261.1405	241.0455	227.6208	224.4636	232.4198	249.3575	270.7383	290.8332	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.5401	37.5401	37.5401	37.5401	37.5401	37.5401	37.5401	37.5401	37.5401	37.5401	37.5401	37.5401	(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)													
	-116.3209	-116.3209	-116.3209	-116.3209	-116.3209	-116.3209	-116.3209	-116.3209	-116.3209	-116.3209	-116.3209	-116.3209	(71)
Water heating gains (Table 5)													
	121.8968	119.5114	114.5578	107.8235	103.4513	97.2951	92.0625	98.7669	101.1490	108.1192	115.9897	119.5213	(72)
Total internal gains													
	523.8106	521.4478	503.8879	475.2963	445.6724	417.6362	399.7581	406.4398	421.4282	450.2558	483.3781	508.7896	(73)

6. Solar gains

[Jan]													
	Area	Solar flux	Specific data	g	Specific data	FF	Access	Gains					
	m2	Table 6a	or Table 6b	W/m2	or Table 6c		factor	W					
							Table 6d						
North	0.7400	10.6334	0.7100	0.7100	0.7000	0.7700	2.7101	(74)					
Northeast	2.5500	11.2829	0.7100	0.7100	0.7000	0.7700	9.9095	(75)					
Southeast	10.3900	36.7938	0.7100	0.7100	0.7000	0.7700	131.6680	(77)					
Southwest	3.4100	36.7938	0.7100	0.7100	0.7000	0.7700	43.2135	(79)					
West	0.7400	19.6403	0.7100	0.7100	0.7000	0.7700	5.0057	(80)					
Northwest	4.9400	11.2829	0.7100	0.7100	0.7000	0.7700	19.1972	(81)					
Solar gains	211.7041	372.1070	539.2558	717.9777	849.1726	862.6853	823.5514	722.7560	600.7344	419.4194	255.6764	179.8079	(83)
Total gains	735.5147	893.5548	1043.1437	1193.2740	1294.8450	1280.3214	1223.3095	1129.1958	1022.1626	869.6751	739.0544	688.5976	(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	28.5757	28.6623	28.7476	29.1554	29.2330	29.5996	29.5996	29.6685	29.4573	29.2330	29.0764	28.9146	
alpha	2.9050	2.9108	2.9165	2.9437	2.9489	2.9733	2.9733	2.9779	2.9638	2.9489	2.9384	2.9276	
util living area	0.9880	0.9784	0.9591	0.9157	0.8334	0.7027	0.5661	0.6176	0.8129	0.9414	0.9805	0.9901	(86)
MIT	18.6395	18.9055	19.3342	19.8952	20.3970	20.7575	20.9086	20.8792	20.5918	19.9325	19.1887	18.6022	(87)
Th 2	19.7949	19.7980	19.8012	19.8158	19.8186	19.8314	19.8314	19.8338	19.8265	19.8186	19.8130	19.8072	(88)
util rest of house	0.9855	0.9737	0.9500	0.8954	0.7901	0.6196	0.4420	0.4962	0.7481	0.9232	0.9756	0.9880	(89)
MIT 2	16.6614	17.0494	17.6710	18.4787	19.1677	19.6275	19.7809	19.7609	19.4419	18.5473	17.4729	16.6140	(90)
Living area fraction									fLA = Living area / (4) =				(91)
MIT	16.9405	17.3112	17.9057	18.6786	19.3412	19.7869	19.9400	19.9187	19.6041	18.7427	17.7150	16.8945	(92)
Temperature adjustment												-0.1500	
adjusted MIT	16.7905	17.1612	17.7557	18.5286	19.1912	19.6369	19.7900	19.7687	19.4541	18.5927	17.5650	16.7445	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9749	0.9579	0.9271	0.8660	0.7618	0.6037	0.4371	0.4885	0.7224	0.8962	0.9607	0.9789	(94)
Useful gains	717.0773	855.9577	967.1354	1033.3645	986.3758	772.9602	534.7219	551.6507	738.4402	779.3808	709.9756	674.0808	(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													
	2300.4935	2251.4529	2060.6699	1738.1288	1348.7032	895.6055	567.2076	597.5969	956.6107	1439.0026	1894.2482	2283.3578	(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													
	1178.0617	937.7728	813.5897	507.4303	269.5715	0.0000	0.0000	0.0000	0.0000	490.7587	852.6763	1197.3020	(98)
Space heating													
Space heating per m2													
													(98) / (4) = 46.0977 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.6000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													6895.3234 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1178.0617	937.7728	813.5897	507.4303	269.5715	0.0000	0.0000	0.0000	0.0000	490.7587	852.6763	1197.3020	(98)
Space heating efficiency (main heating system 1)	90.6000	90.6000	90.6000	90.6000	90.6000	0.0000	0.0000	0.0000	0.0000	90.6000	90.6000	90.6000	(210)
Space heating fuel (main heating system)	1300.2888	1035.0693	898.0018	560.0776	297.5403	0.0000	0.0000	0.0000	0.0000	541.6762	941.1438	1321.5254	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	211.8042	186.4860	195.3826	174.4973	170.5308	151.6990	145.0471	160.0489	160.0442	180.9755	192.1806	206.4889	(64)
Efficiency of water heater (217)m	88.7880	88.6312	88.3099	87.5982	86.1307	79.9000	79.9000	79.9000	79.9000	87.4450	88.4220	79.9000	(216)
Fuel for water heating, kWh/month	238.5504	210.4067	221.2465	199.2020	197.9908	189.8611	181.5358	200.3115	200.3057	206.9592	217.3447	232.4022	(219)
Water heating fuel used												2496.1165	(219)
Annual totals kWh/year													
Space heating fuel - main system												6895.3234	(211)
Space heating fuel - secondary												0.0000	(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)												495.1161	(232)
Total delivered energy for all uses												9961.5560	(238)

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	6895.3234	0.2160	1489.3898	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2496.1165	0.2160	539.1612	(264)
Space and water heating			2028.5510	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	495.1161	0.5190	256.9653	(268)
Total CO2, kg/year			2324.4413	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			17.1500	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		17.1500	ZC1
Total Floor Area	TFA	135.5200	
Assumed number of occupants	N	2.9080	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		13.3041	ZC2
CO2 emissions from cooking, equation (L16)		1.3931	ZC3
Total CO2 emissions		31.8472	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		31.8472	ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	61.3700 (1b)	x 2.3100 (2b)	= 141.7647 (1b) - (3b)
First floor	74.1500 (1c)	x 2.5600 (2c)	= 189.8240 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	135.5200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 331.5887 (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					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1206 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3706 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3706 (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	0.4726	0.4633	0.4540	0.4077	0.3984	0.3521	0.3521	0.3428	0.3706	0.3984	0.4170	0.4355 (22b)
Effective ac	0.6117	0.6073	0.6031	0.5831	0.5794	0.5620	0.5620	0.5588	0.5687	0.5794	0.5869	0.5948 (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
TER Semi-glazed door			4.1400	1.2000	4.9680		(26a)
TER Opening Type (Uw = 1.40)			22.7700	1.3258	30.1875		(27)
150mm TE Platinum			61.3700	0.1300	7.9781		(28a)
Over Garage			17.3700	0.1300	2.2581		(28b)
50mm Alreflex Plat	168.0000	26.9100	141.0900	0.1800	25.3962		(29a)
Wall to Garage	19.8700		19.8700	0.1800	3.5766		(29a)
1st Flr horiz clg	74.1500		74.1500	0.1300	9.6395		(30)
Grd Flr Bay	3.4800		3.4800	0.1300	0.4524		(30)
Total net area of external elements Aum(A, m ²)			344.2400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		84.4564		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							20.7355 (36)
Total fabric heat loss						(33) + (36) =	105.1919 (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	66.9298	66.4554	65.9903	63.8061	63.3974	61.4950	61.4950	61.1427	62.2278	63.3974	64.2242	65.0885 (38)
Heat transfer coeff	172.1217	171.6473	171.1822	168.9980	168.5893	166.6869	166.6869	166.3346	167.4197	168.5893	169.4161	170.2804 (39)
Average = Sum(39)m / 12 =												168.9960 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2701	1.2666	1.2632	1.2470	1.2440	1.2300	1.2300	1.2274	1.2354	1.2440	1.2501	1.2565 (40)
HLP (average)												1.2470 (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												2.9080 (42)
Average daily hot water use (litres/day)												103.2655 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	113.5921	109.4615	105.3309	101.2002	97.0696	92.9390	92.9390	97.0696	101.2002	105.3309	109.4615	113.5921 (44)
Energy conte	168.4538	147.3308	152.0322	132.5453	127.1804	109.7470	101.6967	116.6985	118.0922	137.6251	150.2286	163.1385 (45)
Energy content (annual)												Total = Sum(45)m = 1624.7691 (45)
Distribution loss (46)m = 0.15 x (45)m												
	25.2681	22.0996	22.8048	19.8818	19.0771	16.4621	15.2545	17.5048	17.7138	20.6438	22.5343	24.4708 (46)
Water storage loss:												

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Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Store volume												180.0000 (47)	
a) If manufacturer declared loss factor is known (kWh/day):													
Temperature factor from Table 2b												1.5520 (48)	
Enter (49) or (54) in (55)												0.5400 (49)	
Total storage loss												0.8381 (55)	
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.1422	25.9803	25.1422	25.9803	25.1422	25.9803 (56)
If cylinder contains dedicated solar storage	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.1422	25.9803	25.1422	25.9803	25.1422	25.9803 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month													
	217.6965	191.8080	201.2748	180.1995	176.4231	157.4012	150.9394	165.9412	165.7464	186.8678	197.8828	212.3812	212.3812 (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	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =					0.0000 (63)
Output from w/h													
	217.6965	191.8080	201.2748	180.1995	176.4231	157.4012	150.9394	165.9412	165.7464	186.8678	197.8828	212.3812	212.3812 (64)
								Total per year (kWh/year) = Sum(64)m =					2204.5618 (64)
Heat gains from water heating, kWh/month													
	95.4050	84.5693	89.9448	82.1947	81.6816	74.6142	73.2083	78.1964	77.3890	85.1545	88.0744	93.6377	93.6377 (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	145.4011	145.4011	145.4011	145.4011	145.4011	145.4011	145.4011	145.4011	145.4011	145.4011	145.4011	145.4011 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	28.0355	24.9009	20.2508	15.3311	11.4602	9.6752	10.4544	13.5890	18.2391	23.1588	27.0297	28.8147 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	304.2579	307.4152	299.4590	282.5213	261.1405	241.0455	227.6208	224.4636	232.4198	249.3575	270.7383	290.8332 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5401	37.5401	37.5401	37.5401	37.5401	37.5401	37.5401	37.5401	37.5401	37.5401	37.5401	37.5401 (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)	-116.3209	-116.3209	-116.3209	-116.3209	-116.3209	-116.3209	-116.3209	-116.3209	-116.3209	-116.3209	-116.3209	-116.3209 (71)
Water heating gains (Table 5)	128.2326	125.8471	120.8936	114.1593	109.7871	103.6309	98.3983	105.1027	107.4848	114.4550	122.3255	125.8571 (72)
Total internal gains	530.1463	527.7835	510.2237	481.6320	452.0081	423.9719	406.0938	412.7756	427.7640	456.5915	489.7138	515.1254 (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

North					0.7400	10.6334		0.6300	0.7000	0.7700		2.4048 (74)
Northeast					2.5500	11.2829		0.6300	0.7000	0.7700		8.7929 (75)
Southeast					10.3900	36.7938		0.6300	0.7000	0.7700		116.8322 (77)
Southwest					3.4100	36.7938		0.6300	0.7000	0.7700		38.3443 (79)
West					0.7400	19.6403		0.6300	0.7000	0.7700		4.4417 (80)
Northwest					4.9400	11.2829		0.6300	0.7000	0.7700		17.0342 (81)

Solar gains	187.8501	330.1794	478.4946	637.0788	753.4912	765.4813	730.7569	641.3187	533.0460	372.1609	226.8678	159.5479 (83)
Total gains	717.9965	857.9630	988.7183	1118.7108	1205.4993	1189.4532	1136.8507	1054.0943	960.8100	828.7524	716.5816	674.6733 (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	54.6771	54.8282	54.9771	55.6877	55.8227	56.4598	56.4598	56.5794	56.2127	55.8227	55.5503	55.2683
alpha	4.6451	4.6552	4.6651	4.7125	4.7215	4.7640	4.7640	4.7720	4.7475	4.7215	4.7034	4.6846
util living area	0.9988	0.9970	0.9917	0.9727	0.9141	0.7787	0.6143	0.6747	0.8926	0.9845	0.9974	0.9991 (86)
MIT	19.5370	19.7052	19.9804	20.3485	20.6825	20.9040	20.9761	20.9631	20.7969	20.3613	19.8837	19.5135 (87)
Th 2	19.8643	19.8671	19.8698	19.8826	19.8849	19.8961	19.8961	19.8982	19.8918	19.8849	19.8801	19.8751 (88)
util rest of house	0.9984	0.9960	0.9886	0.9613	0.8760	0.6858	0.4753	0.5370	0.8298	0.9760	0.9963	0.9988 (89)
MIT 2	17.9154	18.1630	18.5658	19.1040	19.5617	19.8291	19.8871	19.8823	19.7195	19.1300	18.4335	17.8884 (90)
Living area fraction									fLA = Living area / (4) =			0.1411 (91)
MIT	18.1442	18.3806	18.7653	19.2796	19.7198	19.9807	20.0407	20.0348	19.8715	19.3038	18.6381	18.1177 (92)
Temperature adjustment												0.0000
adjusted MIT	18.1442	18.3806	18.7653	19.2796	19.7198	19.9807	20.0407	20.0348	19.8715	19.3038	18.6381	18.1177 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9973	0.9938	0.9840	0.9529	0.8690	0.6939	0.4947	0.5556	0.8283	0.9695	0.9943	0.9980 (94)
Useful gains	716.0871	852.6169	972.9082	1066.0174	1047.5599	825.3606	562.3915	585.6633	795.8778	803.4880	712.5214	673.3309 (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												
	2382.8843	2313.9026	2099.6102	1754.1277	1352.0592	896.8947	573.5208	604.5960	966.2622	1467.3599	1954.7395	2369.9037 (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												
	1240.0971	981.9840	838.2662	495.4394	226.5475	0.0000	0.0000	0.0000	0.0000	493.9207	894.3970	1262.2501 (98)
Space heating												6432.9020 (98)
Space heating per m2											(98) / (4) =	47.4683 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													6880.1091 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1240.0971	981.9840	838.2662	495.4394	226.5475	0.0000	0.0000	0.0000	0.0000	493.9207	894.3970	1262.2501	(98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)	1326.3070	1050.2503	896.5414	529.8817	242.2968	0.0000	0.0000	0.0000	0.0000	528.2574	956.5744	1350.0001	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	217.6965	191.8080	201.2748	180.1995	176.4231	157.4012	150.9394	165.9412	165.7464	186.8678	197.8828	212.3812	(64)
Efficiency of water heater (217)m	88.7235	88.5596	88.2099	87.3753	85.4819	79.8000	79.8000	79.8000	79.8000	87.2874	88.3538	79.8000	(216)
Fuel for water heating, kWh/month	245.3652	216.5864	228.1770	206.2362	206.3864	197.2446	189.1471	207.9463	207.7023	214.0833	223.9665	239.2072	(219)
Water heating fuel used												2582.0486	(219)
Annual totals kWh/year													
Space heating fuel - main system												6880.1091	(211)
Space heating fuel - secondary												0.0000	(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)												495.1161	(232)
Total delivered energy for all uses												10032.2738	(238)

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	6880.1091	0.2160	1486.1036	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2582.0486	0.2160	557.7225	(264)
Space and water heating			2043.8261	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	495.1161	0.5190	256.9653	(268)
Total CO2, kg/m2/year			2339.7163	(272)
Emissions per m2 for space and water heating			15.0814	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			1.8961	(272b)
Emissions per m2 for pumps and fans			0.2872	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.0814 * 1.00) + 1.8961 + 0.2872, rounded to 2 d.p.			17.2600	(273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	61.3700 (1b)	x 2.3100 (2b)	= 141.7647 (1b) - (3b)
First floor	74.1500 (1c)	x 2.5600 (2c)	= 189.8240 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	135.5200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 331.5887 (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					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1206 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.3711 (18)
Number of sides sheltered					0 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		1.0000 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3711 (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	0.4732	0.4639	0.4546	0.4082	0.3990	0.3526	0.3526	0.3433	0.3711	0.3990	0.4175	0.4361 (22b)
Effective ac	0.6120	0.6076	0.6033	0.5833	0.5796	0.5622	0.5622	0.5589	0.5689	0.5796	0.5872	0.5951 (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
Opening Type 1 (Uw = 1.41)			22.7700	1.3347	30.3916		(27)
Opening Type 14			4.1400	1.5000	6.2100		(26a)
150mm TE Platinum			61.3700	0.1600	9.8192		(28a)
Over Garage			17.3700	0.1900	3.3003		(28b)
50mm Alreflex Plat	168.0000	26.9100	141.0900	0.2700	38.0943		(29a)
Wall to Garage	19.8700		19.8700	0.2800	5.5636		(29a)
1st Flr horiz clg	74.1500		74.1500	0.1100	8.1565		(30)
Grd Flr Bay	3.4800		3.4800	0.1700	0.5916		(30)
Total net area of external elements Aum(A, m ²)			344.2400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		102.1271		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							139.8100 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.0180 (36)
Total fabric heat loss						(33) + (36) =	115.1452 (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	66.9628	66.4871	66.0208	63.8307	63.4209	61.5133	61.5133	61.1601	62.2481	63.4209	64.2498	65.1165 (38)
Heat transfer coeff	182.1079	181.6322	181.1659	178.9758	178.5660	176.6585	176.6585	176.3053	177.3933	178.5660	179.3950	180.2616 (39)
Average = Sum(39)m / 12 =												178.9738 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.3438	1.3403	1.3368	1.3207	1.3176	1.3036	1.3036	1.3010	1.3090	1.3176	1.3238	1.3301 (40)
HLP (average)												1.3206 (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	2.9080 (42)
Average daily hot water use (litres/day)	103.2655 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	113.5921	109.4615	105.3309	101.2002	97.0696	92.9390	92.9390	97.0696	101.2002	105.3309	109.4615	113.5921 (44)
Energy conte	168.4538	147.3308	152.0322	132.5453	127.1804	109.7470	101.6967	116.6985	118.0922	137.6251	150.2286	163.1385 (45)
Energy content (annual)												Total = Sum(45)m = 1624.7691 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												

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Calculation Type: New Build (As Designed)

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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)
Primary 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 (59)
Heat gains from water heating, kWh/month	35.7964	31.3078	32.3068	28.1659	27.0258	23.3212	21.6106	24.7984	25.0946	29.2453	31.9236	34.6669 (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	145.4011	145.4011	145.4011	145.4011	145.4011	145.4011	145.4011	145.4011	145.4011	145.4011	145.4011	145.4011	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	28.0355	24.9009	20.2508	15.3311	11.4602	9.6752	10.4544	13.5890	18.2391	23.1588	27.0297	28.8147	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	304.2579	307.4152	299.4590	282.5213	261.1405	241.0455	227.6208	224.4636	232.4198	249.3575	270.7383	290.8332	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5401	37.5401	37.5401	37.5401	37.5401	37.5401	37.5401	37.5401	37.5401	37.5401	37.5401	37.5401	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-116.3209	-116.3209	-116.3209	-116.3209	-116.3209	-116.3209	-116.3209	-116.3209	-116.3209	-116.3209	-116.3209	-116.3209	(71)
Water heating gains (Table 5)	48.1135	46.5890	43.4232	39.1193	36.3250	32.3906	29.0464	33.3312	34.8536	39.3082	44.3383	46.5953	(72)
Total internal gains	447.0273	445.5254	429.7533	403.5921	375.5461	349.7317	333.7420	338.0042	352.1328	378.4448	408.7266	432.8636	(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	
North	0.7400	10.6334	0.7100	0.7000	0.7700	2.7101	(74)
Northeast	2.5500	11.2829	0.7100	0.7000	0.7700	9.9095	(75)
Southeast	10.3900	36.7938	0.7100	0.7000	0.7700	131.6680	(77)
Southwest	3.4100	36.7938	0.7100	0.7000	0.7700	43.2135	(79)
West	0.7400	19.6403	0.7100	0.7000	0.7700	5.0057	(80)
Northwest	4.9400	11.2829	0.7100	0.7000	0.7700	19.1972	(81)

Solar gains	211.7041	372.1070	539.2558	717.9777	849.1726	862.6853	823.5514	722.7560	600.7344	419.4194	255.6764	179.8079	(83)
Total gains	658.7314	817.6324	969.0091	1121.5697	1224.7187	1212.4169	1157.2935	1060.7602	952.8673	797.8642	664.4030	612.6716	(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	28.9008	28.9765	29.0511	29.4066	29.4741	29.7923	29.7923	29.8520	29.6689	29.4741	29.3379	29.1968	
alpha	2.9267	2.9318	2.9367	2.9604	2.9649	2.9862	2.9862	2.9901	2.9779	2.9649	2.9559	2.9465	
util living area	0.9911	0.9827	0.9656	0.9258	0.8482	0.7224	0.5872	0.6419	0.8334	0.9517	0.9852	0.9928	(86)
MIT	18.5903	18.8582	19.2905	19.8556	20.3682	20.7402	20.9003	20.8672	20.5622	19.8847	19.1346	18.5493	(87)
Th 2	19.8067	19.8094	19.8121	19.8247	19.8270	19.8380	19.8380	19.8401	19.8338	19.8270	19.8223	19.8173	(88)
util rest of house	0.9891	0.9790	0.9577	0.9075	0.8073	0.6409	0.4618	0.5202	0.7725	0.9363	0.9814	0.9912	(89)
MIT 2	17.6149	17.8830	18.3124	18.8730	19.3572	19.6868	19.7998	19.7843	19.5476	18.9121	18.1686	17.5815	(90)
Living area fraction	17.7525	18.0206	18.4504	19.0117	19.4998	19.8354	19.9550	19.9371	19.6907	19.0493	18.3049	17.7181	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.7525	18.0206	18.4504	19.0117	19.4998	19.8354	19.9550	19.9371	19.6907	19.0493	18.3049	17.7181	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9843	0.9710	0.9456	0.8914	0.7937	0.6407	0.4757	0.5316	0.7634	0.9226	0.9743	0.9871	(94)
Ext temp.	648.3627	793.9447	916.2827	999.8089	972.0125	776.8188	550.5674	563.9488	727.4034	736.0707	647.3225	604.7890	(95)
Heat loss rate W	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)
Month fracti	2449.8151	2383.1156	2165.0041	1809.7421	1392.7783	924.8856	592.6950	623.6008	991.7596	1508.7573	2010.1058	2436.7930	(97)
Space heating kWh	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	1340.2806	1067.9228	929.0487	583.1519	313.0498	0.0000	0.0000	0.0000	0.0000	574.8788	981.2040	1363.0110	(98)
Space heating per m2												7152.5476	(98)
												52.7785	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1660.5899	1307.2729	1339.9199	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7198	0.7915	0.7551	0.0000	0.0000	0.0000	0.0000	(101)

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Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1195.2448	1034.6633	1011.7692	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1538.1981	1471.0242	1360.6204	0.0000	0.0000	0.0000	0.0000 (103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	246.9263	324.6525	259.5453	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												831.1242 (104)
Cooled fraction									FC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	61.7316	81.1631	64.8863	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												207.7810 (107)
Space cooling per m2												1.5332 (108)
Energy for space heating												52.7785 (99)
Energy for space cooling												1.5332 (108)
Total												54.3118 (109)
Dwelling Fabric Energy Efficiency (DFEE)												54.3 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	61.3700 (1b)	x 2.3100 (2b)	= 141.7647 (1b) - (3b)
First floor	74.1500 (1c)	x 2.5600 (2c)	= 189.8240 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	135.5200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 331.5887 (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					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) = 0.1206 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3706 (18)
Number of sides sheltered					0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3706 (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	0.4726	0.4633	0.4540	0.4077	0.3984	0.3521	0.3521	0.3428	0.3706	0.3984	0.4170	0.4355 (22b)
Effective ac	0.6117	0.6073	0.6031	0.5831	0.5794	0.5620	0.5620	0.5588	0.5687	0.5794	0.5869	0.5948 (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
TER Semi-glazed door			4.1400	1.2000	4.9680		(26a)
TER Opening Type (Uw = 1.40)			22.7700	1.3258	30.1875		(27)
150mm TE Platinum			61.3700	0.1300	7.9781		(28a)
Over Garage			17.3700	0.1300	2.2581		(28b)
50mm Alreflex Plat	168.0000	26.9100	141.0900	0.1800	25.3962		(29a)
Wall to Garage	19.8700		19.8700	0.1800	3.5766		(29a)
1st Flr horiz clg	74.1500		74.1500	0.1300	9.6395		(30)
Grd Flr Bay	3.4800		3.4800	0.1300	0.4524		(30)
Total net area of external elements Aum(A, m ²)			344.2400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		84.4564		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							20.7355 (36)
Total fabric heat loss						(33) + (36) =	105.1919 (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	66.9298	66.4554	65.9903	63.8061	63.3974	61.4950	61.4950	61.1427	62.2278	63.3974	64.2242	65.0885 (38)
Heat transfer coeff	172.1217	171.6473	171.1822	168.9980	168.5893	166.6869	166.6869	166.3346	167.4197	168.5893	169.4161	170.2804 (39)
Average = Sum(39)m / 12 =												168.9960 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2701	1.2666	1.2632	1.2470	1.2440	1.2300	1.2300	1.2274	1.2354	1.2440	1.2501	1.2565 (40)
HLP (average)												1.2470 (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												2.9080 (42)
Average daily hot water use (litres/day)												103.2655 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	113.5921	109.4615	105.3309	101.2002	97.0696	92.9390	92.9390	97.0696	101.2002	105.3309	109.4615	113.5921 (44)
Energy conte	168.4538	147.3308	152.0322	132.5453	127.1804	109.7470	101.6967	116.6985	118.0922	137.6251	150.2286	163.1385 (45)
Energy content (annual)												Total = Sum(45)m = 1624.7691 (45)
Distribution loss (46)m = 0.15 x (45)m												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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)
Primary 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 (59)
Heat gains from water heating, kWh/month	35.7964	31.3078	32.3068	28.1659	27.0258	23.3212	21.6106	24.7984	25.0946	29.2453	31.9236	34.6669 (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	145.4011	145.4011	145.4011	145.4011	145.4011	145.4011	145.4011	145.4011	145.4011	145.4011	145.4011	145.4011	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	28.0355	24.9009	20.2508	15.3311	11.4602	9.6752	10.4544	13.5890	18.2391	23.1588	27.0297	28.8147	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	304.2579	307.4152	299.4590	282.5213	261.1405	241.0455	227.6208	224.4636	232.4198	249.3575	270.7383	290.8332	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5401	37.5401	37.5401	37.5401	37.5401	37.5401	37.5401	37.5401	37.5401	37.5401	37.5401	37.5401	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-116.3209	-116.3209	-116.3209	-116.3209	-116.3209	-116.3209	-116.3209	-116.3209	-116.3209	-116.3209	-116.3209	-116.3209	(71)
Water heating gains (Table 5)	48.1135	46.5890	43.4232	39.1193	36.3250	32.3906	29.0464	33.3312	34.8536	39.3082	44.3383	46.5953	(72)
Total internal gains	447.0273	445.5254	429.7533	403.5921	375.5461	349.7317	333.7420	338.0042	352.1328	378.4448	408.7266	432.8636	(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
North	0.7400	10.6334	0.6300	0.7000	0.7700	2.4048 (74)
Northeast	2.5500	11.2829	0.6300	0.7000	0.7700	8.7929 (75)
Southeast	10.3900	36.7938	0.6300	0.7000	0.7700	116.8322 (77)
Southwest	3.4100	36.7938	0.6300	0.7000	0.7700	38.3443 (79)
West	0.7400	19.6403	0.6300	0.7000	0.7700	4.4417 (80)
Northwest	4.9400	11.2829	0.6300	0.7000	0.7700	17.0342 (81)

Solar gains	187.8501	330.1794	478.4946	637.0788	753.4912	765.4813	730.7569	641.3187	533.0460	372.1609	226.8678	159.5479	(83)
Total gains	634.8774	775.7048	908.2479	1040.6709	1129.0373	1115.2129	1064.4989	979.3229	885.1789	750.6057	635.5944	592.4115	(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	54.6771	54.8282	54.9771	55.6877	55.8227	56.4598	56.4598	56.5794	56.2127	55.8227	55.5503	55.2683	
alpha	4.6451	4.6552	4.6651	4.7125	4.7215	4.7640	4.7640	4.7720	4.7475	4.7215	4.7034	4.6846	
util living area	0.9993	0.9981	0.9942	0.9792	0.9299	0.8077	0.6479	0.7120	0.9157	0.9895	0.9985	0.9995	(86)
MIT	19.4809	19.6501	19.9277	20.3014	20.6471	20.8866	20.9701	20.9536	20.7648	20.3114	19.8292	19.4578	(87)
Th 2	19.8643	19.8671	19.8698	19.8826	19.8849	19.8961	19.8961	19.8982	19.8918	19.8849	19.8801	19.8751	(88)
util rest of house	0.9990	0.9973	0.9919	0.9702	0.8967	0.7184	0.5052	0.5730	0.8614	0.9836	0.9978	0.9993	(89)
MIT 2	18.4777	18.6487	18.9275	19.3062	19.6346	19.8403	19.8881	19.8840	19.7504	19.3214	18.8381	18.4630	(90)
Living area fraction	18.6192	18.7900	19.0686	19.4466	19.7774	19.9879	20.0408	20.0349	fLA = Living area / (4) =	19.4611	18.9780	18.6033	(91)
MIT	18.6192	18.7900	19.0686	19.4466	19.7774	19.9879	20.0408	20.0349	19.8935	19.4611	18.9780	18.6033	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6192	18.7900	19.0686	19.4466	19.7774	19.9879	20.0408	20.0349	19.8935	19.4611	18.9780	18.6033	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	634.0119	772.8900	898.7848	1004.7058	1007.9594	810.6730	559.2326	579.9242	762.5965	735.8314	633.6676	591.8330	(94)
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	2464.6505	2384.1833	2151.5195	1782.3525	1361.7711	898.0969	573.5346	604.6115	969.9540	1493.8880	2012.3186	2452.6057	(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	1361.9951	1082.7891	932.0346	559.9056	263.2359	0.0000	0.0000	0.0000	0.0000	563.9941	992.6287	1384.4149	(98)
Space heating												7140.9981	(98)
Space heating per m2												52.6933	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1566.8572	1233.4833	1264.1432	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7850	0.8649	0.8272	0.0000	0.0000	0.0000	0.0000	(101)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1229.9489	1066.8764	1045.6616	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1424.5830	1362.5631	1265.4339	0.0000	0.0000	0.0000	0.0000 (103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	140.1366	219.9909	163.5106	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												523.6381 (104)
Cooled fraction									FC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	35.0341	54.9977	40.8777	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												130.9095 (107)
Space cooling per m2												0.9660 (108)
Energy for space heating												52.6933 (99)
Energy for space cooling												0.9660 (108)
Total												53.6593 (109)
Target Fabric Energy Efficiency (TFEE)												61.7 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	H429--H7 Detached			Issued on Date	17/12/2021
Assessment Reference	1	Prop Type Ref			
Property	H429--H7 DS02, Detached , Hipped Roof, Part L2013 Masonry, David Wilson Homes, June 2019				
SAP Rating	84 B	DER	16.97	TER	17.14
Environmental	84 B	% DER<TER	1.01		
CO ₂ Emissions (t/year)	1.84	DFEE	52.44	TFEE	59.52
General Requirements Compliance	Pass	% DFEE<TFEE	11.90		
Assessor Details	Mr. Andrew Maughan, Andrew Maughan, Tel: 01582 544250, Andrew.Maughan@ee-ltd.co.uk			Assessor ID	V844-0001
Client					

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS DESIGNED

Detached House, total floor area 127 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.14 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 16.97 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)59.5 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)52.4 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.28 (max. 0.70)	OK
Floor	0.17 (max. 0.25)	0.19 (max. 0.70)	OK
Roof	0.11 (max. 0.20)	0.17 (max. 0.35)	OK
Openings	1.42 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals: 5.01 (design value)
Maximum 10.0 OK

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Ideal LOGIC HEAT H18

Efficiency: 89.6% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation

Hot water storage Measured cylinder loss: 1.20 kWh/day
Permitted by DBSCG 2.10 OK
Primary pipework insulated: Yes OK

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls: Cylinderstat OK
Independent timer for DHW OK

Boiler interlock Yes OK

7 Low energy lights

Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames Valley): Slight OK

Based on:

Overshading: Average
Windows facing North: 5.26 m², No overhang
Windows facing North East: 0.74 m², No overhang
Windows facing East: 1.89 m², No overhang
Windows facing South: 11.31 m², No overhang
Windows facing West: 2.55 m², No overhang
Windows facing North West: 0.74 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features

Roof U-value 0.11 W/m²K
Roof U-value 0.11 W/m²K

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	57.2400 (1b)	x 2.2900 (2b)	= 131.0796 (1b) - (3b)
First floor	69.5400 (1c)	x 2.6400 (2c)	= 183.5856 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	126.7800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 314.6652 (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					5 * 10 = 50.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					50.0000 / (5) = 0.1589 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.4094 (18)
Number of sides sheltered					4 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.7000 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.2866 (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	0.3654	0.3582	0.3511	0.3152	0.3081	0.2723	0.2723	0.2651	0.2866	0.3081	0.3224	0.3367 (22b)
Effective ac	0.5668	0.5642	0.5616	0.5497	0.5475	0.5371	0.5371	0.5351	0.5411	0.5475	0.5520	0.5567 (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
Opening Type 1 (Uw = 1.41)			22.4900	1.3347	30.0179		(27)
Opening Type 14			4.1400	1.5000	6.2100		(26a)
150mm TE Platinum GF			57.2400	0.1600	9.1584		(28a)
Over Garage			17.7800	0.1900	3.3782		(28b)
50mm Alreflex Plat	157.9200	26.6300	131.2900	0.2700	35.4483		(29a)
Wall to Garage	21.1400		21.1400	0.2800	5.9192		(29a)
1st Flr horiz clg	69.5400		69.5400	0.1100	7.6494		(30)
GF Porch	0.7200		0.7200	0.1100	0.0792		(30)
Grd Flr Bay, F and R	3.5200		3.5200	0.1700	0.5984		(30)
Total net area of external elements Aum(A, m ²)			327.8600				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		98.4590		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							136.6400 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.1144 (36)
Total fabric heat loss						(33) + (36) =	111.5733 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	58.8515	58.5823	58.3185	57.0793	56.8474	55.7681	55.7681	55.5682	56.1838	56.8474	57.3164	57.8068 (38)
Heat transfer coeff	170.4248	170.1557	169.8918	168.6526	168.4207	167.3414	167.3414	167.1415	167.7571	168.4207	168.8898	169.3802 (39)
Average = Sum(39)m / 12 =												168.6515 (39)
HLP	1.3443	1.3421	1.3401	1.3303	1.3284	1.3199	1.3199	1.3184	1.3232	1.3284	1.3321	1.3360 (40)
HLP (average)												1.3303 (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												2.8861 (42)
Average daily hot water use (litres/day)												102.7455 (43)
Daily hot water use	113.0201	108.9102	104.8004	100.6906	96.5808	92.4710	92.4710	96.5808	100.6906	104.8004	108.9102	113.0201 (44)
Energy conte	167.6055	146.5888	151.2665	131.8778	126.5399	109.1943	101.1846	116.1108	117.4975	136.9320	149.4720	162.3169 (45)
Energy content (annual)										Total = Sum(45)m =		1616.5868 (45)
Distribution loss (46)m = 0.15 x (45)m	25.1408	21.9883	22.6900	19.7817	18.9810	16.3791	15.1777	17.4166	17.6246	20.5398	22.4208	24.3475 (46)

Water storage loss:													
Store volume												180.0000 (47)	
a) If manufacturer declared loss factor is known (kWh/day):												1.2000 (48)	
Temperature factor from Table 2b												0.5400 (49)	
Enter (49) or (54) in (55)												0.6480 (55)	
Total storage loss													
	20.0880	18.1440	20.0880	19.4400	20.0880	19.4400	20.0880	20.0880	19.4400	20.0880	19.4400	20.0880 (56)	
If cylinder contains dedicated solar storage													
	20.0880	18.1440	20.0880	19.4400	20.0880	19.4400	20.0880	20.0880	19.4400	20.0880	19.4400	20.0880 (57)	
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)	
Total heat required for water heating calculated for each month													
	210.9559	185.7440	194.6169	173.8298	169.8903	151.1463	144.5350	159.4612	159.4495	180.2824	191.4240	205.6673 (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	210.9559	185.7440	194.6169	173.8298	169.8903	151.1463	144.5350	159.4612	159.4495	180.2824	191.4240	205.6673 (64)	
												Total per year (kWh/year) = Sum (64)m =	2127.0028 (64)
Heat gains from water heating, kWh/month													
	90.4091	80.0649	84.9764	77.4110	76.7548	69.8687	68.3242	73.2872	72.6295	80.2102	83.2611	88.6507 (65)	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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)														0.0000	(201)
Fraction of space heat from main system(s)														1.0000	(202)
Efficiency of main space heating system 1 (in %)														90.6000	(206)
Efficiency of secondary/supplementary heating system, %														0.0000	(208)
Space heating requirement														6153.9987	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
Space heating requirement	1053.4766	830.4927	718.3821	455.4179	246.7470	0.0000	0.0000	0.0000	0.0000	429.6753	761.6543	1079.6770	(98)		
Space heating efficiency (main heating system 1)	90.6000	90.6000	90.6000	90.6000	90.6000	0.0000	0.0000	0.0000	0.0000	90.6000	90.6000	90.6000	(210)		
Space heating fuel (main heating system)	1162.7777	916.6586	792.9162	502.6688	272.3477	0.0000	0.0000	0.0000	0.0000	474.2553	840.6780	1191.6965	(211)		
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)		
Water heating requirement	210.9559	185.7440	194.6169	173.8298	169.8903	151.1463	144.5350	159.4612	159.4495	180.2824	191.4240	205.6673	(64)		
Efficiency of water heater (217)m	88.6200	88.4354	88.0855	87.3679	85.9088	79.9000	79.9000	79.9000	79.9000	87.1505	88.2270	88.6993	(216)		
Fuel for water heating, kWh/month	238.0454	210.0336	220.9409	198.9631	197.7566	189.1694	180.8949	199.5760	199.5614	206.8634	216.9677	231.8702	(219)		
Water heating fuel used												2490.6427	(219)		
Annual totals kWh/year															
Space heating fuel - main system													6153.9987	(211)	
Space heating fuel - secondary													0.0000	(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)														473.5619	(232)
Total delivered energy for all uses														9193.2032	(238)

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	6153.9987	0.2160	1329.2637 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2490.6427	0.2160	537.9788 (264)
Space and water heating			1867.2425 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	473.5619	0.5190	245.7786 (268)
Total CO2, kg/year			2151.9462 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			16.9700 (273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER			16.9700	ZC1
Total Floor Area		TFA	126.7800	
Assumed number of occupants		N	2.8861	
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190	
CO2 emissions from appliances, equation (L14)			13.7323	ZC2
CO2 emissions from cooking, equation (L16)			1.4850	ZC3
Total CO2 emissions			32.1872	ZC4
Residual CO2 emissions offset from biofuel CHP			0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year			0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation			0.0000	ZC7
Net CO2 emissions			32.1872	ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	57.2400 (1b)	x 2.2900 (2b)	= 131.0796 (1b) - (3b)
First floor	69.5400 (1c)	x 2.6400 (2c)	= 183.5856 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	126.7800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 314.6652 (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					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1271 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3771 (18)
Number of sides sheltered					4 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.7000 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.2640 (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	0.3366	0.3300	0.3234	0.2904	0.2838	0.2508	0.2508	0.2442	0.2640	0.2838	0.2970	0.3102 (22b)
Effective ac	0.5566	0.5544	0.5523	0.5422	0.5403	0.5314	0.5314	0.5298	0.5348	0.5403	0.5441	0.5481 (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
TER Semi-glazed door			4.1400	1.2000	4.9680		(26a)
TER Opening Type (Uw = 1.40)			22.4900	1.3258	29.8163		(27)
150mm TE Platinum GF			57.2400	0.1300	7.4412		(28a)
Over Garage			17.7800	0.1300	2.3114		(28b)
50mm Alreflex Plat	157.9200	26.6300	131.2900	0.1800	23.6322		(29a)
Wall to Garage	21.1400		21.1400	0.1800	3.8052		(29a)
1st Flr horiz clg	69.5400		69.5400	0.1300	9.0402		(30)
GF Porch	0.7200		0.7200	0.1300	0.0936		(30)
Grd Flr Bay, F and R	3.5200		3.5200	0.1300	0.4576		(30)
Total net area of external elements Aum(A, m ²)			327.8600				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		81.5657		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							20.9854 (36)
Total fabric heat loss						(33) + (36) =	102.5511 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	57.8015	57.5731	57.3492	56.2977	56.1010	55.1851	55.1851	55.0155	55.5379	56.1010	56.4990	56.9151 (38)
Heat transfer coeff	160.3526	160.1242	159.9003	158.8488	158.6521	157.7362	157.7362	157.5666	158.0890	158.6521	159.0501	159.4661 (39)
Average = Sum(39)m / 12 =												158.8479 (39)
HLP	1.2648	1.2630	1.2612	1.2529	1.2514	1.2442	1.2442	1.2428	1.2470	1.2514	1.2545	1.2578 (40)
HLP (average)												1.2529 (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												2.8861 (42)
Average daily hot water use (litres/day)												102.7455 (43)
Daily hot water use	113.0201	108.9102	104.8004	100.6906	96.5808	92.4710	92.4710	96.5808	100.6906	104.8004	108.9102	113.0201 (44)
Energy conte	167.6055	146.5888	151.2665	131.8778	126.5399	109.1943	101.1846	116.1108	117.4975	136.9320	149.4720	162.3169 (45)
Energy content (annual)										Total = Sum(45)m =		1616.5868 (45)
Distribution loss (46)m = 0.15 x (45)m	25.1408	21.9883	22.6900	19.7817	18.9810	16.3791	15.1777	17.4166	17.6246	20.5398	22.4208	24.3475 (46)

									Water storage loss:													
									Store volume													
a) If manufacturer declared loss factor is known	(kWh/day):											180.0000	(47)									
									Temperature factor from Table 2b													
									Enter (49) or (54) in (55)													
									Total storage loss													
									25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(56)	
									If cylinder contains dedicated solar storage													
									25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(57)	
									Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
									Total heat required for water heating calculated for each month													
									216.8481	191.0661	200.5092	179.5320	175.7826	156.8485	150.4273	165.3535	165.1517	186.1747	197.1262	211.5596	(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	(63)	
																		Solar input	(sum of months) = Sum(63)m =	0.0000	(63)	
									Output from w/h	216.8481	191.0661	200.5092	179.5320	175.7826	156.8485	150.4273	165.3535	165.1517	186.1747	197.1262	211.5596	(64)
																		Total per year (kWh/year) = Sum(64)m =	2196.3795	(64)		
									Heat gains from water heating, kWh/month													
									95.1230	84.3226	89.6903	81.9727	81.4687	74.4305	73.0380	78.0010	77.1913	84.9240	87.8228	93.3645	(65)	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													6167.7157 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1118.8999	875.0976	741.3265	443.0675	206.1742	0.0000	0.0000	0.0000	0.0000	428.9719	804.1763	1149.1002	(98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)	1196.6844	935.9333	792.8626	473.8690	220.5072	0.0000	0.0000	0.0000	0.0000	458.7935	860.0816	1228.9842	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	216.8481	191.0661	200.5092	179.5320	175.7826	156.8485	150.4273	165.3535	165.1517	186.1747	197.1262	211.5596	(64)
Efficiency of water heater (217)m	88.5720	88.3764	87.9883	87.1311	85.2400	79.8000	79.8000	79.8000	79.8000	86.9706	88.1725	88.6518	(216)
Fuel for water heating, kWh/month	244.8270	216.1958	227.8816	206.0481	206.2208	196.5520	188.5053	207.2099	206.9570	214.0662	223.5689	238.6411	(219)
Water heating fuel used												2576.6738	(219)
Annual totals kWh/year													
Space heating fuel - main system												6167.7157	(211)
Space heating fuel - secondary												0.0000	(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)												473.5619	(232)
Total delivered energy for all uses												9292.9514	(238)

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	6167.7157	0.2160	1332.2266 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2576.6738	0.2160	556.5615 (264)
Space and water heating			1888.7881 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	473.5619	0.5190	245.7786 (268)
Total CO2, kg/m2/year			2173.4918 (272)
Emissions per m2 for space and water heating			14.8982 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			1.9386 (272b)
Emissions per m2 for pumps and fans			0.3070 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.8982 * 1.00) + 1.9386 + 0.3070, rounded to 2 d.p.			17.1400 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	57.2400 (1b)	x 2.2900 (2b)	= 131.0796 (1b) - (3b)
First floor	69.5400 (1c)	x 2.6400 (2c)	= 183.5856 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	126.7800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 314.6652 (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					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1271 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.3776 (18)
Number of sides sheltered					4 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.7000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.2643 (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	0.3370	0.3304	0.3238	0.2908	0.2842	0.2511	0.2511	0.2445	0.2643	0.2842	0.2974	0.3106 (22b)
Effective ac	0.5568	0.5546	0.5524	0.5423	0.5404	0.5315	0.5315	0.5299	0.5349	0.5404	0.5442	0.5482 (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
Opening Type 1 (Uw = 1.41)			22.4900	1.3347	30.0179		(27)
Opening Type 14			4.1400	1.5000	6.2100		(26a)
150mm TE Platinum GF			57.2400	0.1600	9.1584		(28a)
Over Garage			17.7800	0.1900	3.3782		(28b)
50mm Alreflex Plat	157.9200	26.6300	131.2900	0.2700	35.4483		(29a)
Wall to Garage	21.1400		21.1400	0.2800	5.9192		(29a)
1st Flr horiz clg	69.5400		69.5400	0.1100	7.6494		(30)
GF Porch	0.7200		0.7200	0.1100	0.0792		(30)
Grd Flr Bay, F and R	3.5200		3.5200	0.1700	0.5984		(30)
Total net area of external elements Aum(A, m ²)			327.8600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	98.4590		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							136.6400 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.1144 (36)
Total fabric heat loss						(33) + (36) =	111.5733 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	57.8171	57.5881	57.3636	56.3093	56.1121	55.1938	55.1938	55.0237	55.5475	56.1121	56.5111	56.9283 (38)
Heat transfer coeff	169.3905	169.1615	168.9370	167.8827	167.6854	166.7671	166.7671	166.5971	167.1208	167.6854	168.0845	168.5017 (39)
Average = Sum(39)m / 12 =												167.8817 (39)
HLP	1.3361	1.3343	1.3325	1.3242	1.3226	1.3154	1.3154	1.3141	1.3182	1.3226	1.3258	1.3291 (40)
HLP (average)												1.3242 (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												2.8861 (42)
Average daily hot water use (litres/day)												102.7455 (43)
Daily hot water use	113.0201	108.9102	104.8004	100.6906	96.5808	92.4710	92.4710	96.5808	100.6906	104.8004	108.9102	113.0201 (44)
Energy conte	167.6055	146.5888	151.2665	131.8778	126.5399	109.1943	101.1846	116.1108	117.4975	136.9320	149.4720	162.3169 (45)
Energy content (annual)										Total = Sum(45)m =		1616.5868 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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)
Primary 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	(59)
Heat gains from water heating, kWh/month	35.6162	31.1501	32.1441	28.0240	26.8897	23.2038	21.5017	24.6735	24.9682	29.0981	31.7628	34.4924	(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	144.3063	144.3063	144.3063	144.3063	144.3063	144.3063	144.3063	144.3063	144.3063	144.3063	144.3063	144.3063	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	26.8150	23.8169	19.3692	14.6637	10.9613	9.2540	9.9993	12.9974	17.4451	22.1506	25.8530	27.5603	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	293.7962	296.8449	289.1623	272.8070	252.1614	232.7574	219.7943	216.7456	224.4282	240.7835	261.4292	280.8332	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.4306	37.4306	37.4306	37.4306	37.4306	37.4306	37.4306	37.4306	37.4306	37.4306	37.4306	37.4306	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-115.4451	-115.4451	-115.4451	-115.4451	-115.4451	-115.4451	-115.4451	-115.4451	-115.4451	-115.4451	-115.4451	-115.4451	(71)
Water heating gains (Table 5)	47.8712	46.3543	43.2045	38.9223	36.1421	32.2275	28.9002	33.1634	34.6781	39.1103	44.1150	46.3607	(72)
Total internal gains	434.7744	433.3081	418.0279	392.6849	365.5567	340.5307	324.9856	329.1983	342.8433	368.3363	397.6891	421.0461	(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
North				5.2600	10.6334		0.7100		0.7000		0.7700		19.2640 (74)
Northeast				0.7400	11.2829		0.7100		0.7000		0.7700		2.8757 (75)
East				1.8900	19.6403		0.7100		0.7000		0.7700		12.7849 (76)
South				11.3100	46.7521		0.7100		0.7000		0.7700		182.1181 (78)
West				2.5500	19.6403		0.7100		0.7000		0.7700		17.2495 (80)
Northwest				0.7400	11.2829		0.7100		0.7000		0.7700		2.8757 (81)
Solar gains	237.1680	405.5379	560.3421	705.6472	802.3357	802.2146	771.0251	697.7424	610.3355	449.5503	284.3229	202.8220	(83)
Total gains	671.9423	838.8460	978.3700	1098.3321	1167.8924	1142.7454	1096.0107	1026.9406	953.1788	817.8866	682.0119	623.8681	(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	28.4078	28.4462	28.4840	28.6629	28.6966	28.8546	28.8546	28.8841	28.7936	28.6966	28.6285	28.5576		
alpha	2.8939	2.8964	2.8989	2.9109	2.9131	2.9236	2.9236	2.9256	2.9196	2.9131	2.9086	2.9038		
util living area	0.9881	0.9769	0.9568	0.9157	0.8404	0.7192	0.5831	0.6285	0.8109	0.9383	0.9801	0.9903	(86)	
MIT	18.6256	18.9108	19.3385	19.8715	20.3637	20.7293	20.8956	20.8666	20.5810	19.9251	19.1656	18.5683	(87)	
Th 2	19.8127	19.8141	19.8154	19.8219	19.8231	19.8288	19.8288	19.8298	19.8266	19.8231	19.8207	19.8181	(88)	
util rest of house	0.9855	0.9721	0.9474	0.8957	0.7986	0.6377	0.4579	0.5071	0.7464	0.9197	0.9752	0.9883	(89)	
MIT 2	17.6570	17.9405	18.3635	18.8869	19.3504	19.6707	19.7885	19.7739	19.5559	18.9487	18.2006	17.6039	(90)	
Living area fraction									fLA = Living area / (4) =			0.1351	(91)	
MIT	17.7879	18.0716	18.4952	19.0200	19.4873	19.8137	19.9381	19.9216	19.6944	19.0807	18.3310	17.7342	(92)	
Temperature adjustment												0.0000		
adjusted MIT	17.7879	18.0716	18.4952	19.0200	19.4873	19.8137	19.9381	19.9216	19.6944	19.0807	18.3310	17.7342	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	658.0843	807.2621	913.2672	965.0657	916.1000	727.3116	516.0330	531.6826	703.0965	739.5287	659.0364	613.2912	(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	2284.7248	2228.1328	2026.4406	1698.9658	1305.8237	869.4819	556.6815	586.6804	934.9467	1422.0852	1887.7554	2280.5302	(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	1210.2206	954.8251	828.2010	528.4081	289.9545	0.0000	0.0000	0.0000	0.0000	507.8220	884.6777	1240.4258	(98)
Space heating												6444.5347	(98)
Space heating per m2												50.8324	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1567.6111	1234.0768	1266.1379	0.0000	0.0000	0.0000	0.0000	(100)

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Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7163	0.7891	0.7599	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1122.8679	973.8246	962.1634	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1453.3404	1396.0731	1317.6262	0.0000	0.0000	0.0000	0.0000 (103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	237.9402	314.1528	264.4644	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												816.5574 (104)
Cooled fraction									FC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
Intermittency factor	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	59.4850	78.5382	66.1161	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												204.1394 (107)
Space cooling per m2												1.6102 (108)
Energy for space heating												50.8324 (99)
Energy for space cooling												1.6102 (108)
Total												52.4426 (109)
Dwelling Fabric Energy Efficiency (DFEE)												52.4 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	57.2400 (1b)	x 2.2900 (2b)	= 131.0796 (1b) - (3b)
First floor	69.5400 (1c)	x 2.6400 (2c)	= 183.5856 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	126.7800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 314.6652 (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					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1271 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3771 (18)
Number of sides sheltered					4 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.7000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.2640 (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	0.3366	0.3300	0.3234	0.2904	0.2838	0.2508	0.2508	0.2442	0.2640	0.2838	0.2970	0.3102 (22b)
Effective ac	0.5566	0.5544	0.5523	0.5422	0.5403	0.5314	0.5314	0.5298	0.5348	0.5403	0.5441	0.5481 (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
TER Semi-glazed door			4.1400	1.2000	4.9680		(26a)
TER Opening Type (Uw = 1.40)			22.4900	1.3258	29.8163		(27)
150mm TE Platinum GF			57.2400	0.1300	7.4412		(28a)
Over Garage			17.7800	0.1300	2.3114		(28b)
50mm Alreflex Plat	157.9200	26.6300	131.2900	0.1800	23.6322		(29a)
Wall to Garage	21.1400		21.1400	0.1800	3.8052		(29a)
1st Flr horiz clg	69.5400		69.5400	0.1300	9.0402		(30)
GF Porch	0.7200		0.7200	0.1300	0.0936		(30)
Grd Flr Bay, F and R	3.5200		3.5200	0.1300	0.4576		(30)
Total net area of external elements Aum(A, m ²)			327.8600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	81.5657		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							20.9854 (36)
Total fabric heat loss						(33) + (36) =	102.5511 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	57.8015	57.5731	57.3492	56.2977	56.1010	55.1851	55.1851	55.0155	55.5379	56.1010	56.4990	56.9151 (38)
Heat transfer coeff	160.3526	160.1242	159.9003	158.8488	158.6521	157.7362	157.7362	157.5666	158.0890	158.6521	159.0501	159.4661 (39)
Average = Sum(39)m / 12 =												158.8479 (39)
HLP	1.2648	1.2630	1.2612	1.2529	1.2514	1.2442	1.2442	1.2428	1.2470	1.2514	1.2545	1.2578 (40)
HLP (average)												1.2529 (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												2.8861 (42)
Average daily hot water use (litres/day)												102.7455 (43)
Daily hot water use	113.0201	108.9102	104.8004	100.6906	96.5808	92.4710	92.4710	96.5808	100.6906	104.8004	108.9102	113.0201 (44)
Energy conte	167.6055	146.5888	151.2665	131.8778	126.5399	109.1943	101.1846	116.1108	117.4975	136.9320	149.4720	162.3169 (45)
Energy content (annual)										Total = Sum(45)m =		1616.5868 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	(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	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month	35.6162	31.1501	32.1441	28.0240	26.8897	23.2038	21.5017	24.6735	24.9682	29.0981	31.7628	34.4924 (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	144.3063	144.3063	144.3063	144.3063	144.3063	144.3063	144.3063	144.3063	144.3063	144.3063	144.3063	144.3063	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	26.8150	23.8169	19.3692	14.6637	10.9613	9.2540	9.9993	12.9974	17.4451	22.1506	25.8530	27.5603	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	293.7962	296.8449	289.1623	272.8070	252.1614	232.7574	219.7943	216.7456	224.4282	240.7835	261.4292	280.8332	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.4306	37.4306	37.4306	37.4306	37.4306	37.4306	37.4306	37.4306	37.4306	37.4306	37.4306	37.4306	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-115.4451	-115.4451	-115.4451	-115.4451	-115.4451	-115.4451	-115.4451	-115.4451	-115.4451	-115.4451	-115.4451	-115.4451	(71)
Water heating gains (Table 5)	47.8712	46.3543	43.2045	38.9223	36.1421	32.2275	28.9002	33.1634	34.6781	39.1103	44.1150	46.3607	(72)
Total internal gains	434.7744	433.3081	418.0279	392.6849	365.5567	340.5307	324.9856	329.1983	342.8433	368.3363	397.6891	421.0461	(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		
North				5.2600	10.6334	0.6300	0.7000		0.7700	17.0934 (74)		
Northeast				0.7400	11.2829	0.6300	0.7000		0.7700	2.5517 (75)		
East				1.8900	19.6403	0.6300	0.7000		0.7700	11.3444 (76)		
South				11.3100	46.7521	0.6300	0.7000		0.7700	161.5977 (78)		
West				2.5500	19.6403	0.6300	0.7000		0.7700	15.3059 (80)		
Northwest				0.7400	11.2829	0.6300	0.7000		0.7700	2.5517 (81)		
Solar gains	210.4448	359.8435	497.2049	626.1376	711.9317	711.8242	684.1490	619.1235	541.5653	398.8968	252.2865	179.9688 (83)
Total gains	645.2192	793.1516	915.2328	1018.8225	1077.4883	1052.3550	1009.1347	948.3218	884.4086	767.2331	649.9756	601.0149 (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	54.9050	54.9834	55.0603	55.4248	55.4936	55.8158	55.8158	55.8758	55.6912	55.4936	55.3547	55.2103	
alpha	4.6603	4.6656	4.6707	4.6950	4.6996	4.7211	4.7211	4.7251	4.7127	4.6996	4.6903	4.6807	
util living area	0.9990	0.9972	0.9921	0.9755	0.9261	0.8076	0.6462	0.6999	0.8992	0.9852	0.9977	0.9993	(86)
MIT	19.5246	19.7029	19.9758	20.3250	20.6526	20.8838	20.9695	20.9555	20.7848	20.3497	19.8643	19.4900	(87)
Th 2	19.8685	19.8699	19.8713	19.8779	19.8791	19.8848	19.8848	19.8859	19.8826	19.8791	19.8766	19.8740	(88)
util rest of house	0.9986	0.9962	0.9890	0.9650	0.8916	0.7177	0.5025	0.5599	0.8383	0.9770	0.9968	0.9990	(89)
MIT 2	18.5246	18.7035	18.9762	19.3248	19.6340	19.8278	19.8768	19.8725	19.7569	19.3536	18.8704	18.4943	(90)
Living area fraction									fLA = Living area / (4) =			0.1351	(91)
MIT	18.6597	18.8386	19.1112	19.4599	19.7717	19.9705	20.0244	20.0189	19.8958	19.4882	19.0046	18.6289	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6597	18.8386	19.1112	19.4599	19.7717	19.9705	20.0244	20.0189	19.8958	19.4882	19.0046	18.6289	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	643.9823	789.0440	902.6033	977.9384	956.2909	763.6744	526.6430	548.4805	742.2085	746.5645	647.1356	600.1856	(94)
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	2302.6186	2231.9010	2016.5410	1677.4323	1280.5877	847.1166	540.1514	570.2134	916.2465	1410.1256	1893.4353	2300.9171	(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	1234.0254	969.5999	828.7696	503.6355	241.2768	0.0000	0.0000	0.0000	0.0000	493.6895	897.3357	1265.3443	(98)
Space heating												6433.6768	(98)
Space heating per m2												(98) / (4) =	50.7468 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b													
Ext. temp.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
	0.0000	0.0000	0.0000	0.0000	0.0000	1482.7205	1167.2480	1197.5063	0.0000	0.0000	0.0000	0.0000	(100)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7836	0.8650	0.8348	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1161.9079	1009.6857	999.6814	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1347.6893	1294.5296	1225.7341	0.0000	0.0000	0.0000	0.0000 (103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	133.7626	211.9239	168.1832	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												513.8696 (104)
Cooled fraction									FC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
Intermittency factor	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	33.4407	52.9810	42.0458	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												128.4674 (107)
Space cooling per m2												1.0133 (108)
Energy for space heating												50.7468 (99)
Energy for space cooling												1.0133 (108)
Total												51.7601 (109)
Target Fabric Energy Efficiency (TFEE)												59.5 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	H442--H7 Detached			Issued on Date	17/12/2021
Assessment Reference	3	Prop Type Ref			
Property	Kirkdale (Hipped Roof), Detached, Part L2013 Masonry, David Wilson Homes				
SAP Rating	85 B	DER	15.83	TER	16.29
Environmental	86 B	% DER<TER	2.84		
CO ₂ Emissions (t/year)	1.75	DFEE	47.81	TFEE	51.78
General Requirements Compliance	Pass	% DFEE<TFEE	7.68		
Assessor Details	Mr. Andrew Maughan, Andrew Maughan, Tel: 01582 544250, Andrew.Maughan@ee-ltd.co.uk			Assessor ID	V844-0001
Client					

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS DESIGNED

Detached House, total floor area 124 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating: Mains gas
Fuel factor: 1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.29 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 15.83 kgCO₂/m² OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 51.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 47.8 kWh/m²/yr OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Floor	0.15 (max. 0.25)	0.15 (max. 0.70)	OK
Roof	0.11 (max. 0.20)	0.17 (max. 0.35)	OK
Openings	1.38 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals: 5.01 (design value)
Maximum 10.0 OK

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Ideal LOGIC COMBI ESPl 35
Combi boiler
Efficiency: 89.6% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation

Hot water storage: No cylinder

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

7 Low energy lights

Percentage of fixed lights with low-energy fittings: 100%
Minimum 75% OK

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Midlands): Not significant OK

Based on:

Overshading: Average

Windows facing North: 5.05 m², No overhang

Windows facing North East: 0.72 m², No overhang

Windows facing East: 0.72 m², No overhang

Windows facing South: 9.39 m², No overhang

Windows facing West: 0.72 m², No overhang

Windows facing North West: 0.72 m², No overhang

Air change rate: 4.00 ach

Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features

Roof U-value 0.11 W/m²K

Door U-value 1.10 W/m²K

Thermal bridging y-value 0.038 W/m²K

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	62.4600 (1b)	x 2.3100 (2b)	= 144.2826 (1b) - (3b)
First floor	61.9000 (1c)	x 2.5600 (2c)	= 158.4640 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	124.3600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 302.7466 (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					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) = 0.1321 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.3826 (18)
Number of sides sheltered					4 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.7000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.2678 (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	0.3415	0.3348	0.3281	0.2946	0.2879	0.2544	0.2544	0.2477	0.2678	0.2879	0.3013	0.3147 (22b)
Effective ac	0.5583	0.5560	0.5538	0.5434	0.5415	0.5324	0.5324	0.5307	0.5359	0.5415	0.5454	0.5495 (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
Opening Type 1 (Uw = 1.41)			17.3200	1.3347	23.1174		(27)
Opening Type 4			2.3800	1.0000	2.6180		(26)
Opening Type 7			2.0000	1.5000	3.0000		(26a)
150mm TE Platinum GF			62.4600	0.1500	9.3690		(28a)
50mm Alreflex Plat	154.4600	21.7000	132.7600	0.2700	35.8452		(29a)
1st Flr Horiz Cl	61.9000		61.9000	0.1100	6.8090		(30)
Grd Floor Bay	0.4400		0.4400	0.1700	0.0748		(30)
Total net area of external elements Aum(A, m ²)			279.2600				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		80.8334		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							159.8200 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.6482 (36)
Total fabric heat loss						(33) + (36) =	91.4816 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	55.7786	55.5524	55.3306	54.2892	54.0943	53.1873	53.1873	53.0193	53.5367	54.0943	54.4885	54.9006 (38)
Heat transfer coeff	147.2601	147.0339	146.8122	145.7708	145.5759	144.6689	144.6689	144.5009	145.0182	145.5759	145.9701	146.3822 (39)
Average = Sum(39)m / 12 =												145.7698 (39)
HLP	1.1841	1.1823	1.1805	1.1722	1.1706	1.1633	1.1633	1.1620	1.1661	1.1706	1.1738	1.1771 (40)
HLP (average)												1.1722 (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												2.8787 (42)
Average daily hot water use (litres/day)												102.5691 (43)
Daily hot water use	112.8260	108.7233	104.6205	100.5177	96.4150	92.3122	92.3122	96.4150	100.5177	104.6205	108.7233	112.8260 (44)
Energy conte	167.3178	146.3372	151.0069	131.6514	126.3227	109.0069	101.0109	115.9115	117.2958	136.6970	149.2155	162.0383 (45)
Energy content (annual)										Total = Sum(45)m =		1613.8118 (45)
Distribution loss (46)m = 0.15 x (45)m	25.0977	21.9506	22.6510	19.7477	18.9484	16.3510	15.1516	17.3867	17.5944	20.5045	22.3823	24.3057 (46)
Water storage loss:												
Total storage loss												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	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	14.1581	12.7765	14.1190	13.6288	14.0489	13.5543	13.9803	14.0248	13.5943	14.0846	13.6709	14.1455 (61)
Total heat required for water heating calculated for each month	181.4759	159.1137	165.1258	145.2802	140.3716	122.5612	114.9913	129.9363	130.8901	150.7816	162.8864	176.1838 (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	181.4759	159.1137	165.1258	145.2802	140.3716	122.5612	114.9913	129.9363	130.8901	150.7816	162.8864	176.1838 (64)
Heat gains from water heating, kWh/month	59.1727	51.8512	53.7395	47.1813	45.5145	39.6334	37.0812	42.0468	42.3994	48.9729	53.0319	57.4141 (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	143.9350	143.9350	143.9350	143.9350	143.9350	143.9350	143.9350	143.9350	143.9350	143.9350	143.9350	143.9350	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	27.8430	24.7299	20.1117	15.2258	11.3815	9.6087	10.3826	13.4957	18.1139	22.9997	26.8441	28.6168	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	290.7858	293.8032	286.1994	270.0116	249.5775	230.3723	217.5421	214.5247	222.1285	238.3163	258.7504	277.9555	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.3935	37.3935	37.3935	37.3935	37.3935	37.3935	37.3935	37.3935	37.3935	37.3935	37.3935	37.3935	(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)	-115.1480	-115.1480	-115.1480	-115.1480	-115.1480	-115.1480	-115.1480	-115.1480	-115.1480	-115.1480	-115.1480	-115.1480	(71)
Water heating gains (Table 5)	79.5332	77.1596	72.2305	65.5296	61.1754	55.0463	49.8403	56.5145	58.8881	65.8238	73.6554	77.1695	(72)
Total internal gains	467.3424	464.8732	447.7221	419.9476	391.3149	364.2079	346.9455	353.7153	368.3110	396.3203	428.4303	452.9224	(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
North				5.0500	10.6334		0.7100		0.7000		0.7700		18.4949 (74)
Northeast				0.7200	11.2829		0.7100		0.7000		0.7700		2.7980 (75)
East				0.7200	19.6403		0.7100		0.7000		0.7700		4.8705 (76)
South				9.3900	46.7521		0.7100		0.7000		0.7700		151.2015 (78)
West				0.7200	19.6403		0.7100		0.7000		0.7700		4.8705 (80)
Northwest				0.7200	11.2829		0.7100		0.7000		0.7700		2.7980 (81)
Solar gains	185.0333	313.4198	427.3987	532.4530	602.8558	602.3624	579.0573	525.2660	463.2252	345.6956	221.2281	158.6507	(83)
Total gains	652.3757	778.2930	875.1208	952.4005	994.1707	966.5703	926.0029	878.9813	831.5362	742.0158	649.6584	611.5730	(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	37.4907	37.5484	37.6051	37.8738	37.9245	38.1623	38.1623	38.2066	38.0703	37.9245	37.8221	37.7156	
alpha	3.4994	3.5032	3.5070	3.5249	3.5283	3.5442	3.5442	3.5471	3.5380	3.5283	3.5215	3.5144	
util living area	0.9929	0.9863	0.9734	0.9442	0.8813	0.7629	0.6178	0.6611	0.8455	0.9571	0.9876	0.9943	(86)
MIT	19.1027	19.3239	19.6614	20.0917	20.4980	20.8015	20.9322	20.9119	20.6869	20.1553	19.5431	19.0578	(87)
Th 2	19.9327	19.9342	19.9356	19.9423	19.9436	19.9495	19.9495	19.9506	19.9472	19.9436	19.9410	19.9384	(88)
util rest of house	0.9913	0.9831	0.9670	0.9292	0.8460	0.6865	0.4968	0.5443	0.7872	0.9428	0.9842	0.9930	(89)
MIT 2	17.3934	17.7160	18.2063	18.8273	19.3910	19.7793	19.9116	19.8971	19.6492	18.9267	18.0416	17.3313	(90)
Living area fraction	0.9913	0.9831	0.9670	0.9292	0.8460	0.6865	0.4968	0.5443	0.7872	0.9428	0.9842	0.9930	(91)
MIT	17.7536	18.0548	18.5130	19.0938	19.6243	19.9948	20.1267	20.1110	19.8679	19.1856	18.3580	17.6952	(92)
Temperature adjustment	17.6036	17.9048	18.3630	18.9438	19.4743	19.8448	19.9767	19.9610	19.7179	19.0356	18.2080	-0.1500	(93)
adjusted MIT	17.6036	17.9048	18.3630	18.9438	19.4743	19.8448	19.9767	19.9610	19.7179	19.0356	18.2080	17.5452	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9857	0.9741	0.9534	0.9104	0.8267	0.6777	0.5002	0.5456	0.7716	0.9255	0.9757	0.9883	(94)
Ext temp.	643.0311	758.1446	834.3204	867.1013	821.8629	655.0659	463.1912	479.5702	641.6126	686.7216	633.8616	604.4422	(95)
Heat loss rate W	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)
Month fracti	1959.0938	1912.1523	1741.6316	1464.0907	1131.7578	758.7523	488.5004	514.5690	814.7024	1228.0198	1621.4416	1953.4963	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	(97a)
Space heating	979.1507	775.4932	675.0395	429.8324	230.5618	0.0000	0.0000	0.0000	0.0000	402.7259	711.0576	1003.6963	(98)
Space heating per m2												5207.5574	(98)
												41.8749	(99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													5754.2071 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	979.1507	775.4932	675.0395	429.8324	230.5618	0.0000	0.0000	0.0000	0.0000	402.7259	711.0576	1003.6963	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	1081.9345	856.8986	745.9000	474.9529	254.7644	0.0000	0.0000	0.0000	0.0000	445.0010	785.6991	1109.0567	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	181.4759	159.1137	165.1258	145.2802	140.3716	122.5612	114.9913	129.9363	130.8901	150.7816	162.8864	176.1838	(64)
Efficiency of water heater (217)m	89.9843	89.9387	89.8527	89.6697	89.2618	87.3000	87.3000	87.3000	87.3000	89.6053	89.8859	90.0073	(216)
Fuel for water heating, kWh/month	201.6751	176.9134	183.7740	162.0171	157.2582	140.3908	131.7196	148.8388	149.9314	168.2732	181.2146	195.7438	(219)
Water heating fuel used												1997.7500	(219)
Annual totals kWh/year													
Space heating fuel - main system												5754.2071	(211)
Space heating fuel - secondary												0.0000	(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)												491.7156	(232)
Total delivered energy for all uses												8318.6727	(238)

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	5754.2071	0.2160	1242.9087 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1997.7500	0.2160	431.5140 (264)
Space and water heating			1674.4227 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	491.7156	0.5190	255.2004 (268)
Total CO2, kg/year			1968.5481 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			15.8300 (273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		15.8300	ZC1
Total Floor Area	TFA	124.3600	
Assumed number of occupants	N	2.8787	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		13.8560	ZC2
CO2 emissions from cooking, equation (L16)		1.5125	ZC3
Total CO2 emissions		31.1985	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		31.1985	ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	62.4600 (1b)	x 2.3100 (2b)	= 144.2826 (1b) - (3b)
First floor	61.9000 (1c)	x 2.5600 (2c)	= 158.4640 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	124.3600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 302.7466 (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					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1321 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3821 (18)
Number of sides sheltered					4 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.7000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.2675 (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	0.3410	0.3344	0.3277	0.2942	0.2875	0.2541	0.2541	0.2474	0.2675	0.2875	0.3009	0.3143 (22b)
Effective ac	0.5582	0.5559	0.5537	0.5433	0.5413	0.5323	0.5323	0.5306	0.5358	0.5413	0.5453	0.5494 (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
TER Opaque door			2.3800	1.0000	2.3800		(26)
TER Semi-glazed door			2.0000	1.2000	2.4000		(26a)
TER Opening Type (Uw = 1.40)			17.3200	1.3258	22.9621		(27)
150mm TE Platinum GF			62.4600	0.1300	8.1198		(28a)
50mm Alreflex Plat	154.4600	21.7000	132.7600	0.1800	23.8968		(29a)
1st Flr Horiz Cl	61.9000		61.9000	0.1300	8.0470		(30)
Grd Floor Bay	0.4400		0.4400	0.1300	0.0572		(30)
Total net area of external elements Aum(A, m ²)			279.2600				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		67.8629		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.3949 (36)
Total fabric heat loss						(33) + (36) =	80.2578 (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	55.7633	55.5377	55.3166	54.2779	54.0835	53.1788	53.1788	53.0113	53.5273	54.0835	54.4767	54.8877 (38)
Heat transfer coeff	136.0212	135.7955	135.5744	134.5357	134.3413	133.4366	133.4366	133.2691	133.7851	134.3413	134.7345	135.1455 (39)
Average = Sum(39)m / 12 =												134.5347 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0938	1.0920	1.0902	1.0818	1.0803	1.0730	1.0730	1.0716	1.0758	1.0803	1.0834	1.0867 (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												2.8787 (42)
Average daily hot water use (litres/day)												102.5691 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.8260	108.7233	104.6205	100.5177	96.4150	92.3122	92.3122	96.4150	100.5177	104.6205	108.7233	112.8260 (44)
Energy conte	167.3178	146.3372	151.0069	131.6514	126.3227	109.0069	101.0109	115.9115	117.2958	136.6970	149.2155	162.0383 (45)
Energy content (annual)												Total = Sum(45)m = 1613.8118 (45)
Distribution loss (46)m = 0.15 x (45)m	25.0977	21.9506	22.6510	19.7477	18.9484	16.3510	15.1516	17.3867	17.5944	20.5045	22.3823	24.3057 (46)
Water storage loss:												
Total storage loss												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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 (56)
Combi loss	50.9589	46.0274	50.9589	49.3151	49.1320	45.5238	47.0413	49.1320	49.3151	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month	218.2767	192.3646	201.9658	180.9665	175.4547	154.5307	148.0522	165.0435	166.6109	187.6559	198.5305	212.9972 (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	218.2767	192.3646	201.9658	180.9665	175.4547	154.5307	148.0522	165.0435	166.6109	187.6559	198.5305	212.9972 (64)
Heat gains from water heating, kWh/month	68.3729	60.1640	62.9495	56.1029	54.2853	47.6257	45.3464	50.8236	51.3296	58.1915	61.9429	66.6175 (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	143.9350	143.9350	143.9350	143.9350	143.9350	143.9350	143.9350	143.9350	143.9350	143.9350	143.9350	143.9350	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	27.8430	24.7299	20.1117	15.2258	11.3815	9.6087	10.3826	13.4957	18.1139	22.9997	26.8441	28.6168	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	290.7858	293.8032	286.1994	270.0116	249.5775	230.3723	217.5421	214.5247	222.1285	238.3163	258.7504	277.9555	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.3935	37.3935	37.3935	37.3935	37.3935	37.3935	37.3935	37.3935	37.3935	37.3935	37.3935	37.3935	(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)	-115.1480	-115.1480	-115.1480	-115.1480	-115.1480	-115.1480	-115.1480	-115.1480	-115.1480	-115.1480	-115.1480	-115.1480	(71)
Water heating gains (Table 5)	91.8990	89.5297	84.6096	77.9207	72.9641	66.1469	60.9495	68.3113	71.2912	78.2143	86.0318	89.5396	(72)
Total internal gains	479.7083	477.2433	460.1011	432.3386	403.1036	375.3085	358.0547	365.5121	380.7140	408.7108	440.8067	465.2925	(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
North				5.0500	10.6334		0.6300		0.7000		0.7700		16.4110 (74)
Northeast				0.7200	11.2829		0.6300		0.7000		0.7700		2.4827 (75)
East				0.7200	19.6403		0.6300		0.7000		0.7700		4.3217 (76)
South				9.3900	46.7521		0.6300		0.7000		0.7700		134.1647 (78)
West				0.7200	19.6403		0.6300		0.7000		0.7700		4.3217 (80)
Northwest				0.7200	11.2829		0.6300		0.7000		0.7700		2.4827 (81)
Solar gains	164.1845	278.1049	379.2411	472.4583	534.9283	534.4906	513.8114	466.0811	411.0308	306.7440	196.3010	140.7745	(83)
Total gains	643.8927	755.3482	839.3422	904.7969	938.0320	909.7990	871.8661	831.5932	791.7449	715.4548	637.1077	606.0670	(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)													
tau	63.4909	63.5964	63.7002	64.1920	64.2848	64.7207	64.7207	64.8021	64.5521	64.2848	64.0973	63.9023	
alpha	5.2327	5.2398	5.2467	5.2795	5.2857	5.3147	5.3147	5.3201	5.3035	5.2857	5.2732	5.2602	
util living area	0.9990	0.9975	0.9934	0.9795	0.9344	0.8138	0.6441	0.6924	0.8983	0.9856	0.9978	0.9993	(86)
MIT	19.7576	19.9064	20.1357	20.4329	20.7148	20.9130	20.9804	20.9715	20.8378	20.4707	20.0543	19.7281	(87)
Th 2	20.0059	20.0074	20.0089	20.0157	20.0170	20.0230	20.0230	20.0241	20.0207	20.0170	20.0144	20.0117	(88)
util rest of house	0.9987	0.9966	0.9909	0.9709	0.9045	0.7323	0.5157	0.5668	0.8415	0.9780	0.9968	0.9991	(89)
MIT 2	18.3371	18.5556	18.8909	19.3247	19.7158	19.9586	20.0150	20.0110	19.8796	19.3836	18.7772	18.2981	(90)
Living area fraction	18.6365	18.8403	19.1532	19.5583	19.9264	20.1597	20.2184	20.2134	20.0815	19.6127	19.0464	18.5995	(92)
MIT	18.6365	18.8403	19.1532	19.5583	19.9264	20.1597	20.2184	20.2134	20.0815	19.6127	19.0464	18.5995	(93)
Temperature adjustment												0.0000	
adjusted MIT	18.6365	18.8403	19.1532	19.5583	19.9264	20.1597	20.2184	20.2134	20.0815	19.6127	19.0464	18.5995	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	642.5835	751.6525	829.1477	873.7063	845.3198	677.9580	473.2872	493.1545	669.6682	696.6213	634.1955	605.1637	(94)
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	1950.0665	1893.0240	1715.4519	1433.9168	1105.1396	741.8742	482.8333	508.2148	800.2415	1210.7806	1609.5894	1946.0237	(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	972.7673	767.0017	659.4103	403.3515	193.3059	0.0000	0.0000	0.0000	0.0000	382.5345	702.2836	997.5998	(98)
Space heating												5078.2547	(98)
Space heating per m2												40.8351	(99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													5437.1035 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	972.7673	767.0017	659.4103	403.3515	193.3059	0.0000	0.0000	0.0000	0.0000	382.5345	702.2836	997.5998	(98)
Space heating efficiency (main heating system 1)	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)	1041.5068	821.2009	706.0068	431.8539	206.9656	0.0000	0.0000	0.0000	0.0000	409.5658	751.9096	1068.0940	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	218.2767	192.3646	201.9658	180.9665	175.4547	154.5307	148.0522	165.0435	166.6109	187.6559	198.5305	212.9972	(64)
Efficiency of water heater (217)m	88.3632	88.1762	87.8104	87.0106	85.2955	80.3000	80.3000	80.3000	80.3000	86.8066	87.9617	88.4428	(216)
Fuel for water heating, kWh/month	247.0222	218.1593	230.0022	207.9822	205.7022	192.4417	184.3738	205.5336	207.4856	216.1769	225.7012	240.8306	(219)
Water heating fuel used												2581.4115	(219)
Annual totals kWh/year													
Space heating fuel - main system												5437.1035	(211)
Space heating fuel - secondary												0.0000	(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)												491.7156	(232)
Total delivered energy for all uses												8585.2307	(238)

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	5437.1035	0.2160	1174.4144 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2581.4115	0.2160	557.5849 (264)
Space and water heating			1731.9992 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	491.7156	0.5190	255.2004 (268)
Total CO2, kg/m2/year			2026.1247 (272)
Emissions per m2 for space and water heating			13.9273 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.0521 (272b)
Emissions per m2 for pumps and fans			0.3130 (272c)
Target Carbon Dioxide Emission Rate (TER) = (13.9273 * 1.00) + 2.0521 + 0.3130, rounded to 2 d.p.			16.2900 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	62.4600 (1b)	x 2.3100 (2b)	= 144.2826 (1b) - (3b)
First floor	61.9000 (1c)	x 2.5600 (2c)	= 158.4640 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	124.3600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 302.7466 (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					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1321 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.3826 (18)
Number of sides sheltered					4 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.7000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.2678 (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	0.3415	0.3348	0.3281	0.2946	0.2879	0.2544	0.2544	0.2477	0.2678	0.2879	0.3013	0.3147 (22b)
Effective ac	0.5583	0.5560	0.5538	0.5434	0.5415	0.5324	0.5324	0.5307	0.5359	0.5415	0.5454	0.5495 (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
Opening Type 1 (Uw = 1.41)			17.3200	1.3347	23.1174		(27)
Opening Type 4			2.3800	1.0000	2.6180		(26)
Opening Type 7			2.0000	1.5000	3.0000		(26a)
150mm TE Platinum GF			62.4600	0.1500	9.3690		(28a)
50mm Alreflex Plat	154.4600	21.7000	132.7600	0.2700	35.8452		(29a)
1st Flr Horiz Cl	61.9000		61.9000	0.1100	6.8090		(30)
Grd Floor Bay	0.4400		0.4400	0.1700	0.0748		(30)
Total net area of external elements Aum(A, m ²)			279.2600				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		80.8334		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							159.8200 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.6482 (36)
Total fabric heat loss						(33) + (36) =	91.4816 (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	55.7786	55.5524	55.3306	54.2892	54.0943	53.1873	53.1873	53.0193	53.5367	54.0943	54.4885	54.9006 (38)
Heat transfer coeff	147.2601	147.0339	146.8122	145.7708	145.5759	144.6689	144.6689	144.5009	145.0182	145.5759	145.9701	146.3822 (39)
Average = Sum(39)m / 12 =												145.7698 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1841	1.1823	1.1805	1.1722	1.1706	1.1633	1.1633	1.1620	1.1661	1.1706	1.1738	1.1771 (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												2.8787 (42)
Average daily hot water use (litres/day)												102.5691 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.8260	108.7233	104.6205	100.5177	96.4150	92.3122	92.3122	96.4150	100.5177	104.6205	108.7233	112.8260 (44)
Energy conte	167.3178	146.3372	151.0069	131.6514	126.3227	109.0069	101.0109	115.9115	117.2958	136.6970	149.2155	162.0383 (45)
Energy content (annual)												Total = Sum(45)m = 1613.8118 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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 (56)
Primary 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 (57)
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
	35.5550	31.0967	32.0890	27.9759	26.8436	23.1640	21.4648	24.6312	24.9254	29.0481	31.7083	34.4331 (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	143.9350	143.9350	143.9350	143.9350	143.9350	143.9350	143.9350	143.9350	143.9350	143.9350	143.9350	143.9350	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	27.8430	24.7299	20.1117	15.2258	11.3815	9.6087	10.3826	13.4957	18.1139	22.9997	26.8441	28.6168	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	290.7858	293.8032	286.1994	270.0116	249.5775	230.3723	217.5421	214.5247	222.1285	238.3163	258.7504	277.9555	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.3935	37.3935	37.3935	37.3935	37.3935	37.3935	37.3935	37.3935	37.3935	37.3935	37.3935	37.3935	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-115.1480	-115.1480	-115.1480	-115.1480	-115.1480	-115.1480	-115.1480	-115.1480	-115.1480	-115.1480	-115.1480	-115.1480	(71)
Water heating gains (Table 5)	47.7890	46.2748	43.1303	38.8555	36.0801	32.1722	28.8506	33.1064	34.6186	39.0432	44.0393	46.2811	(72)
Total internal gains	432.5983	430.9884	415.6219	390.2734	363.2196	338.3338	322.9557	327.3073	341.0415	366.5396	395.8142	419.0340	(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			
North				5.0500	10.6334	0.7100	0.7000	0.7700	18.4949 (74)			
Northeast				0.7200	11.2829	0.7100	0.7000	0.7700	2.7980 (75)			
East				0.7200	19.6403	0.7100	0.7000	0.7700	4.8705 (76)			
South				9.3900	46.7521	0.7100	0.7000	0.7700	151.2015 (78)			
West				0.7200	19.6403	0.7100	0.7000	0.7700	4.8705 (80)			
Northwest				0.7200	11.2829	0.7100	0.7000	0.7700	2.7980 (81)			
Solar gains	185.0333	313.4198	427.3987	532.4530	602.8558	602.3624	579.0573	525.2660	463.2252	345.6956	221.2281	158.6507 (83)
Total gains	617.6315	744.4082	843.0206	922.7264	966.0753	940.6962	902.0131	852.5733	804.2667	712.2352	617.0423	577.6846 (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	37.4907	37.5484	37.6051	37.8738	37.9245	38.1623	38.1623	38.2066	38.0703	37.9245	37.8221	37.7156	
alpha	3.4994	3.5032	3.5070	3.5249	3.5283	3.5442	3.5442	3.5471	3.5380	3.5283	3.5215	3.5144	
util living area	0.9940	0.9880	0.9762	0.9487	0.8888	0.7737	0.6297	0.6748	0.8559	0.9617	0.9894	0.9953	(86)
MIT	19.0673	19.2902	19.6311	20.0667	20.4796	20.7915	20.9279	20.9058	20.6715	20.1288	19.5105	19.0230	(87)
Th 2	19.9327	19.9342	19.9356	19.9423	19.9436	19.9495	19.9495	19.9506	19.9472	19.9436	19.9410	19.9384	(88)
util rest of house	0.9927	0.9852	0.9703	0.9347	0.8550	0.6985	0.5080	0.5579	0.7998	0.9487	0.9865	0.9942	(89)
MIT 2	18.1638	18.3864	18.7253	19.1574	19.5504	19.8265	19.9217	19.9111	19.7318	19.2242	18.6119	18.1238	(90)
Living area fraction									fLA = Living area / (4) =			0.2108	(91)
MIT	18.3542	18.5769	18.9162	19.3490	19.7463	20.0298	20.1338	20.1208	19.9299	19.4148	18.8013	18.3133	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3542	18.5769	18.9162	19.3490	19.7463	20.0298	20.1338	20.1208	19.9299	19.4148	18.8013	18.3133	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	611.3082	729.8190	811.7350	853.3882	818.6919	663.2104	479.1956	493.5288	642.3482	669.5642	606.0047	572.9456	(94)
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	2069.6232	2010.9676	1822.8520	1523.1649	1171.3422	785.5285	511.2263	537.6539	845.4365	1283.2279	1708.0421	2065.9343	(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	1084.9864	860.9319	752.2710	482.2392	262.3719	0.0000	0.0000	0.0000	0.0000	456.5658	793.4669	1110.7835	(98)
Space heating												5803.6167	(98)
Space heating per m2										(98) / (4) =		46.6679	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1359.8872	1070.5495	1098.2067	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7347	0.8129	0.7855	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	999.1284	870.2551	862.6554	0.0000	0.0000	0.0000	0.0000	(102)

FULL SAP CALCULATION PRINTOUT

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Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1216.8182	1169.0419	1113.7039	0.0000	0.0000	0.0000	0.0000 (103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	156.7366	222.2974	186.7801	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												565.8141 (104)
Cooled fraction									fC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
Intermittency factor	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	39.1842	55.5743	46.6950	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												141.4535 (107)
Space cooling per m2												1.1375 (108)
Energy for space heating												46.6679 (99)
Energy for space cooling												1.1375 (108)
Total												47.8053 (109)
Dwelling Fabric Energy Efficiency (DFEE)												47.8 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	62.4600 (1b)	x 2.3100 (2b)	= 144.2826 (1b) - (3b)
First floor	61.9000 (1c)	x 2.5600 (2c)	= 158.4640 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	124.3600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 302.7466 (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					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1321 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3821 (18)
Number of sides sheltered					4 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.7000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.2675 (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	0.3410	0.3344	0.3277	0.2942	0.2875	0.2541	0.2541	0.2474	0.2675	0.2875	0.3009	0.3143 (22b)
Effective ac	0.5582	0.5559	0.5537	0.5433	0.5413	0.5323	0.5323	0.5306	0.5358	0.5413	0.5453	0.5494 (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
TER Opaque door			2.3800	1.0000	2.3800		(26)
TER Semi-glazed door			2.0000	1.2000	2.4000		(26a)
TER Opening Type (Uw = 1.40)			17.3200	1.3258	22.9621		(27)
150mm TE Platinum GF			62.4600	0.1300	8.1198		(28a)
50mm Alreflex Plat	154.4600	21.7000	132.7600	0.1800	23.8968		(29a)
1st Flr Horiz Cl	61.9000		61.9000	0.1300	8.0470		(30)
Grd Floor Bay	0.4400		0.4400	0.1300	0.0572		(30)
Total net area of external elements Aum(A, m ²)			279.2600				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		67.8629		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.3949 (36)
Total fabric heat loss						(33) + (36) =	80.2578 (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	55.7633	55.5377	55.3166	54.2779	54.0835	53.1788	53.1788	53.0113	53.5273	54.0835	54.4767	54.8877 (38)
Heat transfer coeff	136.0212	135.7955	135.5744	134.5357	134.3413	133.4366	133.4366	133.2691	133.7851	134.3413	134.7345	135.1455 (39)
Average = Sum(39)m / 12 =												134.5347 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0938	1.0920	1.0902	1.0818	1.0803	1.0730	1.0730	1.0716	1.0758	1.0803	1.0834	1.0867 (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												2.8787 (42)
Average daily hot water use (litres/day)												102.5691 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.8260	108.7233	104.6205	100.5177	96.4150	92.3122	92.3122	96.4150	100.5177	104.6205	108.7233	112.8260 (44)
Energy conte	167.3178	146.3372	151.0069	131.6514	126.3227	109.0069	101.0109	115.9115	117.2958	136.6970	149.2155	162.0383 (45)
Energy content (annual)												Total = Sum(45)m = 1613.8118 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss												

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Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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 (56)
Primary 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 (57)
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
	35.5550	31.0967	32.0890	27.9759	26.8436	23.1640	21.4648	24.6312	24.9254	29.0481	31.7083	34.4331 (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	143.9350	143.9350	143.9350	143.9350	143.9350	143.9350	143.9350	143.9350	143.9350	143.9350	143.9350	143.9350	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	27.8430	24.7299	20.1117	15.2258	11.3815	9.6087	10.3826	13.4957	18.1139	22.9997	26.8441	28.6168	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	290.7858	293.8032	286.1994	270.0116	249.5775	230.3723	217.5421	214.5247	222.1285	238.3163	258.7504	277.9555	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.3935	37.3935	37.3935	37.3935	37.3935	37.3935	37.3935	37.3935	37.3935	37.3935	37.3935	37.3935	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-115.1480	-115.1480	-115.1480	-115.1480	-115.1480	-115.1480	-115.1480	-115.1480	-115.1480	-115.1480	-115.1480	-115.1480	(71)
Water heating gains (Table 5)	47.7890	46.2748	43.1303	38.8555	36.0801	32.1722	28.8506	33.1064	34.6186	39.0432	44.0393	46.2811	(72)
Total internal gains	432.5983	430.9884	415.6219	390.2734	363.2196	338.3338	322.9557	327.3073	341.0415	366.5396	395.8142	419.0340	(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
				North	5.0500	10.6334	0.6300		0.7000		0.7700		16.4110 (74)
				Northeast	0.7200	11.2829	0.6300		0.7000		0.7700		2.4827 (75)
				East	0.7200	19.6403	0.6300		0.7000		0.7700		4.3217 (76)
				South	9.3900	46.7521	0.6300		0.7000		0.7700		134.1647 (78)
				West	0.7200	19.6403	0.6300		0.7000		0.7700		4.3217 (80)
				Northwest	0.7200	11.2829	0.6300		0.7000		0.7700		2.4827 (81)
Solar gains	164.1845	278.1049	379.2411	472.4583	534.9283	534.4906	513.8114	466.0811	411.0308	306.7440	196.3010	140.7745	(83)
Total gains	596.7827	709.0933	794.8630	862.7317	898.1479	872.8243	836.7672	793.3884	752.0723	673.2836	592.1152	559.8085	(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	63.4909	63.5964	63.7002	64.1920	64.2848	64.7207	64.7207	64.8021	64.5521	64.2848	64.0973	63.9023	
alpha	5.2327	5.2398	5.2467	5.2795	5.2857	5.3147	5.3147	5.3201	5.3035	5.2857	5.2732	5.2602	
util living area	0.9993	0.9981	0.9948	0.9832	0.9438	0.8323	0.6660	0.7173	0.9138	0.9890	0.9984	0.9995	(86)
MIT	19.7218	19.8715	20.1028	20.4038	20.6928	20.9023	20.9772	20.9663	20.8194	20.4406	20.0202	19.6929	(87)
Th 2	20.0059	20.0074	20.0089	20.0157	20.0170	20.0230	20.0230	20.0241	20.0207	20.0170	20.0144	20.0117	(88)
util rest of house	0.9991	0.9975	0.9929	0.9761	0.9171	0.7536	0.5357	0.5910	0.8623	0.9830	0.9978	0.9994	(89)
MIT 2	18.8308	18.9814	19.2131	19.5161	19.7924	19.9725	20.0164	20.0133	19.9108	19.5555	19.1358	18.8065	(90)
Living area fraction									fLA = Living area / (4) =			0.2108	(91)
MIT	19.0186	19.1690	19.4006	19.7032	19.9822	20.1685	20.2189	20.2141	20.1023	19.7421	19.3222	18.9933	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0186	19.1690	19.4006	19.7032	19.9822	20.1685	20.2189	20.2141	20.1023	19.7421	19.3222	18.9933	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9988	0.9967	0.9912	0.9731	0.9160	0.7670	0.5635	0.6178	0.8676	0.9807	0.9971	0.9991	(94)
Ext temp.	596.0385	706.7701	787.8917	839.5198	822.6874	669.4547	471.5494	490.1191	652.4870	660.3021	590.3888	559.3101	(95)
Heat loss rate W	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)
Month fracti	2002.0416	1937.6689	1748.9912	1453.4124	1112.6381	743.0419	482.8973	508.3062	803.0142	1228.1601	1646.7576	1999.2529	(97)
Space heating kWh	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	1046.0663	827.1640	715.0580	442.0027	215.7234	0.0000	0.0000	0.0000	0.0000	422.4864	760.5855	1071.3174	(98)
Space heating per m2												5500.4037	(98)
										(98) / (4) =		44.2297	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1254.3044	987.4311	1012.8452	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7978	0.8810	0.8544	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1000.6925	869.9533	865.4220	0.0000	0.0000	0.0000	0.0000	(102)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1137.4875	1092.7804	1044.5267	0.0000	0.0000	0.0000	0.0000 (103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	98.4924	165.7834	133.2539	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												397.5297 (104)
Cooled fraction									fC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	24.6231	41.4458	33.3135	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												99.3824 (107)
Space cooling per m2												0.7992 (108)
Energy for space heating												44.2297 (99)
Energy for space cooling												0.7992 (108)
Total												45.0288 (109)
Target Fabric Energy Efficiency (TFEE)												51.8 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	H456--X7 Detached			Issued on Date	17/12/2021
Assessment Reference	2	Prop Type Ref			
Property	Avondale DS07, Detached, Part L2013 Masonry, David Wilson Homes				
SAP Rating	85 B	DER	15.92	TER	16.14
Environmental	85 B	% DER<TER	1.39		
CO ₂ Emissions (t/year)	1.96	DFEE	51.29	TFEE	56.20
General Requirements Compliance	Pass	% DFEE<TFEE	8.75		
Assessor Details	Mr. Andrew Maughan, Andrew Maughan, Tel: 01582 544250, Andrew.Maughan@ee-ltd.co.uk			Assessor ID	V844-0001
Client					

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS DESIGNED

Detached House, total floor area 137 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating:Mains gas

Fuel factor:1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER) 16.14 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 15.92 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)56.2 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)51.3 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Floor	0.15 (max. 0.25)	0.15 (max. 0.70)	OK
Roof	0.11 (max. 0.20)	0.17 (max. 0.35)	OK
Openings	1.39 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals:	5.01 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas

Data from database

Ideal LOGIC HEAT H18

Efficiency: 89.6% SEDBUK2009

Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation

Hot water storage Measured cylinder loss: 1.27 kWh/day

Permitted by DBSCG 2.09 OK

Primary pipework insulated: Yes OK

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls: Cylinderstat OK

Independent timer for DHW OK

Boiler interlock Yes OK

7 Low energy lights

Percentage of fixed lights with low-energy fittings:100%

Minimum 75% OK

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Midlands): Not significant OK

Based on:

Overshading: Average

Windows facing North: 8.61 m², No overhang

Windows facing East: 4.53 m², No overhang

Windows facing South East: 0.68 m², No overhang

Windows facing South: 7.26 m², No overhang

Windows facing South West: 0.68 m², No overhang

Windows facing West: 4.60 m², No overhang

Air change rate: 4.00 ach

Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features

Roof U-value 0.11 W/m²K

Door U-value 1.10 W/m²K

Thermal bridging y-value 0.038 W/m²K

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	68.6600 (1b)	x 2.3100 (2b)	= 158.6046 (1b) - (3b)
First floor	68.1300 (1c)	x 2.6400 (2c)	= 179.8632 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	136.7900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 338.4678 (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					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1182 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.3687 (18)
Number of sides sheltered					4 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.7000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.2581 (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												
Effective ac	0.3290	0.3226	0.3161	0.2839	0.2774	0.2452	0.2452	0.2387	0.2581	0.2774	0.2903	0.3032 (22b)
	0.5541	0.5520	0.5500	0.5403	0.5385	0.5301	0.5301	0.5285	0.5333	0.5385	0.5421	0.5460 (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
Opening Type 1 (Uw = 1.41)			26.3600	1.3347	35.1833		(27)
Opening Type 9			1.9700	1.5000	2.9550		(26a)
Opening Type 10			2.3800	1.1000	2.6180		(26)
150mm TE Platinum GF			68.6600	0.1500	10.2990		(28a)
50mm Alreflex Plat	184.5800	30.7100	153.8700	0.2700	41.5449		(29a)
400mm Min Wool	68.1300		68.1300	0.1100	7.4943		(30)
GF Bay	0.4300		0.4300	0.1700	0.0731		(30)
Total net area of external elements Aum(A, m ²)			321.8000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		100.1676		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							164.2800 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.1019 (36)
Total fabric heat loss						(33) + (36) =	112.2694 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	61.8939	61.6591	61.4289	60.3479	60.1456	59.2041	59.2041	59.0298	59.5668	60.1456	60.5548	60.9826 (38)
Average = Sum(39)m / 12 =	174.1633	173.9285	173.6983	172.6173	172.4151	171.4736	171.4736	171.2992	171.8362	172.4151	172.8242	173.2520 (39)
												172.6164 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2732	1.2715	1.2698	1.2619	1.2604	1.2536	1.2536	1.2523	1.2562	1.2604	1.2634	1.2666 (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												2.9107 (42)
Average daily hot water use (litres/day)												103.3294 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	113.6623	109.5291	105.3959	101.2628	97.1296	92.9964	92.9964	97.1296	101.2628	105.3959	109.5291	113.6623 (44)
Energy content (annual)	168.5579	147.4218	152.1261	132.6272	127.2590	109.8148	101.7596	116.7706	118.1652	137.7102	150.3214	163.2393 (45)
Distribution loss (46)m = 0.15 x (45)m												
Water storage loss:	25.2837	22.1133	22.8189	19.8941	19.0888	16.4722	15.2639	17.5156	17.7248	20.6565	22.5482	24.4859 (46)
Store volume												178.0000 (47)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

a) If manufacturer declared loss factor is known (kWh/day):												1.2700 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.6858 (55)
Total storage loss	21.2598	19.2024	21.2598	20.5740	21.2598	20.5740	21.2598	21.2598	20.5740	21.2598	20.5740	21.2598 (56)
If cylinder contains dedicated solar storage	21.2598	19.2024	21.2598	20.5740	21.2598	20.5740	21.2598	21.2598	20.5740	21.2598	20.5740	21.2598 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	213.0801	187.6354	196.6483	175.7132	171.7812	152.9008	146.2818	161.2928	161.2512	182.2324	193.4074	207.7615 (62)
WWHRS	-30.8449	-27.1406	-27.6999	-22.7837	-21.1515	-17.4464	-14.7609	-17.8735	-18.3970	-22.7473	-26.3565	-29.8145 eq. (G10)
Total of WWHRS savings												-277.0168
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	182.2352	160.4949	168.9484	152.9295	150.6297	135.4544	131.5209	143.4192	142.8542	159.4850	167.0509	177.9470 (64)
Heat gains from water heating, kWh/month	91.6633	81.1886	86.1997	78.5673	77.9314	70.9822	69.4528	74.4440	73.7587	81.4064	84.4507	89.8948 (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	145.5355	145.5355	145.5355	145.5355	145.5355	145.5355	145.5355	145.5355	145.5355	145.5355	145.5355	145.5355 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	27.5665	24.4843	19.9120	15.0746	11.2685	9.5133	10.2795	13.3616	17.9340	22.7713	26.5775	28.3326 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	305.7318	308.9043	300.9096	283.8898	262.4055	242.2132	228.7235	225.5509	233.5456	250.5654	272.0498	292.2421 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5535	37.5535	37.5535	37.5535	37.5535	37.5535	37.5535	37.5535	37.5535	37.5535	37.5535	37.5535 (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)	-116.4284	-116.4284	-116.4284	-116.4284	-116.4284	-116.4284	-116.4284	-116.4284	-116.4284	-116.4284	-116.4284	-116.4284 (71)
Water heating gains (Table 5)	123.2033	120.8164	115.8598	109.1213	104.7465	98.5864	93.3506	100.0591	102.4427	109.4172	117.2926	120.8264 (72)
Total internal gains	526.1622	523.8656	506.3420	477.7464	448.0810	419.9735	402.0141	408.6323	423.5829	452.4145	485.5805	511.0617 (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
North				8.6100	10.6334		0.7100		0.7000		0.7700		31.5329 (74)
East				4.5300	19.6403		0.7100		0.7000		0.7700		30.6433 (76)
Southeast				0.6800	36.7938		0.7100		0.7000		0.7700		8.6173 (77)
South				7.2600	46.7521		0.7100		0.7000		0.7700		116.9034 (78)
Southwest				0.6800	36.7938		0.7100		0.7000		0.7700		8.6173 (79)
West				4.6000	19.6403		0.7100		0.7000		0.7700		31.1168 (80)
Solar gains	227.4311	401.8915	585.4153	780.0689	920.1749	933.0089	891.4790	784.5934	652.7797	454.0418	275.1210		192.8405 (83)
Total gains	753.5932	925.7572	1091.7573	1257.8154	1368.2559	1352.9825	1293.4932	1193.2257	1076.3626	906.4563	760.7015		703.9022 (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	35.8410	35.8894	35.9369	36.1620	36.2044	36.4032	36.4032	36.4402	36.3264	36.2044	36.1187	36.0295
alpha	3.3894	3.3926	3.3958	3.4108	3.4136	3.4269	3.4269	3.4293	3.4218	3.4136	3.4079	3.4020
util living area	0.9924	0.9842	0.9660	0.9210	0.8305	0.6874	0.5411	0.5961	0.8097	0.9493	0.9863	0.9939 (86)
MIT	19.0257	19.2731	19.6612	20.1477	20.5718	20.8463	20.9499	20.9296	20.7118	20.1452	19.4870	18.9764 (87)
Th 2	19.8619	19.8632	19.8646	19.8708	19.8720	19.8774	19.8774	19.8784	19.8753	19.8720	19.8696	19.8671 (88)
util rest of house	0.9905	0.9805	0.9576	0.9005	0.7846	0.6017	0.4200	0.4751	0.7415	0.9320	0.9825	0.9925 (89)
MIT 2	17.2336	17.5940	18.1555	18.8493	19.4217	19.7553	19.8522	19.8395	19.6141	18.8600	17.9116	17.1651 (90)
Living area fraction	17.5526	17.8929	18.4235	19.0805	19.6264	19.9495	20.0476	20.0336	19.8095	19.0888	18.1921	17.4875 (91)
MIT	17.5526	17.8929	18.4235	19.0805	19.6264	19.9495	20.0476	20.0336	19.8095	19.0888	18.1921	17.4875 (92)
Temperature adjustment	17.4026	17.7429	18.2735	18.9305	19.4764	19.7995	19.8976	19.8836	19.6595	18.9388	18.0421	-0.1500
adjusted MIT	17.4026	17.7429	18.2735	18.9305	19.4764	19.7995	19.8976	19.8836	19.6595	18.9388	18.0421	17.3375 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9842	0.9699	0.9409	0.8783	0.7655	0.5951	0.4223	0.4757	0.7257	0.9120	0.9727	0.9872 (94)
Ext temp.	741.6939	897.8688	1027.2723	1104.7491	1047.4266	805.1123	546.2852	567.6727	781.0848	826.6764	739.9119	694.8781 (95)
Heat loss rate W	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)
Month fracti	2281.9992	2233.7515	2045.0453	1731.4322	1340.7742	891.5713	565.4526	596.7317	955.3300	1437.7333	1891.0526	2276.0976 (97)
Space heating kWh	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	1145.9872	897.7132	757.2232	451.2118	218.2506	0.0000	0.0000	0.0000	0.0000	454.6263	828.8213	1176.4273 (98)
Space heating per m ²												5930.2608 (98)
												(98) / (4) = 43.3530 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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)														0.0000	(201)
Fraction of space heat from main system(s)														1.0000	(202)
Efficiency of main space heating system 1 (in %)														90.6000	(206)
Efficiency of secondary/supplementary heating system, %														0.0000	(208)
Space heating requirement														6545.5418	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
Space heating requirement	1145.9872	897.7132	757.2232	451.2118	218.2506	0.0000	0.0000	0.0000	0.0000	454.6263	828.8213	1176.4273	(98)		
Space heating efficiency (main heating system 1)	90.6000	90.6000	90.6000	90.6000	90.6000	0.0000	0.0000	0.0000	0.0000	90.6000	90.6000	90.6000	(210)		
Space heating fuel (main heating system)	1264.8865	990.8534	835.7872	498.0263	240.8947	0.0000	0.0000	0.0000	0.0000	501.7951	914.8138	1298.4849	(211)		
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)		
Water heating requirement	182.2352	160.4949	168.9484	152.9295	150.6297	135.4544	131.5209	143.4192	142.8542	159.4850	167.0509	177.9470	(64)		
Efficiency of water heater (217)m	88.9654	88.7965	88.4395	87.6294	85.9025	79.9000	79.9000	79.9000	79.9000	87.5550	88.6095	89.0335	(216)		
Fuel for water heating, kWh/month	204.8384	180.7446	191.0327	174.5185	175.3496	169.5299	164.6069	179.4984	178.7912	182.1541	188.5248	199.8653	(219)		
Water heating fuel used												2189.4544	(219)		
Annual totals kWh/year															
Space heating fuel - main system													6545.5418	(211)	
Space heating fuel - secondary													0.0000	(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)														486.8324	(232)
Total delivered energy for all uses														9296.8286	(238)

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	6545.5418	0.2160	1413.8370 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2189.4544	0.2160	472.9221 (264)
Space and water heating			1886.7592 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	486.8324	0.5190	252.6660 (268)
Total CO2, kg/year			2178.3502 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			15.9200 (273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER			15.9200	ZC1
Total Floor Area		TFA	136.7900	
Assumed number of occupants		N	2.9107	
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190	
CO2 emissions from appliances, equation (L14)			13.2444	ZC2
CO2 emissions from cooking, equation (L16)			1.3806	ZC3
Total CO2 emissions			30.5450	ZC4
Residual CO2 emissions offset from biofuel CHP			0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year			0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation			0.0000	ZC7
Net CO2 emissions			30.5450	ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	68.6600 (1b)	x 2.3100 (2b)	= 158.6046 (1b) - (3b)
First floor	68.1300 (1c)	x 2.6400 (2c)	= 179.8632 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	136.7900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 338.4678 (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					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1182 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3682 (18)
Number of sides sheltered					4 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.7000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.2577 (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	0.3286	0.3222	0.3157	0.2835	0.2771	0.2448	0.2448	0.2384	0.2577	0.2771	0.2899	0.3028 (22b)
Effective ac	0.5540	0.5519	0.5498	0.5402	0.5384	0.5300	0.5300	0.5284	0.5332	0.5384	0.5420	0.5459 (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
TER Opaque door			2.3800	1.0000	2.3800		(26)
TER Semi-glazed door			1.9700	1.2000	2.3640		(26a)
TER Opening Type (Uw = 1.40)			26.3600	1.3258	34.9470		(27)
150mm TE Platinum GF			68.6600	0.1300	8.9258		(28a)
50mm Alreflex Plat	184.5800	30.7100	153.8700	0.1800	27.6966		(29a)
400mm Min Wool	68.1300		68.1300	0.1300	8.8569		(30)
GF Bay	0.4300		0.4300	0.1300	0.0559		(30)
Total net area of external elements Aum(A, m ²)			321.8000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		85.2262		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.9908 (36)
Total fabric heat loss						(33) + (36) =	100.2170 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	61.8775	61.6433	61.4138	60.3357	60.1340	59.1950	59.1950	59.0211	59.5567	60.1340	60.5420	60.9686 (38)
Average = Sum(39)m / 12 =	162.0944	161.8603	161.6307	160.5527	160.3510	159.4120	159.4120	159.2381	159.7737	160.3510	160.7590	161.1856 (39)
												160.5517 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1850	1.1833	1.1816	1.1737	1.1722	1.1654	1.1654	1.1641	1.1680	1.1722	1.1752	1.1783 (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												2.9107 (42)
Average daily hot water use (litres/day)												103.3294 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	113.6623	109.5291	105.3959	101.2628	97.1296	92.9964	92.9964	97.1296	101.2628	105.3959	109.5291	113.6623 (44)
Energy content (annual)	168.5579	147.4218	152.1261	132.6272	127.2590	109.8148	101.7596	116.7706	118.1652	137.7102	150.3214	163.2393 (45)
Distribution loss (46)m = 0.15 x (45)m												1625.7730 (45)
Water storage loss:	25.2837	22.1133	22.8189	19.8941	19.0888	16.4722	15.2639	17.5156	17.7248	20.6565	22.5482	24.4859 (46)
Store volume												178.0000 (47)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

a) If manufacturer declared loss factor is known (kWh/day):												1.5417 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8325 (55)
Total storage loss												
	25.8086	23.3110	25.8086	24.9760	25.8086	24.9760	25.8086	25.8086	24.9760	25.8086	24.9760	25.8086 (56)
If cylinder contains dedicated solar storage												
	25.8086	23.3110	25.8086	24.9760	25.8086	24.9760	25.8086	25.8086	24.9760	25.8086	24.9760	25.8086 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month												
	217.6289	191.7440	201.1971	180.1153	176.3300	157.3029	150.8306	165.8416	165.6533	186.7811	197.8095	212.3103 (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												
	217.6289	191.7440	201.1971	180.1153	176.3300	157.3029	150.8306	165.8416	165.6533	186.7811	197.8095	212.3103 (64)
Total per year (kWh/year) = Sum(64)m =												2203.5443 (64)
Heat gains from water heating, kWh/month												
	95.3023	84.4755	89.8387	82.0890	81.5704	74.5039	73.0918	78.0830	77.2804	85.0454	87.9723	93.5339 (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	145.5355	145.5355	145.5355	145.5355	145.5355	145.5355	145.5355	145.5355	145.5355	145.5355	145.5355	145.5355 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	27.5665	24.4843	19.9120	15.0746	11.2685	9.5133	10.2795	13.3616	17.9340	22.7713	26.5775	28.3326 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	305.7318	308.9043	300.9096	283.8898	262.4055	242.2132	228.7235	225.5509	233.5456	250.5654	272.0498	292.2421 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	37.5535	37.5535	37.5535	37.5535	37.5535	37.5535	37.5535	37.5535	37.5535	37.5535	37.5535	37.5535 (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)												
	-116.4284	-116.4284	-116.4284	-116.4284	-116.4284	-116.4284	-116.4284	-116.4284	-116.4284	-116.4284	-116.4284	-116.4284 (71)
Water heating gains (Table 5)												
	128.0945	125.7076	120.7510	114.0125	109.6376	103.4776	98.2417	104.9503	107.3338	114.3084	122.1838	125.7176 (72)
Total internal gains												
	531.0533	528.7568	511.2332	482.6376	452.9722	424.8647	406.9053	413.5235	428.4741	457.3057	490.4716	515.9529 (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		
North					8.6100	10.6334	0.6300	0.7000	0.7700	27.9799 (74)		
East					4.5300	19.6403	0.6300	0.7000	0.7700	27.1905 (76)		
Southeast					0.6800	36.7938	0.6300	0.7000	0.7700	7.6464 (77)		
South					7.2600	46.7521	0.6300	0.7000	0.7700	103.7312 (78)		
Southwest					0.6800	36.7938	0.6300	0.7000	0.7700	7.6464 (79)		
West					4.6000	19.6403	0.6300	0.7000	0.7700	27.6107 (80)		

Solar gains	201.8050	356.6080	519.4530	692.1738	816.4932	827.8812	791.0307	696.1885	579.2271	402.8822	244.1215	171.1120 (83)
Total gains	732.8584	885.3648	1030.6862	1174.8114	1269.4654	1252.7459	1197.9360	1109.7120	1007.7012	860.1879	734.5931	687.0649 (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	58.6035	58.6883	58.7716	59.1663	59.2407	59.5897	59.5897	59.6547	59.4548	59.2407	59.0903	58.9340
alpha	4.9069	4.9126	4.9181	4.9444	4.9494	4.9726	4.9726	4.9770	4.9637	4.9494	4.9394	4.9289
util living area												
	0.9988	0.9967	0.9901	0.9654	0.8912	0.7373	0.5678	0.6291	0.8674	0.9814	0.9972	0.9991 (86)
MIT	19.6526	19.8238	20.0967	20.4473	20.7539	20.9339	20.9855	20.9765	20.8437	20.4369	19.9735	19.6193 (87)
Th 2	19.9320	19.9334	19.9348	19.9411	19.9423	19.9478	19.9478	19.9488	19.9457	19.9423	19.9399	19.9374 (88)
util rest of house												
	0.9984	0.9956	0.9864	0.9517	0.8482	0.6449	0.4410	0.5004	0.7992	0.9716	0.9961	0.9988 (89)
MIT 2	18.1313	18.3823	18.7801	19.2856	19.6970	19.9030	19.9424	19.9390	19.8167	19.2790	18.6061	18.0862 (90)
Living area fraction												
MIT	18.4021	18.6389	19.0145	19.4924	19.8852	20.0865	20.1281	20.1237	19.9996	19.4851	18.8495	18.3591 (92)
Temperature adjustment												
adjusted MIT	18.4021	18.6389	19.0145	19.4924	19.8852	20.0865	20.1281	20.1237	19.9996	19.4851	18.8495	18.3591 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9974	0.9934	0.9819	0.9442	0.8455	0.6582	0.4636	0.5231	0.8034	0.9657	0.9942	0.9981 (94)
Useful gains	730.9812	879.5621	1011.9901	1109.2013	1073.2972	824.5396	555.3977	580.4520	809.5375	830.6703	730.3482	685.7706 (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												
	2285.8669	2223.7777	2022.7274	1700.6427	1312.4991	874.6186	562.4229	592.9480	942.5935	1424.7358	1888.8457	2282.2452 (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												
	1156.8349	903.3129	751.9886	425.8378	177.9662	0.0000	0.0000	0.0000	0.0000	441.9847	834.1182	1187.7772 (98)
Space heating												
												5879.8205 (98)
Space heating per m2												
												(98) / (4) = 42.9843 (99)

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Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													6288.5781 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1156.8349	903.3129	751.9886	425.8378	177.9662	0.0000	0.0000	0.0000	0.0000	441.9847	834.1182	1187.7772	(98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)	1237.2566	966.1100	804.2659	455.4415	190.3382	0.0000	0.0000	0.0000	0.0000	472.7110	892.1050	1270.3499	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	217.6289	191.7440	201.1971	180.1153	176.3300	157.3029	150.8306	165.8416	165.6533	186.7811	197.8095	212.3103	(64)
Efficiency of water heater (217)m	88.6186	88.4240	88.0091	87.0313	84.8385	79.8000	79.8000	79.8000	79.8000	87.0333	88.2322	88.6966	(216)
Fuel for water heating, kWh/month	245.5793	216.8462	228.6094	206.9546	207.8420	197.1214	189.0107	207.8215	207.5855	214.6087	224.1919	239.3670	(219)
Water heating fuel used												2585.5383	(219)
Annual totals kWh/year													
Space heating fuel - main system												6288.5781	(211)
Space heating fuel - secondary												0.0000	(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)												486.8324	(232)
Total delivered energy for all uses												9435.9488	(238)

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	6288.5781	0.2160	1358.3329 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2585.5383	0.2160	558.4763 (264)
Space and water heating			1916.8091 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	486.8324	0.5190	252.6660 (268)
Total CO2, kg/m2/year			2208.4002 (272)
Emissions per m2 for space and water heating			14.0128 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			1.8471 (272b)
Emissions per m2 for pumps and fans			0.2846 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.0128 * 1.00) + 1.8471 + 0.2846, rounded to 2 d.p.			16.1400 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	68.6600 (1b)	x 2.3100 (2b)	= 158.6046 (1b) - (3b)
First floor	68.1300 (1c)	x 2.6400 (2c)	= 179.8632 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	136.7900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 338.4678 (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					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1182 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.3687 (18)
Number of sides sheltered					4 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.7000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.2581 (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	0.3290	0.3226	0.3161	0.2839	0.2774	0.2452	0.2452	0.2387	0.2581	0.2774	0.2903	0.3032 (22b)
Effective ac	0.5541	0.5520	0.5500	0.5403	0.5385	0.5301	0.5301	0.5285	0.5333	0.5385	0.5421	0.5460 (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
Opening Type 1 (Uw = 1.41)			26.3600	1.3347	35.1833		(27)
Opening Type 9			1.9700	1.5000	2.9550		(26a)
Opening Type 10			2.3800	1.1000	2.6180		(26)
150mm TE Platinum GF			68.6600	0.1500	10.2990		(28a)
50mm Alreflex Plat	184.5800	30.7100	153.8700	0.2700	41.5449		(29a)
400mm Min Wool	68.1300		68.1300	0.1100	7.4943		(30)
GF Bay	0.4300		0.4300	0.1700	0.0731		(30)
Total net area of external elements Aum(A, m ²)			321.8000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		100.1676		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							164.2800 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.1019 (36)
Total fabric heat loss						(33) + (36) =	112.2694 (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	61.8939	61.6591	61.4289	60.3479	60.1456	59.2041	59.2041	59.0298	59.5668	60.1456	60.5548	60.9826 (38)
Heat transfer coeff	174.1633	173.9285	173.6983	172.6173	172.4151	171.4736	171.4736	171.2992	171.8362	172.4151	172.8242	173.2520 (39)
Average = Sum(39)m / 12 =												172.6164 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2732	1.2715	1.2698	1.2619	1.2604	1.2536	1.2536	1.2523	1.2562	1.2604	1.2634	1.2666 (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												2.9107 (42)
Average daily hot water use (litres/day)												103.3294 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	113.6623	109.5291	105.3959	101.2628	97.1296	92.9964	92.9964	97.1296	101.2628	105.3959	109.5291	113.6623 (44)
Energy conte	168.5579	147.4218	152.1261	132.6272	127.2590	109.8148	101.7596	116.7706	118.1652	137.7102	150.3214	163.2393 (45)
Energy content (annual)										Total = Sum(45)m =		1625.7730 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss												

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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 (56)
Primary 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 (57)
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
	35.8186	31.3271	32.3268	28.1833	27.0425	23.3356	21.6239	24.8138	25.1101	29.2634	31.9433	34.6884 (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	145.5355	145.5355	145.5355	145.5355	145.5355	145.5355	145.5355	145.5355	145.5355	145.5355	145.5355	145.5355	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	27.5665	24.4843	19.9120	15.0746	11.2685	9.5133	10.2795	13.3616	17.9340	22.7713	26.5775	28.3326	(67)
Appliances gains (calculated in Appendix L13 or L13a), also see Table 5	305.7318	308.9043	300.9096	283.8898	262.4055	242.2132	228.7235	225.5509	233.5456	250.5654	272.0498	292.2421	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5535	37.5535	37.5535	37.5535	37.5535	37.5535	37.5535	37.5535	37.5535	37.5535	37.5535	37.5535	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-116.4284	-116.4284	-116.4284	-116.4284	-116.4284	-116.4284	-116.4284	-116.4284	-116.4284	-116.4284	-116.4284	-116.4284	(71)
Water heating gains (Table 5)	48.1432	46.6178	43.4500	39.1434	36.3475	32.4106	29.0644	33.3518	34.8751	39.3325	44.3657	46.6241	(72)
Total internal gains	448.1021	446.6670	430.9322	404.7686	376.6821	350.7977	334.7280	338.9250	353.0154	379.3299	409.6536	433.8595	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	FF Access factor Table 6d	Gains W
North	8.6100	10.6334	0.7100	0.7000	0.7700	31.5329 (74)
East	4.5300	19.6403	0.7100	0.7000	0.7700	30.6433 (76)
Southeast	0.6800	36.7938	0.7100	0.7000	0.7700	8.6173 (77)
South	7.2600	46.7521	0.7100	0.7000	0.7700	116.9034 (78)
Southwest	0.6800	36.7938	0.7100	0.7000	0.7700	8.6173 (79)
West	4.6000	19.6403	0.7100	0.7000	0.7700	31.1168 (80)

Solar gains	227.4311	401.8915	585.4153	780.0689	920.1749	933.0089	891.4790	784.5934	652.7797	454.0418	275.1210	192.8405	(83)
Total gains	675.5332	848.5585	1016.3475	1184.8375	1296.8570	1283.8067	1226.2070	1123.5184	1005.7951	833.3717	684.7746	626.6999	(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	35.8410	35.8894	35.9369	36.1620	36.2044	36.4032	36.4032	36.4402	36.3264	36.2044	36.1187	36.0295	
alpha	3.3894	3.3926	3.3958	3.4108	3.4136	3.4269	3.4269	3.4293	3.4218	3.4136	3.4079	3.4020	
util living area	0.9945	0.9878	0.9721	0.9318	0.8476	0.7100	0.5646	0.6230	0.8328	0.9595	0.9900	0.9958	(86)
MIT	18.9562	19.2065	19.6003	20.0979	20.5378	20.8293	20.9429	20.9192	20.6807	20.0894	19.4207	18.9073	(87)
Th 2	19.8619	19.8632	19.8646	19.8708	19.8720	19.8774	19.8774	19.8784	19.8753	19.8720	19.8696	19.8671	(88)
util rest of house	0.9932	0.9848	0.9651	0.9134	0.8044	0.6252	0.4406	0.5002	0.7686	0.9451	0.9871	0.9947	(89)
MIT 2	17.9984	18.2481	18.6386	19.1273	19.5366	19.7835	19.8575	19.8473	19.6741	19.1286	18.4674	17.9534	(90)
Living area fraction									fLA = Living area / (4) =			0.1780	(91)
MIT	18.1689	18.4187	18.8098	19.3001	19.7149	19.9696	20.0507	20.0381	19.8533	19.2996	18.6371	18.1232	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1689	18.4187	18.8098	19.3001	19.7149	19.9696	20.0507	20.0381	19.8533	19.2996	18.6371	18.1232	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9904	0.9796	0.9564	0.9019	0.7973	0.6329	0.4611	0.5194	0.7671	0.9354	0.9826	0.9924	(94)
Ext temp.	669.0279	831.2777	971.9957	1068.6035	1034.0266	812.5576	565.4543	583.5158	771.5806	779.5376	672.8908	621.9554	(95)
Heat loss rate W	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)
Month fracti	2415.4582	2351.2896	2138.1894	1795.2292	1381.8844	920.7494	591.7031	623.2095	988.6184	1499.9475	1993.8885	2412.2272	(97)
Space heating kWh	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	1299.3441	1021.4480	867.6481	523.1705	258.8062	0.0000	0.0000	0.0000	0.0000	535.9850	951.1183	1331.9622	(98)
Space heating per m2												49.6343	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1611.8514	1268.9043	1301.8739	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7765	0.8449	0.8101	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1251.5847	1072.0827	1054.6572	0.0000	0.0000	0.0000	0.0000	(102)

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Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1621.8252	1551.7190	1434.0455	0.0000	0.0000	0.0000	0.0000 (103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	266.5732	356.8494	282.2649	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												905.6874 (104)
Cooled fraction									fC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
Intermittency factor	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	66.6433	89.2123	70.5662	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												226.4219 (107)
Space cooling per m2												1.6553 (108)
Energy for space heating												49.6343 (99)
Energy for space cooling												1.6553 (108)
Total												51.2896 (109)
Dwelling Fabric Energy Efficiency (DFEE)												51.3 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	68.6600 (1b)	x 2.3100 (2b)	= 158.6046 (1b) - (3b)
First floor	68.1300 (1c)	x 2.6400 (2c)	= 179.8632 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	136.7900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 338.4678 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
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																4 * 10 =	40.0000 (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) =					40.0000 / (5) =	0.1182 (8)	
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.3682 (18)							
Number of sides sheltered										4 (19)							
Shelter factor										(20) = 1 - [0.075 x (19)] =					0.7000 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.2577 (21)		
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind factor	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)				
Adj infilt rate	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)				
	0.3286	0.3222	0.3157	0.2835	0.2771	0.2448	0.2448	0.2384	0.2577	0.2771	0.2899	0.3028	(22b)				
Effective ac	0.5540	0.5519	0.5498	0.5402	0.5384	0.5300	0.5300	0.5284	0.5332	0.5384	0.5420	0.5459	(25)				

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.3800	1.0000	2.3800		(26)					
TER Semi-glazed door			1.9700	1.2000	2.3640		(26a)					
TER Opening Type (Uw = 1.40)			26.3600	1.3258	34.9470		(27)					
150mm TE Platinum GF			68.6600	0.1300	8.9258		(28a)					
50mm Alreflex Plat	184.5800	30.7100	153.8700	0.1800	27.6966		(29a)					
400mm Min Wool	68.1300		68.1300	0.1300	8.8569		(30)					
GF Bay	0.4300		0.4300	0.1300	0.0559		(30)					
Total net area of external elements Aum(A, m2)			321.8000				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		85.2262		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.9908 (36)					
Total fabric heat loss						(33) + (36) =	100.2170 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 61.8775	Feb 61.6433	Mar 61.4138	Apr 60.3357	May 60.1340	Jun 59.1950	Jul 59.1950	Aug 59.0211	Sep 59.5567	Oct 60.1340	Nov 60.5420	Dec 60.9686 (38)
Heat transfer coeff	162.0944	161.8603	161.6307	160.5527	160.3510	159.4120	159.4120	159.2381	159.7737	160.3510	160.7590	161.1856 (39)
Average = Sum(39)m / 12 =												160.5517 (39)
HLP	Jan 1.1850	Feb 1.1833	Mar 1.1816	Apr 1.1737	May 1.1722	Jun 1.1654	Jul 1.1654	Aug 1.1641	Sep 1.1680	Oct 1.1722	Nov 1.1752	Dec 1.1783 (40)
HLP (average)												1.1737 (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												2.9107 (42)
Average daily hot water use (litres/day)												103.3294 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.6623	109.5291	105.3959	101.2628	97.1296	92.9964	92.9964	97.1296	101.2628	105.3959	109.5291	113.6623 (44)
Energy conte	168.5579	147.4218	152.1261	132.6272	127.2590	109.8148	101.7596	116.7706	118.1652	137.7102	150.3214	163.2393 (45)
Energy content (annual)												Total = Sum(45)m = 1625.7730 (45)
Distribution loss (46)m = 0.15 x (45)m												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)	
Water storage loss:												
Total storage loss												

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Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	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)
Primary 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 (59)
Heat gains from water heating, kWh/month	35.8186	31.3271	32.3268	28.1833	27.0425	23.3356	21.6239	24.8138	25.1101	29.2634	31.9433	34.6884 (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	145.5355	145.5355	145.5355	145.5355	145.5355	145.5355	145.5355	145.5355	145.5355	145.5355	145.5355	145.5355	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	27.5665	24.4843	19.9120	15.0746	11.2685	9.5133	10.2795	13.3616	17.9340	22.7713	26.5775	28.3326	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	305.7318	308.9043	300.9096	283.8898	262.4055	242.2132	228.7235	225.5509	233.5456	250.5654	272.0498	292.2421	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5535	37.5535	37.5535	37.5535	37.5535	37.5535	37.5535	37.5535	37.5535	37.5535	37.5535	37.5535	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-116.4284	-116.4284	-116.4284	-116.4284	-116.4284	-116.4284	-116.4284	-116.4284	-116.4284	-116.4284	-116.4284	-116.4284	(71)
Water heating gains (Table 5)	48.1432	46.6178	43.4500	39.1434	36.3475	32.4106	29.0644	33.3518	34.8751	39.3325	44.3657	46.6241	(72)
Total internal gains	448.1021	446.6670	430.9322	404.7686	376.6821	350.7977	334.7280	338.9250	353.0154	379.3299	409.6536	433.8595	(73)

6. Solar gains

[Jan]		Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	FF Access factor Table 6d	Gains W	
North		8.6100	10.6334	0.6300	0.7000	0.7700	27.9799	(74)
East		4.5300	19.6403	0.6300	0.7000	0.7700	27.1905	(76)
Southeast		0.6800	36.7938	0.6300	0.7000	0.7700	7.6464	(77)
South		7.2600	46.7521	0.6300	0.7000	0.7700	103.7312	(78)
Southwest		0.6800	36.7938	0.6300	0.7000	0.7700	7.6464	(79)
West		4.6000	19.6403	0.6300	0.7000	0.7700	27.6107	(80)

Solar gains	201.8050	356.6080	519.4530	692.1738	816.4932	827.8812	791.0307	696.1885	579.2271	402.8822	244.1215	171.1120	(83)
Total gains	649.9071	803.2750	950.3852	1096.9424	1193.1753	1178.6789	1125.7587	1035.1135	932.2425	782.2121	653.7751	604.9714	(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	58.6035	58.6883	58.7716	59.1663	59.2407	59.5897	59.5897	59.6547	59.4548	59.2407	59.0903	58.9340	
alpha	4.9069	4.9126	4.9181	4.9444	4.9494	4.9726	4.9726	4.9770	4.9637	4.9494	4.9394	4.9289	
util living area	0.9993	0.9979	0.9929	0.9733	0.9098	0.7673	0.5993	0.6653	0.8938	0.9873	0.9984	0.9995	(86)
MIT	19.5963	19.7686	20.0443	20.4018	20.7225	20.9207	20.9817	20.9700	20.8158	20.3878	19.9189	19.5634	(87)
Th 2	19.9320	19.9334	19.9348	19.9411	19.9423	19.9478	19.9478	19.9488	19.9457	19.9423	19.9399	19.9374	(88)
util rest of house	0.9991	0.9971	0.9903	0.9623	0.8714	0.6766	0.4679	0.5334	0.8331	0.9804	0.9977	0.9993	(89)
MIT 2	18.6463	18.8194	19.0949	19.4509	19.7495	19.9101	19.9430	19.9399	19.8380	19.4423	18.9750	18.6177	(90)
Living area fraction									fLA = Living area / (4) =			0.1780	(91)
MIT	18.8154	18.9884	19.2639	19.6202	19.9227	20.0900	20.1279	20.1233	20.0120	19.6106	19.1430	18.7860	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8154	18.9884	19.2639	19.6202	19.9227	20.0900	20.1279	20.1233	20.0120	19.6106	19.1430	18.7860	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9987	0.9961	0.9880	0.9580	0.8706	0.6902	0.4915	0.5569	0.8377	0.9774	0.9969	0.9991	(94)
Useful gains	649.0541	800.1767	938.9373	1050.8836	1038.7635	813.4757	553.3267	576.4868	780.9815	764.5438	651.7410	604.4131	(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	2352.8719	2280.3504	2063.0360	1721.1489	1318.5223	875.1721	562.3955	592.8908	944.5895	1444.8605	1936.0185	2351.0578	(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	1267.6405	994.6767	836.3294	482.5910	208.1405	0.0000	0.0000	0.0000	0.0000	506.1556	924.6798	1299.5037	(98)
Space heating												6519.7173	(98)
Space heating per m2										(98) / (4) =		47.6622	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1498.4727	1179.6487	1210.2096	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8327	0.9025	0.8696	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1247.7814	1064.6159	1052.3955	0.0000	0.0000	0.0000	0.0000	(102)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1498.9486	1434.3119	1330.7151	0.0000	0.0000	0.0000	0.0000 (103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	180.8404	275.0538	207.0697	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												662.9639 (104)
Cooled fraction									fC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
Intermittency factor	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	45.2101	68.7634	51.7674	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												165.7410 (107)
Space cooling per m2												1.2116 (108)
Energy for space heating												47.6622 (99)
Energy for space cooling												1.2116 (108)
Total												48.8739 (109)
Target Fabric Energy Efficiency (TFEE)												56.2 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	H469--H7 Detached			Issued on Date	17/12/2021
Assessment Reference	1	Prop Type Ref			
Property	Holden, Detached, Hipped Roof, Part L2013 Masonry, David Wilson Homes				
SAP Rating	85 B	DER	15.11	TER	15.37
Environmental	86 B	% DER<TER	1.70		
CO ₂ Emissions (t/year)	1.91	DFEE	48.15	TFEE	52.86
General Requirements Compliance	Pass	% DFEE<TFEE	8.91		
Assessor Details	Mr. Andrew Maughan, Andrew Maughan, Tel: 01582 544250, Andrew.Maughan@ee-ltd.co.uk			Assessor ID	V844-0001
Client					

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS DESIGNED

Detached House, total floor area 141 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 15.37 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 15.11 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)52.9 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)48.2 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Floor	0.15 (max. 0.25)	0.15 (max. 0.70)	OK
Roof	0.11 (max. 0.20)	0.17 (max. 0.35)	OK
Openings	1.42 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals: 5.01 (design value)
Maximum 10.0 OK

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Ideal LOGIC HEAT H18

Efficiency: 89.6% SEDBUK2009
Minimum: 88.0%

OK

Secondary heating system: None

5 Cylinder insulation

Hot water storage Measured cylinder loss: 1.27 kWh/day
Permitted by DBSCG 2.10 OK
Primary pipework insulated: Yes OK

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls:

Cylinderstat OK
Independent timer for DHW OK

Boiler interlock

Yes OK

7 Low energy lights

Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Midlands): Not significant OK

Based on:

Overshading: Average
Windows facing North: 6.85 m², No overhang
Windows facing North East: 0.72 m², No overhang
Windows facing East: 2.55 m², No overhang
Windows facing South: 12.43 m², No overhang
Windows facing West: 3.21 m², No overhang
Windows facing North West: 0.72 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features

Roof U-value 0.11 W/m²K

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	72.9600 (1b)	x 2.3000 (2b)	= 167.8080 (1b) - (3b)
First floor	68.3300 (1c)	x 2.5600 (2c)	= 174.9248 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	141.2900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 342.7328 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
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																4 * 10 =	40.0000 (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) =					40.0000	/ (5) =	0.1167 (8)
Pressure test										Yes							
Measured/design AP50										5.0100							
Infiltration rate										0.3672 (18)							
Number of sides sheltered										4 (19)							
Shelter factor										(20) = 1 - [0.075 x (19)] =					0.7000	(20)	
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.2570	(21)	
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind factor	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)				
Adj infilt rate	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)				
	0.3277	0.3213	0.3149	0.2828	0.2763	0.2442	0.2442	0.2378	0.2570	0.2763	0.2892	0.3020	(22b)				
Effective ac	0.5537	0.5516	0.5496	0.5400	0.5382	0.5298	0.5298	0.5283	0.5330	0.5382	0.5418	0.5456	(25)				

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
Opening Type 1 (Uw = 1.41)			26.4800	1.3347	35.3434			(27)					
Opening Type 4			4.3800	1.5000	6.5700			(26a)					
150mm TE Platinum GF			72.9600	0.1500	10.9440			(28a)					
50mm Alreflex Plat	171.1600	30.8600	140.3000	0.2700	37.8810			(29a)					
1st Flr Horiz Cl	68.3300		68.3300	0.1100	7.5163			(30)					
Grd Floor Bays	3.5300		3.5300	0.1700	0.6001			(30)					
Total net area of external elements Aum(A, m2)			315.9800					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	98.8548			(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								162.0600 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								12.4822 (36)					
Total fabric heat loss						(33) + (36) =		111.3370 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 62.6250	Feb 62.3892	Mar 62.1580	Apr 61.0720	May 60.8689	Jun 59.9231	Jul 59.9231	Aug 59.7479	Sep 60.2874	Oct 60.8689	Nov 61.2799	Dec 61.7096	(38)
Heat transfer coeff	173.9621	173.7262	173.4950	172.4091	172.2059	171.2601	171.2601	171.0850	171.6244	172.2059	172.6169	173.0466	(39)
Average = Sum(39)m / 12 =												172.4081	(39)
HLP	Jan 1.2312	Feb 1.2296	Mar 1.2279	Apr 1.2202	May 1.2188	Jun 1.2121	Jul 1.2121	Aug 1.2109	Sep 1.2147	Oct 1.2188	Nov 1.2217	Dec 1.2248	(40)
HLP (average)												1.2202	(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												2.9195 (42)
Average daily hot water use (litres/day)												103.5381 (43)
Daily hot water use	Jan 113.8919	Feb 109.7504	Mar 105.6089	Apr 101.4674	May 97.3258	Jun 93.1843	Jul 93.1843	Aug 97.3258	Sep 101.4674	Oct 105.6089	Nov 109.7504	Dec 113.8919 (44)
Energy conte	168.8985	147.7197	152.4335	132.8952	127.5161	110.0367	101.9652	117.0065	118.4040	137.9884	150.6251	163.5691 (45)
Energy content (annual)												Total = Sum(45)m = 1629.0579 (45)
Distribution loss (46)m = 0.15 x (45)m	25.3348	22.1580	22.8650	19.9343	19.1274	16.5055	15.2948	17.5510	17.7606	20.6983	22.5938	24.5354 (46)
Water storage loss:												180.0000 (47)
Store volume												1.2700 (48)
a) If manufacturer declared loss factor is known (kWh/day):												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.6858 (55)
Total storage loss	21.2598	19.2024	21.2598	20.5740	21.2598	20.5740	21.2598	21.2598	20.5740	21.2598	20.5740	21.2598 (56)
If cylinder contains dedicated solar storage	21.2598	19.2024	21.2598	20.5740	21.2598	20.5740	21.2598	21.2598	20.5740	21.2598	20.5740	21.2598 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	213.4207	187.9333	196.9557	175.9812	172.0383	153.1227	146.4874	161.5287	161.4900	182.5106	193.7111	208.0913 (62)
WWHRS	-30.9260	-27.2120	-27.7728	-22.8434	-21.2068	-17.4920	-14.7992	-17.9201	-18.4450	-22.8068	-26.4257	-29.8930 eq. (G10)
Total of WWHRS savings												-277.7427
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	182.4947	160.7213	169.1829	153.1378	150.8315	135.6307	131.6881	143.6087	143.0450	159.7038	167.2855	178.1984 (64)
Heat gains from water heating, kWh/month	91.7765	81.2877	86.3019	78.6565	78.0169	71.0560	69.5212	74.5224	73.8381	81.4989	84.5517	90.0045 (65)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.6000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													6317.0975 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1117.6386	864.3435	724.3388	432.0679	209.7410	0.0000	0.0000	0.0000	0.0000	425.0688	799.5861	1150.5055	(98)
Space heating efficiency (main heating system 1)	90.6000	90.6000	90.6000	90.6000	90.6000	0.0000	0.0000	0.0000	0.0000	90.6000	90.6000	90.6000	(210)
Space heating fuel (main heating system)	1233.5966	954.0215	799.4910	476.8961	231.5022	0.0000	0.0000	0.0000	0.0000	469.1709	882.5454	1269.8737	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	182.4947	160.7213	169.1829	153.1378	150.8315	135.6307	131.6881	143.6087	143.0450	159.7038	167.2855	178.1984	(64)
Efficiency of water heater (217)m	88.9284	88.7368	88.3595	87.5325	85.7939	79.9000	79.9000	79.9000	79.9000	87.4034	88.5483	79.9000	(216)
Fuel for water heating, kWh/month	205.2153	181.1214	191.4710	174.9496	175.8068	169.7506	164.8162	179.7355	179.0300	182.7204	188.9199	200.2195	(219)
Water heating fuel used												2193.7562	(219)
Annual totals kWh/year													
Space heating fuel - main system												6317.0975	(211)
Space heating fuel - secondary												0.0000	(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)												496.8699	(232)
Total delivered energy for all uses												9082.7236	(238)

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	6317.0975	0.2160	1364.4931	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2193.7562	0.2160	473.8513	(264)
Space and water heating			1838.3444	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	496.8699	0.5190	257.8755	(268)
Total CO2, kg/year			2135.1449	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			15.1100	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		15.1100	ZC1
Total Floor Area	TFA	141.2900	
Assumed number of occupants	N	2.9195	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		13.0382	ZC2
CO2 emissions from cooking, equation (L16)		1.3382	ZC3
Total CO2 emissions		29.4864	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		29.4864	ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	72.9600 (1b)	x 2.3000 (2b)	= 167.8080 (1b) - (3b)
First floor	68.3300 (1c)	x 2.5600 (2c)	= 174.9248 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	141.2900		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 342.7328 (5)
Dwelling volume			

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					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1167 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3667 (18)
Number of sides sheltered					4 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.7000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.2567 (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	0.3273	0.3209	0.3145	0.2824	0.2759	0.2439	0.2439	0.2374	0.2567	0.2759	0.2888	0.3016 (22b)
Effective ac	0.5536	0.5515	0.5494	0.5399	0.5381	0.5297	0.5297	0.5282	0.5329	0.5381	0.5417	0.5455 (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
TER Semi-glazed door			4.3800	1.2000	5.2560		(26a)
TER Opening Type (Uw = 1.40)			26.4800	1.3258	35.1061		(27)
150mm TE Platinum GF			72.9600	0.1300	9.4848		(28a)
50mm Alreflex Plat	171.1600	30.8600	140.3000	0.1800	25.2540		(29a)
1st Flr Horiz Cl	68.3300		68.3300	0.1300	8.8829		(30)
Grd Floor Bays	3.5300		3.5300	0.1300	0.4589		(30)
Total net area of external elements Aum, m ²			315.9800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		84.4427		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.3477 (36)
Total fabric heat loss						(33) + (36) =	99.7904 (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	62.6085	62.3733	62.1427	61.0597	60.8571	59.9139	59.9139	59.7392	60.2772	60.8571	61.2670	61.6955 (38)
Heat transfer coeff	162.3989	162.1636	161.9331	160.8501	160.6475	159.7043	159.7043	159.5296	160.0676	160.6475	161.0574	161.4859 (39)
Average = Sum(39)m / 12 =												160.8491 (39)
HLP	1.1494	1.1477	1.1461	1.1384	1.1370	1.1303	1.1303	1.1291	1.1329	1.1370	1.1399	1.1429 (40)
HLP (average)												1.1384 (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												2.9195 (42)
Average daily hot water use (litres/day)												103.5381 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	113.8919	109.7504	105.6089	101.4674	97.3258	93.1843	93.1843	97.3258	101.4674	105.6089	109.7504	113.8919 (44)
Energy content (annual)	168.8985	147.7197	152.4335	132.8952	127.5161	110.0367	101.9652	117.0065	118.4040	137.9884	150.6251	163.5691 (45)
Distribution loss (46)m = 0.15 x (45)m	25.3348	22.1580	22.8650	19.9343	19.1274	16.5055	15.2948	17.5510	17.7606	20.6983	22.5938	24.5354 (46)
Water storage loss:												180.0000 (47)
Store volume												1.5520 (48)
a) If manufacturer declared loss factor is known (kWh/day):												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8381 (55)
Total storage loss	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (56)
If cylinder contains dedicated solar storage	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	218.1411	192.1969	201.6761	180.5494	176.7588	157.6909	151.2078	166.2492	166.0582	187.2311	198.2793	212.8118 (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	218.1411	192.1969	201.6761	180.5494	176.7588	157.6909	151.2078	166.2492	166.0582	187.2311	198.2793	212.8118 (64)
Heat gains from water heating, kWh/month	95.5529	84.6986	90.0783	82.3110	81.7932	74.7106	73.2976	78.2988	77.4927	85.2753	88.2062	93.7809 (65)
Total per year (kWh/year) = Sum(64)m =												2208.8506 (64)

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	145.9750	145.9750	145.9750	145.9750	145.9750	145.9750	145.9750	145.9750	145.9750	145.9750	145.9750	145.9750	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	28.1348	24.9891	20.3225	15.3854	11.5008	9.7095	10.4914	13.6371	18.3037	23.2408	27.1254	28.9168	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	310.8740	314.0999	305.9707	288.6647	266.8190	246.2871	232.5705	229.3446	237.4737	254.7798	276.6255	297.1574	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5975	37.5975	37.5975	37.5975	37.5975	37.5975	37.5975	37.5975	37.5975	37.5975	37.5975	37.5975	(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)	-116.7800	-116.7800	-116.7800	-116.7800	-116.7800	-116.7800	-116.7800	-116.7800	-116.7800	-116.7800	-116.7800	-116.7800	(71)
Water heating gains (Table 5)	128.4313	126.0396	121.0729	114.3208	109.9371	103.7647	98.5182	105.2403	107.6287	114.6173	122.5086	126.0496	(72)
Total internal gains	537.2326	534.9211	517.1587	488.1635	458.0494	429.5537	411.3726	418.0145	433.1987	462.4304	496.0521	521.9163	(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		
North				6.8500		10.6334		0.6300		0.7000		0.7700		22.2605 (74)
Northeast				0.7200		11.2829		0.6300		0.7000		0.7700		2.4827 (75)
East				2.5500		19.6403		0.6300		0.7000		0.7700		15.3059 (76)
South				12.4300		46.7521		0.6300		0.7000		0.7700		177.6003 (78)
West				3.2100		19.6403		0.6300		0.7000		0.7700		19.2674 (80)
Northwest				0.7200		11.2829		0.6300		0.7000		0.7700		2.4827 (81)
Solar gains	239.3996	411.1446	572.3877	727.2169	832.0627	834.0425	800.7566	721.1220	625.6835	456.9670	287.3348	204.5069	(83)	
Total gains	776.6322	946.0656	1089.5464	1215.3804	1290.1121	1263.5962	1212.1292	1139.1366	1058.8822	919.3973	783.3869	726.4232	(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	60.4179	60.5056	60.5917	60.9997	61.0766	61.4373	61.4373	61.5046	61.2979	61.0766	60.9212	60.7595
alpha	5.0279	5.0337	5.0394	5.0666	5.0718	5.0958	5.0958	5.1003	5.0865	5.0718	5.0614	5.0506
util living area	0.9987	0.9961	0.9887	0.9633	0.8901	0.7366	0.5640	0.6181	0.8528	0.9777	0.9968	0.9991 (86)
MIT	19.7127	19.8905	20.1547	20.4835	20.7696	20.9391	20.9873	20.9801	20.8657	20.4857	20.0292	19.6774 (87)
Th 2	19.9607	19.9620	19.9634	19.9696	19.9707	19.9761	19.9761	19.9771	19.9741	19.9707	19.9684	19.9659 (88)
util rest of house	0.9982	0.9948	0.9846	0.9491	0.8474	0.6459	0.4408	0.4935	0.7824	0.9664	0.9955	0.9987 (89)
MIT 2	18.2392	18.4998	18.8845	19.3579	19.7409	19.9347	19.9714	19.9688	19.8649	19.3687	18.7075	18.1913 (90)
Living area fraction	fLA = Living area / (4) =											0.1466 (91)
MIT	18.4552	18.7036	19.0707	19.5229	19.8917	20.0819	20.1203	20.1171	20.0116	19.5325	18.9013	18.4091 (92)
Temperature adjustment												0.0000
adjusted MIT	18.4552	18.7036	19.0707	19.5229	19.8917	20.0819	20.1203	20.1171	20.0116	19.5325	18.9013	18.4091 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9972	0.9924	0.9796	0.9412	0.8435	0.6561	0.4588	0.5114	0.7854	0.9597	0.9933	0.9979	(94)
Ext temp.	774.4331	938.8705	1067.3337	1143.8745	1088.1850	829.0766	556.1399	582.6106	831.6453	882.3730	778.1755	724.9323	(95)
Heat loss rate W	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)
Month fracti	2298.7886	2238.4472	2035.6057	1708.6876	1315.9769	875.4826	562.2074	592.9820	946.2497	1434.9762	1900.6797	2294.5745	(97)
Space heating kWh	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	1134.1205	873.3156	720.3944	406.6654	169.4772	0.0000	0.0000	0.0000	0.0000	411.1368	808.2030	1167.8138	(98)
Space heating per m2												5691.1266 (98)	
												(98) / (4) =	40.2798 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												93.5000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												6086.7664 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1134.1205	873.3156	720.3944	406.6654	169.4772	0.0000	0.0000	0.0000	0.0000	411.1368	808.2030	1167.8138 (98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000 (210)
Space heating fuel (main heating system)	1212.9631	934.0273	770.4753	434.9363	181.2590	0.0000	0.0000	0.0000	0.0000	439.7185	864.3882	1248.9987 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating requirement	218.1411	192.1969	201.6761	180.5494	176.7588	157.6909	151.2078	166.2492	166.0582	187.2311	198.2793	212.8118 (64)
Efficiency of water heater (217)m	88.5839	88.3628	87.9215	86.9167	84.7019	79.8000	79.8000	79.8000	79.8000	86.8559	88.1710	79.8000 (216)
Fuel for water heating, kWh/month	246.2536	217.5088	229.3820	207.7269	208.6833	197.6076	189.4835	208.3323	208.0929	215.5652	224.8805	240.0113 (219)
Water heating fuel used												2593.5280 (219)
Annual totals kWh/year												
Space heating fuel - main system												6086.7664 (211)
Space heating fuel - secondary												0.0000 (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)												496.8699 (232)
Total delivered energy for all uses												9252.1644 (238)

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	6086.7664	0.2160	1314.7416 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2593.5280	0.2160	560.2021 (264)
Space and water heating			1874.9436 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	496.8699	0.5190	257.8755 (268)
Total CO2, kg/m2/year			2171.7441 (272)
Emissions per m2 for space and water heating			13.2702 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			1.8252 (272b)
Emissions per m2 for pumps and fans			0.2755 (272c)
Target Carbon Dioxide Emission Rate (TER) = (13.2702 * 1.00) + 1.8252 + 0.2755, rounded to 2 d.p.			15.3700 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	72.9600 (1b)	x 2.3000 (2b)	= 167.8080 (1b) - (3b)
First floor	68.3300 (1c)	x 2.5600 (2c)	= 174.9248 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	141.2900		(3a) + (3b) + (3c) + (3d) + (3e) ... (3n) = 342.7328 (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					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1167 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.3672 (18)
Number of sides sheltered					4 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.7000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.2570 (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	0.3277	0.3213	0.3149	0.2828	0.2763	0.2442	0.2442	0.2378	0.2570	0.2763	0.2892	0.3020 (22b)
Effective ac	0.5537	0.5516	0.5496	0.5400	0.5382	0.5298	0.5298	0.5283	0.5330	0.5382	0.5418	0.5456 (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
Opening Type 1 (Uw = 1.41)			26.4800	1.3347	35.3434		(27)
Opening Type 4			4.3800	1.5000	6.5700		(26a)
150mm TE Platinum GF			72.9600	0.1500	10.9440		(28a)
50mm Alreflex Plat	171.1600	30.8600	140.3000	0.2700	37.8810		(29a)
1st Flr Horiz Cl	68.3300		68.3300	0.1100	7.5163		(30)
Grd Floor Bays	3.5300		3.5300	0.1700	0.6001		(31)
Total net area of external elements Aum(A, m ²)			315.9800				(32)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	98.8548		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							162.0600 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.4822 (36)
Total fabric heat loss						(33) + (36) =	111.3370 (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	62.6250	62.3892	62.1580	61.0720	60.8689	59.9231	59.9231	59.7479	60.2874	60.8689	61.2799	61.7096 (38)
Heat transfer coeff	173.9621	173.7262	173.4950	172.4091	172.2059	171.2601	171.2601	171.0850	171.6244	172.2059	172.6169	173.0466 (39)
Average = Sum(39)m / 12 =												172.4081 (39)
HLP	1.2312	1.2296	1.2279	1.2202	1.2188	1.2121	1.2121	1.2109	1.2147	1.2188	1.2217	1.2248 (40)
HLP (average)												1.2202 (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												2.9195 (42)
Average daily hot water use (litres/day)												103.5381 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	113.8919	109.7504	105.6089	101.4674	97.3258	93.1843	93.1843	97.3258	101.4674	105.6089	109.7504	113.8919 (44)
Energy content (annual)	168.8985	147.7197	152.4335	132.8952	127.5161	110.0367	101.9652	117.0065	118.4040	137.9884	150.6251	163.5691 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1629.0579 (45)
Water 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 (46)
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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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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	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month	35.8909	31.3904	32.3921	28.2402	27.0972	23.3828	21.6676	24.8639	25.1608	29.3225	32.0078	34.7584 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	145.9750	145.9750	145.9750	145.9750	145.9750	145.9750	145.9750	145.9750	145.9750	145.9750	145.9750	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	28.1348	24.9891	20.3225	15.3854	11.5008	9.7095	10.4914	13.6371	18.3037	23.2408	27.1254	28.9168 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	310.8740	314.0999	305.9707	288.6647	266.8190	246.2871	232.5705	229.3446	237.4737	254.7798	276.6255	297.1574 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5975	37.5975	37.5975	37.5975	37.5975	37.5975	37.5975	37.5975	37.5975	37.5975	37.5975	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-116.7800	-116.7800	-116.7800	-116.7800	-116.7800	-116.7800	-116.7800	-116.7800	-116.7800	-116.7800	-116.7800	(71)
Water heating gains (Table 5)	48.2405	46.7119	43.5378	39.2225	36.4209	32.4761	29.1231	33.4192	34.9456	39.4120	44.4553	46.7183 (72)
Total internal gains	454.0418	452.5935	436.6235	410.0652	381.5332	355.2651	338.9775	343.1934	357.5156	384.2251	414.9988	439.5850 (73)

6. Solar gains												

[Jan]				Area	Solar flux				FF		Access	Gains
				m2	Table 6a		g		Specific data		factor	W
					W/m2		or Table 6b		Specific data		Table 6d	
									or Table 6c			
North			6.8500		10.6334		0.7100		0.7000		0.7700	25.0872 (74)
Northeast			0.7200		11.2829		0.7100		0.7000		0.7700	2.7980 (75)
East			2.5500		19.6403		0.7100		0.7000		0.7700	17.2495 (76)
South			12.4300		46.7521		0.7100		0.7000		0.7700	200.1527 (78)
West			3.2100		19.6403		0.7100		0.7000		0.7700	21.7141 (80)
Northwest			0.7200		11.2829		0.7100		0.7000		0.7700	2.7980 (81)

Solar gains	269.7995	463.3534	645.0718	819.5619	937.7214	939.9527	902.4400	812.6931	705.1354	514.9945	323.8218	230.4760 (83)
Total gains	723.8414	915.9469	1081.6954	1229.6271	1319.2546	1295.2178	1241.4175	1155.8865	1062.6510	899.2196	738.8206	670.0611 (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	36.5620	36.6117	36.6605	36.8914	36.9349	37.1389	37.1389	37.1769	37.0600	36.9349	36.8469	36.7554
alpha	3.4375	3.4408	3.4440	3.4594	3.4623	3.4759	3.4759	3.4785	3.4707	3.4623	3.4565	3.4504
util living area	0.9937	0.9855	0.9681	0.9272	0.8444	0.7079	0.5599	0.6114	0.8164	0.9519	0.9881	0.9951 (86)
MIT	19.0278	19.2901	19.6740	20.1441	20.5588	20.8375	20.9470	20.9272	20.7131	20.1539	19.4903	18.9754 (87)
Th 2	19.8951	19.8964	19.8977	19.9038	19.9050	19.9103	19.9103	19.9113	19.9083	19.9050	19.9027	19.9002 (88)
util rest of house	0.9922	0.9821	0.9603	0.9082	0.8017	0.6252	0.4399	0.4927	0.7509	0.9357	0.9848	0.9940 (89)
MIT 2	18.0953	18.3568	18.7368	19.1978	19.5835	19.8199	19.8914	19.8829	19.7281	19.2163	18.5620	18.0469 (90)
Living area fraction									fLA = Living area / (4) =			0.1466 (91)
MIT	18.2320	18.4936	18.8741	19.3365	19.7264	19.9691	20.0462	20.0360	19.8724	19.3537	18.6981	18.1830 (92)
Temperature adjustment												0.0000
adjusted MIT	18.2320	18.4936	18.8741	19.3365	19.7264	19.9691	20.0462	20.0360	19.8724	19.3537	18.6981	18.1830 (93)

8. Space heating requirement												

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9889	0.9761	0.9509	0.8962	0.7936	0.6301	0.4559	0.5075	0.7484	0.9251	0.9796	0.9914 (94)
Ext temp.	715.8329	894.0714	1028.5347	1101.9365	1046.9956	816.1213	565.9679	586.5592	795.2422	831.8526	723.7797	664.2715 (95)
Heat loss rate W	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)
	2423.6345	2361.5578	2146.8517	1799.3511	1382.1986	919.5069	590.1893	622.0652	990.6909	1507.4452	2002.0290	2419.7080 (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	1270.6044	986.1508	832.0278	502.1385	249.3910	0.0000	0.0000	0.0000	0.0000	502.6409	920.3395	1306.0448 (98)
Space heating												6569.3378 (98)
Space heating per m2										(98) / (4) =		46.4954 (99)

8c. Space cooling requirement												

Calculated for June, July and August. See Table 10b												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1609.8451	1267.3248	1300.2457	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7830	0.8517	0.8226	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1260.4908	1079.3707	1069.5672	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1636.8149	1571.0983	1473.5449	0.0000	0.0000	0.0000	0.0000 (103)

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Month fraction	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	270.9534	365.8453	300.5594	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												937.3581 (104)
Cooled fraction									fC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	67.7383	91.4613	75.1399	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												234.3395 (107)
Space cooling per m2												1.6586 (108)
Energy for space heating												46.4954 (99)
Energy for space cooling												1.6586 (108)
Total												48.1540 (109)
Dwelling Fabric Energy Efficiency (DFEE)												48.2 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	72.9600 (1b)	x 2.3000 (2b)	= 167.8080 (1b) - (3b)
First floor	68.3300 (1c)	x 2.5600 (2c)	= 174.9248 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	141.2900		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 342.7328 (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					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1167 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3667 (18)
Number of sides sheltered					4 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.7000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.2567 (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	0.3273	0.3209	0.3145	0.2824	0.2759	0.2439	0.2439	0.2374	0.2567	0.2759	0.2888	0.3016 (22b)
Effective ac	0.5536	0.5515	0.5494	0.5399	0.5381	0.5297	0.5297	0.5282	0.5329	0.5381	0.5417	0.5455 (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
TER Semi-glazed door			4.3800	1.2000	5.2560		(26a)
TER Opening Type (Uw = 1.40)			26.4800	1.3258	35.1061		(27)
150mm TE Platinum GF			72.9600	0.1300	9.4848		(28a)
50mm Alreflex Plat	171.1600	30.8600	140.3000	0.1800	25.2540		(29a)
1st Flr Horiz Cl	68.3300		68.3300	0.1300	8.8829		(30)
Grd Floor Bays	3.5300		3.5300	0.1300	0.4589		(31)
Total net area of external elements Aum, m ²			315.9800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		84.4427		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.3477 (36)
Total fabric heat loss						(33) + (36) =	99.7904 (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	62.6085	62.3733	62.1427	61.0597	60.8571	59.9139	59.9139	59.7392	60.2772	60.8571	61.2670	61.6955 (38)
Heat transfer coeff	162.3989	162.1636	161.9331	160.8501	160.6475	159.7043	159.7043	159.5296	160.0676	160.6475	161.0574	161.4859 (39)
Average = Sum(39)m / 12 =												160.8491 (39)
HLP	1.1494	1.1477	1.1461	1.1384	1.1370	1.1303	1.1303	1.1291	1.1329	1.1370	1.1399	1.1429 (40)
HLP (average)												1.1384 (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												2.9195 (42)
Average daily hot water use (litres/day)												103.5381 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	113.8919	109.7504	105.6089	101.4674	97.3258	93.1843	93.1843	97.3258	101.4674	105.6089	109.7504	113.8919 (44)
Energy content (annual)	168.8985	147.7197	152.4335	132.8952	127.5161	110.0367	101.9652	117.0065	118.4040	137.9884	150.6251	163.5691 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1629.0579 (45)
Water 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 (46)
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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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)
Primary 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 (59)
Heat gains from water heating, kWh/month	35.8909	31.3904	32.3921	28.2402	27.0972	23.3828	21.6676	24.8639	25.1608	29.3225	32.0078	34.7584 (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	145.9750	145.9750	145.9750	145.9750	145.9750	145.9750	145.9750	145.9750	145.9750	145.9750	145.9750	145.9750	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	28.1348	24.9891	20.3225	15.3854	11.5008	9.7095	10.4914	13.6371	18.3037	23.2408	27.1254	28.9168	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	310.8740	314.0999	305.9707	288.6647	266.8190	246.2871	232.5705	229.3446	237.4737	254.7798	276.6255	297.1574	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5975	37.5975	37.5975	37.5975	37.5975	37.5975	37.5975	37.5975	37.5975	37.5975	37.5975	37.5975	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-116.7800	-116.7800	-116.7800	-116.7800	-116.7800	-116.7800	-116.7800	-116.7800	-116.7800	-116.7800	-116.7800	-116.7800	(71)
Water heating gains (Table 5)	48.2405	46.7119	43.5378	39.2225	36.4209	32.4761	29.1231	33.4192	34.9456	39.4120	44.4553	46.7183	(72)
Total internal gains	454.0418	452.5935	436.6235	410.0652	381.5332	355.2651	338.9775	343.1934	357.5156	384.2251	414.9988	439.5850	(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	
North					6.8500	10.6334		0.6300	0.7000	0.7700		22.2605 (74)	
Northeast					0.7200	11.2829		0.6300	0.7000	0.7700		2.4827 (75)	
East					2.5500	19.6403		0.6300	0.7000	0.7700		15.3059 (76)	
South					12.4300	46.7521		0.6300	0.7000	0.7700		177.6003 (78)	
West					3.2100	19.6403		0.6300	0.7000	0.7700		19.2674 (80)	
Northwest					0.7200	11.2829		0.6300	0.7000	0.7700		2.4827 (81)	
Solar gains	239.3996	411.1446	572.3877	727.2169	832.0627	834.0425	800.7566	721.1220	625.6835	456.9670	287.3348	204.5069	(83)
Total gains	693.4414	863.7380	1009.0112	1137.2821	1213.5959	1189.3077	1139.7341	1064.3154	983.1991	841.1920	702.3336	644.0920	(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	60.4179	60.5056	60.5917	60.9997	61.0766	61.4373	61.4373	61.5046	61.2979	61.0766	60.9212	60.7595	
alpha	5.0279	5.0337	5.0394	5.0666	5.0718	5.0958	5.0958	5.1003	5.0865	5.0718	5.0614	5.0506	
util living area	0.9992	0.9974	0.9919	0.9716	0.9088	0.7668	0.5953	0.6536	0.8802	0.9845	0.9981	0.9995	(86)
MIT	19.6577	19.8367	20.1039	20.4396	20.7394	20.9265	20.9839	20.9745	20.8406	20.4386	19.9760	19.6228	(87)
Th 2	19.9607	19.9620	19.9634	19.9696	19.9707	19.9761	19.9761	19.9771	19.9741	19.9707	19.9684	19.9659	(88)
util rest of house	0.9989	0.9965	0.9888	0.9601	0.8707	0.6777	0.4675	0.5256	0.8165	0.9763	0.9972	0.9993	(89)
MIT 2	18.7305	18.9102	19.1768	19.5109	19.7895	19.9411	19.9719	19.9696	19.8824	19.5149	19.0546	18.6998	(90)
Living area fraction									fLA = Living area / (4) =			0.1466	(91)
MIT	18.8664	19.0460	19.3127	19.6470	19.9287	20.0855	20.1202	20.1169	20.0228	19.6503	19.1897	18.8351	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8664	19.0460	19.3127	19.6470	19.9287	20.0855	20.1202	20.1169	20.0228	19.6503	19.1897	18.8351	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	692.4154	859.7837	995.1291	1086.6558	1054.4265	818.5390	554.3175	579.2814	806.3464	818.2670	699.7532	643.4321	(94)
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	2365.5648	2293.9687	2074.8029	1728.6539	1321.9258	876.0584	562.1983	592.9592	948.0551	1453.9037	1947.1305	2363.3605	(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	1244.8231	963.7723	803.2773	462.2386	199.0195	0.0000	0.0000	0.0000	0.0000	472.9137	898.1117	1279.6267	(98)
Space heating												6323.7830	(98)
Space heating per m2												44.7575	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1501.2201	1181.8116	1212.4249	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8392	0.9089	0.8817	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1259.8378	1074.1454	1069.0538	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1513.0238	1452.2476	1366.5138	0.0000	0.0000	0.0000	0.0000	(103)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Month fraction	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	182.2939	281.3080	221.3102	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												684.9122 (104)
Cooled fraction									fC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	45.5735	70.3270	55.3276	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												171.2280 (107)
Space cooling per m2												1.2119 (108)
Energy for space heating												44.7575 (99)
Energy for space cooling												1.2119 (108)
Total												45.9694 (109)
Target Fabric Energy Efficiency (TFEE)												52.9 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	H500--X7 Detached			Issued on Date	17/12/2021
Assessment Reference	1	Prop Type Ref			
Property	H500--X7 , Detached, David Wilson Homes				
SAP Rating	86 B	DER	14.82	TER	14.93
Environmental	85 B	% DER<TER	0.76		
CO ₂ Emissions (t/year)	2.31	DFEE	49.28	TFEE	54.80
General Requirements Compliance	Pass	% DFEE<TFEE	10.07		
Assessor Details	Mr. Andrew Maughan, Andrew Maughan, Tel: 01582 544250, Andrew.Maughan@ee-ltd.co.uk			Assessor ID	V844-0001
Client					

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS DESIGNED

Detached House, total floor area 173 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating:Mains gas

Fuel factor:1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER) 14.93 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 14.82 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)54.8 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)49.3 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.30 (max. 0.70)	OK
Floor	0.16 (max. 0.25)	0.16 (max. 0.70)	OK
Roof	0.14 (max. 0.20)	0.17 (max. 0.35)	OK
Openings	1.46 (max. 2.00)	1.90 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals:	5.01 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas

Data from database

Ideal LOGIC HEAT H24

Efficiency: 89.8% SEDBUK2009

Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation

Hot water storage Measured cylinder loss: 1.48 kWh/day

Permitted by DBSCG 2.30 OK

Primary pipework insulated: Yes OK

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls: Cylinderstat OK

Independent timer for DHW OK

Boiler interlock Yes OK

7 Low energy lights

Percentage of fixed lights with low-energy fittings:100%

Minimum 75% OK

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Midlands): Medium OK

Based on:

Overshading: Average

Windows facing North: 1.78 m², No overhang

Windows facing North East: 9.04 m², No overhang

Windows facing East: 1.78 m², No overhang

Windows facing South East: 0.66 m², No overhang

Windows facing South West: 11.71 m², No overhang

Air change rate: 2.50 ach

Blinds/curtains: None

10 Key features

External wall U-value 0.12 W/m²K

Roof U-value 0.12 W/m²K

Roof U-value 0.11 W/m²K

Door U-value 1.10 W/m²K

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	69.9500 (1b)	x 2.3900 (2b)	= 167.1805 (1b) - (3b)
First floor	58.8700 (1c)	x 2.5600 (2c)	= 150.7072 (1c) - (3c)
Second floor	43.7700 (1d)	x 2.2500 (2d)	= 98.4825 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	172.5900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 416.3702 (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					6 * 10 = 60.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				Air changes per hour 60.0000 / (5) = 0.1441 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.3946 (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) =				0.3354 (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	0.4277	0.4193	0.4109	0.3690	0.3606	0.3186	0.3186	0.3103	0.3354	0.3606	0.3773	0.3941 (22b)
Effective ac	0.5914	0.5879	0.5844	0.5681	0.5650	0.5508	0.5508	0.5481	0.5563	0.5650	0.5712	0.5777 (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
Opening Type 1			2.3500	1.1000	2.5850		(26a)
Opening Type 2			1.9700	1.5000	2.9550		(26a)
Opening Type 3 (Uw = 1.41)			8.1900	1.3347	10.9314		(27)
Opening Type 5 (Uw = 1.41)			16.7800	1.3347	22.3966		(27)
Opening Type 12 (Uw = 1.90)			1.8400	1.7658	3.2491		(27a)
Opening Type 23 (Uw = 1.80)			3.1000	1.6791	5.2052		(27a)
150mm TE Platinum GF			69.9500	0.1600	11.1920		(28a)
50mm Alreflex Plat	185.5100	27.0900	158.4200	0.2700	42.7734		(29a)
Dormer Wall	5.6800	2.2000	3.4800	0.3000	1.0440		(29a)
Wall to Roofspace	24.3200		24.3200	0.1200	2.9184		(29a)
Ceiling to Roofspace	15.1100		15.1100	0.1200	1.8132		(30)
Dormer Flat Roof	2.6500		2.6500	0.1700	0.4505		(30)
GF Flat Roof	1.1100		1.1100	0.1700	0.1887		(30)
GF Sloping Ceiling	11.0000	1.8400	9.1600	0.1600	1.4656		(30)
Horizontal Ceiling	22.6400		22.6400	0.1100	2.4904		(30)
Roof Sloping Ceiling	28.7400	3.1000	25.6400	0.1600	4.1024		(30)
Total net area of external elements Aum(A, m ²)			366.7100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	115.7609		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							143.3410 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							18.8215 (36)
Total fabric heat loss						(33) + (36) =	134.5823 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 81.2655	Feb 80.7776	Mar 80.2994	Apr 78.0531	May 77.6329	Jun 75.6765	Jul 75.6765	Aug 75.3142	Sep 76.4300	Oct 77.6329	Nov 78.4831	Dec 79.3719 (38)
Heat transfer coeff	215.8478	215.3599	214.8817	212.6355	212.2152	210.2588	210.2588	209.8965	211.0124	212.2152	213.0654	213.9542 (39)
Average = Sum(39)m / 12 =												212.6335 (39)

HLP	Jan 1.2506	Feb 1.2478	Mar 1.2450	Apr 1.2320	May 1.2296	Jun 1.2183	Jul 1.2183	Aug 1.2162	Sep 1.2226	Oct 1.2296	Nov 1.2345	Dec 1.2397 (40)
HLP (average)												1.2320 (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	2.9660 (42)
Average daily hot water use (litres/day)	104.6432 (43)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	115.1075	110.9218	106.7360	102.5503	98.3646	94.1789	94.1789	98.3646	102.5503	106.7360	110.9218	115.1075	(44)
Energy conte	170.7011	149.2963	154.0604	134.3136	128.8771	111.2111	103.0534	118.2553	119.6677	139.4611	152.2327	165.3149	(45)
Energy content (annual)	Total = Sum (45)m =												1646.4447 (45)
Distribution loss (46)m = 0.15 x (45)m	25.6052	22.3944	23.1091	20.1470	19.3316	16.6817	15.4580	17.7383	17.9502	20.9192	22.8349	24.7972	(46)
Water storage loss:													
Store volume													210.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.4800 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													0.7992 (55)
Total storage loss	24.7752	22.3776	24.7752	23.9760	24.7752	23.9760	24.7752	24.7752	23.9760	24.7752	23.9760	24.7752	(56)
If cylinder contains dedicated solar storage	24.7752	22.3776	24.7752	23.9760	24.7752	23.9760	24.7752	24.7752	23.9760	24.7752	23.9760	24.7752	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month	218.7387	192.6851	202.0980	180.8016	176.9147	157.6991	151.0910	166.2929	166.1557	187.4987	198.7207	213.3525	(62)
WWHRS	-20.9037	-18.3934	-18.7724	-15.4396	-14.3331	-11.8220	-10.0015	-12.1108	-12.4658	-15.4143	-17.8610	-20.2056	eq. (G10)
Total of WWHRS savings	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	-187.7233
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	197.8350	174.2917	183.3256	165.3619	162.5816	145.8771	141.0895	154.1821	153.6898	172.0844	180.8597	193.1469	(64)
Heat gains from water heating, kWh/month	95.1882	84.3520	89.6552	81.8497	81.2817	74.1681	72.6953	77.7500	76.9799	84.8009	87.8078	93.3973	(65)
Total per year (kWh/year) = Sum (64)m =													2024.3254 (64)

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	148.3014	148.3014	148.3014	148.3014	148.3014	148.3014	148.3014	148.3014	148.3014	148.3014	148.3014	148.3014	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	31.3628	27.8562	22.6542	17.1507	12.8203	10.8235	11.6951	15.2018	20.4038	25.9073	30.2376	32.2345	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	344.1820	347.7535	338.7533	319.5931	295.4067	272.6750	257.4887	253.9172	262.9174	282.0776	306.2640	328.9957	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.8301	37.8301	37.8301	37.8301	37.8301	37.8301	37.8301	37.8301	37.8301	37.8301	37.8301	37.8301	(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)	-118.6411	-118.6411	-118.6411	-118.6411	-118.6411	-118.6411	-118.6411	-118.6411	-118.6411	-118.6411	-118.6411	-118.6411	(71)
Water heating gains (Table 5)	127.9411	125.5239	120.5042	113.6801	109.2496	103.0112	97.7088	104.5027	106.9165	113.9797	121.9553	125.5340	(72)
Total internal gains	573.9763	571.6240	552.4022	520.9143	487.9671	457.0001	437.3831	444.1121	460.7281	492.4550	528.9473	557.2546	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
Southwest	8.1900	36.7938	0.7100	0.7000	0.7700	103.7883 (79)
North	1.7800	10.6334	0.7200	0.7000	0.7700	6.6108 (74)
Northeast	9.0400	11.2829	0.7200	0.7000	0.7700	35.6250 (75)
East	1.7800	19.6403	0.7200	0.7000	0.7700	12.2104 (76)
Southeast	0.6600	36.7938	0.7200	0.7000	0.7700	8.4817 (77)
Southwest	3.5200	36.7938	0.7200	0.7000	0.7700	45.2357 (79)
Southwest	1.8400	35.6211	0.7100	0.7000	1.0000	29.3173 (82)
Southwest	3.1000	40.5020	0.7100	0.7000	1.0000	56.1612 (82)

Solar gains	297.4305	535.9019	803.5863	1101.5005	1321.6106	1348.3546	1285.0230	1116.8063	906.9382	611.9664	361.7625	250.8766	(83)
Total gains	871.4068	1107.5258	1355.9885	1622.4148	1809.5777	1805.3547	1722.4061	1560.9184	1367.6662	1104.4214	890.7097	808.1312	(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	31.8373	31.9094	31.9804	32.3183	32.3823	32.6836	32.6836	32.7400	32.5668	32.3823	32.2530	32.1190	
alpha	3.1225	3.1273	3.1320	3.1546	3.1588	3.1789	3.1789	3.1827	3.1711	3.1588	3.1502	3.1413	
util living area	0.9910	0.9806	0.9569	0.8989	0.7914	0.6399	0.4999	0.5595	0.7835	0.9406	0.9840	0.9929	(86)
MIT	18.8099	19.0960	19.5451	20.1050	20.5649	20.8466	20.9483	20.9256	20.6905	20.0613	19.3268	18.7626	(87)
Th 2	18.8797	19.8819	19.8841	19.8945	19.8964	19.9054	19.9054	19.9071	19.9019	19.8964	19.8925	19.8884	(88)
util rest of house	0.9890	0.9765	0.9475	0.8762	0.7443	0.5589	0.3897	0.4478	0.7166	0.9226	0.9799	0.9913	(89)
MIT 2	16.9530	17.3699	18.0192	18.8169	19.4345	19.7797	19.8775	19.8632	19.6140	18.7739	17.7149	16.8891	(90)
Living area fraction	17.2173	17.6156	18.2365	19.0002	19.5954	19.9316	20.0299	20.0144	fLA = Living area / (4) =	18.9571	17.9444	0.1424	(91)
MIT	17.2173	17.6156	18.2365	19.0002	19.5954	19.9316	20.0299	20.0144	19.7673	18.9571	17.9444	17.1558	(92)
Temperature adjustment	17.0673	17.4656	18.0865	18.8502	19.4454	19.7816	19.8799	19.8644	19.6173	18.8071	17.7944	-0.1500	
adjusted MIT	17.0673	17.4656	18.0865	18.8502	19.4454	19.7816	19.8799	19.8644	19.6173	18.8071	17.7944	17.0058	(93)

8. Space heating requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9811	0.9629	0.9261	0.8490	0.7219	0.5488	0.3870	0.4430	0.6959	0.8979	0.9678	0.9847	(94)
Useful gains	854.9021	1066.4693	1255.7874	1377.3713	1306.2679	990.7759	666.5941	691.5602	951.7879	991.6112	861.9853	795.7481	(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	2755.7952	2706.1371	2489.7193	2115.7732	1643.6943	1089.4740	689.6291	727.1756	1164.2133	1741.6786	2278.6000	2739.8534	(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	1414.2645	1101.8568	918.0453	531.6494	251.0452	0.0000	0.0000	0.0000	0.0000	558.0501	1019.9626	1446.4143	(98)
Space heating												7241.2882	(98)
Space heating per m2											(98) / (4) =	41.9566	(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)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													90.8000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													7974.9870	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	1414.2645	1101.8568	918.0453	531.6494	251.0452	0.0000	0.0000	0.0000	0.0000	558.0501	1019.9626	1446.4143	(98)	
Space heating efficiency (main heating system 1)	90.8000	90.8000	90.8000	90.8000	90.8000	0.0000	0.0000	0.0000	0.0000	90.8000	90.8000	90.8000	(210)	
Space heating fuel (main heating system)	1557.5600	1213.4987	1011.0631	585.5170	276.4815	0.0000	0.0000	0.0000	0.0000	614.5926	1123.3068	1592.9673	(211)	
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	
Water heating														
Water heating requirement	197.8350	174.2917	183.3256	165.3619	162.5816	145.8771	141.0895	154.1821	153.6898	172.0844	180.8597	193.1469	(64)	
Efficiency of water heater	89.3355	89.1731	88.8250	88.0108	86.2702	80.1000	80.1000	80.1000	80.1000	88.0285	89.0092	89.3933	(216)	
Fuel for water heating, kWh/month	221.4517	195.4532	206.3897	187.8883	188.4562	182.1188	176.1417	192.4870	191.8725	195.4871	203.1922	216.0643	(219)	
Water heating fuel used												2357.0027	(219)	
Annual totals kWh/year														
Space heating fuel - main system												7974.9870	(211)	
Space heating fuel - secondary												0.0000	(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)													553.8772	(232)
Total delivered energy for all uses													10960.8669	(238)

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	7974.9870	0.2160	1722.5972	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2357.0027	0.2160	509.1126	(264)
Space and water heating			2231.7098	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	553.8772	0.5190	287.4623	(268)
Total CO2, kg/year			2558.0970	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.8200	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		14.8200	ZC1
Total Floor Area		172.5900	
Assumed number of occupants	TFA	2.9660	
CO2 emission factor in Table 12 for electricity displaced from grid	N	0.5190	
CO2 emissions from appliances, equation (L14)	EF	11.8173	ZC2
CO2 emissions from cooking, equation (L16)		1.1019	ZC3
Total CO2 emissions		27.7393	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		27.7393	ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	69.9500 (1b)	x 2.3900 (2b)	= 167.1805 (1b) - (3b)
First floor	58.8700 (1c)	x 2.5600 (2c)	= 150.7072 (1c) - (3c)
Second floor	43.7700 (1d)	x 2.2500 (2d)	= 98.4825 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	172.5900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 416.3702 (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							4 * 10 =	40.0000 (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) =						40.0000 / (5) =	0.0961 (8)				
Pressure test							Yes					
Measured/design AP50							5.0000					
Infiltration rate							0.3461 (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) =	0.2942 (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	0.3751	0.3677	0.3603	0.3236	0.3162	0.2795	0.2795	0.2721	0.2942	0.3162	0.3309	0.3456 (22b)
Effective ac	0.5703	0.5676	0.5649	0.5524	0.5500	0.5390	0.5390	0.5370	0.5433	0.5500	0.5548	0.5597 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
TER Semi-glazed door			4.3200	1.2000	5.1840			(26a)					
TER Opening Type (Uw = 1.40)			24.9700	1.3258	33.1042			(27)					
TER Room Window (Uw = 1.70)			4.9400	1.5918	7.8633			(27a)					
150mm TE Platinum GF			69.9500	0.1300	9.0935			(28a)					
50mm Alreflex Plat	185.5100	27.0900	158.4200	0.1800	28.5156			(29a)					
Dormer Wall	5.6800	2.2000	3.4800	0.1800	0.6264			(29a)					
Wall to Roofspace	24.3200		24.3200	0.1800	4.3776			(29a)					
Ceiling to Roofspace	15.1100		15.1100	0.1300	1.9643			(30)					
Dormer Flat Roof	2.6500		2.6500	0.1300	0.3445			(30)					
GF Flat Roof	1.1100		1.1100	0.1300	0.1443			(30)					
GF Sloping Ceiling	11.0000	1.8400	9.1600	0.1300	1.1908			(30)					
Horizontal Ceiling	22.6400		22.6400	0.1300	2.9432			(30)					
Roof Sloping Ceiling	28.7400	3.1000	25.6400	0.1300	3.3332			(30)					
Total net area of external elements Aum(A, m2)			366.7100					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26) ... (30) + (32) =	98.6849			(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								22.0240 (36)					
Total fabric heat loss						(33) + (36) =		120.7089 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 78.3648	Feb 77.9896	Mar 77.6218	Apr 75.8941	May 75.5709	Jun 74.0661	Jul 74.0661	Aug 73.7875	Sep 74.6457	Oct 75.5709	Nov 76.2248	Dec 76.9084	(38)
Heat transfer coeff	199.0737	198.6984	198.3306	196.6030	196.2797	194.7750	194.7750	194.4963	195.3546	196.2797	196.9336	197.6173	(39)
Average = Sum(39)m / 12 =												196.6014	(39)
HLP	Jan 1.1534	Feb 1.1513	Mar 1.1491	Apr 1.1391	May 1.1373	Jun 1.1285	Jul 1.1285	Aug 1.1269	Sep 1.1319	Oct 1.1373	Nov 1.1410	Dec 1.1450	(40)
HLP (average)												1.1391	(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												2.9660 (42)
Average daily hot water use (litres/day)												104.6432 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Energy conte	115.1075	110.9218	106.7360	102.5503	98.3646	94.1789	94.1789	98.3646	102.5503	106.7360	110.9218	115.1075 (44)
Energy content (annual)	170.7011	149.2963	154.0604	134.3136	128.8771	111.2111	103.0534	118.2553	119.6677	139.4611	152.2327	165.3149 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1646.4447 (45)
	25.6052	22.3944	23.1091	20.1470	19.3316	16.6817	15.4580	17.7383	17.9502	20.9192	22.8349	24.7972 (46)
Water storage loss:												
Store volume												210.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.7016 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.9188 (55)
Total storage loss												
	28.4842	25.7277	28.4842	27.5653	28.4842	27.5653	28.4842	28.4842	27.5653	28.4842	27.5653	28.4842 (56)
If cylinder contains dedicated solar storage												
	28.4842	25.7277	28.4842	27.5653	28.4842	27.5653	28.4842	28.4842	27.5653	28.4842	27.5653	28.4842 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month												
Solar input	222.4477	196.0351	205.8070	184.3909	180.6237	161.2885	154.8000	170.0019	169.7450	191.2077	202.3101	217.0615 (62)
	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	222.4477	196.0351	205.8070	184.3909	180.6237	161.2885	154.8000	170.0019	169.7450	191.2077	202.3101	217.0615 (64)
Heat gains from water heating, kWh/month												
	98.1554	87.0321	92.6223	84.7211	84.2489	77.0396	75.6625	80.7172	79.8514	87.7681	90.6793	96.3645 (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	148.3014	148.3014	148.3014	148.3014	148.3014	148.3014	148.3014	148.3014	148.3014	148.3014	148.3014	148.3014 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	31.3628	27.8562	22.6542	17.1507	12.8203	10.8235	11.6951	15.2018	20.4038	25.9073	30.2376	32.2345 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	344.1820	347.7535	338.7533	319.5931	295.4067	272.6750	257.4887	253.9172	262.9174	282.0776	306.2640	328.9957 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	37.8301	37.8301	37.8301	37.8301	37.8301	37.8301	37.8301	37.8301	37.8301	37.8301	37.8301	37.8301 (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)												
	-118.6411	-118.6411	-118.6411	-118.6411	-118.6411	-118.6411	-118.6411	-118.6411	-118.6411	-118.6411	-118.6411	-118.6411 (71)
Water heating gains (Table 5)												
	131.9293	129.5120	124.4924	117.6682	113.2378	106.9994	101.6970	108.4908	110.9047	117.9679	125.9434	129.5221 (72)
Total internal gains												
	577.9645	575.6121	556.3903	524.9024	491.9553	460.9883	441.3713	448.1002	464.7163	496.4432	532.9354	561.2428 (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
North					1.7800	10.6334		0.6300	0.7000	0.7700		5.7845 (74)
Northeast					9.0400	11.2829		0.6300	0.7000	0.7700		31.1719 (75)
East					1.7800	19.6403		0.6300	0.7000	0.7700		10.6841 (76)
Southeast					0.6600	36.7938		0.6300	0.7000	0.7700		7.4215 (77)
Southwest					11.7100	36.7938		0.6300	0.7000	0.7700		131.6751 (79)
Southwest					4.9400	35.6211		0.6300	0.7000	1.0000		75.8471 (82)
Solar gains	262.5842	473.0472	709.1390	971.6998	1165.5621	1189.0123	1133.2206	985.0854	800.2334	540.1394	319.3670	221.4920 (83)
Total gains	840.5487	1048.6593	1265.5293	1496.6022	1657.5173	1650.0005	1574.5919	1433.1856	1264.9497	1036.5825	852.3024	782.7348 (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	60.2059	60.3196	60.4315	60.9625	61.0629	61.5347	61.5347	61.6228	61.3521	61.0629	60.8602	60.6496
alpha	5.0137	5.0213	5.0288	5.0642	5.0709	5.1023	5.1023	5.1082	5.0901	5.0709	5.0573	5.0433
util living area	0.9992	0.9975	0.9909	0.9622	0.8728	0.7016	0.5329	0.6019	0.8612	0.9839	0.9981	0.9995 (86)
MIT	19.6488	19.8287	20.1174	20.4881	20.7934	20.9514	20.9902	20.9825	20.8588	20.4429	19.9717	19.6179 (87)
Th 2	19.9574	19.9592	19.9609	19.9690	19.9705	19.9776	19.9776	19.9789	19.9749	19.9705	19.9675	19.9642 (88)
util rest of house	0.9990	0.9966	0.9875	0.9477	0.8265	0.6105	0.4150	0.4794	0.7926	0.9754	0.9973	0.9993 (89)
MIT 2	18.1436	18.4077	18.8290	19.3638	19.7680	19.9455	19.9740	19.9717	19.8589	19.3090	18.6231	18.1031 (90)
Living area fraction									fLA = Living area / (4) =			0.1424 (91)
MIT	18.3579	18.6100	19.0124	19.5238	19.9140	20.0887	20.1187	20.1156	20.0012	19.4704	18.8151	18.3187 (92)
Temperature adjustment												0.0000
adjusted MIT	18.3579	18.6100	19.0124	19.5238	19.9140	20.0887	20.1187	20.1156	20.0012	19.4704	18.8151	18.3187 (93)

8. Space heating requirement

Utilisation	0.9983	0.9949	0.9831	0.9396	0.8235	0.6211	0.4317	0.4966	0.7947	0.9695	0.9959	0.9988 (94)
Useful gains	839.1338	1043.3000	1244.1818	1406.1932	1364.9641	1024.8155	679.7611	711.6490	1005.2810	1004.9823	848.8012	781.8082 (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	2798.5491	2724.1550	2481.5995	2088.6800	1612.2436	1069.0563	685.3489	722.6614	1152.8332	1741.0766	2307.0935	2790.1029 (97)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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	1457.8050	1129.5346	920.6387	491.3905	183.9759	0.0000	0.0000	0.0000	0.0000	547.6542	1049.9705	1494.1713 (98)
Space heating												7275.1406 (98)
Space heating per m2										(98) / (4) =		42.1527 (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)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												93.5000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												7780.8990 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1457.8050	1129.5346	920.6387	491.3905	183.9759	0.0000	0.0000	0.0000	0.0000	547.6542	1049.9705	1494.1713 (98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000 (210)
Space heating fuel (main heating system)	1559.1498	1208.0584	984.6403	525.5513	196.7657	0.0000	0.0000	0.0000	0.0000	585.7264	1122.9631	1598.0441 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	222.4477	196.0351	205.8070	184.3909	180.6237	161.2885	154.8000	170.0019	169.7450	191.2077	202.3101	217.0615 (64)
Efficiency of water heater (217)m	88.9215	88.7403	88.3359	87.3058	84.8629	79.8000	79.8000	79.8000	79.8000	87.4650	88.5812	79.8000 (216)
Fuel for water heating, kWh/month	250.1618	220.9087	232.9821	211.2011	212.8418	202.1159	193.9850	213.0350	212.7131	218.6105	228.3895	243.9263 (219)
Water heating fuel used												2640.8708 (219)
Annual totals kWh/year												
Space heating fuel - main system												7780.8990 (211)
Space heating fuel - secondary												0.0000 (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)												553.8772 (232)
Total delivered energy for all uses												11050.6470 (238)

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	7780.8990	0.2160	1680.6742 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2640.8708	0.2160	570.4281 (264)
Space and water heating			2251.1023 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	553.8772	0.5190	287.4623 (268)
Total CO2, kg/m2/year			2577.4895 (272)
Emissions per m2 for space and water heating			13.0431 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			1.6656 (272b)
Emissions per m2 for pumps and fans			0.2255 (272c)
Target Carbon Dioxide Emission Rate (TER) = (13.0431 * 1.00) + 1.6656 + 0.2255, rounded to 2 d.p.			14.9300 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	69.9500 (1b)	x 2.3900 (2b)	= 167.1805 (1b) - (3b)
First floor	58.8700 (1c)	x 2.5600 (2c)	= 150.7072 (1c) - (3c)
Second floor	43.7700 (1d)	x 2.2500 (2d)	= 98.4825 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	172.5900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 416.3702 (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					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) = 0.0961 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.3466 (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) =				0.2946 (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	0.3756	0.3682	0.3609	0.3240	0.3167	0.2799	0.2799	0.2725	0.2946	0.3167	0.3314	0.3461 (22b)
Effective ac	0.5705	0.5678	0.5651	0.5525	0.5501	0.5392	0.5392	0.5371	0.5434	0.5501	0.5549	0.5599 (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
Opening Type 1			2.3500	1.1000	2.5850		(26a)
Opening Type 2			1.9700	1.5000	2.9550		(26a)
Opening Type 3 (Uw = 1.41)			8.1900	1.3347	10.9314		(27)
Opening Type 5 (Uw = 1.41)			16.7800	1.3347	22.3966		(27)
Opening Type 12 (Uw = 1.90)			1.8400	1.7658	3.2491		(27a)
Opening Type 23 (Uw = 1.80)			3.1000	1.6791	5.2052		(27a)
150mm TE Platinum GF			69.9500	0.1600	11.1920		(28a)
50mm Alreflex Plat	185.5100	27.0900	158.4200	0.2700	42.7734		(29a)
Dormer Wall	5.6800	2.2000	3.4800	0.3000	1.0440		(29a)
Wall to Roofspace	24.3200		24.3200	0.1200	2.9184		(29a)
Ceiling to Roofspace	15.1100		15.1100	0.1200	1.8132		(30)
Dormer Flat Roof	2.6500		2.6500	0.1700	0.4505		(30)
GF Flat Roof	1.1100		1.1100	0.1700	0.1887		(30)
GF Sloping Ceiling	11.0000	1.8400	9.1600	0.1600	1.4656		(30)
Horizontal Ceiling	22.6400		22.6400	0.1100	2.4904		(30)
Roof Sloping Ceiling	28.7400	3.1000	25.6400	0.1600	4.1024		(30)
Total net area of external elements Aum(A, m ²)			366.7100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	115.7609		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							143.3410 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							18.8215 (36)
Total fabric heat loss						(33) + (36) =	134.5823 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	78.3928	78.0164	77.6475	75.9149	75.5907	74.0816	74.0816	73.8022	74.6629	75.5907	76.2465	76.9321 (38)
Heat transfer coeff	212.9751	212.5988	212.2299	210.4972	210.1731	208.6640	208.6640	208.3845	209.2453	210.1731	210.8289	211.5145 (39)
Average = Sum(39)m / 12 =												210.4957 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2340	1.2318	1.2297	1.2196	1.2178	1.2090	1.2090	1.2074	1.2124	1.2178	1.2216	1.2255 (40)
Days in month												1.2196 (40)
	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9660 (42)
Average daily hot water use (litres/day)	104.6432 (43)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	115.1075	110.9218	106.7360	102.5503	98.3646	94.1789	94.1789	98.3646	102.5503	106.7360	110.9218	115.1075	(44)
Energy conte	170.7011	149.2963	154.0604	134.3136	128.8771	111.2111	103.0534	118.2553	119.6677	139.4611	152.2327	165.3149	(45)
Energy content (annual)	Total = Sum (45)m = 1646.4447 (45)												
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(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)
Primary 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	(59)
Heat gains from water heating, kWh/month	36.2740	31.7255	32.7378	28.5416	27.3864	23.6324	21.8989	25.1293	25.4294	29.6355	32.3495	35.1294	(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	148.3014	148.3014	148.3014	148.3014	148.3014	148.3014	148.3014	148.3014	148.3014	148.3014	148.3014	148.3014	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	31.3628	27.8562	22.6542	17.1507	12.8203	10.8235	11.6951	15.2018	20.4038	25.9073	30.2376	32.2345	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	344.1820	347.7535	338.7533	319.5931	295.4067	272.6750	257.4887	253.9172	262.9174	282.0776	306.2640	328.9957	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.8301	37.8301	37.8301	37.8301	37.8301	37.8301	37.8301	37.8301	37.8301	37.8301	37.8301	37.8301	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-118.6411	-118.6411	-118.6411	-118.6411	-118.6411	-118.6411	-118.6411	-118.6411	-118.6411	-118.6411	-118.6411	-118.6411	(71)
Water heating gains (Table 5)	48.7554	47.2105	44.0025	39.6412	36.8096	32.8227	29.4339	33.7759	35.3186	39.8327	44.9298	47.2170	(72)
Total internal gains	491.7906	490.3106	472.9004	443.8753	412.5271	383.8116	366.1082	370.3853	386.1301	415.3080	448.9218	475.9376	(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
Southwest				8.1900	36.7938		0.7100		0.7000		0.7700		103.7883 (79)
North				1.7800	10.6334		0.7200		0.7000		0.7700		6.6108 (74)
Northeast				9.0400	11.2829		0.7200		0.7000		0.7700		35.6250 (75)
East				1.7800	19.6403		0.7200		0.7000		0.7700		12.2104 (76)
Southeast				0.6600	36.7938		0.7200		0.7000		0.7700		8.4817 (77)
Southwest				3.5200	36.7938		0.7200		0.7000		0.7700		45.2357 (79)
Southwest				1.8400	35.6211		0.7100		0.7000		1.0000		29.3173 (82)
Southwest				3.1000	40.5020		0.7100		0.7000		1.0000		56.1612 (82)
Solar gains	297.4305	535.9019	803.5863	1101.5005	1321.6106	1348.3546	1285.0230	1116.8063	906.9382	611.9664	361.7625	250.8766	(83)
Total gains	789.2211	1026.2125	1276.4867	1545.3758	1734.1378	1732.1662	1651.1312	1487.1916	1293.0683	1027.2743	810.6843	726.8142	(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	32.2667	32.3238	32.3800	32.6465	32.6969	32.9334	32.9334	32.9775	32.8419	32.6969	32.5952	32.4895	
alpha	3.1511	3.1549	3.1587	3.1764	3.1798	3.1956	3.1956	3.1985	3.1895	3.1798	3.1730	3.1660	
util living area	0.9932	0.9842	0.9627	0.9082	0.8041	0.6552	0.5147	0.5778	0.8015	0.9498	0.9877	0.9948	(86)
MIT	18.7746	19.0624	19.5148	20.0787	20.5485	20.8380	20.9448	20.9197	20.6711	20.0246	19.2850	18.7232	(87)
Th 2	19.8929	19.8946	19.8963	19.9043	19.9058	19.9128	19.9128	19.9141	19.9101	19.9058	19.9028	19.8996	(88)
util rest of house	0.9917	0.9808	0.9545	0.8872	0.7587	0.5746	0.4032	0.4651	0.7373	0.9343	0.9845	0.9936	(89)
MIT 2	17.8558	18.1430	18.5909	19.1427	19.5761	19.8213	19.8922	19.8812	19.6983	19.1029	18.3720	17.8094	(90)
Living area fraction	fLA = Living area / (4) =												0.1424 (91)
MIT	17.9866	18.2739	18.7224	19.2759	19.7145	19.9660	20.0420	20.0291	19.8368	19.2341	18.5019	17.9395	(92)
Temperature adjustment													0.0000
adjusted MIT	17.9866	18.2739	18.7224	19.2759	19.7145	19.9660	20.0420	20.0291	19.8368	19.2341	18.5019	17.9395	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9881	0.9740	0.9429	0.8725	0.7496	0.5789	0.4173	0.4780	0.7323	0.9217	0.9787	0.9907	(94)
Useful gains	779.8029	999.4936	1203.6298	1348.2955	1299.8742	1002.7531	688.9520	710.8578	946.8826	946.8145	793.4241	720.0187	(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	2914.9156	2843.2731	2593.9553	2184.1010	1684.4419	1119.6892	718.2255	756.2445	1200.4040	1814.6588	2403.8552	2906.1036	(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	1588.5238	1239.0199	1034.4022	601.7800	286.1184	0.0000	0.0000	0.0000	0.0000	645.6762	1159.5104	1626.4472	(98)
Space heating													8181.4780 (98)
Space heating per m2	(98) / (4) = 47.4041 (99)												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	1961.4414	1544.1134	1583.7223	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7849	0.8484	0.8105	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1539.5773	1310.0807	1283.6625	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2088.1465	1993.3849	1812.9675	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	394.9698	508.3783	393.8029	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling													
Cooled fraction													1297.1510 (104)
Intermittency factor (Table 10b)													fC = cooled area / (4) = 1.0000 (105)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	98.7425	127.0946	98.4507	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling													324.2878 (107)
Space cooling per m2													1.8789 (108)
Energy for space heating													47.4041 (99)
Energy for space cooling													1.8789 (108)
Total													49.2831 (109)
Dwelling Fabric Energy Efficiency (DFEE)													49.3 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	69.9500 (1b)	x 2.3900 (2b)	= 167.1805 (1b) - (3b)
First floor	58.8700 (1c)	x 2.5600 (2c)	= 150.7072 (1c) - (3c)
Second floor	43.7700 (1d)	x 2.2500 (2d)	= 98.4825 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	172.5900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 416.3702 (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					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) = 0.0961 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3461 (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) =				0.2942 (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	0.3751	0.3677	0.3603	0.3236	0.3162	0.2795	0.2795	0.2721	0.2942	0.3162	0.3309	0.3456 (22b)
Effective ac	0.5703	0.5676	0.5649	0.5524	0.5500	0.5390	0.5390	0.5370	0.5433	0.5500	0.5548	0.5597 (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
TER Semi-glazed door			4.3200	1.2000	5.1840		(26a)
TER Opening Type (Uw = 1.40)			24.9700	1.3258	33.1042		(27)
TER Room Window (Uw = 1.70)			4.9400	1.5918	7.8633		(27a)
150mm TE Platinum GF			69.9500	0.1300	9.0935		(28a)
50mm Alreflex Plat	185.5100	27.0900	158.4200	0.1800	28.5156		(29a)
Dormer Wall	5.6800	2.2000	3.4800	0.1800	0.6264		(29a)
Wall to Roofspace	24.3200		24.3200	0.1800	4.3776		(29a)
Ceiling to Roofspace	15.1100		15.1100	0.1300	1.9643		(30)
Dormer Flat Roof	2.6500		2.6500	0.1300	0.3445		(30)
GF Flat Roof	1.1100		1.1100	0.1300	0.1443		(30)
GF Sloping Ceiling	11.0000	1.8400	9.1600	0.1300	1.1908		(30)
Horizontal Ceiling	22.6400		22.6400	0.1300	2.9432		(30)
Roof Sloping Ceiling	28.7400	3.1000	25.6400	0.1300	3.3332		(30)
Total net area of external elements Aum(A, m ²)			366.7100				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		98.6849		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							22.0240 (36)
Total fabric heat loss						(33) + (36) =	120.7089 (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	78.3648	77.9896	77.6218	75.8941	75.5709	74.0661	74.0661	73.7875	74.6457	75.5709	76.2248	76.9084 (38)
Heat transfer coeff	199.0737	198.6984	198.3306	196.6030	196.2797	194.7750	194.7750	194.4963	195.3546	196.2797	196.9336	197.6173 (39)
Average = Sum(39)m / 12 =												196.6014 (39)
HLP	1.1534	1.1513	1.1491	1.1391	1.1373	1.1285	1.1285	1.1269	1.1319	1.1373	1.1410	1.1450 (40)
HLP (average)												1.1391 (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												2.9660 (42)
Average daily hot water use (litres/day)												104.6432 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy conte	115.1075	110.9218	106.7360	102.5503	98.3646	94.1789	94.1789	98.3646	102.5503	106.7360	110.9218	115.1075 (44)
Energy content (annual)	170.7011	149.2963	154.0604	134.3136	128.8771	111.2111	103.0534	118.2553	119.6677	139.4611	152.2327	165.3149 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1646.4447 (45)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (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)
Primary 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 (59)
Heat gains from water heating, kWh/month	36.2740	31.7255	32.7378	28.5416	27.3864	23.6324	21.8989	25.1293	25.4294	29.6355	32.3495	35.1294 (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)
(66)m	148.3014	148.3014	148.3014	148.3014	148.3014	148.3014	148.3014	148.3014	148.3014	148.3014	148.3014	148.3014	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	31.3628	27.8562	22.6542	17.1507	12.8203	10.8235	11.6951	15.2018	20.4038	25.9073	30.2376	32.2345	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	344.1820	347.7535	338.7533	319.5931	295.4067	272.6750	257.4887	253.9172	262.9174	282.0776	306.2640	328.9957	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.8301	37.8301	37.8301	37.8301	37.8301	37.8301	37.8301	37.8301	37.8301	37.8301	37.8301	37.8301	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-118.6411	-118.6411	-118.6411	-118.6411	-118.6411	-118.6411	-118.6411	-118.6411	-118.6411	-118.6411	-118.6411	-118.6411	(71)
Water heating gains (Table 5)	48.7554	47.2105	44.0025	39.6412	36.8096	32.8227	29.4339	33.7759	35.3186	39.8327	44.9298	47.2170	(72)
Total internal gains	491.7906	490.3106	472.9004	443.8753	412.5271	383.8116	366.1082	370.3853	386.1301	415.3080	448.9218	475.9376	(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
North				1.7800	10.6334		0.6300		0.7000		0.7700		5.7845 (74)
Northeast				9.0400	11.2829		0.6300		0.7000		0.7700		31.1719 (75)
East				1.7800	19.6403		0.6300		0.7000		0.7700		10.6841 (76)
Southeast				0.6600	36.7938		0.6300		0.7000		0.7700		7.4215 (77)
Southwest				11.7100	36.7938		0.6300		0.7000		0.7700		131.6751 (79)
Southwest				4.9400	35.6211		0.6300		0.7000		1.0000		75.8471 (82)
Solar gains	262.5842	473.0472	709.1390	971.6998	1165.5621	1189.0123	1133.2206	985.0854	800.2334	540.1394	319.3670	221.4920	(83)
Total gains	754.3748	963.3578	1182.0394	1415.5751	1578.0892	1572.8239	1499.3289	1355.4707	1186.3636	955.4473	768.2888	697.4296	(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)													
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
alpha	60.2059	60.3196	60.4315	60.9625	61.0629	61.5347	61.5347	61.6228	61.3521	61.0629	60.8602	60.6496	
util living area	5.0137	5.0213	5.0288	5.0642	5.0709	5.1023	5.1023	5.1082	5.0901	5.0709	5.0573	5.0433	
0.9995	0.9983	0.9932	0.9695	0.8896	0.7263	0.5570	0.6309	0.8842	0.9886	0.9988	0.9997	0.9997	(86)
MIT	19.6021	19.7828	20.0738	20.4512	20.7701	20.9431	20.9880	20.9784	20.8368	20.4018	19.9263	19.5715	(87)
Th 2	19.9574	19.9592	19.9609	19.9690	19.9705	19.9776	19.9776	19.9789	19.9749	19.9705	19.9675	19.9642	(88)
util rest of house	0.9994	0.9977	0.9907	0.9573	0.8469	0.6354	0.4351	0.5051	0.8216	0.9823	0.9983	0.9996	(89)
MIT 2	18.6723	18.8542	19.1452	19.5213	19.8140	19.9514	19.9746	19.9726	19.8805	19.4793	19.0043	18.6472	(90)
Living area fraction									fLA =	Living area / (4) =		0.1424	(91)
MIT	18.8047	18.9864	19.2774	19.6537	19.9501	20.0926	20.1188	20.1158	20.0166	19.6106	19.1356	18.7788	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8047	18.9864	19.2774	19.6537	19.9501	20.0926	20.1188	20.1158	20.0166	19.6106	19.1356	18.7788	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9991	0.9969	0.9884	0.9525	0.8459	0.6465	0.4525	0.5229	0.8247	0.9793	0.9977	0.9994	(94)
Useful gains	753.7087	960.3698	1168.2776	1348.3243	1334.8465	1016.8878	678.4681	708.8349	978.4125	935.6253	766.5451	697.0163	(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	2887.5064	2798.9468	2534.1577	2114.2037	1619.3345	1069.8138	685.3817	722.7143	1155.8359	1768.5966	2370.2118	2881.0194	(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	1587.5455	1235.5237	1016.2148	551.4332	211.6590	0.0000	0.0000	0.0000	0.0000	619.7306	1154.6400	1624.8983	(98)
Space heating												8001.6452	(98)
Space heating per m2												46.3622	(99)
										(98) / (4) =			

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1830.8848	1441.3348	1478.1721	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8532	0.9171	0.8819	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1562.1863	1321.9173	1303.5516	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1909.7663	1823.4641	1665.5696	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	250.2576	373.1508	269.3414	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling													
Cooled fraction									fC = cooled area / (4) =			892.7498	(104)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	62.5644	93.2877	67.3353	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling													
Space cooling per m2												223.1874	(107)
Energy for space heating												1.2932	(108)
Energy for space cooling												46.3622	(99)
Total												1.2932	(108)
Target Fabric Energy Efficiency (TFEE)												47.6553	(109)
												54.8	(109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	H588---7 Detached			Issued on Date	17/12/2021
Assessment Reference	1	Prop Type Ref			
Property	H588---7 DS05, Detached, Part L2013 Masonry, David Wilson Homes				
SAP Rating	85 B	DER	15.32	TER	15.37
Environmental	85 B	% DER<TER	0.34		
CO ₂ Emissions (t/year)	2.51	DFEE	51.85	TFEE	57.99
General Requirements Compliance	Pass	% DFEE<TFEE	10.58		
Assessor Details	Mr. Andrew Maughan, Andrew Maughan, Tel: 01582 544250, Andrew.Maughan@ee-ltd.co.uk			Assessor ID	V844-0001
Client					

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS DESIGNED

Detached House, total floor area 182 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 15.37 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 15.32 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)58.0 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)51.9 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Floor	0.15 (max. 0.25)	0.15 (max. 0.70)	OK
Roof	0.11 (max. 0.20)	0.17 (max. 0.35)	OK
Openings	1.40 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals: 5.01 (design value)
Maximum 10.0 OK

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Ideal LOGIC HEAT H24

Efficiency: 89.8% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation

Hot water storage Measured cylinder loss: 1.64 kWh/day
Permitted by DBSCG 2.56 OK
Primary pipework insulated: Yes OK

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls: Cylinderstat OK
Independent timer for DHW OK

Boiler interlock Yes OK

7 Low energy lights

Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Midlands): Slight OK

Based on:

Overshading: Average
Windows facing North East: 6.57 m², No overhang
Windows facing East: 1.36 m², No overhang
Windows facing South East: 8.38 m², No overhang
Windows facing South: 2.04 m², No overhang
Windows facing South West: 6.31 m², No overhang
Windows facing West: 0.68 m², No overhang
Windows facing North West: 9.68 m², No overhang
Air change rate: 2.50 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features

Roof U-value 0.11 W/m²K
Door U-value 1.10 W/m²K
Thermal bridging y-value 0.039 W/m²K

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	92.9300 (1b)	x 2.3800 (2b)	= 221.1734 (1b) - (3b)
First floor	89.3300 (1c)	x 2.5600 (2c)	= 228.6848 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	182.2600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 449.8582 (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					6 * 10 = 60.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				60.0000 / (5) = 0.1334 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.3839 (18)
Number of sides sheltered					0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3839 (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	0.4894	0.4798	0.4702	0.4223	0.4127	0.3647	0.3647	0.3551	0.3839	0.4127	0.4319	0.4511 (22b)
Effective ac	0.6198	0.6151	0.6106	0.5892	0.5851	0.5665	0.5665	0.5630	0.5737	0.5851	0.5933	0.6017 (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
Opening Type 1			2.3500	1.1000	2.5850		(26a)
Opening Type 2 (Uw = 1.41)			35.0200	1.3347	46.7420		(27)
Opening Type 5			1.9700	1.5000	2.9550		(26a)
150mm TE Platinum GF			92.9300	0.1500	13.9395		(28a)
50mm A Platinum	220.1800	39.3400	180.8400	0.2700	48.8268		(29a)
400mm Mineral Wool	89.5900		89.5900	0.1100	9.8549		(30)
Flat Roof	3.6000		3.6000	0.1700	0.6120		(30)
Total net area of external elements Aum(A, m ²)			406.3000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		125.5152		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							156.7200 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.8746 (36)
Total fabric heat loss						(33) + (36) =	141.3897 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	92.0078	91.3173	90.6405	87.4616	86.8669	84.0982	84.0982	83.5855	85.1647	86.8669	88.0701	89.3280 (38)
Heat transfer coeff	233.3975	232.7070	232.0303	228.8514	228.2566	225.4879	225.4879	224.9752	226.5544	228.2566	229.4598	230.7177 (39)
Average = Sum(39)m / 12 =												228.8485 (39)
HLP	1.2806	1.2768	1.2731	1.2556	1.2524	1.2372	1.2372	1.2344	1.2430	1.2524	1.2590	1.2659 (40)
HLP (average)												1.2556 (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												2.9788 (42)
Average daily hot water use (litres/day)												104.9460 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	115.4406	111.2428	107.0449	102.8471	98.6492	94.4514	94.4514	98.6492	102.8471	107.0449	111.2428	115.4406 (44)
Energy conte	171.1951	149.7283	154.5062	134.7023	129.2500	111.5329	103.3517	118.5975	120.0140	139.8647	152.6733	165.7933 (45)
Energy content (annual)											Total = Sum(45)m =	1651.2093 (45)
Distribution loss	(46)m = 0.15 x (45)m											
	25.6793	22.4592	23.1759	20.2053	19.3875	16.7299	15.5027	17.7896	18.0021	20.9797	22.9010	24.8690 (46)
Water storage loss:												
Store volume												250.0000 (47)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

a) If manufacturer declared loss factor is known (kWh/day):												1.6400 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8856 (55)
Total storage loss	27.4536	24.7968	27.4536	26.5680	27.4536	26.5680	27.4536	27.4536	26.5680	27.4536	26.5680	27.4536 (56)
If cylinder contains dedicated solar storage	27.4536	24.7968	27.4536	26.5680	27.4536	26.5680	27.4536	27.4536	26.5680	27.4536	26.5680	27.4536 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	221.9111	195.5363	205.2222	183.7823	179.9660	160.6129	154.0677	169.3135	169.0940	190.5807	201.7533	216.5093 (62)
WWHRS	-20.9821	-18.4625	-18.8429	-15.4974	-14.3865	-11.8660	-10.0386	-12.1558	-12.5122	-15.4718	-17.9279	-20.2815 eq. (G10)
Total of WWHRS savings												-188.4252
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	200.9289	177.0738	186.3793	168.2849	165.5795	148.7469	144.0290	157.1577	156.5818	175.1089	183.8254	196.2278 (64)
Heat gains from water heating, kWh/month	97.4952	86.4311	91.9461	84.0525	83.5484	76.3487	74.9372	80.0065	79.1686	87.0778	90.0279	95.6991 (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	148.9390	148.9390	148.9390	148.9390	148.9390	148.9390	148.9390	148.9390	148.9390	148.9390	148.9390	148.9390 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	31.9175	28.3488	23.0548	17.4540	13.0471	11.0149	11.9020	15.4706	20.7646	26.3655	30.7724	32.8046 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	353.8564	357.5283	348.2752	328.5764	303.7102	280.3394	264.7264	261.0544	270.3076	290.0064	314.8726	338.2433 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.8939	37.8939	37.8939	37.8939	37.8939	37.8939	37.8939	37.8939	37.8939	37.8939	37.8939	37.8939 (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)	-119.1512	-119.1512	-119.1512	-119.1512	-119.1512	-119.1512	-119.1512	-119.1512	-119.1512	-119.1512	-119.1512	-119.1512 (71)
Water heating gains (Table 5)	131.0419	128.6177	123.5835	116.7396	112.2963	106.0399	100.7221	107.5356	109.9565	117.0401	125.0387	128.6278 (72)
Total internal gains	587.4974	585.1765	565.5952	533.4516	499.7352	468.0759	448.0321	454.7423	471.7103	504.0936	541.3654	570.3573 (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
Northeast						6.5700	11.2829	0.7100	0.7000			0.7700			25.5316 (75)
East						1.3600	19.6403	0.7100	0.7000			0.7700			9.1997 (76)
Southeast						8.3800	36.7938	0.7100	0.7000			0.7700			106.1961 (77)
South						2.0400	46.7521	0.7100	0.7000			0.7700			32.8489 (78)
Southwest						6.3100	36.7938	0.7100	0.7000			0.7700			79.9639 (79)
West						0.6800	19.6403	0.7100	0.7000			0.7700			4.5999 (80)
Northwest						9.6800	11.2829	0.7100	0.7000			0.7700			37.6173 (81)
Solar gains		295.9574	526.4337	778.4457	1060.2136	1273.5607	1301.8468	1239.5408	1074.8716	875.2772	597.6080	358.5780			250.6173 (83)
Total gains		883.4548	1111.6102	1344.0409	1593.6653	1773.2959	1769.9226	1687.5729	1529.6139	1346.9876	1101.7016	899.9434			820.9747 (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	33.9952	34.0960	34.1955	34.6705	34.7608	35.1876	35.1876	35.2678	35.0220	34.7608	34.5785	34.3900
alpha	3.2663	3.2731	3.2797	3.3114	3.3174	3.3458	3.3458	3.3512	3.3348	3.3174	3.3052	3.2927
util living area	0.9939	0.9867	0.9698	0.9249	0.8322	0.6861	0.5424	0.6043	0.8229	0.9564	0.9890	0.9952 (86)
MIT	18.8651	19.1248	19.5401	20.0786	20.5392	20.8364	20.9451	20.9209	20.6755	20.0600	19.3654	18.8293 (87)
Th 2	19.8561	19.8591	19.8620	19.8758	19.8783	19.8904	19.8904	19.8926	19.8857	19.8783	19.8731	19.8677 (88)
util rest of house	0.9925	0.9836	0.9624	0.9057	0.7877	0.6024	0.4234	0.4853	0.7587	0.9416	0.9859	0.9941 (89)
MIT 2	17.0043	17.3842	17.9874	18.7624	19.3883	19.7577	19.8617	19.8472	19.5838	18.7516	17.7454	16.9589 (90)
Living area fraction	17.2712	17.6339	18.2101	18.9512	19.5533	19.9124	20.0171	20.0012	19.7404	18.9392	17.9777	17.2271 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.1212	17.4839	18.0601	18.8012	19.4033	19.7624	19.8671	19.8512	19.5904	18.7892	17.8277	17.0771 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9868	0.9735	0.9454	0.8815	0.7651	0.5916	0.4207	0.4804	0.7378	0.9208	0.9769	0.9895 (94)
Useful gains	871.8140	1082.1853	1270.6908	1404.8361	1356.7720	1047.0608	710.0423	734.8440	993.7838	1014.4932	879.1492	812.3364 (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	2992.4325	2928.3572	2682.2948	2265.9051	1758.3367	1164.0699	736.6947	776.4249	1243.8746	1869.2443	2461.5815	2970.9829 (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	1577.7401	1240.6275	1050.2334	619.9697	298.7641	0.0000	0.0000	0.0000	0.0000	635.9348	1139.3512	1606.0330 (98)
Space heating												8168.6538 (98)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Space heating per m2 (98) / (4) = 44.8187 (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)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.8000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													8996.3148 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1577.7401	1240.6275	1050.2334	619.9697	298.7641	0.0000	0.0000	0.0000	0.0000	635.9348	1139.3512	1606.0330	(98)
Space heating efficiency (main heating system 1)	90.8000	90.8000	90.8000	90.8000	90.8000	0.0000	0.0000	0.0000	0.0000	90.8000	90.8000	90.8000	(210)
Space heating fuel (main heating system)	1737.5993	1366.3298	1156.6447	682.7860	329.0354	0.0000	0.0000	0.0000	0.0000	700.3687	1254.7921	1768.7588	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	200.9289	177.0738	186.3793	168.2849	165.5795	148.7469	144.0290	157.1577	156.5818	175.1089	183.8254	196.2278	(64)
Efficiency of water heater (217)m	89.4502	89.3099	89.0080	88.2823	86.6715	80.1000	80.1000	80.1000	80.1000	88.2546	89.1456	80.1000	(216)
Fuel for water heating, kWh/month	224.6267	198.2690	209.3962	190.6213	191.0426	185.7015	179.8115	196.2019	195.4829	198.4133	206.2081	219.2531	(219)
Water heating fuel used												2395.0281	(219)
Annual totals kWh/year													
Space heating fuel - main system												8996.3148	(211)
Space heating fuel - secondary												0.0000	(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)												563.6730	(232)
Total delivered energy for all uses												12030.0159	(238)

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	8996.3148	0.2160	1943.2040	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2395.0281	0.2160	517.3261	(264)
Space and water heating			2460.5301	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	563.6730	0.5190	292.5463	(268)
Total CO2, kg/year			2792.0014	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			15.3200	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		15.3200	ZC1
Total Floor Area	TFA	182.2600	
Assumed number of occupants	N	2.9788	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		11.5049	ZC2
CO2 emissions from cooking, equation (L16)		1.0452	ZC3
Total CO2 emissions		27.8700	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		27.8700	ZC8

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SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	92.9300 (1b)	x 2.3800 (2b)	= 221.1734 (1b) - (3b)
First floor	89.3300 (1c)	x 2.5600 (2c)	= 228.6848 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	182.2600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 449.8582 (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					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) = 0.0889 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3389 (18)
Number of sides sheltered					0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3389 (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	0.4321	0.4236	0.4152	0.3728	0.3643	0.3220	0.3220	0.3135	0.3389	0.3643	0.3813	0.3982 (22b)
Effective ac	0.5934	0.5897	0.5862	0.5695	0.5664	0.5518	0.5518	0.5491	0.5574	0.5664	0.5727	0.5793 (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
TER Semi-glazed door			4.3200	1.2000	5.1840		(26a)
TER Opening Type (Uw = 1.40)			35.0200	1.3258	46.4280		(27)
150mm TE Platinum GF			92.9300	0.1300	12.0809		(28a)
50mm A Platinum	220.1800	39.3400	180.8400	0.1800	32.5512		(29a)
400mm Mineral Wool	89.5900		89.5900	0.1300	11.6467		(30)
Flat Roof	3.6000		3.6000	0.1300	0.4680		(31)
Total net area of external elements Aum(A, m ²)			406.3000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		108.3588		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							19.1189 (36)
Total fabric heat loss						(33) + (36) =	127.4777 (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	88.0867	87.5485	87.0210	84.5431	84.0795	81.9213	81.9213	81.5217	82.7526	84.0795	85.0173	85.9978 (38)
Heat transfer coeff	215.5644	215.0262	214.4987	212.0208	211.5572	209.3991	209.3991	208.9994	210.2303	211.5572	212.4951	213.4756 (39)
Average = Sum(39)m / 12 =												212.0186 (39)
HLP	1.1827	1.1798	1.1769	1.1633	1.1607	1.1489	1.1489	1.1467	1.1535	1.1607	1.1659	1.1713 (40)
HLP (average)												1.1633 (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												2.9788 (42)
Average daily hot water use (litres/day)												104.9460 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	115.4406	111.2428	107.0449	102.8471	98.6492	94.4514	94.4514	98.6492	102.8471	107.0449	111.2428	115.4406 (44)
Energy content (annual)	171.1951	149.7283	154.5062	134.7023	129.2500	111.5329	103.3517	118.5975	120.0140	139.8647	152.6733	165.7933 (45)
Distribution loss (46)m = 0.15 x (45)m	25.6793	22.4592	23.1759	20.2053	19.3875	16.7299	15.5027	17.7896	18.0021	20.9797	22.9010	24.8690 (46)
Water storage loss:												250.0000 (47)
Store volume												1.8903 (48)
a) If manufacturer declared loss factor is known (kWh/day):												

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Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.0208 (55)
Total storage loss												
31.6444 28.5820 31.6444 30.6236 31.6444 30.6236 31.6444 31.6444 30.6236 31.6444 30.6236 31.6444 (56)												
If cylinder contains dedicated solar storage												
31.6444 28.5820 31.6444 30.6236 31.6444 30.6236 31.6444 31.6444 30.6236 31.6444 30.6236 31.6444 (57)												
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month												
226.1019 199.3215 209.4130 187.8379 184.1568 164.6685 158.2585 173.5043 173.1496 194.7715 205.8089 220.7001 (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												
226.1019 199.3215 209.4130 187.8379 184.1568 164.6685 158.2585 173.5043 173.1496 194.7715 205.8089 220.7001 (64)												
Total per year (kWh/year) = Sum(64)m =												2297.6924 (64)
Heat gains from water heating, kWh/month												
100.8478 89.4592 95.2987 87.2970 86.9011 79.5932 78.2899 83.3591 82.4131 90.4305 93.2723 99.0517 (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)												
(66)m 148.9390 148.9390 148.9390 148.9390 148.9390 148.9390 148.9390 148.9390 148.9390 148.9390 148.9390 148.9390 (66)												
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
31.9175 28.3488 23.0548 17.4540 13.0471 11.0149 11.9020 15.4706 20.7646 26.3655 30.7724 32.8046 (67)												
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
353.8564 357.5283 348.2752 328.5764 303.7102 280.3394 264.7264 261.0544 270.3076 290.0064 314.8726 338.2433 (68)												
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
37.8939 37.8939 37.8939 37.8939 37.8939 37.8939 37.8939 37.8939 37.8939 37.8939 37.8939 37.8939 (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)												
-119.1512 -119.1512 -119.1512 -119.1512 -119.1512 -119.1512 -119.1512 -119.1512 -119.1512 -119.1512 -119.1512 -119.1512 (71)												
Water heating gains (Table 5)												
135.5481 133.1239 128.0897 121.2458 116.8025 110.5461 105.2283 112.0418 114.4627 121.5463 129.5449 133.1340 (72)												
Total internal gains	592.0037	589.6827	570.1014	537.9578	504.2414	472.5821	452.5383	459.2486	476.2166	508.5998	545.8716	574.8636 (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	
Northeast					6.5700	11.2829	0.6300	0.7000	0.7700		22.6548 (75)	
East					1.3600	19.6403	0.6300	0.7000	0.7700		8.1632 (76)	
Southeast					8.3800	36.7938	0.6300	0.7000	0.7700		94.2304 (77)	
South					2.0400	46.7521	0.6300	0.7000	0.7700		29.1476 (78)	
Southwest					6.3100	36.7938	0.6300	0.7000	0.7700		70.9539 (79)	
West					0.6800	19.6403	0.6300	0.7000	0.7700		4.0816 (80)	
Northwest					9.6800	11.2829	0.6300	0.7000	0.7700		33.3787 (81)	
Solar gains	262.6101	467.1172	690.7335	940.7529	1130.0609	1155.1598	1099.8742	953.7593	776.6544	530.2719	318.1749	222.3787 (83)
Total gains	854.6137	1056.7999	1260.8349	1478.7108	1634.3023	1627.7419	1552.4125	1413.0079	1252.8710	1038.8718	864.0464	797.2423 (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 58.7154 58.8623 59.0071 59.6967 59.8275 60.4441 60.4441 60.5597 60.2051 59.8275 59.5635 59.2899												
alpha 4.9144 4.9242 4.9338 4.9798 4.9885 5.0296 5.0296 5.0373 5.0137 4.9885 4.9709 4.9527												
util living area	0.9993	0.9980	0.9931	0.9717	0.9000	0.7441	0.5752	0.6457	0.8884	0.9874	0.9984	0.9995 (86)
MIT 19.5935 19.7663 20.0472 20.4199 20.7446 20.9335 20.9854 20.9748 20.8262 20.3960 19.9257 19.5682 (87)												
Th 2 19.9338 19.9362 19.9385 19.9495 19.9515 19.9611 19.9611 19.9629 19.9574 19.9515 19.9474 19.9431 (88)												
util rest of house	0.9991	0.9973	0.9904	0.9602	0.8592	0.6527	0.4487	0.5169	0.8264	0.9805	0.9978	0.9994 (89)
MIT 2 18.0461 18.3004 18.7115 19.2546 19.6943 19.9157 19.9556 19.9521 19.8096 19.2286 18.5417 18.0154 (90)												
Living area fraction	0.9991	0.9973	0.9904	0.9602	0.8592	0.6527	0.4487	0.5169	0.8264	0.9805	0.9978	0.9994 (89)
MIT 18.2680 18.5106 18.9031 19.4217 19.8450 20.0617 20.1033 20.0988 19.9554 19.3960 18.7402 18.2381 (92)												
Temperature adjustment	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (91)
adjusted MIT 18.2680 18.5106 18.9031 19.4217 19.8450 20.0617 20.1033 20.0988 19.9554 19.3960 18.7402 18.2381 (93)												

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	853.3572	1052.3110	1243.9733	1408.3665	1396.1150	1078.2462	724.5734	755.8097	1035.2199	1013.0309	861.0255	796.4118 (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	3011.0024	2926.6369	2660.4412	2230.8291	1723.1271	1143.6657	733.5887	773.0388	1230.9784	1860.8614	2473.4874	2996.7976 (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	1605.2881	1259.5470	1053.8521	592.1730	243.2970	0.0000	0.0000	0.0000	0.0000	630.7859	1160.9726	1637.0870 (98)
Space heating												8183.0027 (98)
Space heating per m2												44.8974 (99)

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													8751.8746 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1605.2881	1259.5470	1053.8521	592.1730	243.2970	0.0000	0.0000	0.0000	0.0000	630.7859	1160.9726	1637.0870	(98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)	1716.8856	1347.1091	1127.1146	633.3401	260.2107	0.0000	0.0000	0.0000	0.0000	674.6374	1241.6819	1750.8952	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	226.1019	199.3215	209.4130	187.8379	184.1568	164.6685	158.2585	173.5043	173.1496	194.7715	205.8089	220.7001	(64)
Efficiency of water heater (217)m	89.0263	88.8719	88.5322	87.6692	85.5576	79.8000	79.8000	79.8000	79.8000	87.7249	88.7089	89.0810	(216)
Fuel for water heating, kWh/month	253.9721	224.2796	236.5389	214.2575	215.2431	206.3516	198.3189	217.4240	216.9794	222.0254	232.0047	247.7520	(219)
Water heating fuel used												2685.1472	(219)
Annual totals kWh/year													
Space heating fuel - main system												8751.8746	(211)
Space heating fuel - secondary												0.0000	(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)												563.6730	(232)
Total delivered energy for all uses												12075.6948	(238)

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	8751.8746	0.2160	1890.4049 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2685.1472	0.2160	579.9918 (264)
Space and water heating			2470.3967 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	563.6730	0.5190	292.5463 (268)
Total CO2, kg/m2/year			2801.8680 (272)
Emissions per m2 for space and water heating			13.5542 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			1.6051 (272b)
Emissions per m2 for pumps and fans			0.2136 (272c)
Target Carbon Dioxide Emission Rate (TER) = (13.5542 * 1.00) + 1.6051 + 0.2136, rounded to 2 d.p.			15.3700 (273)

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Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	92.9300 (1b)	x 2.3800 (2b)	= 221.1734 (1b) - (3b)
First floor	89.3300 (1c)	x 2.5600 (2c)	= 228.6848 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	182.2600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 449.8582 (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					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.0889 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.3394 (18)
Number of sides sheltered					0 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		1.0000 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3394 (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	0.4328	0.4243	0.4158	0.3734	0.3649	0.3224	0.3224	0.3140	0.3394	0.3649	0.3818	0.3988 (22b)
Effective ac	0.5936	0.5900	0.5864	0.5697	0.5666	0.5520	0.5520	0.5493	0.5576	0.5666	0.5729	0.5795 (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
Opening Type 1			2.3500	1.1000	2.5850		(26a)
Opening Type 2 (Uw = 1.41)			35.0200	1.3347	46.7420		(27)
Opening Type 5			1.9700	1.5000	2.9550		(26a)
150mm TE Platinum GF			92.9300	0.1500	13.9395		(28a)
50mm A Platinum	220.1800	39.3400	180.8400	0.2700	48.8268		(29a)
400mm Mineral Wool	89.5900		89.5900	0.1100	9.8549		(30)
Flat Roof	3.6000		3.6000	0.1700	0.6120		(30)
Total net area of external elements Aum(A, m ²)			406.3000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		125.5152		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							156.7200 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.8746 (36)
Total fabric heat loss						(33) + (36) =	141.3897 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	88.1276	87.5878	87.0587	84.5735	84.1086	81.9441	81.9441	81.5432	82.7778	84.1086	85.0492	86.0326 (38)
Heat transfer coeff	229.5174	228.9776	228.4485	225.9633	225.4983	223.3338	223.3338	222.9329	224.1675	225.4983	226.4389	227.4223 (39)
Average = Sum(39)m / 12 =												225.9610 (39)
HLP	1.2593	1.2563	1.2534	1.2398	1.2372	1.2254	1.2254	1.2232	1.2299	1.2372	1.2424	1.2478 (40)
HLP (average)												1.2398 (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												2.9788 (42)
Average daily hot water use (litres/day)												104.9460 (43)
Daily hot water use	115.4406	111.2428	107.0449	102.8471	98.6492	94.4514	94.4514	98.6492	102.8471	107.0449	111.2428	115.4406 (44)
Energy conte	171.1951	149.7283	154.5062	134.7023	129.2500	111.5329	103.3517	118.5975	120.0140	139.8647	152.6733	165.7933 (45)
Energy content (annual)												Total = Sum(45)m = 1651.2093 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss												

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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 (56)
Primary 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 (57)
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
	36.3790	31.8173	32.8326	28.6242	27.4656	23.7007	21.9622	25.2020	25.5030	29.7213	32.4431	35.2311 (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	148.9390	148.9390	148.9390	148.9390	148.9390	148.9390	148.9390	148.9390	148.9390	148.9390	148.9390	148.9390 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	31.9175	28.3488	23.0548	17.4540	13.0471	11.0149	11.9020	15.4706	20.7646	26.3655	30.7724	32.8046 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	353.8564	357.5283	348.2752	328.5764	303.7102	280.3394	264.7264	261.0544	270.3076	290.0064	314.8726	338.2433 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.8939	37.8939	37.8939	37.8939	37.8939	37.8939	37.8939	37.8939	37.8939	37.8939	37.8939	37.8939 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-119.1512	-119.1512	-119.1512	-119.1512	-119.1512	-119.1512	-119.1512	-119.1512	-119.1512	-119.1512	-119.1512	-119.1512 (71)
Water heating gains (Table 5)	48.8964	47.3471	44.1298	39.7559	36.9162	32.9177	29.5191	33.8736	35.4208	39.9479	45.0598	47.3536 (72)
Total internal gains	502.3520	500.9059	483.1415	453.4679	421.3551	391.9537	373.8291	378.0804	394.1747	424.0014	458.3865	486.0832 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W
Northeast	6.5700	11.2829	0.7100	0.7000	0.7700	25.5316 (75)
East	1.3600	19.6403	0.7100	0.7000	0.7700	9.1997 (76)
Southeast	8.3800	36.7938	0.7100	0.7000	0.7700	106.1961 (77)
South	2.0400	46.7521	0.7100	0.7000	0.7700	32.8489 (78)
Southwest	6.3100	36.7938	0.7100	0.7000	0.7700	79.9639 (79)
West	0.6800	19.6403	0.7100	0.7000	0.7700	4.5999 (80)
Northwest	9.6800	11.2829	0.7100	0.7000	0.7700	37.6173 (81)

Solar gains	295.9574	526.4337	778.4457	1060.2136	1273.5607	1301.8468	1239.5408	1074.8716	875.2772	597.6080	358.5780	250.6173 (83)
Total gains	798.3094	1027.3396	1261.5872	1513.6815	1694.9158	1693.8005	1613.3699	1452.9520	1269.4519	1021.6095	816.9645	736.7005 (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)												
tau	34.5699	34.6514	34.7316	35.1136	35.1860	35.5270	35.5270	35.5909	35.3949	35.1860	35.0398	34.8883
alpha	3.3047	3.3101	3.3154	3.3409	3.3457	3.3685	3.3685	3.3727	3.3597	3.3457	3.3360	3.3259
util living area	0.9956	0.9895	0.9744	0.9329	0.8442	0.7018	0.5585	0.6238	0.8401	0.9640	0.9917	0.9966 (86)
MIT	18.8405	19.1007	19.5171	20.0557	20.5237	20.8275	20.9415	20.9146	20.6561	20.0277	19.3316	18.7998 (87)
Th 2	19.8729	19.8752	19.8775	19.8883	19.8903	19.8998	19.8998	19.9015	19.8961	19.8903	19.8862	19.8820 (88)
util rest of house	0.9945	0.9870	0.9680	0.9154	0.8018	0.6192	0.4385	0.5045	0.7795	0.9515	0.9894	0.9958 (89)
MIT 2	17.8966	18.1573	18.5714	19.1045	19.5416	19.8032	19.8786	19.8674	19.6743	19.0877	18.3965	17.8626 (90)
Living area fraction									fLA = Living area / (4) =			0.1434 (91)
MIT	18.0320	18.2926	18.7070	19.2409	19.6824	19.9501	20.0310	20.0176	19.8151	19.2225	18.5306	17.9970 (92)
Temperature adjustment												0.0000
adjusted MIT	18.0320	18.2926	18.7070	19.2409	19.6824	19.9501	20.0310	20.0176	19.8151	19.2225	18.5306	17.9970 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9920	0.9820	0.9592	0.9026	0.7925	0.6234	0.4538	0.5183	0.7741	0.9413	0.9853	0.9938 (94)
Useful gains	791.9168	1008.8752	1210.1026	1366.3157	1343.1910	1055.9593	732.1832	753.1362	982.7387	961.6551	804.9499	732.1419 (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	3151.7297	3066.6112	2788.6784	2336.6692	1800.0211	1194.8520	766.2630	806.4763	1281.1440	1944.3700	2588.3327	3137.7418 (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	1755.7008	1382.7986	1174.4604	698.6545	339.8816	0.0000	0.0000	0.0000	0.0000	731.1399	1284.0356	1789.7663 (98)
Space heating												9156.4377 (98)
Space heating per m2										(98) / (4) =		50.2383 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	2099.3376	1652.6700	1694.2904	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7741	0.8414	0.8008	0.0000	0.0000	0.0000	0.0000 (101)

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Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1625.1266	1390.5255	1356.8723	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2115.9381	2018.6289	1833.9541	0.0000	0.0000	0.0000	0.0000 (103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	353.3842	467.3090	354.9488	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												1175.6420 (104)
Cooled fraction									FC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	88.3461	116.8272	88.7372	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												293.9105 (107)
Space cooling per m2												1.6126 (108)
Energy for space heating												50.2383 (99)
Energy for space cooling												1.6126 (108)
Total												51.8509 (109)
Dwelling Fabric Energy Efficiency (DFEE)												51.9 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	92.9300 (1b)	x 2.3800 (2b)	= 221.1734 (1b) - (3b)
First floor	89.3300 (1c)	x 2.5600 (2c)	= 228.6848 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	182.2600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 449.8582 (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					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) = 0.0889 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3389 (18)
Number of sides sheltered					0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3389 (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	0.4321	0.4236	0.4152	0.3728	0.3643	0.3220	0.3220	0.3135	0.3389	0.3643	0.3813	0.3982 (22b)
Effective ac	0.5934	0.5897	0.5862	0.5695	0.5664	0.5518	0.5518	0.5491	0.5574	0.5664	0.5727	0.5793 (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
TER Semi-glazed door			4.3200	1.2000	5.1840		(26a)
TER Opening Type (Uw = 1.40)			35.0200	1.3258	46.4280		(27)
150mm TE Platinum GF			92.9300	0.1300	12.0809		(28a)
50mm A Platinum	220.1800	39.3400	180.8400	0.1800	32.5512		(29a)
400mm Mineral Wool	89.5900		89.5900	0.1300	11.6467		(30)
Flat Roof	3.6000		3.6000	0.1300	0.4680		(31)
Total net area of external elements Aum(A, m ²)			406.3000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		108.3588		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							19.1189 (36)
Total fabric heat loss						(33) + (36) =	127.4777 (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	88.0867	87.5485	87.0210	84.5431	84.0795	81.9213	81.9213	81.5217	82.7526	84.0795	85.0173	85.9978 (38)
Heat transfer coeff	215.5644	215.0262	214.4987	212.0208	211.5572	209.3991	209.3991	208.9994	210.2303	211.5572	212.4951	213.4756 (39)
Average = Sum(39)m / 12 =												212.0186 (39)
HLP	1.1827	1.1798	1.1769	1.1633	1.1607	1.1489	1.1489	1.1467	1.1535	1.1607	1.1659	1.1713 (40)
HLP (average)												1.1633 (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												2.9788 (42)
Average daily hot water use (litres/day)												104.9460 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	115.4406	111.2428	107.0449	102.8471	98.6492	94.4514	94.4514	98.6492	102.8471	107.0449	111.2428	115.4406 (44)
Energy content (annual)	171.1951	149.7283	154.5062	134.7023	129.2500	111.5329	103.3517	118.5975	120.0140	139.8647	152.6733	165.7933 (45)
Distribution loss (46)m = 0.15 x (45)m												1651.2093 (45)
Water 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 (46)
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)

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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	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month	36.3790	31.8173	32.8326	28.6242	27.4656	23.7007	21.9622	25.2020	25.5030	29.7213	32.4431	35.2311 (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	148.9390	148.9390	148.9390	148.9390	148.9390	148.9390	148.9390	148.9390	148.9390	148.9390	148.9390	148.9390	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	31.9175	28.3488	23.0548	17.4540	13.0471	11.0149	11.9020	15.4706	20.7646	26.3655	30.7724	32.8046	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	353.8564	357.5283	348.2752	328.5764	303.7102	280.3394	264.7264	261.0544	270.3076	290.0064	314.8726	338.2433	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.8939	37.8939	37.8939	37.8939	37.8939	37.8939	37.8939	37.8939	37.8939	37.8939	37.8939	37.8939	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-119.1512	-119.1512	-119.1512	-119.1512	-119.1512	-119.1512	-119.1512	-119.1512	-119.1512	-119.1512	-119.1512	-119.1512	(71)
Water heating gains (Table 5)	48.8964	47.3471	44.1298	39.7559	36.9162	32.9177	29.5191	33.8736	35.4208	39.9479	45.0598	47.3536	(72)
Total internal gains	502.3520	500.9059	483.1415	453.4679	421.3551	391.9537	373.8291	378.0804	394.1747	424.0014	458.3865	486.0832	(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	
Northeast	6.5700	11.2829	0.6300	0.7000	0.7700	22.6548	(75)
East	1.3600	19.6403	0.6300	0.7000	0.7700	8.1632	(76)
Southeast	8.3800	36.7938	0.6300	0.7000	0.7700	94.2304	(77)
South	2.0400	46.7521	0.6300	0.7000	0.7700	29.1476	(78)
Southwest	6.3100	36.7938	0.6300	0.7000	0.7700	70.9539	(79)
West	0.6800	19.6403	0.6300	0.7000	0.7700	4.0816	(80)
Northwest	9.6800	11.2829	0.6300	0.7000	0.7700	33.3787	(81)

Solar gains	262.6101	467.1172	690.7335	940.7529	1130.0609	1155.1598	1099.8742	953.7593	776.6544	530.2719	318.1749	222.3787	(83)
Total gains	764.9621	968.0231	1173.8750	1394.2209	1551.4160	1547.1135	1473.7033	1331.8397	1170.8291	954.2734	776.5613	708.4619	(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	58.7154	58.8623	59.0071	59.6967	59.8275	60.4441	60.4441	60.5597	60.2051	59.8275	59.5635	59.2899	
alpha	4.9144	4.9242	4.9338	4.9798	4.9885	5.0296	5.0296	5.0373	5.0137	4.9885	4.9709	4.9527	
util living area	0.9996	0.9986	0.9949	0.9775	0.9148	0.7691	0.6017	0.6767	0.9091	0.9912	0.9990	0.9997	(86)
MIT	19.5477	19.7212	20.0040	20.3818	20.7181	20.9225	20.9822	20.9690	20.8011	20.3549	19.8810	19.5227	(87)
Th 2	19.9338	19.9362	19.9385	19.9495	19.9515	19.9611	19.9611	19.9629	19.9574	19.9515	19.9474	19.9431	(88)
util rest of house	0.9995	0.9982	0.9929	0.9680	0.8781	0.6792	0.4714	0.5455	0.8540	0.9862	0.9986	0.9996	(89)
MIT 2	18.5992	18.7744	19.0581	19.4390	19.7543	19.9241	19.9564	19.9535	19.8382	19.4181	18.9432	18.5815	(90)
Living area fraction										fLA = Living area / (4) =		0.1434	(91)
MIT	18.7352	18.9102	19.1938	19.5742	19.8926	20.0673	20.1035	20.0992	19.9763	19.5524	19.0777	18.7165	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7352	18.9102	19.1938	19.5742	19.8926	20.0673	20.1035	20.0992	19.9763	19.5524	19.0777	18.7165	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9992	0.9975	0.9910	0.9636	0.8756	0.6895	0.4902	0.5642	0.8553	0.9835	0.9981	0.9995	(94)
Ext temp.	764.3778	965.5672	1163.2870	1343.4511	1358.3644	1066.6630	722.4389	751.3601	1001.3564	938.5174	775.0831	708.0959	(95)
Heat loss rate W	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)
Month fracti	3111.7225	3012.5561	2722.7978	2263.1557	1733.1950	1144.8501	733.6400	773.1251	1235.3754	1893.9534	2545.1947	3098.9162	(97)
Space heating kWh	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	1746.4245	1375.5765	1160.2760	662.1873	278.8739	0.0000	0.0000	0.0000	0.0000	710.8444	1274.4803	1778.7703	(98)
Space heating per m2												8987.4332	(98)
											(98) / (4) =	49.3111	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1968.3512	1549.5531	1588.3955	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8290	0.8994	0.8597	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1631.8077	1393.7271	1365.4663	0.0000	0.0000	0.0000	0.0000	(102)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1944.4858	1855.3823	1692.3943	0.0000	0.0000	0.0000	0.0000 (103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	225.1282	343.4715	243.2344	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												811.8341 (104)
Cooled fraction									fC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
Intermittency factor	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	56.2821	85.8679	60.8086	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												202.9585 (107)
Space cooling per m2												1.1136 (108)
Energy for space heating												49.3111 (99)
Energy for space cooling												1.1136 (108)
Total												50.4246 (109)
Target Fabric Energy Efficiency (TFEE)												58.0 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	H597---7 Detached			Issued on Date	17/12/2021
Assessment Reference	1	Prop Type Ref			
Property	H597---7, Detached, H-Range, David Wilson Homes				
SAP Rating	87 B	DER	13.25	TER	13.28
Environmental	86 B	% DER<TER	0.25		
CO ₂ Emissions (t/year)	2.56	DFEE	45.28	TFEE	49.98
General Requirements Compliance	Pass	% DFEE<TFEE	9.40		
Assessor Details	Mr. Andrew Maughan, Andrew Maughan, Tel: 01582 544250, Andrew.Maughan@ee-ltd.co.uk			Assessor ID	V844-0001
Client					

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS DESIGNED

Detached House, total floor area 215 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating:Mains gas

Fuel factor:1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER) 13.28 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 13.25 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)50.0 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)45.3 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.30 (max. 0.70)	OK
Floor	0.15 (max. 0.25)	0.15 (max. 0.70)	OK
Roof	0.14 (max. 0.20)	0.17 (max. 0.35)	OK
Openings	1.47 (max. 2.00)	1.80 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals:	5.01 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas

Data from database

Ideal LOGIC HEAT H24

Efficiency: 89.8% SEDBUK2009

Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation

Hot water storage Measured cylinder loss: 1.81 kWh/day

Permitted by DBSCG 2.86 OK

Primary pipework insulated: Yes OK

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls:

Cylinderstat OK

Independent timer for DHW OK

Boiler interlock

Yes OK

7 Low energy lights

Percentage of fixed lights with low-energy fittings:100%

Minimum 75% OK

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Midlands): Not significant OK

Based on:

Overshading: Average

Windows facing North: 13.65 m², No overhang

Windows facing South: 16.68 m², No overhang

Windows facing West: 1.24 m², No overhang

Air change rate: 8.00 ach

Blinds/curtains: None

10 Key features

External wall U-value 0.12 W/m²K

Roof U-value 0.12 W/m²K

Roof U-value 0.11 W/m²K

Door U-value 1.10 W/m²K

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	78.3000 (1b)	x 2.3300 (2b)	= 182.4390 (1b) - (3b)
First floor	78.2700 (1c)	x 2.8200 (2c)	= 220.7214 (1c) - (3c)
Second floor	58.0300 (1d)	x 2.1300 (2d)	= 123.6039 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	214.6000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 526.7643 (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					6 * 10 = 60.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour 60.0000 / (5) = 0.1139 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.3644 (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) =		0.3097 (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	0.3949	0.3872	0.3794	0.3407	0.3330	0.2943	0.2943	0.2865	0.3097	0.3330	0.3485	0.3639 (22b)
Effective ac	0.5780	0.5750	0.5720	0.5580	0.5554	0.5433	0.5433	0.5410	0.5480	0.5554	0.5607	0.5662 (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
Opening Type 1			2.3500	1.1000	2.5850		(26a)
Opening Type 2 (Uw = 1.41)			31.5700	1.3347	42.1372		(27)
Opening Type 4			1.9700	1.5000	2.9550		(26a)
Opening Type 21 (Uw = 1.80)			8.3800	1.6791	14.0709		(27a)
150mm Platinium			78.3000	0.1500	11.7450		(28a)
50mm Platinium	208.4400	35.8900	172.5500	0.2700	46.5885		(29a)
Dormer Wall	7.3700		7.3700	0.3000	2.2110		(29a)
Wall to Roofspace	22.4600		22.4600	0.1200	2.6952		(29a)
Ceiling to Roofspace	21.0900		21.0900	0.1200	2.5308		(30)
Flat Roof	3.8900		3.8900	0.1700	0.6613		(30)
Horizontal Ceiling	21.3600		21.3600	0.1100	2.3496		(30)
Sloping Ceiling	42.7900	8.3800	34.4100	0.1600	5.5056		(30)
Total net area of external elements Aum(A, m ²)			405.7000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	136.0351		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							145.2290 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							20.7157 (36)
Total fabric heat loss						(33) + (36) =	156.7507 (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	100.4718	99.9454	99.4295	97.0060	96.5526	94.4418	94.4418	94.0510	95.2549	96.5526	97.4699	98.4288 (38)
Heat transfer coeff	257.2225	256.6961	256.1802	253.7567	253.3033	251.1926	251.1926	250.8017	252.0056	253.3033	254.2206	255.1795 (39)
Average = Sum(39)m / 12 =												253.7546 (39)
HLP	1.1986	1.1962	1.1938	1.1825	1.1804	1.1705	1.1705	1.1687	1.1743	1.1804	1.1846	1.1891 (40)
HLP (average)												1.1825 (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												3.0209 (42)
Average daily hot water use (litres/day)												105.9466 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	116.5412	112.3034	108.0655	103.8276	99.5898	95.3519	95.3519	99.5898	103.8276	108.0655	112.3034	116.5412 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy content (annual)	172.8273	151.1558	155.9793	135.9865	130.4823	112.5963	104.3370	119.7283	121.1582	141.1982	154.1289	167.3740 (45)
Distribution loss (46)m = 0.15 x (45)m	25.9241	22.6734	23.3969	20.3980	19.5723	16.8894	15.6506	17.9592	18.1737	21.1797	23.1193	25.1061 (46)
Water storage loss:												
Store volume												300.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.8100 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.9774 (55)
Total storage loss												
30.2994	27.3672	30.2994	29.3220	30.2994	29.3220	30.2994	30.2994	29.3220	30.2994	29.3220	30.2994	(56)
If cylinder contains dedicated solar storage												
30.2994	27.3672	30.2994	29.3220	30.2994	29.3220	30.2994	30.2994	29.3220	30.2994	29.3220	30.2994	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	(59)
Total heat required for water heating calculated for each month												
226.3891	199.5342	209.5411	187.8205	184.0441	164.4303	157.8988	173.2901	172.9922	194.7600	205.9629	220.9358	(62)
WWHRS	-19.1173	-16.8216	-17.1682	-14.1194	-13.1069	-10.8103	-9.1451	-11.0740	-11.3988	-14.0956	-16.3338	-18.4791 eq. (G10)
Total of WWHRS savings												-171.6701
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	207.2718	182.7126	192.3729	173.7012	170.9372	153.6200	148.7537	162.2161	161.5934	180.6644	189.6291	202.4567 (64)
Heat gains from water heating, kWh/month	100.3145	88.9620	94.7126	86.6827	86.2348	78.9055	77.5415	82.6591	81.7523	89.7978	92.7151	98.5013 (65)
Total per year (kWh/year) = Sum (64)m =												2125.9292 (64)

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	151.0454	151.0454	151.0454	151.0454	151.0454	151.0454	151.0454	151.0454	151.0454	151.0454	151.0454	151.0454 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	34.6559	30.7810	25.0328	18.9515	14.1664	11.9599	12.9231	16.7979	22.5461	28.6275	33.4125	35.6191 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	384.7181	388.7102	378.6501	357.2333	330.1983	304.7893	287.8145	283.8224	293.8825	315.2994	342.3343	367.7433 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.1045	38.1045	38.1045	38.1045	38.1045	38.1045	38.1045	38.1045	38.1045	38.1045	38.1045	38.1045 (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)	-120.8363	-120.8363	-120.8363	-120.8363	-120.8363	-120.8363	-120.8363	-120.8363	-120.8363	-120.8363	-120.8363	-120.8363 (71)
Water heating gains (Table 5)	134.8313	132.3840	127.3018	120.3927	115.9070	109.5909	104.2225	111.1009	113.5449	120.6960	128.7709	132.3942 (72)
Total internal gains	625.5189	623.1889	602.2984	567.8910	531.5854	497.6538	476.2737	483.0349	501.2872	535.9365	575.8313	607.0702 (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			
North				13.6500	10.6334	0.7100	0.7000	0.7700	49.9913 (74)			
South				16.6800	46.7521	0.7100	0.7000	0.7700	268.5879 (78)			
West				1.2400	19.6403	0.7100	0.7000	0.7700	8.3880 (80)			
North				0.5100	15.6897	0.7100	0.7000	1.0000	3.5792 (82)			
South				7.8700	45.6416	0.7100	0.7000	1.0000	160.6697 (82)			
Solar gains	491.2161	848.3601	1192.4901	1532.0650	1766.7612	1776.5529	1703.3758	1524.6613	1309.4298	946.0942	590.4632	419.0308 (83)
Total gains	1116.7350	1471.5490	1794.7885	2099.9560	2298.3466	2274.2067	2179.6496	2007.6961	1810.7170	1482.0307	1166.2945	1026.1010 (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	33.6567	33.7257	33.7936	34.1164	34.1775	34.4646	34.4646	34.5184	34.3535	34.1775	34.0541	33.9262
alpha	3.2438	3.2484	3.2529	3.2744	3.2785	3.2976	3.2976	3.3012	3.2902	3.2785	3.2703	3.2617
util living area	0.9906	0.9772	0.9492	0.8865	0.7756	0.6217	0.4789	0.5314	0.7511	0.9275	0.9820	0.9928 (86)
MIT	18.9400	19.2583	19.6994	20.2158	20.6280	20.8739	20.9601	20.9435	20.7538	20.1823	19.4515	18.8836 (87)
Th 2	19.9211	19.9231	19.9250	19.9341	19.9358	19.9437	19.9437	19.9451	19.9406	19.9358	19.9323	19.9287 (88)
util rest of house	0.9886	0.9725	0.9385	0.8623	0.7279	0.5428	0.3750	0.4256	0.6822	0.9067	0.9775	0.9913 (89)
MIT 2	17.1643	17.6272	18.2627	18.9941	19.5429	19.8408	19.9221	19.9120	19.7154	18.9651	17.9171	17.0867 (90)
Living area fraction									fLA = Living area / (4) =			0.0883 (91)
MIT	17.3211	17.7712	18.3896	19.1020	19.6388	19.9321	20.0138	20.0031	19.8071	19.0725	18.0526	17.2454 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.1711	17.6212	18.2396	18.9520	19.4888	19.7821	19.8638	19.8531	19.6571	18.9225	17.9026	17.0954 (93)

8. Space heating requirement

Utilisation	0.9803	0.9573	0.9154	0.8344	0.7048	0.5296	0.3667	0.4157	0.6607	0.8799	0.9641	0.9845 (94)
Useful gains	1094.7253	1408.7318	1642.8896	1752.1769	1619.8542	1204.4497	799.1793	834.5135	1196.4192	1303.9738	1124.4391	1010.2085 (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	3310.7421	3265.4872	3007.4469	2550.7664	1972.9169	1301.6978	819.8323	866.0448	1400.4082	2108.1289	2746.2417	3290.6369 (97)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Month fraction	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	1648.7165	1247.7397	1015.2306	574.9845	262.6787	0.0000	0.0000	0.0000	0.0000	598.2914	1167.6979	1696.6387 (98)
Space heating												8211.9779 (98)
Space heating per m2										(98) / (4) =		38.2664 (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)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												90.8000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												9044.0285 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1648.7165	1247.7397	1015.2306	574.9845	262.6787	0.0000	0.0000	0.0000	0.0000	598.2914	1167.6979	1696.6387 (98)
Space heating efficiency (main heating system 1)	90.8000	90.8000	90.8000	90.8000	90.8000	0.0000	0.0000	0.0000	0.0000	90.8000	90.8000	90.8000 (210)
Space heating fuel (main heating system)	1815.7670	1374.1626	1118.0954	633.2428	289.2937	0.0000	0.0000	0.0000	0.0000	658.9112	1286.0109	1868.5448 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	207.2718	182.7126	192.3729	173.7012	170.9372	153.6200	148.7537	162.2161	161.5934	180.6644	189.6291	202.4567 (64)
Efficiency of water heater	89.4653	89.2767	88.9080	88.0705	86.2577	80.1000	80.1000	80.1000	80.1000	88.0714	89.1365	80.1000 (216)
Fuel for water heating, kWh/month	231.6784	204.6588	216.3729	197.2297	198.1705	191.7852	185.7100	202.5170	201.7395	205.1341	212.7401	226.1453 (219)
Water heating fuel used												2473.8816 (219)
Annual totals kWh/year												
Space heating fuel - main system												9044.0285 (211)
Space heating fuel - secondary												0.0000 (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)												612.0336 (232)
Total delivered energy for all uses												12204.9436 (238)

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	9044.0285	0.2160	1953.5102 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2473.8816	0.2160	534.3584 (264)
Space and water heating			2487.8686 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	612.0336	0.5190	317.6454 (268)
Total CO2, kg/year			2844.4390 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.2500 (273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER			13.2500 ZC1
Total Floor Area		TFA	214.6000
Assumed number of occupants		N	3.0209
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190
CO2 emissions from appliances, equation (L14)			10.6233 ZC2
CO2 emissions from cooking, equation (L16)			0.8924 ZC3
Total CO2 emissions			24.7657 ZC4
Residual CO2 emissions offset from biofuel CHP			0.0000 ZC5
Additional allowable electricity generation, kWh/m²/year			0.0000 ZC6
Resulting CO2 emissions offset from additional allowable electricity generation			0.0000 ZC7
Net CO2 emissions			24.7657 ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	78.3000 (1b)	x 2.3300 (2b)	= 182.4390 (1b) - (3b)
First floor	78.2700 (1c)	x 2.8200 (2c)	= 220.7214 (1c) - (3c)
Second floor	58.0300 (1d)	x 2.1300 (2d)	= 123.6039 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	214.6000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 526.7643 (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					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) = 0.0759 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3259 (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) =				0.2770 (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	0.3532	0.3463	0.3394	0.3047	0.2978	0.2632	0.2632	0.2563	0.2770	0.2978	0.3117	0.3255 (22b)
Effective ac	0.5624	0.5600	0.5576	0.5464	0.5443	0.5346	0.5346	0.5328	0.5384	0.5443	0.5486	0.5530 (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
TER Semi-glazed door			4.3200	1.2000	5.1840		(26a)
TER Opening Type (Uw = 1.40)			31.5700	1.3258	41.8542		(27)
TER Room Window (Uw = 1.70)			8.3800	1.5918	13.3390		(27a)
150mm Platinum			78.3000	0.1300	10.1790		(28a)
50mm Platinum	208.4400	35.8900	172.5500	0.1800	31.0590		(29a)
Dormer Wall	7.3700		7.3700	0.1800	1.3266		(29a)
Wall to Roofspace	22.4600		22.4600	0.1800	4.0428		(29a)
Ceiling to Roofspace	21.0900		21.0900	0.1300	2.7417		(30)
Flat Roof	3.8900		3.8900	0.1300	0.5057		(30)
Horizontal Ceiling	21.3600		21.3600	0.1300	2.7768		(30)
Sloping Ceiling	42.7900	8.3800	34.4100	0.1300	4.4733		(30)
Total net area of external elements Aum(A, m ²)			405.7000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		117.4820		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							22.4935 (36)
Total fabric heat loss						(33) + (36) =	139.9755 (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	97.7609	97.3398	96.9270	94.9882	94.6255	92.9368	92.9368	92.6241	93.5873	94.6255	95.3593	96.1265 (38)
Heat transfer coeff	237.7364	237.3153	236.9025	234.9637	234.6010	232.9123	232.9123	232.5996	233.5628	234.6010	235.3348	236.1020 (39)
Average = Sum(39)m / 12 =												234.9620 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1078	1.1058	1.1039	1.0949	1.0932	1.0853	1.0853	1.0839	1.0884	1.0932	1.0966	1.1002 (40)
HLP (average)												1.0949 (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												3.0209 (42)
Average daily hot water use (litres/day)												105.9466 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	116.5412	112.3034	108.0655	103.8276	99.5898	95.3519	95.3519	99.5898	103.8276	108.0655	112.3034	116.5412 (44)
Energy conte	172.8273	151.1558	155.9793	135.9865	130.4823	112.5963	104.3370	119.7283	121.1582	141.1982	154.1289	167.3740 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Energy content (annual)												Total = Sum(45)m = 1666.9522 (45)
Distribution loss (46)m = 0.15 x (45)m												
25.9241 22.6734 23.3969 20.3980 19.5723 16.8894 15.6506 17.9592 18.1737 21.1797 23.1193 25.1061 (46)												
Water storage loss:												
Store volume												300.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.1127 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.1409 (55)
Total storage loss												
35.3664 31.9439 35.3664 34.2256 35.3664 34.2256 35.3664 35.3664 34.2256 35.3664 34.2256 35.3664 (56)												
If cylinder contains dedicated solar storage												
35.3664 31.9439 35.3664 34.2256 35.3664 34.2256 35.3664 35.3664 34.2256 35.3664 34.2256 35.3664 (57)												
Primary loss												23.2624 (59)
23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 22.5120 23.2624 22.5120												
Total heat required for water heating calculated for each month												
231.4561 204.1109 214.6081 192.7241 189.1111 169.3339 162.9659 178.3571 177.8958 199.8270 210.8665 226.0028 (62)												
Solar input												0.0000 (63)
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												
231.4561 204.1109 214.6081 192.7241 189.1111 169.3339 162.9659 178.3571 177.8958 199.8270 210.8665 226.0028 (64)												
Heat gains from water heating, kWh/month												
104.3681 92.6234 98.7662 90.6056 90.2884 82.8283 81.5951 86.7127 85.6752 93.8515 96.6379 102.5549 (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 151.0454 151.0454 151.0454 151.0454 151.0454 151.0454 151.0454 151.0454 151.0454 151.0454 151.0454 151.0454 (66)												
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
34.6559 30.7810 25.0328 18.9515 14.1664 11.9599 12.9231 16.7979 22.5461 28.6275 33.4125 35.6191 (67)												
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
384.7181 388.7102 378.6501 357.2333 330.1983 304.7893 287.8145 283.8224 293.8825 315.2994 342.3343 367.7433 (68)												
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
38.1045 38.1045 38.1045 38.1045 38.1045 38.1045 38.1045 38.1045 38.1045 38.1045 38.1045 38.1045 (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)												
-120.8363 -120.8363 -120.8363 -120.8363 -120.8363 -120.8363 -120.8363 -120.8363 -120.8363 -120.8363 -120.8363 -120.8363 (71)												
Water heating gains (Table 5)												
140.2797 137.8324 132.7502 125.8411 121.3554 115.0393 109.6709 116.5493 118.9933 126.1444 134.2193 137.8426 (72)												
Total internal gains												
630.9673 628.6373 607.7468 573.3394 537.0338 503.1022 481.7221 488.4833 506.7356 541.3849 581.2798 612.5186 (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		
North			13.6500		10.6334		0.6300		0.7000		0.7700		44.3584 (74)
South			16.6800		46.7521		0.6300		0.7000		0.7700		238.3245 (78)
West			1.2400		19.6403		0.6300		0.7000		0.7700		7.4429 (80)
North			0.5100		15.6897		0.6300		0.7000		1.0000		3.1759 (82)
South			7.8700		45.6416		0.6300		0.7000		1.0000		142.5661 (82)
Solar gains	435.8678	752.7702	1058.1250	1359.4379	1567.6895	1576.3780	1511.4462	1352.8685	1161.8884	839.4920	523.9321		371.8161 (83)
Total gains	1066.8351	1381.4075	1665.8718	1932.7774	2104.7233	2079.4801	1993.1683	1841.3517	1668.6240	1380.8769	1105.2119		984.3347 (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 62.6861 62.7974 62.9068 63.4259 63.5239 63.9845 63.9845 64.0705 63.8063 63.5239 63.3259 63.1201												
alpha 5.1791 5.1865 5.1938 5.2284 5.2349 5.2656 5.2656 5.2714 5.2538 5.2349 5.2217 5.2080												
util living area 0.9992 0.9967 0.9879 0.9532 0.8543 0.6767 0.5065 0.5667 0.8251 0.9773 0.9977 0.9995 (86)												
MIT 19.7192 19.9218 20.2103 20.5576 20.8303 20.9630 20.9933 20.9883 20.8961 20.5179 20.0417 19.6827 (87)												
Th 2 19.9945 19.9961 19.9976 20.0050 20.0064 20.0128 20.0128 20.0140 20.0103 20.0064 20.0036 20.0007 (88)												
util rest of house 0.9989 0.9956 0.9835 0.9362 0.8056 0.5884 0.3969 0.4525 0.7513 0.9660 0.9967 0.9993 (89)												
MIT 2 18.2727 18.5698 18.9897 19.4871 19.8425 19.9887 20.0104 20.0092 19.9282 19.4411 18.7511 18.2238 (90)												
Living area fraction 18.4004 18.6892 19.0975 19.5816 19.9297 20.0747 20.0972 20.0957 20.0136 19.5362 18.8651 18.3527 (91)												
MIT 18.4004 18.6892 19.0975 19.5816 19.9297 20.0747 20.0972 20.0957 20.0136 19.5362 18.8651 18.3527 (92)												
Temperature adjustment 0.0000												
adjusted MIT 18.4004 18.6892 19.0975 19.5816 19.9297 20.0747 20.0972 20.0957 20.0136 19.5362 18.8651 18.3527 (93)												

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9982	0.9934	0.9780	0.9270	0.8013	0.5943	0.4065	0.4623	0.7516	0.9586	0.9950	0.9988 (94)
Ext temp.	1064.8992	1372.2522	1629.2591	1791.6707	1686.5296	1235.7417	810.1885	851.2810	1254.1198	1323.6641	1099.7035	983.1395 (95)
Heat loss rate W	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)
Month fracti	3352.1900	3272.3916	2984.3839	2509.7976	1930.6946	1275.1320	814.5329	859.6158	1381.2040	2096.4352	2768.7278	3341.4701 (97)
Space heating kWh	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)
	1701.7443	1276.8937	1008.2129	517.0513	181.6588	0.0000	0.0000	0.0000	0.0000	574.9416	1201.6975	1754.5980 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Space heating
Space heating per m2 (98) / (4) = 8216.7982 (98)
38.2889 (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)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													8788.0194 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1701.7443	1276.8937	1008.2129	517.0513	181.6588	0.0000	0.0000	0.0000	0.0000	574.9416	1201.6975	1754.5980	(98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)	1820.0474	1365.6617	1078.3025	552.9961	194.2875	0.0000	0.0000	0.0000	0.0000	614.9108	1285.2380	1876.5754	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	231.4561	204.1109	214.6081	192.7241	189.1111	169.3339	162.9659	178.3571	177.8958	199.8270	210.8665	226.0028	(64)
Efficiency of water heater (217)m	89.0701	88.8579	88.4193	87.3208	84.7069	79.8000	79.8000	79.8000	79.8000	87.4749	88.7241	89.1362	(216)
Fuel for water heating, kWh/month	259.8584	229.7047	242.7164	220.7080	223.2536	212.1978	204.2179	223.5051	222.9270	228.4394	237.6654	253.5477	(217)
Water heating fuel used												2758.7415	(219)
Annual totals kWh/year													
Space heating fuel - main system												8788.0194	(211)
Space heating fuel - secondary												0.0000	(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)												612.0336	(232)
Total delivered energy for all uses												12233.7945	(238)

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	8788.0194	0.2160	1898.2122 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2758.7415	0.2160	595.8882 (264)
Space and water heating			2494.1003 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	612.0336	0.5190	317.6454 (268)
Total CO2, kg/m2/year			2850.6708 (272)
Emissions per m2 for space and water heating			11.6221 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			1.4802 (272b)
Emissions per m2 for pumps and fans			0.1814 (272c)
Target Carbon Dioxide Emission Rate (TER) = (11.6221 * 1.00) + 1.4802 + 0.1814, rounded to 2 d.p.			13.2800 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	78.3000 (1b)	x 2.3300 (2b)	= 182.4390 (1b) - (3b)
First floor	78.2700 (1c)	x 2.8200 (2c)	= 220.7214 (1c) - (3c)
Second floor	58.0300 (1d)	x 2.1300 (2d)	= 123.6039 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	214.6000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 526.7643 (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					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour 40.0000 / (5) = 0.0759 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.3264 (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) =		0.2775 (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	0.3538	0.3468	0.3399	0.3052	0.2983	0.2636	0.2636	0.2567	0.2775	0.2983	0.3122	0.3260 (22b)
Effective ac	0.5626	0.5601	0.5578	0.5466	0.5445	0.5347	0.5347	0.5329	0.5385	0.5445	0.5487	0.5531 (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
Opening Type 1			2.3500	1.1000	2.5850		(26a)
Opening Type 2 (Uw = 1.41)			31.5700	1.3347	42.1372		(27)
Opening Type 4			1.9700	1.5000	2.9550		(26a)
Opening Type 21 (Uw = 1.80)			8.3800	1.6791	14.0709		(27a)
150mm Platinium			78.3000	0.1500	11.7450		(28a)
50mm Platinium	208.4400	35.8900	172.5500	0.2700	46.5885		(29a)
Dormer Wall	7.3700		7.3700	0.3000	2.2110		(29a)
Wall to Roofspace	22.4600		22.4600	0.1200	2.6952		(29a)
Ceiling to Roofspace	21.0900		21.0900	0.1200	2.5308		(30)
Flat Roof	3.8900		3.8900	0.1700	0.6613		(30)
Horizontal Ceiling	21.3600		21.3600	0.1100	2.3496		(30)
Sloping Ceiling	42.7900	8.3800	34.4100	0.1600	5.5056		(30)
Total net area of external elements Aum(A, m ²)			405.7000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	136.0351		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							145.2290 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							20.7157 (36)
Total fabric heat loss						(33) + (36) =	156.7507 (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	97.7942	97.3718	96.9577	95.0130	94.6491	92.9553	92.9553	92.6416	93.6077	94.6491	95.3852	96.1548 (38)
Heat transfer coeff	254.5449	254.1225	253.7085	251.7637	251.3998	249.7060	249.7060	249.3924	250.3585	251.3998	252.1359	252.9055 (39)
Average = Sum(39)m / 12 =												251.7620 (39)
HLP	1.1861	1.1842	1.1822	1.1732	1.1715	1.1636	1.1636	1.1621	1.1666	1.1715	1.1749	1.1785 (40)
HLP (average)												1.1732 (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												3.0209 (42)
Average daily hot water use (litres/day)												105.9466 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	116.5412	112.3034	108.0655	103.8276	99.5898	95.3519	95.3519	99.5898	103.8276	108.0655	112.3034	116.5412 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy conte	172.8273	151.1558	155.9793	135.9865	130.4823	112.5963	104.3370	119.7283	121.1582	141.1982	154.1289	167.3740 (45)
Energy content (annual)										Total =	Sum (45)m =	1666.9522 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (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)
Primary 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 (59)
Heat gains from water heating, kWh/month	36.7258	32.1206	33.1456	28.8971	27.7275	23.9267	22.1716	25.4423	25.7461	30.0046	32.7524	35.5670 (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	151.0454	151.0454	151.0454	151.0454	151.0454	151.0454	151.0454	151.0454	151.0454	151.0454	151.0454	151.0454 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	34.6559	30.7810	25.0328	18.9515	14.1664	11.9599	12.9231	16.7979	22.5461	28.6275	33.4125	35.6191 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	384.7181	388.7102	378.6501	357.2333	330.1983	304.7893	287.8145	283.8224	293.8825	315.2994	342.3343	367.7433 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.1045	38.1045	38.1045	38.1045	38.1045	38.1045	38.1045	38.1045	38.1045	38.1045	38.1045	38.1045 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-120.8363	-120.8363	-120.8363	-120.8363	-120.8363	-120.8363	-120.8363	-120.8363	-120.8363	-120.8363	-120.8363	-120.8363 (71)
Water heating gains (Table 5)	49.3626	47.7985	44.5505	40.1349	37.2681	33.2316	29.8006	34.1966	35.7585	40.3288	45.4894	47.8051 (72)
Total internal gains	537.0502	535.6034	516.5471	484.6333	449.9465	418.2944	398.8518	403.1305	420.5008	452.5693	489.5499	519.4811 (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		
North				13.6500	10.6334	0.7100	0.7000		0.7700	49.9913 (74)		
South				16.6800	46.7521	0.7100	0.7000		0.7700	268.5879 (78)		
West				1.2400	19.6403	0.7100	0.7000		0.7700	8.3880 (80)		
North				0.5100	15.6897	0.7100	0.7000		1.0000	3.5792 (82)		
South				7.8700	45.6416	0.7100	0.7000		1.0000	160.6697 (82)		
Solar gains	491.2161	848.3601	1192.4901	1532.0650	1766.7612	1776.5529	1703.3758	1524.6613	1309.4298	946.0942	590.4632	419.0308 (83)
Total gains	1028.2663	1383.9635	1709.0372	2016.6982	2216.7078	2194.8473	2102.2277	1927.7918	1729.9306	1398.6635	1080.0130	938.5119 (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	34.0107	34.0673	34.1229	34.3865	34.4362	34.6698	34.6698	34.7134	34.5795	34.4362	34.3357	34.2312
alpha	3.2674	3.2712	3.2749	3.2924	3.2957	3.3113	3.3113	3.3142	3.3053	3.2957	3.2890	3.2821
util living area	0.9926	0.9807	0.9548	0.8952	0.7872	0.6352	0.4916	0.5468	0.7672	0.9365	0.9855	0.9945 (86)
MIT	18.9066	19.2272	19.6720	20.1930	20.6142	20.8671	20.9575	20.9393	20.7392	20.1511	19.4137	18.8469 (87)
Th 2	19.9311	19.9327	19.9342	19.9415	19.9429	19.9492	19.9492	19.9504	19.9468	19.9429	19.9401	19.9372 (88)
util rest of house	0.9911	0.9767	0.9451	0.8724	0.7407	0.5565	0.3863	0.4398	0.7000	0.9179	0.9818	0.9933 (89)
MIT 2	18.0130	18.3321	18.7709	19.2778	19.6629	19.8746	19.9334	19.9259	19.7821	19.2499	18.5249	17.9580 (90)
Living area fraction									fLA = Living area / (4) =			0.0883 (91)
MIT	18.0919	18.4111	18.8505	19.3586	19.7469	19.9623	20.0239	20.0154	19.8666	19.3295	18.6034	18.0365 (92)
Temperature adjustment												0.0000
adjusted MIT	18.0919	18.4111	18.8505	19.3586	19.7469	19.9623	20.0239	20.0154	19.8666	19.3295	18.6034	18.0365 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	1015.0394	1340.7851	1593.6886	1728.9019	1620.3935	1223.6513	828.6277	861.4547	1200.8651	1264.3313	1053.3229	929.3384 (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	3510.6515	3433.4795	3133.4296	2633.1061	2022.9951	1338.9925	854.9575	901.6418	1443.7198	2194.5972	2900.4221	3499.3155 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	1856.7354	1406.2906	1145.5673	651.0270	299.5356	0.0000	0.0000	0.0000	0.0000	692.1178	1329.9115	1912.0630 (98)
Space heating												9293.2483 (98)
Space heating per m2										(98) / (4) =		43.3050 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	2347.2366	1847.8246	1895.3819	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8044	0.8665	0.8359	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1888.0008	1601.2287	1584.2676	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2590.2160	2483.6067	2296.6250	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	505.5949	656.4893	529.9939	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling													
Cooled fraction									FC = cooled area / (4) =			1692.0781	(104)
Intermittency factor (Table 10b)												1.0000	(105)
Intermittency factor	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	126.3987	164.1223	132.4985	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling													
Space cooling per m2												423.0195	(107)
Energy for space heating												1.9712	(108)
Energy for space cooling												43.3050	(99)
Total												1.9712	(108)
Dwelling Fabric Energy Efficiency (DFEE)												45.2762	(109)
												45.3	(109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	78.3000 (1b)	x 2.3300 (2b)	= 182.4390 (1b) - (3b)
First floor	78.2700 (1c)	x 2.8200 (2c)	= 220.7214 (1c) - (3c)
Second floor	58.0300 (1d)	x 2.1300 (2d)	= 123.6039 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	214.6000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 526.7643 (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					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) = 0.0759 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3259 (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) =				0.2770 (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	0.3532	0.3463	0.3394	0.3047	0.2978	0.2632	0.2632	0.2563	0.2770	0.2978	0.3117	0.3255 (22b)
Effective ac	0.5624	0.5600	0.5576	0.5464	0.5443	0.5346	0.5346	0.5328	0.5384	0.5443	0.5486	0.5530 (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
TER Semi-glazed door			4.3200	1.2000	5.1840		(26a)
TER Opening Type (Uw = 1.40)			31.5700	1.3258	41.8542		(27)
TER Room Window (Uw = 1.70)			8.3800	1.5918	13.3390		(27a)
150mm Platinum			78.3000	0.1300	10.1790		(28a)
50mm Platinum	208.4400	35.8900	172.5500	0.1800	31.0590		(29a)
Dormer Wall	7.3700		7.3700	0.1800	1.3266		(29a)
Wall to Roofspace	22.4600		22.4600	0.1800	4.0428		(29a)
Ceiling to Roofspace	21.0900		21.0900	0.1300	2.7417		(30)
Flat Roof	3.8900		3.8900	0.1300	0.5057		(30)
Horizontal Ceiling	21.3600		21.3600	0.1300	2.7768		(30)
Sloping Ceiling	42.7900	8.3800	34.4100	0.1300	4.4733		(30)
Total net area of external elements Aum(A, m ²)			405.7000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		117.4820		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							22.4935 (36)
Total fabric heat loss						(33) + (36) =	139.9755 (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	97.7609	97.3398	96.9270	94.9882	94.6255	92.9368	92.9368	92.6241	93.5873	94.6255	95.3593	96.1265 (38)
Heat transfer coeff	237.7364	237.3153	236.9025	234.9637	234.6010	232.9123	232.9123	232.5996	233.5628	234.6010	235.3348	236.1020 (39)
Average = Sum(39)m / 12 =												234.9620 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1078	1.1058	1.1039	1.0949	1.0932	1.0853	1.0853	1.0839	1.0884	1.0932	1.0966	1.1002 (40)
HLP (average)												1.0949 (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												3.0209 (42)
Average daily hot water use (litres/day)												105.9466 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	116.5412	112.3034	108.0655	103.8276	99.5898	95.3519	95.3519	99.5898	103.8276	108.0655	112.3034	116.5412 (44)
Energy conte	172.8273	151.1558	155.9793	135.9865	130.4823	112.5963	104.3370	119.7283	121.1582	141.1982	154.1289	167.3740 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1666.9522 (45)											
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (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)
Primary 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 (59)
Heat gains from water heating, kWh/month	36.7258	32.1206	33.1456	28.8971	27.7275	23.9267	22.1716	25.4423	25.7461	30.0046	32.7524	35.5670 (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)
(66)m	151.0454	151.0454	151.0454	151.0454	151.0454	151.0454	151.0454	151.0454	151.0454	151.0454	151.0454	151.0454	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	34.6559	30.7810	25.0328	18.9515	14.1664	11.9599	12.9231	16.7979	22.5461	28.6275	33.4125	35.6191	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	384.7181	388.7102	378.6501	357.2333	330.1983	304.7893	287.8145	283.8224	293.8825	315.2994	342.3343	367.7433	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.1045	38.1045	38.1045	38.1045	38.1045	38.1045	38.1045	38.1045	38.1045	38.1045	38.1045	38.1045	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-120.8363	-120.8363	-120.8363	-120.8363	-120.8363	-120.8363	-120.8363	-120.8363	-120.8363	-120.8363	-120.8363	-120.8363	(71)
Water heating gains (Table 5)	49.3626	47.7985	44.5505	40.1349	37.2681	33.2316	29.8006	34.1966	35.7585	40.3288	45.4894	47.8051	(72)
Total internal gains	537.0502	535.6034	516.5471	484.6333	449.9465	418.2944	398.8518	403.1305	420.5008	452.5693	489.5499	519.4811	(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
North			13.6500		10.6334		0.6300		0.7000		0.7700		44.3584 (74)
South			16.6800		46.7521		0.6300		0.7000		0.7700		238.3245 (78)
West			1.2400		19.6403		0.6300		0.7000		0.7700		7.4429 (80)
North			0.5100		15.6897		0.6300		0.7000		1.0000		3.1759 (82)
South			7.8700		45.6416		0.6300		0.7000		1.0000		142.5661 (82)
Solar gains	435.8678	752.7702	1058.1250	1359.4379	1567.6895	1576.3780	1511.4462	1352.8685	1161.8884	839.4920	523.9321		371.8161 (83)
Total gains	972.9180	1288.3737	1574.6721	1844.0712	2017.6361	1994.6724	1910.2980	1755.9990	1582.3892	1292.0613	1013.4820		891.2971 (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	62.6861	62.7974	62.9068	63.4259	63.5239	63.9845	63.9845	64.0705	63.8063	63.5239	63.3259	63.1201	
alpha	5.1791	5.1865	5.1938	5.2284	5.2349	5.2656	5.2656	5.2714	5.2538	5.2349	5.2217	5.2080	
util living area	0.9995	0.9976	0.9905	0.9608	0.8706	0.6987	0.5269	0.5910	0.8477	0.9828	0.9985	0.9997	(86)
MIT	19.6779	19.8814	20.1723	20.5264	20.8119	20.9571	20.9919	20.9858	20.8804	20.4826	20.0016	19.6417	(87)
Th 2	19.9945	19.9961	19.9976	20.0050	20.0064	20.0128	20.0128	20.0140	20.0103	20.0064	20.0036	20.0007	(88)
util rest of house	0.9993	0.9968	0.9870	0.9460	0.8247	0.6100	0.4137	0.4735	0.7777	0.9739	0.9978	0.9996	(89)
MIT 2	18.7777	18.9821	19.2723	19.6227	19.8804	19.9934	20.0108	20.0100	19.9441	19.5870	19.1085	18.7466	(90)
Living area fraction	fLA = Living area / (4) =												0.0883 (91)
MIT	18.8572	19.0615	19.3518	19.7025	19.9627	20.0785	20.0974	20.0962	20.0268	19.6661	19.1874	18.8256	(92)
Temperature adjustment													0.0000
adjusted MIT	18.8572	19.0615	19.3518	19.7025	19.9627	20.0785	20.0974	20.0962	20.0268	19.6661	19.1874	18.8256	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9990	0.9957	0.9840	0.9404	0.8223	0.6164	0.4237	0.4837	0.7791	0.9698	0.9971	0.9994	(94)
Useful gains	971.9392	1282.8579	1549.4879	1734.1434	1659.1819	1229.4330	809.3156	849.4381	1232.8394	1252.9937	1010.4978	890.7254	(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	3460.7791	3360.7460	3044.6277	2538.2026	1938.4368	1276.0077	814.5939	859.7238	1384.2691	2126.9144	2844.5815	3453.1363	(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	1851.6970	1396.3408	1112.3840	578.9226	207.7657	0.0000	0.0000	0.0000	0.0000	650.1970	1320.5403	1906.4337	(98)
Space heating													9024.2810 (98)
Space heating per m2	(98) / (4) =												42.0516 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

Ext. temp.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	2189.3760	1723.5513	1767.7572	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8717	0.9315	0.9044	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1908.5467	1605.5694	1598.8087	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2369.8655	2272.2985	2107.3006	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	332.1495	496.0465	378.3180	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												1206.5140	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	83.0374	124.0116	94.5795	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												301.6285	(107)
Space cooling per m2												1.4055	(108)
Energy for space heating												42.0516	(99)
Energy for space cooling												1.4055	(108)
Total												43.4572	(109)
Target Fabric Energy Efficiency (TFEE)												50.0	(109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	P341 WDH7 Detached			Issued on Date	17/12/2021
Assessment Reference	1	Prop Type Ref			
Property	DS03 Hadley (Hipped Roof), Detached, Part L2013 Masonry, David Wilson Homes				
SAP Rating	83 B	DER	18.86	TER	19.02
Environmental	84 B	% DER<TER	0.85		
CO ₂ Emissions (t/year)	1.54	DFEE	54.88	TFEE	59.12
General Requirements Compliance	Pass	% DFEE<TFEE	7.18		
Assessor Details	Mr. Andrew Maughan, Andrew Maughan, Tel: 01582 544250, Andrew.Maughan@ee-ltd.co.uk			Assessor ID	V844-0001
Client					

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS DESIGNED

Detached House, total floor area 92 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 19.02 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 18.86 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)59.1 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)54.9 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Floor	0.15 (max. 0.25)	0.15 (max. 0.70)	OK
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.39 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals: 5.01 (design value)
Maximum 10.0 OK

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Ideal LOGIC COMBI ESPl 35
Combi boiler
Efficiency: 89.6% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

7 Low energy lights

Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Midlands): Not significant OK

Based on:

Overshading: Average
Windows facing East: 9.31 m², No overhang
Windows facing West: 6.39 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features

Roof U-value 0.11 W/m²K

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	45.8200 (1b)	x 2.3100 (2b)	= 105.8442 (1b) - (3b)
First floor	45.8200 (1c)	x 2.5600 (2c)	= 117.2992 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	91.6400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 223.1434 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour				
										heating	heating							
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																5 * 10 =	50.0000 (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) =							50.0000 / (5) =	0.2241 (8)
Pressure test																	Yes	
Measured/design AP50																	5.0100	
Infiltration rate																	0.4746	(18)
Number of sides sheltered																	0	(19)
Shelter factor																	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor																	(21) = (18) x (20) =	0.4746 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec						
	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	0.6051	0.5932	0.5813	0.5220	0.5102	0.4508	0.4508	0.4390	0.4746	0.5102	0.5339	0.5576	(22b)					
Effective ac	0.6831	0.6760	0.6690	0.6363	0.6301	0.6016	0.6016	0.5964	0.6126	0.6301	0.6425	0.6555	(25)					

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
Opening Type 1 (Uw = 1.41)			15.7000	1.3347	20.9551			(27)					
Opening Type 4			2.3800	1.2000	2.8560			(26a)					
Opening Type 6			2.0000	1.5000	3.0000			(26a)					
150mm TE Platinum GF			45.8200	0.1500	6.8730			(28a)					
50mm Alreflex Plat	134.9400	20.0800	114.8600	0.2700	31.0122			(29a)					
1st Flr Horiz Cl	45.8200		45.8200	0.1100	5.0402			(30)					
Total net area of external elements Aum(A, m2)			226.5800					(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		69.7365			(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								171.5000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								9.2641 (36)					
Total fabric heat loss						(33) + (36) =		79.0006 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 50.2987	Feb 49.7753	Mar 49.2622	Apr 46.8522	May 46.4014	Jun 44.3024	Jul 44.3024	Aug 43.9137	Sep 45.1109	Oct 46.4014	Nov 47.3135	Dec 48.2671	(38)
Heat transfer coeff	129.2993	128.7758	128.2628	125.8528	125.4019	123.3030	123.3030	122.9143	124.1115	125.4019	126.3141	127.2677	(39)
Average = Sum(39)m / 12 =												125.8507	(39)
HLP	Jan 1.4109	Feb 1.4052	Mar 1.3996	Apr 1.3733	May 1.3684	Jun 1.3455	Jul 1.3455	Aug 1.3413	Sep 1.3543	Oct 1.3684	Nov 1.3784	Dec 1.3888	(40)
HLP (average)												1.3733	(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												2.6475 (42)
Average daily hot water use (litres/day)												97.0783 (43)
Daily hot water use	Jan 106.7862	Feb 102.9030	Mar 99.0199	Apr 95.1368	May 91.2536	Jun 87.3705	Jul 87.3705	Aug 91.2536	Sep 95.1368	Oct 99.0199	Nov 102.9030	Dec 106.7862 (44)
Energy conte	158.3608	138.5034	142.9231	124.6038	119.5603	103.1715	95.6035	109.7064	111.0167	129.3792	141.2276	153.3640 (45)
Energy content (annual)										Total = Sum(45)m =		1527.4203 (45)
Distribution loss (46)m = 0.15 x (45)m	23.7541	20.7755	21.4385	18.6906	17.9340	15.4757	14.3405	16.4560	16.6525	19.4069	21.1841	23.0046 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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	14.1366	12.7577	14.0962	13.5973	14.0184	13.5291	13.9570	13.9968	13.5663	14.0640	13.6517	14.1246	(61)
Total heat required for water heating calculated for each month	172.4974	151.2611	157.0193	138.2011	133.5787	116.7006	109.5606	123.7033	124.5830	143.4433	154.8793	167.4886	(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	172.4974	151.2611	157.0193	138.2011	133.5787	116.7006	109.5606	123.7033	124.5830	143.4433	154.8793	167.4886	(64)
Heat gains from water heating, kWh/month	56.1891	49.2418	51.0460	44.8301	43.2584	37.6868	35.2774	39.9766	40.3046	46.5346	50.3711	54.5247	(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	132.3755	132.3755	132.3755	132.3755	132.3755	132.3755	132.3755	132.3755	132.3755	132.3755	132.3755	132.3755	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.2260	19.7410	16.0544	12.1542	9.0854	7.6703	8.2880	10.7731	14.4596	18.3598	21.4286	22.8438	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	242.0627	244.5746	238.2448	224.7694	207.7592	191.7720	181.0915	178.5797	184.9095	198.3848	215.3951	231.3823	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.2375	36.2375	36.2375	36.2375	36.2375	36.2375	36.2375	36.2375	36.2375	36.2375	36.2375	36.2375	(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)	-105.9004	-105.9004	-105.9004	-105.9004	-105.9004	-105.9004	-105.9004	-105.9004	-105.9004	-105.9004	-105.9004	-105.9004	(71)
Water heating gains (Table 5)	75.5230	73.2765	68.6102	62.2640	58.1430	52.3428	47.4159	53.7320	55.9786	62.5465	69.9599	73.2859	(72)
Total internal gains	405.5244	403.3047	388.6221	364.9003	340.7003	317.4977	302.5081	308.7974	321.0604	345.0038	372.4962	393.2246	(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				9.3100	19.6403			0.7100	0.7000	0.7700		62.9777
West				6.3900	19.6403			0.7100	0.7000	0.7700		43.2253 (80)
Solar gains	106.2030	207.7555	342.1437	498.9962	611.5386	626.0186	595.9952	511.9511	397.9273	246.5194	132.4226	87.3361 (83)
Total gains	511.7274	611.0602	730.7658	863.8965	952.2389	943.5163	898.5033	820.7485	718.9877	591.5232	504.9188	480.5607 (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	33.7637	33.9010	34.0366	34.6884	34.8131	35.4057	35.4057	35.5177	35.1751	34.8131	34.5617	34.3027	34.3027	
alpha	3.2509	3.2601	3.2691	3.3126	3.3209	3.3604	3.3604	3.3678	3.3450	3.3209	3.3041	3.2868	3.2868	
util living area	0.9929	0.9868	0.9708	0.9275	0.8396	0.6977	0.5544	0.6129	0.8321	0.9591	0.9883	0.9943	0.9943	(86)
MIT	18.8829	19.1124	19.5212	20.0669	20.5252	20.8296	20.9422	20.9187	20.6647	20.0460	19.3766	18.8604	18.8604	(87)
Th 2	19.7549	19.7593	19.7636	19.7838	19.7876	19.8054	19.8054	19.8086	19.7985	19.7876	19.7800	19.7719	19.7719	(88)
util rest of house	0.9911	0.9834	0.9630	0.9070	0.7922	0.6070	0.4238	0.4831	0.7635	0.9437	0.9848	0.9928	0.9928	(89)
MIT 2	16.9547	17.2911	17.8855	18.6735	19.2948	19.6736	19.7779	19.7657	19.4973	18.6613	17.6904	16.9319	16.9319	(90)
Living area fraction	17.3166	17.6330	18.1925	18.9351	19.5258	19.8906	19.9964	19.9821	19.7164	18.9212	18.0069	17.2938	17.2938	(91)
MIT	17.3166	17.6330	18.1925	18.9351	19.5258	19.8906	19.9964	19.9821	19.7164	18.9212	18.0069	17.2938	17.2938	(92)
Temperature adjustment	17.1666	17.4830	18.0425	18.7851	19.3758	19.7406	19.8464	19.8321	19.5664	18.7712	17.8569	17.1438	17.1438	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	504.0048	594.9678	692.0625	764.3703	735.7847	567.4898	385.1820	398.8025	537.1015	547.0550	492.6972	474.5959	(94)
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	1663.6425	1620.3819	1480.4757	1244.0632	962.5566	633.8496	400.2924	421.8569	678.4458	1024.6870	1358.7497	1647.3326	(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	862.7705	689.0782	586.5794	345.3788	168.7183	0.0000	0.0000	0.0000	0.0000	355.3582	623.5579	872.5161	(98)
Space heating												4503.9573	(98)
Space heating per m2												49.1484	(99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4976.7484 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	862.7705	689.0782	586.5794	345.3788	168.7183	0.0000	0.0000	0.0000	0.0000	355.3582	623.5579	872.5161	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	953.3375	761.4124	648.1540	381.6341	186.4290	0.0000	0.0000	0.0000	0.0000	392.6610	689.0142	964.1062	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	172.4974	151.2611	157.0193	138.2011	133.5787	116.7006	109.5606	123.7033	124.5830	143.4433	154.8793	167.4886	(64)
Efficiency of water heater (217)m	89.9506	89.9068	89.8049	89.5618	89.0575	87.3000	87.3000	87.3000	87.3000	89.5560	89.8448	87.3000	(216)
Fuel for water heating, kWh/month	191.7690	168.2421	174.8449	154.3081	149.9915	133.6777	125.4989	141.6990	142.7067	160.1716	172.3855	186.1628	(219)
Water heating fuel used												1901.4579	(219)
Annual totals kWh/year													
Space heating fuel - main system												4976.7484	(211)
Space heating fuel - secondary												0.0000	(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)												392.5187	(232)
Total delivered energy for all uses												7345.7250	(238)

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	4976.7484	0.2160	1074.9777 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1901.4579	0.2160	410.7149 (264)
Space and water heating			1485.6926 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	392.5187	0.5190	203.7172 (268)
Total CO2, kg/year			1728.3348 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			18.8600 (273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		18.8600 ZC1
Total Floor Area	TFA	91.6400
Assumed number of occupants	N	2.6475
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190
CO2 emissions from appliances, equation (L14)		15.6527 ZC2
CO2 emissions from cooking, equation (L16)		1.9919 ZC3
Total CO2 emissions		36.5046 ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000 ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000 ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000 ZC7
Net CO2 emissions		36.5046 ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	45.8200 (1b)	x 2.3100 (2b)	= 105.8442 (1b) - (3b)
First floor	45.8200 (1c)	x 2.5600 (2c)	= 117.2992 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	91.6400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 223.1434 (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)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1344 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3844 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3844 (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	0.4902	0.4806	0.4709	0.4229	0.4133	0.3652	0.3652	0.3556	0.3844	0.4133	0.4325	0.4517 (22b)
Effective ac	0.6201	0.6155	0.6109	0.5894	0.5854	0.5667	0.5667	0.5632	0.5739	0.5854	0.5935	0.6020 (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
TER Semi-glazed door			4.3800	1.2000	5.2560		(26a)
TER Opening Type (Uw = 1.40)			15.7000	1.3258	20.8144		(27)
150mm TE Platinum GF			45.8200	0.1300	5.9566		(28a)
50mm Alreflex Plat	134.9400	20.0800	114.8600	0.1800	20.6748		(29a)
1st Flr Horiz Cl	45.8200		45.8200	0.1300	5.9566		(30)
Total net area of external elements Aum(A, m ²)			226.5800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		58.6584		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.8049 (36)
Total fabric heat loss						(33) + (36) =	69.4633 (37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)							
(38)m	45.6648	45.3213	44.9845	43.4031	43.1072	41.7298	41.7298
Heat transfer coeff	115.1280	114.7845	114.4478	112.8664	112.5705	111.1931	111.1931
Average = Sum(39)m / 12 =							112.8649 (39)
HLP	1.2563	1.2526	1.2489	1.2316	1.2284	1.2134	1.2134
HLP (average)							1.2106
Days in month	31	28	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6475 (42)
Average daily hot water use (litres/day)												97.0783 (43)
Daily hot water use	106.7862	102.9030	99.0199	95.1368	91.2536	87.3705	87.3705	91.2536	95.1368	99.0199	102.9030	106.7862 (44)
Energy conte	158.3608	138.5034	142.9231	124.6038	119.5603	103.1715	95.6035	109.7064	111.0167	129.3792	141.2276	153.3640 (45)
Energy content (annual)										Total = Sum(45)m =		1527.4203 (45)
Distribution loss (46)m = 0.15 x (45)m	23.7541	20.7755	21.4385	18.6906	17.9340	15.4757	14.3405	16.4560	16.6525	19.4069	21.1841	23.0046 (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												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Combi 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 (57)
Total heat required for water heating calculated for each month	50.9589	46.0274	50.4595	46.9168	46.5019	43.0868	44.5231	46.5019	46.9168	50.4595	49.3151	50.9589 (61)
Solar input	209.3197	184.5308	193.3825	171.5206	166.0622	146.2583	140.1266	156.2083	157.9334	179.8387	190.5426	204.3229 (62)
Output from w/h	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)
Heat gains from water heating, kWh/month	209.3197	184.5308	193.3825	171.5206	166.0622	146.2583	140.1266	156.2083	157.9334	179.8387	190.5426	204.3229 (64)
	65.3947	57.5592	60.1368	53.1600	51.3793	45.0762	42.9189	48.1029	48.6422	55.6335	59.2869	63.7333 (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	132.3755	132.3755	132.3755	132.3755	132.3755	132.3755	132.3755	132.3755	132.3755	132.3755	132.3755	132.3755	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.2260	19.7410	16.0544	12.1542	9.0854	7.6703	8.2880	10.7731	14.4596	18.3598	21.4286	22.8438	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	242.0627	244.5746	238.2448	224.7694	207.7592	191.7720	181.0915	178.5797	184.9095	198.3848	215.3951	231.3823	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.2375	36.2375	36.2375	36.2375	36.2375	36.2375	36.2375	36.2375	36.2375	36.2375	36.2375	36.2375	(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)	-105.9004	-105.9004	-105.9004	-105.9004	-105.9004	-105.9004	-105.9004	-105.9004	-105.9004	-105.9004	-105.9004	-105.9004	(71)
Water heating gains (Table 5)	87.8961	85.6536	80.8290	73.8333	69.0582	62.6059	57.6867	64.6544	67.5587	74.7762	82.3430	85.6630	(72)
Total internal gains	417.8975	415.6818	400.8409	376.4696	351.6154	327.7608	312.7789	319.7198	332.6404	357.2335	384.8793	405.6017	(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					9.3100	19.6403	0.6300	0.7000				0.7700	55.8816
West					6.3900	19.6403	0.6300	0.7000				0.7700	38.3548 (76)
Solar gains	94.2364	184.3464	303.5923	442.7713	542.6328	555.4813	528.8408	454.2665	353.0904	218.7426	117.5017		77.4954 (83)
Total gains	512.1339	600.0282	704.4332	819.2409	894.2483	883.2420	841.6198	773.9862	685.7308	575.9760	502.3810		483.0971 (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	55.2766	55.4420	55.6051	56.3843	56.5325	57.2328	57.2328	57.3644	56.9610	56.5325	56.2335	55.9242	
alpha	4.6851	4.6961	4.7070	4.7590	4.7688	4.8155	4.8155	4.8243	4.7974	4.7688	4.7489	4.7283	
util living area	0.9985	0.9966	0.9897	0.9629	0.8848	0.7284	0.5627	0.6263	0.8721	0.9825	0.9970	0.9989	(86)
MIT	19.5812	19.7424	20.0313	20.4175	20.7417	20.9308	20.9841	20.9741	20.8251	20.3888	19.9179	19.5594	(87)
Th 2	19.8752	19.8782	19.8811	19.8948	19.8973	19.9093	19.9093	19.9115	19.9047	19.8973	19.8922	19.8867	(88)
util rest of house	0.9980	0.9953	0.9859	0.9482	0.8394	0.6332	0.4326	0.4940	0.8036	0.9731	0.9957	0.9985	(89)
MIT 2	17.9874	18.2249	18.6470	19.2083	19.6426	19.8631	19.9036	19.9009	19.7603	19.1779	18.4917	17.9635	(90)
Living area fraction	18.2865	18.5097	18.9068	19.4352	19.8489	20.0635	20.1064	20.1023	19.9601	19.4052	18.7594	18.2630	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2865	18.5097	18.9068	19.4352	19.8489	20.0635	20.1064	20.1023	19.9601	19.4052	18.7594	18.2630	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	510.5012	595.8784	691.0901	770.2326	748.4970	572.2208	384.6781	401.4270	553.9426	557.0258	499.1965	481.9251	(94)
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	1610.2419	1562.1831	1419.9352	1189.0715	917.3205	607.5067	389.8831	410.7266	654.7135	991.2056	1319.4795	1600.3001	(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	818.2070	649.3568	542.2608	301.5640	125.6047	0.0000	0.0000	0.0000	0.0000	323.0297	590.6038	832.0710	(98)
Space heating												4182.6978	(98)
Space heating per m2												45.6427	(99)

8c. Space cooling requirement

Not applicable

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4478.2631 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	818.2070	649.3568	542.2608	301.5640	125.6047	0.0000	0.0000	0.0000	0.0000	323.0297	590.6038	832.0710	(98)
Space heating efficiency (main heating system 1)	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)	876.0246	695.2428	580.5790	322.8737	134.4804	0.0000	0.0000	0.0000	0.0000	345.8562	632.3381	890.8683	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	209.3197	184.5308	193.3825	171.5206	166.0622	146.2583	140.1266	156.2083	157.9334	179.8387	190.5426	204.3229	(64)
Efficiency of water heater (217)m	88.1416	87.9520	87.5067	86.4574	84.3588	80.3000	80.3000	80.3000	80.3000	86.5087	87.7090	88.2126	(217)
Fuel for water heating, kWh/month	237.4812	209.8085	220.9917	198.3874	196.8521	182.1398	174.5038	194.5309	196.6793	207.8851	217.2440	231.6255	(219)
Water heating fuel used												2468.1295	(219)
Annual totals kWh/year													
Space heating fuel - main system												4478.2631	(211)
Space heating fuel - secondary												0.0000	(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)												392.5187	(232)
Total delivered energy for all uses												7413.9113	(238)

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	4478.2631	0.2160	967.3048 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2468.1295	0.2160	533.1160 (264)
Space and water heating			1500.4208 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	392.5187	0.5190	203.7172 (268)
Total CO2, kg/m2/year			1743.0630 (272)
Emissions per m2 for space and water heating			16.3730 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.2230 (272b)
Emissions per m2 for pumps and fans			0.4248 (272c)
Target Carbon Dioxide Emission Rate (TER) = (16.3730 * 1.00) + 2.2230 + 0.4248, rounded to 2 d.p.			19.0200 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	45.8200 (1b)	x 2.3100 (2b)	= 105.8442 (1b) - (3b)
First floor	45.8200 (1c)	x 2.5600 (2c)	= 117.2992 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	91.6400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 223.1434 (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)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1344 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.3849 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3849 (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	0.4908	0.4812	0.4716	0.4234	0.4138	0.3657	0.3657	0.3561	0.3849	0.4138	0.4331	0.4523 (22b)
Effective ac	0.6204	0.6158	0.6112	0.5896	0.5856	0.5669	0.5669	0.5634	0.5741	0.5856	0.5938	0.6023 (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
Opening Type 1 (Uw = 1.41)			15.7000	1.3347	20.9551		(27)
Opening Type 4			2.3800	1.2000	2.8560		(26a)
Opening Type 6			2.0000	1.5000	3.0000		(26a)
150mm TE Platinum GF			45.8200	0.1500	6.8730		(28a)
50mm Alreflex Plat	134.9400	20.0800	114.8600	0.2700	31.0122		(29a)
1st Flr Horiz Cl	45.8200		45.8200	0.1100	5.0402		(30)
Total net area of external elements Aum(A, m ²)			226.5800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	69.7365		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							171.5000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.2641 (36)
Total fabric heat loss						(33) + (36) =	79.0006 (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	45.6878	45.3434	45.0058	43.4202	43.1235	41.7425	41.7425	41.4868	42.2745	43.1235	43.7237	44.3511 (38)
Heat transfer coeff	124.6884	124.3440	124.0064	122.4208	122.1241	120.7431	120.7431	120.4874	121.2751	122.1241	122.7243	123.3517 (39)
Average = Sum(39)m / 12 =												122.4194 (39)
HLP	1.3606	1.3569	1.3532	1.3359	1.3327	1.3176	1.3176	1.3148	1.3234	1.3327	1.3392	1.3460 (40)
HLP (average)												1.3359 (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												2.6475 (42)
Average daily hot water use (litres/day)												97.0783 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	106.7862	102.9030	99.0199	95.1368	91.2536	87.3705	87.3705	91.2536	95.1368	99.0199	102.9030	106.7862 (44)
Energy content (annual)	158.3608	138.5034	142.9231	124.6038	119.5603	103.1715	95.6035	109.7064	111.0167	129.3792	141.2276	153.3640 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1527.4203 (45)
Water 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 (46)
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)

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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	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month	33.6517	29.4320	30.3712	26.4783	25.4066	21.9239	20.3157	23.3126	23.5910	27.4931	30.0109	32.5898 (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	132.3755	132.3755	132.3755	132.3755	132.3755	132.3755	132.3755	132.3755	132.3755	132.3755	132.3755	132.3755	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.2260	19.7410	16.0544	12.1542	9.0854	7.6703	8.2880	10.7731	14.4596	18.3598	21.4286	22.8438	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	242.0627	244.5746	238.2448	224.7694	207.7592	191.7720	181.0915	178.5797	184.9095	198.3848	215.3951	231.3823	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.2375	36.2375	36.2375	36.2375	36.2375	36.2375	36.2375	36.2375	36.2375	36.2375	36.2375	36.2375	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-105.9004	-105.9004	-105.9004	-105.9004	-105.9004	-105.9004	-105.9004	-105.9004	-105.9004	-105.9004	-105.9004	-105.9004	(71)
Water heating gains (Table 5)	45.2307	43.7976	40.8214	36.7754	34.1486	30.4499	27.3061	31.3342	32.7653	36.9531	41.6817	43.8036	(72)
Total internal gains	372.2322	370.8258	357.8333	336.4117	313.7059	292.6048	279.3983	283.3996	294.8471	316.4104	341.2181	360.7422	(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					9.3100	19.6403	0.7100		0.7000			0.7700			62.9777 (76)
West					6.3900	19.6403	0.7100		0.7000			0.7700			43.2253 (80)

Solar gains	106.2030	207.7555	342.1437	498.9962	611.5386	626.0186	595.9952	511.9511	397.9273	246.5194	132.4226			87.3361 (83)	
Total gains	478.4351	578.5813	699.9770	835.4080	925.2445	918.6234	875.3935	795.3506	692.7744	562.9298	473.6407			448.0784 (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	35.0123	35.1093	35.2049	35.6608	35.7475	36.1563	36.1563	36.2331	35.9977	35.7475	35.5727	35.3917	
alpha	3.3342	3.3406	3.3470	3.3774	3.3832	3.4104	3.4104	3.4155	3.3998	3.3832	3.3715	3.3594	
util living area	0.9943	0.9887	0.9736	0.9314	0.8437	0.7024	0.5580	0.6197	0.8396	0.9635	0.9904	0.9954	(86)
MIT	18.9162	19.1438	19.5492	20.0827	20.5364	20.8329	20.9440	20.9195	20.6662	20.0500	19.3879	18.8835	(87)
Th 2	19.7936	19.7966	19.7994	19.8128	19.8153	19.8271	19.8271	19.8293	19.8226	19.8153	19.8103	19.8049	(88)
util rest of house	0.9928	0.9858	0.9665	0.9120	0.7976	0.6132	0.4290	0.4913	0.7734	0.9496	0.9874	0.9943	(89)
MIT 2	17.9040	18.1324	18.5356	19.0640	19.4850	19.7382	19.8086	19.7998	19.6156	19.0440	18.3866	17.8796	(90)
Living area fraction									fLA = Living area / (4) =			0.1877	(91)
MIT	18.0940	18.3222	18.7259	19.2552	19.6823	19.9436	20.0217	20.0100	19.8128	19.2328	18.5745	18.0681	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.0940	18.3222	18.7259	19.2552	19.6823	19.9436	20.0217	20.0100	19.8128	19.2328	18.5745	18.0681	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	473.5689	567.4915	670.5948	752.3715	732.3958	572.3045	395.6619	407.9968	535.3362	529.3824	465.5932	444.3957	(94)
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	(95)
Heat loss rate W	1719.9498	1668.9728	1516.0868	1267.6876	974.8327	645.2088	413.1518	434.9585	692.8157	1054.2765	1408.2054	1710.6489	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	927.3074	740.1955	629.0460	371.0276	180.3731	0.0000	0.0000	0.0000	0.0000	390.5211	678.6808	942.0924	(98)
Space heating												4859.2439	(98)
Space heating per m2												53.0254	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1134.9853	893.4991	915.7041	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7862	0.8520	0.8166	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	892.2849	761.2867	747.7551	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1174.0453	1121.4126	1029.6709	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	202.8675	267.9337	209.7453	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												680.5465	(104)

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Cooled fraction											FC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	50.7169	66.9834	52.4363	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												170.1366 (107)
Space cooling per m2												1.8566 (108)
Energy for space heating												53.0254 (99)
Energy for space cooling												1.8566 (108)
Total												54.8819 (109)
Dwelling Fabric Energy Efficiency (DFEE)												54.9 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	45.8200 (1b)	x 2.3100 (2b)	= 105.8442 (1b) - (3b)
First floor	45.8200 (1c)	x 2.5600 (2c)	= 117.2992 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	91.6400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 223.1434 (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)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1344 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3844 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3844 (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	0.4902	0.4806	0.4709	0.4229	0.4133	0.3652	0.3652	0.3556	0.3844	0.4133	0.4325	0.4517 (22b)
Effective ac	0.6201	0.6155	0.6109	0.5894	0.5854	0.5667	0.5667	0.5632	0.5739	0.5854	0.5935	0.6020 (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
TER Semi-glazed door			4.3800	1.2000	5.2560		(26a)
TER Opening Type (Uw = 1.40)			15.7000	1.3258	20.8144		(27)
150mm TE Platinum GF			45.8200	0.1300	5.9566		(28a)
50mm Alreflex Plat	134.9400	20.0800	114.8600	0.1800	20.6748		(29a)
1st Flr Horiz Cl	45.8200		45.8200	0.1300	5.9566		(30)
Total net area of external elements Aum(A, m ²)			226.5800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	58.6584		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.8049 (36)
Total fabric heat loss						(33) + (36) =	69.4633 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	45.6648	45.3213	44.9845	43.4031	43.1072	41.7298	41.7298	41.4747	42.2603	43.1072	43.7058	44.3315 (38)
Heat transfer coeff	115.1280	114.7845	114.4478	112.8664	112.5705	111.1931	111.1931	110.9380	111.7236	112.5705	113.1691	113.7948 (39)
Average = Sum(39)m / 12 =												112.8649 (39)
HLP	1.2563	1.2526	1.2489	1.2316	1.2284	1.2134	1.2134	1.2106	1.2192	1.2284	1.2349	1.2418 (40)
HLP (average)												1.2316 (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												2.6475 (42)
Average daily hot water use (litres/day)												97.0783 (43)
Daily hot water use	106.7862	102.9030	99.0199	95.1368	91.2536	87.3705	87.3705	91.2536	95.1368	99.0199	102.9030	106.7862 (44)
Energy conte	158.3608	138.5034	142.9231	124.6038	119.5603	103.1715	95.6035	109.7064	111.0167	129.3792	141.2276	153.3640 (45)
Energy content (annual)										Total = Sum(45)m =		1527.4203 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (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												

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Calculation Type: New Build (As Designed)

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Primary 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 (57)
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
	33.6517	29.4320	30.3712	26.4783	25.4066	21.9239	20.3157	23.3126	23.5910	27.4931	30.0109	32.5898 (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	132.3755	132.3755	132.3755	132.3755	132.3755	132.3755	132.3755	132.3755	132.3755	132.3755	132.3755	132.3755	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.2260	19.7410	16.0544	12.1542	9.0854	7.6703	8.2880	10.7731	14.4596	18.3598	21.4286	22.8438	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	242.0627	244.5746	238.2448	224.7694	207.7592	191.7720	181.0915	178.5797	184.9095	198.3848	215.3951	231.3823	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.2375	36.2375	36.2375	36.2375	36.2375	36.2375	36.2375	36.2375	36.2375	36.2375	36.2375	36.2375	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-105.9004	-105.9004	-105.9004	-105.9004	-105.9004	-105.9004	-105.9004	-105.9004	-105.9004	-105.9004	-105.9004	-105.9004	(71)
Water heating gains (Table 5)	45.2307	43.7976	40.8214	36.7754	34.1486	30.4499	27.3061	31.3342	32.7653	36.9531	41.6817	43.8036	(72)
Total internal gains	372.2322	370.8258	357.8333	336.4117	313.7059	292.6048	279.3983	283.3996	294.8471	316.4104	341.2181	360.7422	(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				9.3100	19.6403	0.6300	0.7000	0.7700	55.8816 (76)			
West				6.3900	19.6403	0.6300	0.7000	0.7700	38.3548 (80)			
Solar gains	94.2364	184.3464	303.5923	442.7713	542.6328	555.4813	528.8408	454.2665	353.0904	218.7426	117.5017	77.4954 (83)
Total gains	466.4686	555.1722	661.4256	779.1830	856.3387	848.0861	808.2391	737.6660	647.9375	535.1529	458.7198	438.2377 (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	55.2766	55.4420	55.6051	56.3843	56.5325	57.2328	57.2328	57.3644	56.9610	56.5325	56.2335	55.9242	
alpha	4.6851	4.6961	4.7070	4.7590	4.7688	4.8155	4.8155	4.8243	4.7974	4.7688	4.7489	4.7283	
util living area	0.9990	0.9975	0.9920	0.9691	0.8983	0.7484	0.5828	0.6510	0.8908	0.9869	0.9980	0.9993	(86)
MIT	19.5355	19.6979	19.9899	20.3834	20.7194	20.9221	20.9816	20.9695	20.8040	20.3507	19.8744	19.5144	(87)
Th 2	19.8752	19.8782	19.8811	19.8948	19.8973	19.9093	19.9093	19.9115	19.9047	19.8973	19.8922	19.8867	(88)
util rest of house	0.9987	0.9966	0.9890	0.9564	0.8560	0.6540	0.4496	0.5164	0.8279	0.9796	0.9971	0.9990	(89)
MIT 2	18.5408	18.7052	18.9979	19.3942	19.7056	19.8732	19.9047	19.9028	19.7912	19.3696	18.8927	18.5287	(90)
Living area fraction													
MIT	18.7275	18.8915	19.1841	19.5798	19.8959	20.0700	20.1068	20.1030	19.9813	19.5537	19.0770	18.7137	(91)
Temperature adjustment													
adjusted MIT	18.7275	18.8915	19.1841	19.5798	19.8959	20.0700	20.1068	20.1030	19.9813	19.5537	19.0770	18.7137	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	465.5938	552.6901	652.4227	741.5932	732.9950	567.6577	383.8099	399.6254	539.8978	522.5659	456.9477	437.6301	(94)
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	1661.0092	1606.0096	1451.6689	1205.3941	922.6185	608.2290	389.9319	410.8009	657.0826	1007.9233	1355.4244	1651.5856	(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	889.3891	707.8307	594.6392	333.9367	141.0799	0.0000	0.0000	0.0000	0.0000	361.1059	646.9032	903.1829	(98)
Space heating												4578.0675	(98)
Space heating per m2												49.9571	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1045.2147	822.8286	843.1286	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8455	0.9099	0.8781	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	883.7442	748.6938	740.3604	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1091.5991	1042.9204	962.2473	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	149.6555	218.9046	165.0838	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												533.6439	(104)
Cooled fraction												1.0000	(105)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	37.4139	54.7261	41.2710	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling											133.4110 (107)
Space cooling per m2											1.4558 (108)
Energy for space heating											49.9571 (99)
Energy for space cooling											1.4558 (108)
Total											51.4129 (109)
Target Fabric Energy Efficiency (TFEE)											59.1 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	T310 -I-7 Mid Terrace			Issued on Date	17/12/2021
Assessment Reference	1	Prop Type Ref			
Property	Kennett, Mid Terr, David Wilson Homes				
SAP Rating	86 B	DER	14.50	TER	15.28
Environmental	88 B	% DER<TER	5.13		
CO ₂ Emissions (t/year)	1.34	DFEE	38.97	TFEE	42.81
General Requirements Compliance	Pass	% DFEE<TFEE	8.97		
Assessor Details	Mr. Andrew Maughan, Andrew Maughan, Tel: 01582 544250, Andrew.Maughan@ee-ltd.co.uk			Assessor ID	V844-0001
Client					

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS DESIGNED

Mid-Terrace House, total floor area 106 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating: Mains gas
Fuel factor: 1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 15.28 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 14.50 kgCO₂/m² OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 42.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 39.0 kWh/m²/yr OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.23 (max. 0.30)	0.30 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.20 (max. 0.35)	OK
Openings	1.42 (max. 2.00)	1.80 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals: 5.01 (design value)
Maximum 10.0 OK

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Ideal LOGIC COMBI ESP1 35
Combi boiler
Efficiency: 89.6% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation

Hot water storage: No cylinder

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

7 Low energy lights

Percentage of fixed lights with low-energy fittings: 100%
Minimum 75% OK

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Midlands): Not significant OK
Based on:
Overshading: Average
Windows facing North: 0.84 m², No overhang
Windows facing South East: 6.45 m², No overhang
Windows facing West: 0.84 m², No overhang
Windows facing North West: 4.39 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

External wall U-value 0.12 W/m²K
Party wall U-value 0.00 W/m²K
Roof U-value 0.12 W/m²K
Door U-value 1.10 W/m²K

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	38.9400 (1b)	x 2.3300 (2b)	= 90.7302 (1b) - (3b)
First floor	37.9800 (1c)	x 2.6300 (2c)	= 99.8874 (1c) - (3c)
Second floor	29.4500 (1d)	x 2.4000 (2d)	= 70.6800 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	106.3700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 261.2976 (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					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour 40.0000 / (5) = 0.1531 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.4036 (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) =		0.3430 (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	0.4374	0.4288	0.4202	0.3773	0.3688	0.3259	0.3259	0.3173	0.3430	0.3688	0.3859	0.4031 (22b)
Effective ac	0.5957	0.5919	0.5883	0.5712	0.5680	0.5531	0.5531	0.5503	0.5588	0.5680	0.5745	0.5812 (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
Opening Type 1			2.3500	1.1000	2.5850		(26a)
Opening Type 2 (Uw = 1.41)			12.5200	1.3347	16.7107		(27)
Opening Type 12 (Uw = 1.80)			2.1800	1.6791	3.6604		(27a)
150mm TE Platinum GF			38.9400	0.1400	5.4516		(28a)
50mm A Platinum	48.1100	13.9000	34.2100	0.2700	9.2367		(29a)
Dormer Wall	1.1500	0.9700	0.1800	0.3000	0.0540		(29a)
Wall to Roofspace	12.6700		12.6700	0.1200	1.5204		(29a)
Ceiling to Apex	10.6900		10.6900	0.2000	2.1380		(30)
Ceiling to Roofspace	8.5300		8.5300	0.1200	1.0236		(30)
Flat Roof	2.1000		2.1000	0.1700	0.3570		(30)
Sloping Ceiling	23.0000	2.1800	20.8200	0.1600	3.3312		(30)
Total net area of external elements Aum(A, m ²)			145.1900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	46.0687		(33)
E-WM-22			108.2900	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							179.3930 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.5612 (36)
Total fabric heat loss						(33) + (36) =	57.6299 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 51.3620	Feb 51.0417	Mar 50.7278	Apr 49.2532	May 48.9773	Jun 47.6931	Jul 47.6931	Aug 47.4553	Sep 48.1878	Oct 48.9773	Nov 49.5355	Dec 50.1189 (38)
Heat transfer coeff	108.9918	108.6716	108.3576	106.8831	106.6072	105.3229	105.3229	105.0851	105.8176	106.6072	107.1653	107.7488 (39)
Average = Sum(39)m / 12 =												106.8818 (39)
HLP	Jan 1.0246	Feb 1.0216	Mar 1.0187	Apr 1.0048	May 1.0022	Jun 0.9902	Jul 0.9902	Aug 0.9879	Sep 0.9948	Oct 1.0022	Nov 1.0075	Dec 1.0130 (40)
HLP (average)												1.0048 (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												2.7912 (42)
Average daily hot water use (litres/day)												100.4908 (43)
Daily hot water use	Jan 110.5398	Feb 106.5202	Mar 102.5006	Apr 98.4809	May 94.4613	Jun 90.4417	Jul 90.4417	Aug 94.4613	Sep 98.4809	Oct 102.5006	Nov 106.5202	Dec 110.5398 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy conte	163.9274	143.3719	147.9470	128.9838	123.7630	106.7981	98.9641	113.5628	114.9191	133.9271	146.1919	158.7549 (45)
Energy content (annual)										Total = Sum (45)m =		1581.1109 (45)
Distribution loss (46)m = 0.15 x (45)m												
	24.5891	21.5058	22.1920	19.3476	18.5645	16.0197	14.8446	17.0344	17.2379	20.0891	21.9288	23.8132 (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	14.1500	12.7694	14.1116	13.6177	14.0371	13.5446	13.9714	14.0140	13.5844	14.0780	13.6637	14.1376 (61)
Total heat required for water heating calculated for each month												
	178.0774	156.1413	162.0586	142.6014	137.8001	120.3427	112.9355	127.5768	128.5035	148.0051	159.8555	172.8925 (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												
	178.0774	156.1413	162.0586	142.6014	137.8001	120.3427	112.9355	127.5768	128.5035	148.0051	159.8555	172.8925 (64)
Heat gains from water heating, kWh/month								Total per year (kWh/year) = Sum (64)m =				1746.7903 (64)
	58.0434	50.8635	52.7203	46.2915	44.6605	38.8965	36.3984	41.2631	41.6067	48.0502	52.0247	56.3204 (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	139.5595	139.5595	139.5595	139.5595	139.5595	139.5595	139.5595	139.5595	139.5595	139.5595	139.5595	139.5595 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	25.3698	22.5332	18.3252	13.8734	10.3705	8.7552	9.4603	12.2969	16.5049	20.9567	24.4596	26.0749 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	266.2338	268.9964	262.0346	247.2136	228.5049	210.9212	199.1743	196.4116	203.3735	218.1944	236.9032	254.4868 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	36.9559	36.9559	36.9559	36.9559	36.9559	36.9559	36.9559	36.9559	36.9559	36.9559	36.9559	36.9559 (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)												
	-111.6476	-111.6476	-111.6476	-111.6476	-111.6476	-111.6476	-111.6476	-111.6476	-111.6476	-111.6476	-111.6476	-111.6476 (71)
Water heating gains (Table 5)												
	78.0153	75.6897	70.8606	64.2938	60.0275	54.0229	48.9226	55.4612	57.7871	64.5837	72.2565	75.6995 (72)
Total internal gains												
	437.4866	435.0872	419.0883	393.2486	366.7707	341.5672	325.4251	332.0375	345.5332	371.6026	401.4872	424.1290 (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
North			0.8400		10.6334		0.7100		0.7000		0.7700		3.0764 (74)
Southeast			6.4500		36.7938		0.7100		0.7000		0.7700		81.7381 (77)
West			0.8400		19.6403		0.7100		0.7000		0.7700		5.6822 (80)
Northwest			4.3900		11.2829		0.7100		0.7000		0.7700		17.0599 (81)
Northwest			2.1800		16.8560		0.7100		0.7000		1.0000		16.4365 (82)
Solar gains	123.9931	225.0393	344.6528	488.6313	603.5248	623.8886	591.2045	501.7081	393.9167	258.6235	151.0343	104.4822	(83)
Total gains	561.4797	660.1265	763.7411	881.8800	970.2956	965.4559	916.6295	833.7457	739.4499	630.2262	552.5215	528.6112	(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	48.6327	48.7760	48.9173	49.5922	49.7205	50.3268	50.3268	50.4407	50.0915	49.7205	49.4616	49.1937
alpha	4.2422	4.2517	4.2612	4.3061	4.3147	4.3551	4.3551	4.3627	4.3394	4.3147	4.2974	4.2796
util living area	0.9953	0.9901	0.9757	0.9296	0.8205	0.6466	0.4924	0.5559	0.8075	0.9603	0.9911	0.9963 (86)
MIT	19.5228	19.7154	20.0312	20.4428	20.7700	20.9412	20.9858	20.9765	20.8431	20.4071	19.8922	19.4926 (87)
Th 2	20.0628	20.0653	20.0678	20.0793	20.0815	20.0915	20.0915	20.0934	20.0877	20.0815	20.0771	20.0725 (88)
util rest of house												
	0.9941	0.9876	0.9695	0.9115	0.7769	0.5715	0.3967	0.4565	0.7452	0.9466	0.9885	0.9954 (89)
MIT 2	18.0734	18.3555	18.8143	19.4054	19.8406	20.0455	20.0844	20.0804	19.9450	19.3671	18.6225	18.0358 (90)
Living area fraction									fLA = Living area / (4) =			0.1758 (91)
MIT	18.3282	18.5946	19.0283	19.5877	20.0040	20.2030	20.2428	20.2379	20.1029	19.5500	18.8457	18.2919 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.1782	18.4446	18.8783	19.4377	19.8540	20.0530	20.0928	20.0879	19.9529	19.4000	18.6957	18.1419 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9906	0.9815	0.9588	0.8959	0.7647	0.5681	0.3968	0.4559	0.7345	0.9329	0.9827	0.9925 (94)
Useful gains	556.1775	647.9089	732.2718	790.0722	742.0043	548.4937	363.7116	380.0924	543.1490	587.9519	542.9671	524.6727 (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												
	1512.6084	1471.9136	1341.2791	1126.3066	869.2758	574.3227	367.8745	387.5485	619.3354	938.1385	1242.6542	1502.2239 (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												
	711.5846	553.7312	453.1014	242.0887	94.6900	0.0000	0.0000	0.0000	0.0000	260.5388	503.7747	727.2981 (98)
Space heating												3546.8074 (98)
Space heating per m2										(98) / (4) =		33.3441 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3919.1242 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	711.5846	553.7312	453.1014	242.0887	94.6900	0.0000	0.0000	0.0000	0.0000	260.5388	503.7747	727.2981	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	786.2813	611.8576	500.6645	267.5014	104.6298	0.0000	0.0000	0.0000	0.0000	287.8882	556.6571	803.6443	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	178.0774	156.1413	162.0586	142.6014	137.8001	120.3427	112.9355	127.5768	128.5035	148.0051	159.8555	172.8925	(64)
Efficiency of water heater (217)m	89.8408	89.7762	89.6344	89.2868	88.5756	87.3000	87.3000	87.3000	87.3000	89.3140	89.7079	87.3000	(216)
Fuel for water heating, kWh/month	198.2143	173.9229	180.7995	159.7117	155.5735	137.8496	129.3648	146.1360	147.1976	165.7132	178.1956	192.3864	(219)
Water heating fuel used												1965.0649	(219)
Annual totals kWh/year													
Space heating fuel - main system												3919.1242	(211)
Space heating fuel - secondary												0.0000	(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)												448.0379	(232)
Total delivered energy for all uses												6407.2271	(238)

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	3919.1242	0.2160	846.5308	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1965.0649	0.2160	424.4540	(264)
Space and water heating			1270.9849	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	448.0379	0.5190	232.5317	(268)
Total CO2, kg/year			1542.4415	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.5000	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		14.5000	ZC1
Total Floor Area	TFA	106.3700	
Assumed number of occupants	N	2.7912	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		14.8317	ZC2
CO2 emissions from cooking, equation (L16)		1.7485	ZC3
Total CO2 emissions		31.0802	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		31.0802	ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	38.9400 (1b)	x 2.3300 (2b)	= 90.7302 (1b) - (3b)
First floor	37.9800 (1c)	x 2.6300 (2c)	= 99.8874 (1c) - (3c)
Second floor	29.4500 (1d)	x 2.4000 (2d)	= 70.6800 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	106.3700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 261.2976 (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					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour 40.0000 / (5) = 0.1531 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4031 (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) =		0.3426 (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	0.4368	0.4283	0.4197	0.3769	0.3683	0.3255	0.3255	0.3169	0.3426	0.3683	0.3854	0.4026 (22b)
Effective ac	0.5954	0.5917	0.5881	0.5710	0.5678	0.5530	0.5530	0.5502	0.5587	0.5678	0.5743	0.5810 (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
TER Semi-glazed door			2.3500	1.2000	2.8200		(26a)
TER Opening Type (Uw = 1.40)			12.5200	1.3258	16.5985		(27)
TER Room Window (Uw = 1.70)			2.1800	1.5918	3.4700		(27a)
150mm TE Platinum GF			38.9400	0.1300	5.0622		(28a)
50mm A Platinum	48.1100	13.9000	34.2100	0.1800	6.1578		(29a)
Dormer Wall	1.1500	0.9700	0.1800	0.1800	0.0324		(29a)
Wall to Roofspace	12.6700		12.6700	0.1800	2.2806		(29a)
Ceiling to Apex	10.6900		10.6900	0.1300	1.3897		(30)
Ceiling to Roofspace	8.5300		8.5300	0.1300	1.1089		(30)
Flat Roof	2.1000		2.1000	0.1300	0.2730		(30)
Sloping Ceiling	23.0000	2.1800	20.8200	0.1300	2.7066		(30)
Total net area of external elements Aum(A, m ²)			145.1900				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		41.8997		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.0576 (36)
Total fabric heat loss						(33) + (36) =	51.9573 (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	51.3415	51.0221	50.7089	49.2380	48.9628	47.6817	47.6817	47.4445	48.1752	48.9628	49.5196	50.1016 (38)
Heat transfer coeff	103.2989	102.9794	102.6662	101.1953	100.9202	99.6391	99.6391	99.4018	100.1325	100.9202	101.4769	102.0589 (39)
Average = Sum(39)m / 12 =												101.1940 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.9711	0.9681	0.9652	0.9514	0.9488	0.9367	0.9367	0.9345	0.9414	0.9488	0.9540	0.9595 (40)
HLP (average)												0.9513 (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												2.7912 (42)
Average daily hot water use (litres/day)												100.4908 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	110.5398	106.5202	102.5006	98.4809	94.4613	90.4417	90.4417	94.4613	98.4809	102.5006	106.5202	110.5398 (44)
Energy conte	163.9274	143.3719	147.9470	128.9838	123.7630	106.7981	98.9641	113.5628	114.9191	133.9271	146.1919	158.7549 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Energy content (annual)												Total = Sum(45)m = 1581.1109 (45)
Distribution loss (46)m = 0.15 x (45)m												
	24.5891	21.5058	22.1920	19.3476	18.5645	16.0197	14.8446	17.0344	17.2379	20.0891	21.9288	23.8132 (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	48.5659	48.1364	44.6014	46.0881	48.1364	48.5659	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month	214.8863	189.3993	198.9059	177.5497	171.8995	151.3994	145.0522	161.6992	163.4850	184.8860	195.5069	209.7138 (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	214.8863	189.3993	198.9059	177.5497	171.8995	151.3994	145.0522	161.6992	163.4850	184.8860	195.5069	209.7138 (64)
												Total per year (kWh/year) = Sum(64)m = 2164.3833 (64)
Heat gains from water heating, kWh/month	67.2456	59.1780	61.9321	55.0286	53.1853	46.6607	44.4276	49.7937	50.3521	57.2705	60.9376	65.5257 (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	139.5595	139.5595	139.5595	139.5595	139.5595	139.5595	139.5595	139.5595	139.5595	139.5595	139.5595	139.5595	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.3698	22.5332	18.3252	13.8734	10.3705	8.7552	9.4603	12.2969	16.5049	20.9567	24.4596	26.0749	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	266.2338	268.9964	262.0346	247.2136	228.5049	210.9212	199.1743	196.4116	203.3735	218.1944	236.9032	254.4868	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.9559	36.9559	36.9559	36.9559	36.9559	36.9559	36.9559	36.9559	36.9559	36.9559	36.9559	36.9559	(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)	-111.6476	-111.6476	-111.6476	-111.6476	-111.6476	-111.6476	-111.6476	-111.6476	-111.6476	-111.6476	-111.6476	-111.6476	(71)
Water heating gains (Table 5)	90.3838	88.0625	83.2421	76.4286	71.4856	64.8065	59.7145	66.9271	69.9334	76.9765	84.6355	88.0722	(72)
Total internal gains	449.8552	447.4600	431.4697	405.3835	378.2288	352.3508	336.2170	343.5034	357.6796	383.9954	413.8661	436.5018	(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	
North					0.8400	10.6334	0.6300		0.7000	0.7700		2.7298 (74)	
Southeast					6.4500	36.7938	0.6300		0.7000	0.7700		72.5281 (77)	
West					0.8400	19.6403	0.6300		0.7000	0.7700		5.0419 (80)	
Northwest					4.3900	11.2829	0.6300		0.7000	0.7700		15.1377 (81)	
Northwest					2.1800	16.8560	0.6300		0.7000	1.0000		14.5845 (82)	
Solar gains	110.0220	199.6828	305.8187	433.5743	535.5220	553.5913	524.5899	445.1776	349.5317	229.4828	134.0163	92.7095 (83)	
Total gains	559.8772	647.1428	737.2884	838.9577	913.7509	905.9421	860.8068	788.6811	707.2113	613.4783	547.8825	529.2113 (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	71.5091	71.7309	71.9497	72.9955	73.1946	74.1356	74.1356	74.3126	73.7703	73.1946	72.7930	72.3779
alpha	5.7673	5.7821	5.7966	5.8664	5.8796	5.9424	5.9424	5.9542	5.9180	5.8796	5.8529	5.8252
util living area	0.9990	0.9973	0.9913	0.9630	0.8658	0.6756	0.5047	0.5701	0.8453	0.9819	0.9976	0.9993 (86)
MIT	19.9360	20.0754	20.3077	20.6184	20.8649	20.9764	20.9964	20.9930	20.9145	20.5901	20.2089	19.9154 (87)
Th 2	20.1075	20.1100	20.1125	20.1241	20.1262	20.1364	20.1364	20.1383	20.1325	20.1262	20.1218	20.1172 (88)
util rest of house	0.9986	0.9965	0.9882	0.9495	0.8222	0.5960	0.4081	0.4683	0.7803	0.9730	0.9966	0.9990 (89)
MIT 2	18.6721	18.8775	19.2173	19.6689	19.9933	20.1207	20.1350	20.1353	20.0623	19.6370	19.0820	18.6492 (90)
Living area fraction	18.8943	19.0881	19.4090	19.8358	20.1465	20.2711	20.2864	20.2861	20.2121	19.8045	19.2801	18.7188 (91)
MIT	18.8943	19.0881	19.4090	19.8358	20.1465	20.2711	20.2864	20.2861	20.2121	19.8045	19.2801	18.7188 (92)
Temperature adjustment												0.0000
adjusted MIT	18.8943	19.0881	19.4090	19.8358	20.1465	20.2711	20.2864	20.2861	20.2121	19.8045	19.2801	18.7188 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9979	0.9950	0.9849	0.9440	0.8234	0.6090	0.4252	0.4862	0.7871	0.9686	0.9952	0.9985	(94)
Ext temp.	558.7131	643.8793	726.1568	791.9626	752.3418	551.6952	365.9747	383.4500	556.6325	594.1981	545.2644	528.4108	(95)
Heat loss rate W	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)
Month fracti	1507.5769	1461.0846	1325.3169	1106.6553	852.4214	565.0643	367.3134	386.2809	612.0249	928.9234	1236.0014	1497.3922	(97)
Space heating kWh	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	705.9547	549.1620	445.7751	226.5788	74.4592	0.0000	0.0000	0.0000	0.0000	249.0356	497.3306	720.9221	(98)
Space heating per m2												3469.2180	(98)
												(98) / (4) = 32.6146	(99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													93.4000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													3714.3662	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	705.9547	549.1620	445.7751	226.5788	74.4592	0.0000	0.0000	0.0000	0.0000	249.0356	497.3306	720.9221	(98)	
Space heating efficiency (main heating system 1)	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)	
Space heating fuel (main heating system)	755.8401	587.9678	477.2753	242.5897	79.7208	0.0000	0.0000	0.0000	0.0000	266.6334	532.4739	771.8652	(211)	
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	
Water heating														
Water heating requirement	214.8863	189.3993	198.9059	177.5497	171.8995	151.3994	145.0522	161.6992	163.4850	184.8860	195.5069	209.7138	(64)	
Efficiency of water heater (217)m	87.8223	87.5753	87.0229	85.6661	83.1063	80.3000	80.3000	80.3000	80.3000	85.8017	87.3015	87.9084	(216)	
Fuel for water heating, kWh/month	244.6831	216.2704	228.5673	207.2578	206.8428	188.5423	180.6378	201.3689	203.5928	215.4805	223.9447	238.5596	(219)	
Water heating fuel used												2555.7478	(219)	
Annual totals kWh/year														
Space heating fuel - main system													3714.3662	(211)
Space heating fuel - secondary													0.0000	(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)													448.0379	(232)
Total delivered energy for all uses													6793.1519	(238)

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	3714.3662	0.2160	802.3031 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2555.7478	0.2160	552.0415 (264)
Space and water heating			1354.3446 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	448.0379	0.5190	232.5317 (268)
Total CO2, kg/m2/year			1625.8013 (272)
Emissions per m2 for space and water heating			12.7324 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.1861 (272b)
Emissions per m2 for pumps and fans			0.3659 (272c)
Target Carbon Dioxide Emission Rate (TER) = (12.7324 * 1.00) + 2.1861 + 0.3659, rounded to 2 d.p.			15.2800 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	38.9400 (1b)	x 2.3300 (2b)	= 90.7302 (1b) - (3b)
First floor	37.9800 (1c)	x 2.6300 (2c)	= 99.8874 (1c) - (3c)
Second floor	29.4500 (1d)	x 2.4000 (2d)	= 70.6800 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	106.3700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 261.2976 (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					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour 40.0000 / (5) = 0.1531 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.4036 (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) =		0.3430 (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	0.4374	0.4288	0.4202	0.3773	0.3688	0.3259	0.3259	0.3173	0.3430	0.3688	0.3859	0.4031 (22b)
Effective ac	0.5957	0.5919	0.5883	0.5712	0.5680	0.5531	0.5531	0.5503	0.5588	0.5680	0.5745	0.5812 (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
Opening Type 1			2.3500	1.1000	2.5850		(26a)
Opening Type 2 (Uw = 1.41)			12.5200	1.3347	16.7107		(27)
Opening Type 12 (Uw = 1.80)			2.1800	1.6791	3.6604		(27a)
150mm TE Platinum GF			38.9400	0.1400	5.4516		(28a)
50mm A Platinum	48.1100	13.9000	34.2100	0.2700	9.2367		(29a)
Dormer Wall	1.1500	0.9700	0.1800	0.3000	0.0540		(29a)
Wall to Roofspace	12.6700		12.6700	0.1200	1.5204		(29a)
Ceiling to Apex	10.6900		10.6900	0.2000	2.1380		(30)
Ceiling to Roofspace	8.5300		8.5300	0.1200	1.0236		(30)
Flat Roof	2.1000		2.1000	0.1700	0.3570		(30)
Sloping Ceiling	23.0000	2.1800	20.8200	0.1600	3.3312		(30)
Total net area of external elements Aum(A, m ²)			145.1900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	46.0687		(33)
E-WM-22			108.2900	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							179.3930 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.5612 (36)
Total fabric heat loss						(33) + (36) =	57.6299 (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	51.3620	51.0417	50.7278	49.2532	48.9773	47.6931	47.6931	47.4553	48.1878	48.9773	49.5355	50.1189 (38)
Heat transfer coeff	108.9918	108.6716	108.3576	106.8831	106.6072	105.3229	105.3229	105.0851	105.8176	106.6072	107.1653	107.7488 (39)
Average = Sum(39)m / 12 =												106.8818 (39)
HLP	1.0246	1.0216	1.0187	1.0048	1.0022	0.9902	0.9902	0.9879	0.9948	1.0022	1.0075	1.0130 (40)
HLP (average)												1.0048 (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												2.7912 (42)
Average daily hot water use (litres/day)												100.4908 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	110.5398	106.5202	102.5006	98.4809	94.4613	90.4417	90.4417	94.4613	98.4809	102.5006	106.5202	110.5398 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy conte	163.9274	143.3719	147.9470	128.9838	123.7630	106.7981	98.9641	113.5628	114.9191	133.9271	146.1919	158.7549 (45)
Energy content (annual)										Total = Sum	(45)m =	1581.1109 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (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)
Primary 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 (59)
Heat gains from water heating, kWh/month	34.8346	30.4665	31.4387	27.4091	26.2996	22.6946	21.0299	24.1321	24.4203	28.4595	31.0658	33.7354 (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	139.5595	139.5595	139.5595	139.5595	139.5595	139.5595	139.5595	139.5595	139.5595	139.5595	139.5595	139.5595 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.3698	22.5332	18.3252	13.8734	10.3705	8.7552	9.4603	12.2969	16.5049	20.9567	24.4596	26.0749 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	266.2338	268.9964	262.0346	247.2136	228.5049	210.9212	199.1743	196.4116	203.3735	218.1944	236.9032	254.4868 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.9559	36.9559	36.9559	36.9559	36.9559	36.9559	36.9559	36.9559	36.9559	36.9559	36.9559	36.9559 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-111.6476	-111.6476	-111.6476	-111.6476	-111.6476	-111.6476	-111.6476	-111.6476	-111.6476	-111.6476	-111.6476	-111.6476 (71)
Water heating gains (Table 5)	46.8207	45.3371	42.2564	38.0681	35.3490	31.5203	28.2660	32.4356	33.9171	38.2520	43.1469	45.3433 (72)
Total internal gains	403.2920	401.7346	387.4840	364.0230	339.0922	316.0646	301.7684	306.0120	318.6633	342.2710	369.3775	390.7728 (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
North	0.8400	10.6334	0.7100	0.7000	0.7700	3.0764 (74)
Southeast	6.4500	36.7938	0.7100	0.7000	0.7700	81.7381 (77)
West	0.8400	19.6403	0.7100	0.7000	0.7700	5.6822 (80)
Northwest	4.3900	11.2829	0.7100	0.7000	0.7700	17.0599 (81)
Northwest	2.1800	16.8560	0.7100	0.7000	1.0000	16.4365 (82)

Solar gains	123.9931	225.0393	344.6528	488.6313	603.5248	623.8886	591.2045	501.7081	393.9167	258.6235	151.0343	104.4822 (83)
Total gains	527.2851	626.7739	732.1368	852.6543	942.6170	939.9532	892.9729	807.7201	712.5799	600.8945	520.4118	495.2550 (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	48.6327	48.7760	48.9173	49.5922	49.7205	50.3268	50.3268	50.4407	50.0915	49.7205	49.4616	49.1937
alpha	4.2422	4.2517	4.2612	4.3061	4.3147	4.3551	4.3551	4.3627	4.3394	4.3147	4.2974	4.2796
util living area	0.9963	0.9918	0.9790	0.9364	0.8318	0.6598	0.5042	0.5711	0.8225	0.9661	0.9929	0.9972 (86)
MIT	19.4836	19.6780	19.9979	20.4176	20.7558	20.9363	20.9844	20.9739	20.8301	20.3780	19.8559	19.4540 (87)
Th 2	20.0628	20.0653	20.0678	20.0793	20.0815	20.0915	20.0915	20.0934	20.0877	20.0815	20.0771	20.0725 (88)
util rest of house	0.9954	0.9898	0.9736	0.9196	0.7895	0.5845	0.4067	0.4701	0.7621	0.9541	0.9908	0.9965 (89)
MIT 2	18.6655	18.8609	19.1795	19.5959	19.9057	20.0573	20.0861	20.0835	19.9809	19.5663	19.0480	18.6435 (90)
Living area fraction	18.8093	19.0046	19.3234	19.7404	20.0551	20.2118	20.2441	20.2400	20.1302	19.7090	19.1900	18.7860 (92)
Temperature adjustment	18.8093	19.0046	19.3234	19.7404	20.0551	20.2118	20.2441	20.2400	20.1302	19.7090	19.1900	18.7860 (93)
adjusted MIT	18.8093	19.0046	19.3234	19.7404	20.0551	20.2118	20.2441	20.2400	20.1302	19.7090	19.1900	18.7860 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	523.9449	618.4271	708.7499	777.8289	742.9344	559.3180	378.2084	393.5064	545.3478	569.5767	514.1830	492.8277 (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	1581.3944	1532.7647	1389.5128	1158.6539	890.7142	591.0552	383.8024	403.5289	638.0973	971.0893	1295.6314	1571.6262 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	786.7424	614.4349	506.4876	274.1940	109.9482	0.0000	0.0000	0.0000	0.0000	298.7254	562.6428	802.6261 (98)
Space heating												3955.8014 (98)
Space heating per m2										(98) / (4) =		37.1891 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	990.0357	779.3898	798.6469	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8773	0.9279	0.9015	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	868.5768	723.2000	719.9821	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1181.2018	1125.7684	1033.6107	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	225.0900	299.5109	233.3396	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling													
Cooled fraction									FC = cooled area / (4) =			757.9406	(104)
Intermittency factor (Table 10b)												1.0000	(105)
Intermittency factor	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	56.2725	74.8777	58.3349	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling													
Space cooling per m2												189.4851	(107)
Energy for space heating												1.7814	(108)
Energy for space cooling												37.1891	(99)
Total												1.7814	(108)
Dwelling Fabric Energy Efficiency (DFEE)												38.9704	(109)
												39.0	(109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	38.9400 (1b)	x 2.3300 (2b)	= 90.7302 (1b) - (3b)
First floor	37.9800 (1c)	x 2.6300 (2c)	= 99.8874 (1c) - (3c)
Second floor	29.4500 (1d)	x 2.4000 (2d)	= 70.6800 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	106.3700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	261.2976 (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					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour 40.0000 / (5) = 0.1531 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4031 (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) =		0.3426 (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	0.4368	0.4283	0.4197	0.3769	0.3683	0.3255	0.3255	0.3169	0.3426	0.3683	0.3854	0.4026 (22b)
Effective ac	0.5954	0.5917	0.5881	0.5710	0.5678	0.5530	0.5530	0.5502	0.5587	0.5678	0.5743	0.5810 (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
TER Semi-glazed door			2.3500	1.2000	2.8200		(26a)
TER Opening Type (Uw = 1.40)			12.5200	1.3258	16.5985		(27)
TER Room Window (Uw = 1.70)			2.1800	1.5918	3.4700		(27a)
150mm TE Platinum GF			38.9400	0.1300	5.0622		(28a)
50mm A Platinum	48.1100	13.9000	34.2100	0.1800	6.1578		(29a)
Dormer Wall	1.1500	0.9700	0.1800	0.1800	0.0324		(29a)
Wall to Roofspace	12.6700		12.6700	0.1800	2.2806		(29a)
Ceiling to Apex	10.6900		10.6900	0.1300	1.3897		(30)
Ceiling to Roofspace	8.5300		8.5300	0.1300	1.1089		(30)
Flat Roof	2.1000		2.1000	0.1300	0.2730		(30)
Sloping Ceiling	23.0000	2.1800	20.8200	0.1300	2.7066		(30)
Total net area of external elements Aum(A, m ²)			145.1900				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		41.8997		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.0576 (36)
Total fabric heat loss						(33) + (36) =	51.9573 (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	51.3415	51.0221	50.7089	49.2380	48.9628	47.6817	47.6817	47.4445	48.1752	48.9628	49.5196	50.1016 (38)
Heat transfer coeff	103.2989	102.9794	102.6662	101.1953	100.9202	99.6391	99.6391	99.4018	100.1325	100.9202	101.4769	102.0589 (39)
Average = Sum(39)m / 12 =												101.1940 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.9711	0.9681	0.9652	0.9514	0.9488	0.9367	0.9367	0.9345	0.9414	0.9488	0.9540	0.9595 (40)
HLP (average)												0.9513 (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												2.7912 (42)
Average daily hot water use (litres/day)												100.4908 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	110.5398	106.5202	102.5006	98.4809	94.4613	90.4417	90.4417	94.4613	98.4809	102.5006	106.5202	110.5398 (44)
Energy conte	163.9274	143.3719	147.9470	128.9838	123.7630	106.7981	98.9641	113.5628	114.9191	133.9271	146.1919	158.7549 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1581.1109 (45)											
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (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)
Primary 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 (59)
Heat gains from water heating, kWh/month	34.8346	30.4665	31.4387	27.4091	26.2996	22.6946	21.0299	24.1321	24.4203	28.4595	31.0658	33.7354 (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	139.5595	139.5595	139.5595	139.5595	139.5595	139.5595	139.5595	139.5595	139.5595	139.5595	139.5595	139.5595	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.3698	22.5332	18.3252	13.8734	10.3705	8.7552	9.4603	12.2969	16.5049	20.9567	24.4596	26.0749	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	266.2338	268.9964	262.0346	247.2136	228.5049	210.9212	199.1743	196.4116	203.3735	218.1944	236.9032	254.4868	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.9559	36.9559	36.9559	36.9559	36.9559	36.9559	36.9559	36.9559	36.9559	36.9559	36.9559	36.9559	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-111.6476	-111.6476	-111.6476	-111.6476	-111.6476	-111.6476	-111.6476	-111.6476	-111.6476	-111.6476	-111.6476	-111.6476	(71)
Water heating gains (Table 5)	46.8207	45.3371	42.2564	38.0681	35.3490	31.5203	28.2660	32.4356	33.9171	38.2520	43.1469	45.3433	(72)
Total internal gains	403.2920	401.7346	387.4840	364.0230	339.0922	316.0646	301.7684	306.0120	318.6633	342.2710	369.3775	390.7728	(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				
North				0.8400	10.6334	0.6300	0.7000	0.7700	2.7298 (74)				
Southeast				6.4500	36.7938	0.6300	0.7000	0.7700	72.5281 (77)				
West				0.8400	19.6403	0.6300	0.7000	0.7700	5.0419 (80)				
Northwest				4.3900	11.2829	0.6300	0.7000	0.7700	15.1377 (81)				
Northwest				2.1800	16.8560	0.6300	0.7000	1.0000	14.5845 (82)				
Solar gains	110.0220	199.6828	305.8187	433.5743	535.5220	553.5913	524.5899	445.1776	349.5317	229.4828	134.0163	92.7095	(83)
Total gains	513.3141	601.4174	693.3027	797.5973	874.6142	869.6559	826.3583	751.1896	668.1949	571.7538	503.3939	483.4824	(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	71.5091	71.7309	71.9497	72.9955	73.1946	74.1356	74.1356	74.3126	73.7703	73.1946	72.7930	72.3779	
alpha	5.7673	5.7821	5.7966	5.8664	5.8796	5.9424	5.9424	5.9542	5.9180	5.8796	5.8529	5.8252	
util living area	0.9994	0.9982	0.9936	0.9702	0.8830	0.6983	0.5247	0.5959	0.8694	0.9870	0.9985	0.9995	(86)
MIT	19.8938	20.0342	20.2692	20.5872	20.8476	20.9720	20.9956	20.9912	20.8990	20.5553	20.1687	19.8738	(87)
Th 2	20.1075	20.1100	20.1125	20.1241	20.1262	20.1364	20.1364	20.1383	20.1325	20.1262	20.1218	20.1172	(88)
util rest of house	0.9991	0.9976	0.9913	0.9589	0.8424	0.6181	0.4249	0.4909	0.8090	0.9804	0.9978	0.9994	(89)
MIT 2	19.0853	19.2275	19.4635	19.7842	20.0221	20.1235	20.1352	20.1357	20.0742	19.7589	19.3719	19.0733	(90)
Living area fraction	19.2274	19.3693	19.6051	19.9254	20.1672	20.2726	20.2865	20.2861	20.2192	19.8989	19.5119	19.2141	(91)
MIT	19.2274	19.3693	19.6051	19.9254	20.1672	20.2726	20.2865	20.2861	20.2192	19.8989	19.5119	19.2141	(92)
Temperature adjustment	19.2274	19.3693	19.6051	19.9254	20.1672	20.2726	20.2865	20.2861	20.2192	19.8989	19.5119	19.2141	(93)
adjusted MIT	19.2274	19.3693	19.6051	19.9254	20.1672	20.2726	20.2865	20.2861	20.2192	19.8989	19.5119	19.2141	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	512.7117	599.5235	686.0232	762.3334	738.6319	549.1199	365.6618	382.6684	545.1880	559.2104	501.9816	483.0827	(94)
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	1541.9841	1490.0440	1345.4542	1115.7192	854.5139	565.2164	367.3169	386.2806	612.7318	938.4425	1259.5249	1532.3177	(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	765.7786	598.4298	490.6166	254.4378	86.2162	0.0000	0.0000	0.0000	0.0000	282.1487	545.4312	780.6308	(98)
Space heating												3803.6897	(98)
Space heating per m2										(98) / (4) =		35.7590	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	936.6072	737.3291	755.4539	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9156	0.9602	0.9394	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	857.5721	708.0181	709.6409	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1102.0330	1050.7020	969.7325	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	176.0119	254.9568	193.5081	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												624.4767	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	44.0030	63.7392	48.3770	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												156.1192	(107)
Space cooling per m2												1.4677	(108)
Energy for space heating												35.7590	(99)
Energy for space cooling												1.4677	(108)
Total												37.2267	(109)
Target Fabric Energy Efficiency (TFEE)												42.8	(109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	T310-E-7 End Terrace			Issued on Date	17/12/2021
Assessment Reference	3	Prop Type Ref			
Property	T310-E-7 DS06 (Gable - I Roof), EOT, Part L2013 Masonry				
SAP Rating	85 B	DER	15.28	TER	15.46
Environmental	87 B	% DER<TER	1.19		
CO ₂ Emissions (t/year)	1.45	DFEE	42.96	TFEE	45.95
General Requirements Compliance	Pass	% DFEE<TFEE	6.51		
Assessor Details	Mr. Andrew Maughan, Andrew Maughan, Tel: 01582 544250, Andrew.Maughan@ee-ltd.co.uk			Assessor ID	V844-0001
Client					

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS DESIGNED

End-Terrace House, total floor area 106 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating:Mains gas

Fuel factor:1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER) 15.46 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 15.28 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)46.0 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)43.0 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.30 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.15 (max. 0.25)	0.15 (max. 0.70)	OK
Roof	0.17 (max. 0.20)	0.21 (max. 0.35)	OK
Openings	1.43 (max. 2.00)	1.80 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals: 5.01 (design value)

Maximum 10.0 OK

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas

Data from database

Ideal LOGIC HEAT H15

Efficiency: 89.4% SEDBUK2009

Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation

Hot water storage Measured cylinder loss: 1.16 kWh/day

Permitted by DBSCG 1.88 OK

Primary pipework insulated: Yes OK

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls: Cylinderstat OK
Independent timer for DHW OK

Boiler interlock Yes OK

7 Low energy lights

Percentage of fixed lights with low-energy fittings:100%

Minimum 75% OK

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Midlands): Slight OK

Based on:

Overshading: Average

Windows facing North: 4.55 m², No overhang

Windows facing North East: 0.72 m², No overhang

Windows facing East: 0.76 m², No overhang

Windows facing South: 6.45 m², No overhang

Windows facing North West: 0.72 m², No overhang

Air change rate: 4.00 ach

Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features

External wall U-value 0.13 W/m²K

Party wall U-value 0.00 W/m²K

Door U-value 1.10 W/m²K

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	37.8500 (1b)	x 2.3100 (2b)	= 87.4335 (1b) - (3b)
First floor	37.3400 (1c)	x 2.6300 (2c)	= 98.2042 (1c) - (3c)
Second floor	30.8100 (1d)	x 2.2700 (2d)	= 69.9387 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	106.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 255.5764 (5)

2. Ventilation rate

	main		secondary		other		total	m3 per hour				
	heating		heating									
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							4 * 10 =	40.0000 (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) =						40.0000 / (5) =	0.1565 (8)				
Pressure test							Yes					
Measured/design AP50							5.0100					
Infiltration rate							0.4070 (18)					
Number of sides sheltered							4 (19)					
Shelter factor							(20) = 1 - [0.075 x (19)] =	0.7000 (20)				
Infiltration rate adjusted to include shelter factor							(21) = (18) x (20) =	0.2849 (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	0.3633	0.3561	0.3490	0.3134	0.3063	0.2707	0.2707	0.2635	0.2849	0.3063	0.3205	0.3348 (22b)
Effective ac	0.5660	0.5634	0.5609	0.5491	0.5469	0.5366	0.5366	0.5347	0.5406	0.5469	0.5514	0.5560 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Opening Type 2 (Uw = 1.41)			13.2000	1.3347	17.6183		(27)					
Opening Type 15			2.3800	1.1000	2.6180		(26)					
Opening Type 1 (Uw = 1.80)			2.9400	1.6791	4.9366		(27a)					
150mm TE Platinum GF			37.8500	0.1500	5.6775		(28a)					
50mm A Platinum	95.9800	14.6100	81.3700	0.2700	21.9699		(29a)					
Dormer Cheeks	5.0600	0.9700	4.0900	0.3000	1.2270		(29a)					
I-Roof Gable	13.8100		13.8100	0.2200	3.0382		(29a)					
Wall to Roofspace	8.6200		8.6200	0.1300	1.1206		(29a)					
Ceiling to Roofspace	6.5500		6.5500	0.1300	0.8515		(30)					
Flat Roof - Dormer	1.7800		1.7800	0.1700	0.3026		(30)					
Flat Roof - GF Bay	0.3900		0.3900	0.1700	0.0663		(30)					
Sloping Ceiling	18.4900	2.9400	15.5500	0.1600	2.4880		(30)					
Susp Ceil to Apex	14.9000		14.9000	0.2100	3.1290		(30)					
Total net area of external elements Aum(A, m2)			203.4300				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	65.0435		(33)					
E-WM-22			57.0900	0.0000	0.0000		(32)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							146.5200 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.3481 (36)					
Total fabric heat loss						(33) + (36) =	75.3916 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 47.7346	Feb 47.5186	Mar 47.3068	Apr 46.3120	May 46.1258	Jun 45.2594	Jul 45.2594	Aug 45.0989	Sep 45.5931	Oct 46.1258	Nov 46.5024	Dec 46.8960 (38)
Heat transfer coeff	123.1263	122.9102	122.6984	121.7036	121.5175	120.6510	120.6510	120.4905	120.9847	121.5175	121.8940	122.2876 (39)
Average = Sum(39)m / 12 =												121.7027 (39)
HLP	Jan 1.1616	Feb 1.1595	Mar 1.1575	Apr 1.1481	May 1.1464	Jun 1.1382	Jul 1.1382	Aug 1.1367	Sep 1.1414	Oct 1.1464	Nov 1.1499	Dec 1.1537 (40)
HLP (average)												1.1481 (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												2.7886 (42)
Average daily hot water use (litres/day)												100.4283 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Daily hot water use	110.4712	106.4540	102.4369	98.4198	94.4026	90.3855	90.3855	94.4026	98.4198	102.4369	106.4540	110.4712 (44)
Energy conte	163.8256	143.2829	147.8551	128.9037	123.6861	106.7317	98.9026	113.4922	114.8477	133.8439	146.1011	158.6563 (45)
Energy content (annual)												1580.1288 (45)
Distribution loss (46)m = 0.15 x (45)m												
	24.5738	21.4924	22.1783	19.3355	18.5529	16.0098	14.8354	17.0238	17.2272	20.0766	21.9152	23.7984 (46)
Water storage loss:												
Store volume												149.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1600 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.6264 (55)
Total storage loss												
	19.4184	17.5392	19.4184	18.7920	19.4184	18.7920	19.4184	19.4184	18.7920	19.4184	18.7920	19.4184 (56)
If cylinder contains dedicated solar storage												
	19.4184	17.5392	19.4184	18.7920	19.4184	18.7920	19.4184	19.4184	18.7920	19.4184	18.7920	19.4184 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month												
	206.5064	181.8333	190.5359	170.2077	166.3669	148.0357	141.5834	156.1730	156.1517	176.5247	187.4051	201.3371 (62)
WWHRS	-29.7173	-26.1479	-26.6871	-21.9540	-20.3830	-16.8137	-14.2278	-17.2273	-17.7309	-21.9212	-25.3961	-28.7239 eq. (G10)
Total of WWHRS savings												-266.9301
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												
	176.7890	155.6854	163.8488	148.2537	145.9840	131.2220	127.3557	138.9457	138.4208	154.6035	162.0090	172.6132 (64)
Heat gains from water heating, kWh/month												
	88.6166	78.4819	83.3065	75.9037	75.2703	68.5315	67.0298	71.8808	71.2301	78.6477	81.6218	86.8979 (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	139.4281	139.4281	139.4281	139.4281	139.4281	139.4281	139.4281	139.4281	139.4281	139.4281	139.4281	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	24.7741	22.0042	17.8950	13.5477	10.1270	8.5497	9.2382	12.0082	16.1174	20.4647	23.8853	25.4627 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	265.6788	268.4357	261.4884	246.6983	228.0285	210.4816	198.7591	196.0022	202.9495	217.7396	236.4094	253.9563 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	36.9428	36.9428	36.9428	36.9428	36.9428	36.9428	36.9428	36.9428	36.9428	36.9428	36.9428	(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	(70)
Losses e.g. evaporation (negative values) (Table 5)												
	-111.5425	-111.5425	-111.5425	-111.5425	-111.5425	-111.5425	-111.5425	-111.5425	-111.5425	-111.5425	-111.5425	(71)
Water heating gains (Table 5)												
	119.1084	116.7885	111.9710	105.4218	101.1697	95.1826	90.0938	96.6140	98.9306	105.7093	113.3636	116.7982 (72)
Total internal gains	477.3897	475.0568	459.1828	433.4962	407.1537	382.0423	365.9195	372.4528	385.8259	411.7420	441.4867	464.0457 (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				
South			2.9400	45.6416	0.7100	0.7000	1.0000	60.0215 (82)				
North			4.5500	10.6334	0.7100	0.7000	0.7700	16.6638 (74)				
Northeast			0.7200	11.2829	0.7100	0.7000	0.7700	2.7980 (75)				
East			0.7600	19.6403	0.7100	0.7000	0.7700	5.1410 (76)				
South			6.4500	46.7521	0.7100	0.7000	0.7700	103.8604 (78)				
Northwest			0.7200	11.2829	0.7100	0.7000	0.7700	2.7980 (81)				
Solar gains	191.2827	331.6594	468.7924	605.1923	699.4927	703.7910	674.6473	602.9679	515.8750	370.6469	230.1870	162.9963 (83)
Total gains	668.6724	806.7162	927.9752	1038.6884	1106.6465	1085.8333	1040.5669	975.4207	901.7010	782.3889	671.6738	627.0420 (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	35.0388	35.1004	35.1610	35.4484	35.5027	35.7577	35.7577	35.8053	35.6590	35.5027	35.3931	35.2791
alpha	3.3359	3.3400	3.3441	3.3632	3.3668	3.3838	3.3838	3.3870	3.3773	3.3668	3.3595	3.3519
util living area	0.9840	0.9698	0.9423	0.8835	0.7790	0.6276	0.4831	0.5287	0.7409	0.9135	0.9726	0.9869 (86)
MIT	19.1643	19.4284	19.8110	20.2689	20.6467	20.8801	20.9628	20.9491	20.7800	20.2763	19.6289	19.1113 (87)
Th 2	19.9509	19.9525	19.9541	19.9617	19.9631	19.9697	19.9697	19.9710	19.9672	19.9631	19.9603	19.9573 (88)
util rest of house	0.9807	0.9638	0.9305	0.8591	0.7322	0.5499	0.3807	0.4253	0.6722	0.8900	0.9660	0.9842 (89)
MIT 2	17.5065	17.8889	18.4386	19.0857	19.5889	19.8714	19.9495	19.9410	19.7667	19.1109	18.1881	17.4334 (90)
Living area fraction												
	17.7830	18.1457	18.6675	19.2830	19.7653	20.0397	20.1185	20.1092	19.9357	19.3052	18.4284	17.7133 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.6330	17.9957	18.5175	19.1330	19.6153	19.8897	19.9685	19.9592	19.7857	19.1552	18.2784	17.5633 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9698	0.9477	0.9091	0.8352	0.7143	0.5433	0.3805	0.4240	0.6584	0.8664	0.9506	0.9748 (94)
Useful gains	648.4543	764.5575	843.5781	867.5145	790.4508	589.9460	395.9571	413.5737	593.6856	677.8283	638.5222	611.2131 (95)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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	1641.6396	1609.5931	1474.5331	1245.3929	961.8488	638.2051	406.4130	428.8472	687.8800	1039.6114	1362.5847	1634.1651 (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	738.9299	567.8639	469.4305	272.0725	127.5201	0.0000	0.0000	0.0000	0.0000	269.1666	521.3250	761.0763 (98)
Space heating												3727.3847 (98)
Space heating per m2											(98) / (4) =	35.1640 (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)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												90.4000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												4123.2131 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	738.9299	567.8639	469.4305	272.0725	127.5201	0.0000	0.0000	0.0000	0.0000	269.1666	521.3250	761.0763 (98)
Space heating efficiency (main heating system 1)	90.4000	90.4000	90.4000	90.4000	90.4000	0.0000	0.0000	0.0000	0.0000	90.4000	90.4000	90.4000 (210)
Space heating fuel (main heating system)	817.4003	628.1680	519.2815	300.9651	141.0621	0.0000	0.0000	0.0000	0.0000	297.7507	576.6869	841.8985 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating requirement	176.7890	155.6854	163.8488	148.2537	145.9840	131.2220	127.3557	138.9457	138.4208	154.6035	162.0090	172.6132 (64)
Efficiency of water heater	88.1161	87.8619	87.3653	86.3129	84.3552	79.7000	79.7000	79.7000	79.7000	86.1790	87.6114	79.7000 (216)
(217)m	88.1161	87.8619	87.3653	86.3129	84.3552	79.7000	79.7000	79.7000	79.7000	86.1790	87.6114	88.2106 (217)
Fuel for water heating, kWh/month	200.6319	177.1932	187.5445	171.7632	173.0586	164.6449	159.7938	174.3359	173.6773	179.3981	184.9178	195.6830 (219)
Water heating fuel used												2142.6421 (219)
Annual totals kWh/year												
Space heating fuel - main system												4123.2131 (211)
Space heating fuel - secondary												0.0000 (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)												437.5189 (232)
Total delivered energy for all uses												6778.3742 (238)

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	4123.2131	0.2160	890.6140 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2142.6421	0.2160	462.8107 (264)
Space and water heating			1353.4247 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	437.5189	0.5190	227.0723 (268)
Total CO2, kg/year			1619.4221 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			15.2800 (273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		15.2800 ZC1
Total Floor Area	TFA	106.0000
Assumed number of occupants	N	2.7886
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190
CO2 emissions from appliances, equation (L14)		14.8524 ZC2
CO2 emissions from cooking, equation (L16)		1.7540 ZC3
Total CO2 emissions		31.8864 ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000 ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000 ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000 ZC7
Net CO2 emissions		31.8864 ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	37.8500 (1b)	x 2.3100 (2b)	= 87.4335 (1b) - (3b)
First floor	37.3400 (1c)	x 2.6300 (2c)	= 98.2042 (1c) - (3c)
Second floor	30.8100 (1d)	x 2.2700 (2d)	= 69.9387 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	106.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 255.5764 (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					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour 40.0000 / (5) = 0.1565 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4065 (18)
Number of sides sheltered					4 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.7000 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.2846 (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	0.3628	0.3557	0.3486	0.3130	0.3059	0.2703	0.2703	0.2632	0.2846	0.3059	0.3201	0.3344 (22b)
Effective ac	0.5658	0.5633	0.5608	0.5490	0.5468	0.5365	0.5365	0.5346	0.5405	0.5468	0.5512	0.5559 (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
TER Opaque door			2.3800	1.0000	2.3800		(26)
TER Opening Type (Uw = 1.40)			13.2000	1.3258	17.5000		(27)
TER Room Window (Uw = 1.70)			2.9400	1.5918	4.6798		(27a)
150mm TE Platinum GF			37.8500	0.1300	4.9205		(28a)
50mm A Platinum	95.9800	14.6100	81.3700	0.1800	14.6466		(29a)
Dormer Cheeks	5.0600	0.9700	4.0900	0.1800	0.7362		(29a)
I-Roof Gable	13.8100		13.8100	0.1800	2.4858		(29a)
Wall to Roofspace	8.6200		8.6200	0.1800	1.5516		(29a)
Ceiling to Roofspace	6.5500		6.5500	0.1300	0.8515		(30)
Flat Roof - Dormer	1.7800		1.7800	0.1300	0.2314		(30)
Flat Roof - GF Bay	0.3900		0.3900	0.1300	0.0507		(30)
Sloping Ceiling	18.4900	2.9400	15.5500	0.1300	2.0215		(30)
Susp Ceil to Apex	14.9000		14.9000	0.1300	1.9370		(30)
Total net area of external elements Aum(A, m ²)			203.4300				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		53.9926		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.2061 (36)
Total fabric heat loss						(33) + (36) =	66.1987 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	47.7210	47.5054	47.2942	46.3018	46.1161	45.2518	45.2518	45.0917	45.5847	46.1161	46.4917	46.8844 (38)
Average = Sum(39)m / 12 =	113.9197	113.7041	113.4928	112.5005	112.3148	111.4505	111.4505	111.2904	111.7834	112.3148	112.6904	113.0831 (39)
	112.4996 (39)											
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0747	1.0727	1.0707	1.0613	1.0596	1.0514	1.0514	1.0499	1.0546	1.0596	1.0631	1.0668 (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												2.7886 (42)
Average daily hot water use (litres/day)												100.4283 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Energy conte	110.4712	106.4540	102.4369	98.4198	94.4026	90.3855	90.3855	94.4026	98.4198	102.4369	106.4540	110.4712	(44)
Energy content (annual)	163.8256	143.2829	147.8551	128.9037	123.6861	106.7317	98.9026	113.4922	114.8477	133.8439	146.1011	158.6563	(45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1580.1288	(45)
Water storage loss:	24.5738	21.4924	22.1783	19.3355	18.5529	16.0098	14.8354	17.0238	17.2272	20.0766	21.9152	23.7984	(46)
Store volume												149.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3884	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7497	(55)
Total storage loss													
If cylinder contains dedicated solar storage	23.2413	20.9922	23.2413	22.4916	23.2413	22.4916	23.2413	23.2413	22.4916	23.2413	22.4916	23.2413	(56)
Primary loss	23.2413	20.9922	23.2413	22.4916	23.2413	22.4916	23.2413	23.2413	22.4916	23.2413	22.4916	23.2413	(57)
Total heat required for water heating calculated for each month	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Solar input	210.3293	185.2863	194.3588	173.9073	170.1899	151.7354	145.4064	159.9960	159.8513	180.3476	191.1047	205.1601	(62)
Output from w/h	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)
	210.3293	185.2863	194.3588	173.9073	170.1899	151.7354	145.4064	159.9960	159.8513	180.3476	191.1047	205.1601	(64)
Heat gains from water heating, kWh/month	91.6750	81.2443	86.3648	78.8634	78.3286	71.4912	70.0881	74.9392	74.1898	81.7061	84.5815	89.9562	(65)
								Total per year (kWh/year) = Sum (64)m =				2127.6730	(64)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9956	0.9891	0.9718	0.9207	0.7999	0.5972	0.4119	0.4597	0.7337	0.9437	0.9899	0.9967 (94)
Useful gains	648.3505	765.0170	854.4894	897.2964	825.4647	603.5184	398.9965	419.0141	621.9228	702.8246	643.2683	610.7824 (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	1645.6199	1601.2583	1456.0138	1220.0666	937.5201	621.6438	401.0059	422.5818	674.1691	1026.6221	1359.3041	1640.0589 (97)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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	741.9684	561.9541	447.5342	232.3945	83.3692	0.0000	0.0000	0.0000	0.0000	240.9053	515.5458	765.7818 (98)
Space heating												3589.4532 (98)
Space heating per m2										(98) / (4) =		33.8628 (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)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												93.5000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												3838.9874 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	741.9684	561.9541	447.5342	232.3945	83.3692	0.0000	0.0000	0.0000	0.0000	240.9053	515.5458	765.7818 (98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000 (210)
Space heating fuel (main heating system)	793.5491	601.0205	478.6462	248.5503	89.1649	0.0000	0.0000	0.0000	0.0000	257.6527	551.3858	819.0179 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	210.3293	185.2863	194.3588	173.9073	170.1899	151.7354	145.4064	159.9960	159.8513	180.3476	191.1047	205.1601 (64)
Efficiency of water heater (217)m	87.8970	87.5879	86.9691	85.5880	83.0276	79.8000	79.8000	79.8000	79.8000	85.5869	87.3332	79.8000 (216)
Fuel for water heating, kWh/month	239.2908	211.5432	223.4804	203.1913	204.9798	190.1446	182.2135	200.4962	200.3149	210.7187	218.8226	233.1190 (219)
Water heating fuel used												2518.3151 (219)
Annual totals kWh/year												
Space heating fuel - main system												3838.9874 (211)
Space heating fuel - secondary												0.0000 (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)												437.5189 (232)
Total delivered energy for all uses												6869.8214 (238)

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	3838.9874	0.2160	829.2213 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2518.3151	0.2160	543.9561 (264)
Space and water heating			1373.1773 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	437.5189	0.5190	227.0723 (268)
Total CO2, kg/m2/year			1639.1747 (272)
Emissions per m2 for space and water heating			12.9545 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.1422 (272b)
Emissions per m2 for pumps and fans			0.3672 (272c)
Target Carbon Dioxide Emission Rate (TER) = (12.9545 * 1.00) + 2.1422 + 0.3672, rounded to 2 d.p.			15.4600 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	37.8500 (1b)	x 2.3100 (2b)	= 87.4335 (1b) - (3b)
First floor	37.3400 (1c)	x 2.6300 (2c)	= 98.2042 (1c) - (3c)
Second floor	30.8100 (1d)	x 2.2700 (2d)	= 69.9387 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	106.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 255.5764 (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											4 * 10 =	40.0000 (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) =										40.0000 / (5) =	0.1565 (8)	
Pressure test												
Measured/design AP50												
Infiltration rate												
Number of sides sheltered												
Shelter factor										(20) = 1 - [0.075 x (19)] =	0.7000 (20)	
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =	0.2849 (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	0.3633	0.3561	0.3490	0.3134	0.3063	0.2707	0.2707	0.2635	0.2849	0.3063	0.3205	0.3348 (22b)
Effective ac	0.5660	0.5634	0.5609	0.5491	0.5469	0.5366	0.5366	0.5347	0.5406	0.5469	0.5514	0.5560 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Opening Type 2 (Uw = 1.41)			13.2000	1.3347	17.6183			(27)				
Opening Type 15			2.3800	1.1000	2.6180			(26)				
Opening Type 1 (Uw = 1.80)			2.9400	1.6791	4.9366			(27a)				
150mm TE Platinum GF			37.8500	0.1500	5.6775			(28a)				
50mm A Platinum	95.9800	14.6100	81.3700	0.2700	21.9699			(29a)				
Dormer Cheeks	5.0600	0.9700	4.0900	0.3000	1.2270			(29a)				
I-Roof Gable	13.8100		13.8100	0.2200	3.0382			(29a)				
Wall to Roofspace	8.6200		8.6200	0.1300	1.1206			(29a)				
Ceiling to Roofspace	6.5500		6.5500	0.1300	0.8515			(30)				
Flat Roof - Dormer	1.7800		1.7800	0.1700	0.3026			(30)				
Flat Roof - GF Bay	0.3900		0.3900	0.1700	0.0663			(30)				
Sloping Ceiling	18.4900	2.9400	15.5500	0.1600	2.4880			(30)				
Susp Ceil to Apex	14.9000		14.9000	0.2100	3.1290			(30)				
Total net area of external elements Aum(A, m2)			203.4300					(31)				
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	65.0435			(33)				
E-WM-22			57.0900	0.0000	0.0000			(32)				
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								146.5200 (35)				
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								10.3481 (36)				
Total fabric heat loss						(33) + (36) =		75.3916 (37)				
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 47.7346	Feb 47.5186	Mar 47.3068	Apr 46.3120	May 46.1258	Jun 45.2594	Jul 45.2594	Aug 45.0989	Sep 45.5931	Oct 46.1258	Nov 46.5024	Dec 46.8960 (38)
Heat transfer coeff	123.1263	122.9102	122.6984	121.7036	121.5175	120.6510	120.6510	120.4905	120.9847	121.5175	121.8940	122.2876 (39)
Average = Sum(39)m / 12 =												121.7027 (39)
HLP	Jan 1.1616	Feb 1.1595	Mar 1.1575	Apr 1.1481	May 1.1464	Jun 1.1382	Jul 1.1382	Aug 1.1367	Sep 1.1414	Oct 1.1464	Nov 1.1499	Dec 1.1537 (40)
HLP (average)												1.1481 (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												2.7886 (42)
Average daily hot water use (litres/day)												100.4283 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Daily hot water use	110.4712	106.4540	102.4369	98.4198	94.4026	90.3855	90.3855	94.4026	98.4198	102.4369	106.4540	110.4712 (44)
Energy conte	163.8256	143.2829	147.8551	128.9037	123.6861	106.7317	98.9026	113.4922	114.8477	133.8439	146.1011	158.6563 (45)
Energy content (annual)										Total =	Sum (45)m =	1580.1288 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (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)
Primary 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 (59)
Heat gains from water heating, kWh/month	34.8129	30.4476	31.4192	27.3920	26.2833	22.6805	21.0168	24.1171	24.4051	28.4418	31.0465	33.7145 (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	139.4281	139.4281	139.4281	139.4281	139.4281	139.4281	139.4281	139.4281	139.4281	139.4281	139.4281	139.4281 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.7741	22.0042	17.8950	13.5477	10.1270	8.5497	9.2382	12.0082	16.1174	20.4647	23.8853	25.4627 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	265.6788	268.4357	261.4884	246.6983	228.0285	210.4816	198.7591	196.0022	202.9495	217.7396	236.4094	253.9563 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.9428	36.9428	36.9428	36.9428	36.9428	36.9428	36.9428	36.9428	36.9428	36.9428	36.9428	36.9428 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-111.5425	-111.5425	-111.5425	-111.5425	-111.5425	-111.5425	-111.5425	-111.5425	-111.5425	-111.5425	-111.5425	-111.5425 (71)
Water heating gains (Table 5)	46.7916	45.3089	42.2301	38.0445	35.3270	31.5007	28.2484	32.4155	33.8960	38.2283	43.1201	45.3151 (72)
Total internal gains	402.0729	400.5773	386.4419	363.1189	338.3110	315.3603	301.0742	305.2543	317.7913	341.2610	368.2432	389.5626 (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		
South				2.9400	45.6416	0.7100	0.7000		1.0000	60.0215 (82)		
North				4.5500	10.6334	0.7100	0.7000		0.7700	16.6638 (74)		
Northeast				0.7200	11.2829	0.7100	0.7000		0.7700	2.7980 (75)		
East				0.7600	19.6403	0.7100	0.7000		0.7700	5.1410 (76)		
South				6.4500	46.7521	0.7100	0.7000		0.7700	103.8604 (78)		
Northwest				0.7200	11.2829	0.7100	0.7000		0.7700	2.7980 (81)		
Solar gains	191.2827	331.6594	468.7924	605.1923	699.4927	703.7910	674.6473	602.9679	515.8750	370.6469	230.1870	162.9963 (83)
Total gains	593.3556	732.2366	855.2343	968.3111	1037.8037	1019.1513	975.7215	908.2222	833.6663	711.9079	598.4303	552.5589 (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	35.0388	35.1004	35.1610	35.4484	35.5027	35.7577	35.7577	35.8053	35.6590	35.5027	35.3931	35.2791	
alpha	3.3359	3.3400	3.3441	3.3632	3.3668	3.3838	3.3838	3.3870	3.3773	3.3668	3.3595	3.3519	
util living area	0.9887	0.9769	0.9532	0.9004	0.8027	0.6557	0.5101	0.5598	0.7721	0.9311	0.9802	0.9910 (86)	
MIT	19.0707	19.3403	19.7332	20.2085	20.6084	20.8627	20.9562	20.9395	20.7477	20.2079	19.5412	19.0176 (87)	
Th 2	19.9509	19.9525	19.9541	19.9617	19.9631	19.9697	19.9697	19.9710	19.9672	19.9631	19.9603	19.9573 (88)	
util rest of house	0.9863	0.9722	0.9433	0.8785	0.7581	0.5777	0.4038	0.4531	0.7061	0.9114	0.9753	0.9891 (89)	
MIT 2	18.1893	18.4574	18.8448	19.3087	19.6766	19.8917	19.9532	19.9462	19.8072	19.3186	18.6645	18.1412 (90)	
Living area fraction									fLA = Living area / (4) =				0.1668 (91)
MIT	18.3364	18.6047	18.9930	19.4588	19.8320	20.0537	20.1205	20.1119	19.9640	19.4669	18.8107	18.2874 (92)	
Temperature adjustment												0.0000	
adjusted MIT	18.3364	18.6047	18.9930	19.4588	19.8320	20.0537	20.1205	20.1119	19.9640	19.4669	18.8107	18.2874 (93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9813	0.9641	0.9318	0.8658	0.7518	0.5846	0.4202	0.4687	0.7058	0.8995	0.9680	0.9849 (94)
Useful gains	582.2367	705.9139	796.8911	838.3731	780.1829	595.8061	409.9859	425.6737	588.4296	640.3533	579.2634	544.1991 (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	1728.2435	1684.4414	1532.8714	1285.0385	988.1848	657.9902	424.7498	447.2458	709.4606	1077.4815	1427.4622	1722.7120 (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	852.6291	657.5705	547.5693	321.5991	154.7534	0.0000	0.0000	0.0000	0.0000	325.2234	610.7031	876.8136 (98)
Space heating												4346.8614 (98)
Space heating per m2										(98) / (4) =		41.0081 (99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

 Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	1134.1194	892.8174	915.7282	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8099	0.8717	0.8465	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	918.4794	778.3107	775.2022	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1257.0038	1205.7059	1133.5182	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	243.7376	317.9821	266.5870	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling													
Cooled fraction									FC = cooled area / (4) =			828.3067	(104)
Intermittency factor (Table 10b)												1.0000	(105)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	60.9344	79.4955	66.6468	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling													
Space cooling per m2												207.0767	(107)
Energy for space heating												1.9536	(108)
Energy for space cooling												41.0081	(99)
Total												1.9536	(108)
Dwelling Fabric Energy Efficiency (DFEE)												42.9617	(109)
												43.0	(109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	37.8500 (1b)	x 2.3100 (2b)	= 87.4335 (1b) - (3b)
First floor	37.3400 (1c)	x 2.6300 (2c)	= 98.2042 (1c) - (3c)
Second floor	30.8100 (1d)	x 2.2700 (2d)	= 69.9387 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	106.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 255.5764 (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					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) = 0.1565 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4065 (18)
Number of sides sheltered					4 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.7000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.2846 (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	0.3628	0.3557	0.3486	0.3130	0.3059	0.2703	0.2703	0.2632	0.2846	0.3059	0.3201	0.3344 (22b)
Effective ac	0.5658	0.5633	0.5608	0.5490	0.5468	0.5365	0.5365	0.5346	0.5405	0.5468	0.5512	0.5559 (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
TER Opaque door			2.3800	1.0000	2.3800		(26)
TER Opening Type (Uw = 1.40)			13.2000	1.3258	17.5000		(27)
TER Room Window (Uw = 1.70)			2.9400	1.5918	4.6798		(27a)
150mm TE Platinum GF			37.8500	0.1300	4.9205		(28a)
50mm A Platinum	95.9800	14.6100	81.3700	0.1800	14.6466		(29a)
Dormer Cheeks	5.0600	0.9700	4.0900	0.1800	0.7362		(29a)
I-Roof Gable	13.8100		13.8100	0.1800	2.4858		(29a)
Wall to Roofspace	8.6200		8.6200	0.1800	1.5516		(29a)
Ceiling to Roofspace	6.5500		6.5500	0.1300	0.8515		(30)
Flat Roof - Dormer	1.7800		1.7800	0.1300	0.2314		(30)
Flat Roof - GF Bay	0.3900		0.3900	0.1300	0.0507		(30)
Sloping Ceiling	18.4900	2.9400	15.5500	0.1300	2.0215		(30)
Susp Ceil to Apex	14.9000		14.9000	0.1300	1.9370		(30)
Total net area of external elements Aum(A, m ²)			203.4300				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		53.9926		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.2061 (36)
Total fabric heat loss						(33) + (36) =	66.1987 (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	47.7210	47.5054	47.2942	46.3018	46.1161	45.2518	45.2518	45.0917	45.5847	46.1161	46.4917	46.8844 (38)
Heat transfer coeff	113.9197	113.7041	113.4928	112.5005	112.3148	111.4505	111.4505	111.2904	111.7834	112.3148	112.6904	113.0831 (39)
Average = Sum(39)m / 12 =												112.4996 (39)
HLP	1.0747	1.0727	1.0707	1.0613	1.0596	1.0514	1.0514	1.0499	1.0546	1.0596	1.0631	1.0668 (40)
HLP (average)												1.0613 (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												2.7886 (42)
Average daily hot water use (litres/day)												100.4283 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy conte	110.4712	106.4540	102.4369	98.4198	94.4026	90.3855	90.3855	94.4026	98.4198	102.4369	106.4540	110.4712 (44)
Energy content (annual)	163.8256	143.2829	147.8551	128.9037	123.6861	106.7317	98.9026	113.4922	114.8477	133.8439	146.1011	158.6563 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1580.1288 (45)
Water 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 (46)
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)
Primary 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 (59)
Heat gains from water heating, kWh/month	34.8129	30.4476	31.4192	27.3920	26.2833	22.6805	21.0168	24.1171	24.4051	28.4418	31.0465	33.7145 (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	139.4281	139.4281	139.4281	139.4281	139.4281	139.4281	139.4281	139.4281	139.4281	139.4281	139.4281	139.4281	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.7741	22.0042	17.8950	13.5477	10.1270	8.5497	9.2382	12.0082	16.1174	20.4647	23.8853	25.4627	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	265.6788	268.4357	261.4884	246.6983	228.0285	210.4816	198.7591	196.0022	202.9495	217.7396	236.4094	253.9563	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.9428	36.9428	36.9428	36.9428	36.9428	36.9428	36.9428	36.9428	36.9428	36.9428	36.9428	36.9428	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-111.5425	-111.5425	-111.5425	-111.5425	-111.5425	-111.5425	-111.5425	-111.5425	-111.5425	-111.5425	-111.5425	-111.5425	(71)
Water heating gains (Table 5)	46.7916	45.3089	42.2301	38.0445	35.3270	31.5007	28.2484	32.4155	33.8960	38.2283	43.1201	45.3151	(72)
Total internal gains	402.0729	400.5773	386.4419	363.1189	338.3110	315.3603	301.0742	305.2543	317.7913	341.2610	368.2432	389.5626	(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
North				4.5500	10.6334		0.6300		0.7000		0.7700		14.7861 (74)
Northeast				0.7200	11.2829		0.6300		0.7000		0.7700		2.4827 (75)
East				0.7600	19.6403		0.6300		0.7000		0.7700		4.5618 (76)
South				6.4500	46.7521		0.6300		0.7000		0.7700		92.1579 (78)
Northwest				0.7200	11.2829		0.6300		0.7000		0.7700		2.4827 (81)
South				2.9400	45.6416		0.6300		0.7000		1.0000		53.2585 (82)
Solar gains	169.7297	294.2893	415.9707	537.0016	620.6766	624.4906	598.6307	535.0279	457.7482	328.8839	204.2505	144.6305	(83)
Total gains	571.8026	694.8666	802.4126	900.1205	958.9877	939.8509	899.7049	840.2821	775.5396	670.1449	572.4937	534.1931	(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	64.6167	64.7392	64.8597	65.4318	65.5400	66.0483	66.0483	66.1433	65.8516	65.5400	65.3215	65.0947	
alpha	5.3078	5.3159	5.3240	5.3621	5.3693	5.4032	5.4032	5.4096	5.3901	5.3693	5.3548	5.3396	
util living area	0.9988	0.9964	0.9887	0.9603	0.8767	0.7092	0.5355	0.5922	0.8412	0.9778	0.9971	0.9992	(86)
MIT	19.8040	19.9771	20.2338	20.5525	20.8164	20.9578	20.9923	20.9871	20.8928	20.5380	20.1037	19.7711	(87)
Th 2	20.0215	20.0232	20.0248	20.0325	20.0340	20.0407	20.0407	20.0419	20.0381	20.0340	20.0311	20.0280	(88)
util rest of house	0.9984	0.9952	0.9846	0.9455	0.8326	0.6224	0.4238	0.4775	0.7713	0.9668	0.9959	0.9989	(89)
MIT 2	18.9255	19.0993	19.3552	19.6711	19.9101	20.0213	20.0387	20.0382	19.9789	19.6631	19.2325	18.8978	(90)
Living area fraction									fLA =	Living area / (4) =			0.1668 (91)
MIT	19.0720	19.2457	19.5017	19.8181	20.0612	20.1776	20.1978	20.1965	20.1314	19.8091	19.3778	19.0435	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0720	19.2457	19.5017	19.8181	20.0612	20.1776	20.1978	20.1965	20.1314	19.8091	19.3778	19.0435	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	570.5747	690.5739	787.8142	847.4098	799.8214	597.3507	398.1348	417.3569	604.1640	645.6509	569.5063	533.3867	(94)
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	1682.8250	1631.1686	1475.6050	1228.2915	939.0895	621.6206	400.9720	422.5148	674.2058	1034.3131	1383.5921	1678.5470	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	827.5142	632.0797	511.7164	274.2348	103.6154	0.0000	0.0000	0.0000	0.0000	289.1647	586.1417	851.9992	(98)
Space heating												4076.4662	(98)
Space heating per m2												38.4572	(99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1047.6344	824.7335	845.8071	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8862	0.9416	0.9216	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	928.4091	776.5329	779.5147	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1169.1519	1121.4901	1058.2223	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	173.3348	256.6481	207.3585	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling													
Cooled fraction									fC = cooled area / (4) =			637.3414	(104)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	43.3337	64.1620	51.8396	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling													
Space cooling per m2													(107)
Energy for space heating													159.3353 (107)
Energy for space cooling													1.5032 (108)
Total													38.4572 (99)
Target Fabric Energy Efficiency (TFEE)													1.5032 (108)
													39.9604 (109)
													46.0 (109)